



CITY OF LINCOLN
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CITY OF LINCOLN STANDARD SPECIFICATIONS for MUNICIPAL CONSTRUCTION 2011



Department of Public Works and Utilities
Parks Department
Lincoln Electric System

These Standard Specifications shall become effective on all construction projects on or after October 1, 2011.

TABLE OF CONTENTS

	Page
GENERAL CONDITIONS & REQUIREMENTS	1
CHAPTER 1 – GENERAL MISCELLANEOUS ITEMS	100
CHAPTER 2 - EARTHWORK	200
CHAPTER 3 - PORTLAND CEMENT CONCRETE (PCC)	300
CHAPTER 4 - PORTLAND CEMENT CONCRETE (PCC) PAVEMENT	400
CHAPTER 5 - PORTLAND CEMENT CONCRETE (PCC) BASE CONSTRUCTION	500
CHAPTER 6 - ASPHALTIC CONCRETE CONSTRUCTION	600
CHAPTER 7 - RETAINING WALLS & STEPS	700
CHAPTER 8 - CHAIN LINK FENCE & PIPE RAILING FENCING	800
CHAPTER 9 - CRUSHED ROCK SURFACING	900
CHAPTER 13 - TRAFFIC PAVEMENT MARKING	1300
CHAPTER 14 - TRAFFIC SIGNS	1400
CHAPTER 15 - TRAFFIC CONTROL	1500
CHAPTER 20 - CONSTRUCTION FOR UTILITIES & STRUCTURES	2000
CHAPTER 21 - STORM SEWERS	2100
CHAPTER 22 - SANITARY SEWERS	2200
CHAPTER 23 - WATER MAINS	2300
CHAPTER 24 - TRAFFIC SIGNALS, ITS & LIGHTING	2400
CHAPTER 25 - ORNAMENTAL STREET LIGHTING	2500
CHAPTER 26 - COMMUNICATIONS	2600
CHAPTER 30 - SEEDING AND SODDING	3000
CHAPTER 31 - LANDSCAPE WORK	3100
CHAPTER 32 - SOIL EROSION & SEDIMENT CONTROL	3200
CHAPTER 33 - IRRIGATION WORK	3300
APPENDIX A – PAY ITEM LIST	4000

GENERAL CONDITIONS & REQUIREMENTS

ARTICLE	TITLE	
I.	DEFINITIONS AND TERMS	4
	A. GENERAL	4
	B. ABBREVIATIONS	4
	C. DEFINITIONS	5
II.	PROPOSAL REQUIREMENTS AND CONDITIONS	9
	A. EXAMINATION OF PLANS, SPECIFICATIONS, SPECIAL PROVISIONS, AND SITE OF WORK	9
	B. TYING BIDS	9
	C. QUANTITIES	9
	D. UNIT PRICES	10
	E. ALTERNATIVES	10
	F. SUBCONTRACTORS	10
	G. CONSTRUCTION PERFORMANCE AND CONSTRUCTION PAYMENT BONDS	10
	H. FAILURE TO EXECUTE THE CONTRACT	11
III.	SCOPE OF WORK	12
	A. INTENT OF DOCUMENTS	12
	B. EXTRA WORK	13
	C. CHANGES IN THE WORK	13
	D. ROCK EXCAVATION	14
	E. HAUL OR OVERHAUL	14
	F. CLEAN UP	14
	G. ACCESS TO THE SITE OF WORK	14
	H. OWNERSHIP OF SALVAGED MATERIALS	15
	I. BORROW AND WASTE SITES	15
IV.	CONTROL OF MATERIALS	16
	A. MATERIAL STORAGE	16
	B. TESTS AND SAMPLES	16
	C. MATERIALS AND WORKMANSHIP	17
	D. ALTERATIONS AND SUBSTITUTIONS	17
	E. MATERIALS SUPPLIED BY THE CITY	18
	F. HAZARDOUS ENVIRONMENTAL CONDITIONS	18
V.	CONTROL OF THE WORK	19
	A. AUTHORITY OF THE CITY ENGINEER	19
	B. AUTHORITY OF THE CITY'S PROJECT MANAGER	19
	C. AUTHORITY OF THE CITY'S ENGINEERING INSPECTOR	20
	D. PRE-CONSTRUCTION AND PROGRESS CONFERENCE	20
	E. PROJECT COORDINATION	21
	F. INSPECTION TESTING AND CORRECTING WORK	21
	G. CORRECTING WORK	22
	H. CONTRACTOR'S USE OF PUBLIC AND PRIVATE UTILITIES	22
	I. SHOP DRAWINGS	23
	J. COORDINATION WITH OTHERS	23

GENERAL CONDITIONS & REQUIREMENTS

ARTICLE	TITLE	
VI.	LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC	24
	A. PROTECTION FROM LOSS	24
	B. ASSUMPTION OF LIABILITY AND INDEMNIFICATION	24
	C. CONTRACTOR'S INSURANCE	24
	D. PATENTED DEVICES, MATERIALS, AND PROCESSES	24
	E. INDEPENDENT CONTRACTORS	25
	F. PROTECTION OF WORK, PROPERTY, AND PERSONS	25
	G. COMPLIANCE WITH LAWS	25
	H. FAIR EMPLOYMENT PRACTICES	26
	I. FAIR LABOR STANDARDS	26
	J. EQUAL EMPLOYMENT AND LIVING WAGE	26
	K. UNEMPLOYMENT CONTRIBUTION	26
	L. ASSIGNMENT OF CONTRACTS	27
	M. PERMITS AND LICENSES	27
	N. PAYMENT OF BILLS	27
	O. STANDARD MANUFACTURER	28
	P. "OR EQUAL" CLAUSE	28
	Q. SANITARY CONVENIENCES	28
	R. EXECUTIVE ORDERS	28
	S. PURCHASING AGENT APPOINTMENT AND EXEMPT SALES CERTIFICATE	29
	T. WEED CONTROL	29
	U. SNOW REMOVAL	30
	V. AUDIT BOARD	30
	W. E-VERIFY	30
VII.	PROSECUTION AND PROGRESS OF WORK	31
	A. NOTIFICATION	31
	B. COMMENCEMENT	31
	C. DELAYS	31
	D. SUPERVISION AND DISCIPLINE BY CONTRACTOR	32
	E. WINTER CONSTRUCTION - SUSPENSION OF WORK	32
	F. EXTENSION OF TIME	33
	G. LIQUIDATED DAMAGES	34
	H. TERMINATION FOR CAUSE	34
	I. TERMINATION BY THE CITY FOR CONVENIENCE	35
	J. CLAIMS & DISPUTES	36
	K. RESOLUTION OF CLAIMS AND DISPUTES	38
VIII.	GUARANTEE AND PAYMENT	39
	A. GUARANTEE	39
	B. SUBSTANTIAL COMPLETION	40
	C. ACCEPTANCE OF WORK	41
	D. PROGRESS PAYMENT	41
	E. FINAL PAYMENT	42
IX.	MISCELLANEOUS	43
	A. AUDIT/EXAMINATION OF RECORDS	43
	B. CONTRACTOR GUARANTEES REGARDING SCHEDULING	44

GENERAL CONDITIONS & REQUIREMENTS

ARTICLE	TITLE	
X.	INSURANCE REQUIREMENTS	45
	A. WAIVERS OF SUBROGATION	45
	B. INSURANCE REQUIREMENTS FOR ALL CITY CONTRACTS	45

I. DEFINITIONS AND TERMS

A. GENERAL

The General Conditions and Requirements and Contract stipulations may refer to conditions which will not be encountered in the performance of Work included in this Contract and which are not applicable thereto. Any requirements, provisions, or other stipulation of these General Conditions and Requirements which pertain to a non-existent condition and are not applicable to the Work to be performed hereunder shall have no meaning in this Contract.

The Special Provisions shall govern in case of any conflicts between the General Conditions and Requirements and the Special Provisions.

B. ABBREVIATIONS

The following abbreviations, when appearing in the Contract Documents, shall be construed to be the same as their respective expressions:

AAP	-	Affirmative Action Plan
AASHTO	-	American Association of State Highway and Transportation Officials
AC	-	Alternating Current
ACI	-	American Concrete Institute
ADA	-	Americans with Disabilities Act
AISC	-	American Institute of Steel Construction
ANSI	-	American National Standards Institute
ASA	-	American Standards Association
ASTM	-	American Society for Testing and Materials
AWG	-	American Wire Gauge
AWS	-	American Welding Society
AWWA	-	American Water Works Association
BC	-	Bundled Cable
Db	-	Decibel
EEI	-	Edison Electric Institute
EEO	-	Equal Employment Opportunity
EIA	-	Electronic Industries Association
FHWA	-	Federal Highway Administration
GRS	-	Galvanized Rigid Steel
HDPE	-	High Density Polyethylene
HZ	-	Hertz
ICEA	-	Insulated Cable Engineers Association
IEC	-	International Electrotechnical Commission
IES	-	Illuminating Engineering Society
IMSA	-	International Municipal Signal Association
IPCEA	-	Insulated Power Cable Engineers Association
IPS	-	Iron Pipe Size
ISO	-	International Standards Organization
LED	-	Light-emitting diode
LES	-	Lincoln Electric System
LPD	-	Lincoln Police Department
LSP	-	Lincoln Standard Plan
MUTCD	-	Manual Uniform Traffic Control Devices
NDOR	-	Nebraska Department of Roads
NEC	-	National Electrical Code
NEMA	-	National Electrical Manufacturers Association
NESC	-	National Electrical Safety Code

I. DEFINITIONS AND TERMS (Continued)

B. ABBREVIATIONS

NM	-	Nanometer
OSHA	-	Occupational Safety and Health Administration
OTDR	-	Optical Time Domain Reflectometer
PVC	-	Polyvinyl Chloride
RMS	-	Root Mean Squared
SCTE	-	Society of Cable Telecommunications Engineers
SJOW	-	Stranded Junior service Oil-resistant Weather-resistant
SSP	-	State Standard Plan
TCLP	-	Toxicity Characteristic Leaching Procedure
THHN	-	Thermoplastic High Heat-resistant Nylon-coated
TIA	-	Telecommunications Industry Association
UL	-	Underwriters Laboratories
USASI	-	USA Standards Institute
UV	-	Ultraviolet

C. DEFINITIONS

1. **Addendum** (Addenda). Additional documents, issued by the City to prospective Bidders prior to the closing date for receipt of bids, which are intended to change or clarify the original plans and/or specifications, i.e., additions, deletions, modifications, or explanations.
2. **Advertisement**. The public announcement, stating the time and place for receiving bids for the Work.
3. **Bid** shall mean the properly signed and guaranteed written offer of the Bidder to perform the Work. Bid shall include Proposals or other formal written offers to perform the Work.
4. **Bidder** shall mean any individual, entity, firm, partnership, or corporation formally submitting a proposal to perform the Work or to supply materials for the Work. Bidder shall include any of the same acting through an authorized agent or representative.
5. **Brand Name**. Wherever in the specifications or proposal form brand names, manufacturer, trade name, or catalog numbers are specified, it is for the purpose of establishing a grade or quality of material only; and the term "or equal" is deemed to follow.
6. **Calendar Days**. Every day shown on the calendar. (Saturdays, Sundays and Holidays included).
7. **Change Order** shall mean a written instrument the City's Project Manager issues and the Mayor and the Contractor approve to state the City and Contractor's agreement for a change in the Work. All Change Orders shall specify the method of payment, if any. All Change Orders shall specify adjustments in the Contract Sum and/or Contract Time, if any.
8. **City**. The City of Lincoln, Nebraska, and shall include the City's authorized representative.
9. **City Engineer** Only the City Engineer or his/her duly authorized representatives.
10. **City Holiday**. A City Holiday shall be defined as those holidays observed by the City as authorized in Section 2.76.370 of the Lincoln Municipal Code

I. DEFINITIONS AND TERMS (Continued)

C. DEFINITIONS (Continued)

11. **City's Project Manager** shall be the person designated by the Department Director bidding the Project. The City's Project Manager is acting as an agent of the City during the construction period and shall decide all questions which may arise as to Contract fulfillment on the part of the Contractor. The City's Project Manager may be either City employee or Consultant.
12. **City's Engineering Inspector** is an appointed agent of the City's Project Manager to inspect all Work done. The City's Engineering Inspector is appointed for the benefit of the City and any inspections shall be for the benefit of the City. The City's Engineering Inspector may be either City employee or Consultant.
13. **Claim** shall include a demand or assertion by the City or the Contractor seeking an adjustment to or interpretation of Contract terms, payment, time or other matters related to the Contract. The party making the Claim shall substantiate any such Claim.
14. **Consultant** shall mean the designated architect, engineer, or professional contracted by the City to provide design, construction, and/or other professional services related to the project.
15. **Contract.** The written agreement between the City and the Contractor, containing all the covenants of that agreement. Contract Documents shall include the Contract, Conditions of the Contract (General, Supplementary and other conditions), Drawings, Specifications, addenda issued prior to execution of the Contract, other documents listed in the Contract and modifications or other agreements required to complete the Work issued after execution of the Contract. Unless specifically excluded in the Contract, Contract Documents shall also include the bidding requirements, Advertisement, Instructions to Bidders, sample forms, Contractor's Bid and Addenda.
16. **Contract Bonds.** The approved forms of security, executed by the Contractor and his surety or sureties, guaranteeing complete execution of the Contract and the payment of all legal debts pertaining to the Contract.
17. **Contractor.** The individual, entity, firm, partnership, or corporation undertaking the execution of the Work under the terms of the Contract who, regardless of any of the Contract terms, is always considered as an independent contractor.
18. **Contract Completion Date.** The calendar date stipulated in the Contract by which the proposed Work shall be complete.
19. **County.** Lancaster County, Nebraska.
20. **Easement.** A right to use or control property for a designated purpose.
21. **Engineer.** An individual who is professionally licensed in Nebraska.
22. **Equipment.** All machinery, tools, supplies necessary for maintenance, and apparatus necessary for the construction of the Work.
23. **Extra Work.** An item of Work not originally a part of the Contract, but necessary for completion and/or execution of the Contract.

I. DEFINITIONS AND TERMS (Continued)

C. DEFINITIONS (Continued)

24. **Final Completion.** The stage when the City determines that the Work has been totally completed in accordance with the terms and conditions of the Contract Documents.
25. **General Conditions.** Standard provisions for all City Contracts. The City may delete or modify any of these standard provisions for a particular Contract by indicating a change in the Special Provisions or in the bid document. Any bidder accepting a purchase order/Contract issued by the City agrees that the provisions included within the Invitation for Bid shall prevail.
26. **Laboratory.** The City of Lincoln's Testing Laboratory or any other laboratory as may be designated by the City's Project Manager for the purpose of testing materials and/or Work performed.
27. **Liquidated Damages.** The amount prescribed in the Contract documents to be paid to the City by the Contractor, or to be deducted from any payments due to the Contractor, for each calendar day or Working day, whichever is specified in the Contract documents, beyond the stated completion date or any extension thereof. Liquidated damages will represent the agreed damages to the City and shall not be construed as a penalty.
28. **Lump Sum.** The total price of a group of items which is priced as a whole.
29. **Materials.** All components used in the Work, materials, supplies and equipment incorporated into the Work shall be new, the latest make/model, of the best quality, and the highest grade Workmanship.
30. **May.** Permissive (see Shall).
31. **Modification.** Any authorized written order the City's Project Manager issued for a minor change in the Work and shall be synonymous with Field Orders and/or Field Modifications.
32. **Notice to Proceed.** Written notice instructing the Contractor to proceed with the Work.
33. **Plans.** The drawings, standard plans, profiles, typical cross sections and supplemental drawings which show the dimensions, locations, details, and character of the Work to be performed. All such documents are considered a part of the Contract documents, whether attached to the plans or separate.
34. **Project.** The total construction related to the Work provided by this Contract. The Project may include construction by the City or by separate Contractors.
35. **Proposal.** The properly signed written (or electronic if authorized) offer of the Bidder to perform all the Work.
36. **Retainage.** The amount of monies held by the City until the Contract is successfully completed.
37. **Right-of-Way.** Land, property, or interest therein devoted to or acquired for the purposes of public roads or utilities.
38. **Shall.** Mandatory. (see May)

I. DEFINITIONS AND TERMS (Continued)

C. DEFINITIONS (Continued)

39. **Site Supervisor.** A certified person at the location of the Work responsible for directing such Work in the Public Right of Way. The Department Director shall be responsible for the certification procedure necessary to approve personnel to supervise Work in the Public Right of Way.
40. **Special Provisions.** Additions to or modifications of the standard specifications and supplemental specifications covering conditions peculiar to the Work.
41. **Specifications.** Any written requirement for materials, equipment, construction systems, standards or Workmanship for the Work, including performance of related services.
42. **Standard Specifications.** The officially adopted Standard Specifications City of Lincoln, Nebraska.
43. **Subcontractor.** An individual, entity, firm, partnership, or corporation to whom the Contractor sublets a portion of the Work.
44. **Subsidiary.** Any item required in carrying out the duties and obligations imposed by the Contract for which no direct pay will be allowed. The cost of subsidiary items will be included in those items for which payment is proposed.
45. **Substantial Completion** shall mean the stage when the City's Project Manager determines (according to the Contract Documents) that the Work or a designated portion thereof is sufficiently complete, and when the Contractor has secured all required occupancy permits, if any, so the City can occupy or use the Work for its intended use.
46. **Supplemental Specifications.** Specifications adopted subsequent to publication of the standard specifications which may add to, delete, or modify the standard specifications.
47. **Surety.** The individual, firm, or corporate body bound with and for the Contractor for the acceptable completion of the Work and the Contract, and for payment of all just claims arising there from.
48. **Utilities.** Overhead or underground wires, pipe lines, conduits, ducts, or structures, sewers or storm sewer drains owned, operated or maintained in or across a public right-of-way or private easement.
49. **Work** shall include the construction and services the Contract Documents require, whether completed or partially completed, and all other labor, materials, equipment and services necessary to fulfill the Contractor's obligations. Work may constitute the whole or a part of the Project.

II. PROPOSAL REQUIREMENTS AND CONDITIONS

A. EXAMINATION OF PLANS, SPECIFICATIONS, SPECIAL PROVISIONS, AND SITE OF WORK

Bidders shall inform themselves of the conditions under which the Work is to be performed, concerning the site of the Work, the structure of the ground, obstacles which may be encountered and all other relevant matters concerning the Work to be performed. Where test boring logs and/or reports indicating underground conditions are attached to the Contract Documents, such logs and/or reports shall be considered only for information and as indicative of conditions as observed at the time and place indicated, and the City shall not be held responsible for any variance in conditions encountered at the time of actual construction.

It shall be the responsibility of the Contractor to satisfy himself by such methods as he deems necessary prior to the letting as to underground structures, underground utilities (both public and private), underground soil and rock formations, ground water, and obstacles to be encountered.

The Contractor to whom a Contract is awarded will not be allowed any extra compensation by reason of any matter or thing concerning which he might fully have informed himself prior to the bidding.

The successful Contractor will be required to employ, so far as is possible, such methods and means in the carrying out of his Work as will not cause any interruption or interference with any other Contractor.

The Bidder is expected to base his bid on materials and equipment which comply fully with the plans and specifications, and in the event he names in his bid materials or equipment which do not conform, he will be responsible for furnishing materials and equipment which fully conform at no change in his bid price.

Before submitting a proposal, each Contractor shall examine the complete specifications and plans, including all related documents contained herein.

B. TYING BIDS

Bidders shall not tie their bids to any other proposal except as may be provided in the proposal form or by special provision.

C. QUANTITIES

Bidders shall satisfy themselves as to the correctness of any quantities listed in the proposal form and shall not, after submission of their proposal, dispute such quantities, nor assert that there was any misunderstanding in regard to the nature or amount of Work to be done.

The quantities on projects involving unit prices and materials to be furnished under this Contract are approximate and are to be used only as a basis for estimating the probable cost of the Work and for comparing the proposals. The City may omit portions of the Work, to increase or decrease the quantities as deemed necessary or desirable, and the actual amount of Work to be done and material to be furnished may differ from the estimated quantities, and the basis for payment under this Contract shall be the actual amount of Work and materials done.

II. PROPOSAL REQUIREMENTS AND CONDITIONS (Continued)

D. UNIT PRICES

On a lump sum or partial lump sum Contract where it is anticipated that unforeseeable changes may occur in the construction covered by the lump sum portion of the bid and which will require more or less quantities than are indicated on the Contract plans, the cost of said more or less quantities may be covered by supplemental unit bid prices in the proposal form. The City reserves the right to reject any or all such supplemental unit prices which it deems to be excessive or unreasonable. In the event of such rejection and subsequent need for said more or less Work, the Contract price shall be adjusted by change order in the manner described in these specifications.

In cases where any part or all of the bidding is to be received on a unit price basis, the quantities stated are not intended to govern. The quantities stated, on which unit prices are so invited, are approximate only and each Bidder will be required to make his own estimates of amounts and to calculate his unit price bid accordingly. Bids will be compared on the basis of the stated number of units in the proposal form. Such estimated quantities, while made from the best information available, are approximate only. Payment on the Contract will be based on actual number of units installed on the completed Work

E. ALTERNATIVES

When provided in the proposal form, Bidders may bid on one or more alternatives at his own discretion unless otherwise directed in these specifications or in the Special Provisions.

F. SUBCONTRACTORS

The Contractor shall notify the City's Project Manager in writing of the names and addresses of the Subcontractors he proposes to use on the Contract. The notification shall be submitted prior to the commencement of the subcontracted Work. The City's Project Manager shall have the right to approve or disapprove the use of any Subcontractor. Nothing contained in the Contract Documents shall create any contractual relationship between any Subcontractor and the City. The Contractor agrees to be fully responsible to the City for the acts or omissions of his Subcontractors and of anyone employed directly or indirectly by him or them and this Contract obligation shall be in addition to the liability imposed by law upon the Contractor.

The Contractor agrees to bind every Subcontractor (and every Subcontractor of a Subcontractor) by the terms of the Contract.

G. CONSTRUCTION PERFORMANCE AND CONSTRUCTION PAYMENT BONDS

Within ten (10) days after the acceptance of the bid, the Contractor shall furnish, on a form acceptable to the City, a construction performance and construction payment Bond, in a sum not less than the Contract Sum, executed by the Contractor and by a corporate surety company authorized to transact business in the State of Nebraska. Such Bond shall be conditioned upon the faithful performance of all the terms and conditions of the Contract Documents, including the holding harmless of the City from failure to do so, and including the making good of any and all guarantees that the Contract Documents may require. The Bond shall be further conditioned upon the payment of all laborers and material suppliers used in the performance of the Contract, including Insurance premiums and interest.

II. PROPOSAL REQUIREMENTS AND CONDITIONS (Continued)

H. FAILURE TO EXECUTE THE CONTRACT

It is agreed by the Bidder that upon a failure to enter into the Contract and furnish the necessary Construction Performance and Construction Payment Bond, within ten (10) Calendar Days, the amount of the Bidder's security may, at the discretion of the City, become the property of the City and will be retained, as damages to the City. The award of the Contract may then, at the discretion of the City, be made to the next lowest responsible bidder, or the Work may be rebid, or may be constructed by the City in any legal manner.

III. SCOPE OF WORK

A. INTENT OF DOCUMENTS

The intent of the documents is to include all labor and materials except that which is specifically designated to be supplied by others, all tools and equipment, and everything necessary for the proper execution of the Work. The Contractor shall perform all necessary and incidental Work and furnish any such materials as fully as if they were particularly delineated or described in the Contract.

The Contractor shall bring to the attention of the City's Project Manager any conflicts between various parts of the Contract Documents or questions pertaining to procedures, traffic control or material.

Special Provisions, supplementing or modifying the specifications, whether incorporated in or furnished by addendum to the Contract Documents, shall be considered an integral part of same. Said special provisions shall supersede the specifications.

If the plans and specifications should be found to be contradictory in any part, the specifications shall govern.

Materials or Work described in words which, so applied, have known technical or trade meaning shall be held to refer to such recognized standards.

Figured dimensions on the plans shall be taken as correct but shall be checked by the Contractor before starting construction. Any errors, omissions, or discrepancies shall be brought to the attention of the City's Project Manager and the City's Project Manager's decision thereon shall be final. Correction of errors or omissions on the drawings or specifications may be made by the City's Project Manager when such correction is necessary for the proper execution of the Work.

The City's Project Manager will furnish the Contractor, free of charge, up to five (5) original-size copies of drawings and specifications that the City's Project Manager deems necessary to carry out the Work. The Contractor may purchase additional copies.

The Contractor may be furnished additional instructions and detail drawings by the City's Project Manager as necessary to carry out the Work required by the Contract Documents. The additional drawings and instructions so supplied shall become a part of the Contract Documents. The Contractor shall carry out the Work in accordance with the additional detail drawings and instructions.

III. SCOPE OF WORK (Continued)

B. EXTRA WORK

In the event portions of such Work are determined by the City's Project Manager to be covered by some of the various items for which there is a bid price or combinations of such items, the remaining portion of such Work will be considered as Extra Work. Extra Work also includes Work specifically designated as Extra Work in the plans or specifications. The Contractor shall do such Extra Work upon receipt of a written order from the City's Project Manager.

Extra Work shall be paid for as determined by the City's Project Manager and shall be on one of the following bases:

1. Unit prices contained in the Contractor's original bid.
2. Supplemental unit prices agreed upon by the City's Project Manager and the Contractor prior to authorization of the change.
3. An agreed lump sum.
4. The actual cost of labor, direct overhead, materials, supplies, equipment and other services required to complete the Work so ordered. In addition, there may be added an amount, to be agreed upon but not to exceed fifteen percent of the actual cost of the Work, to cover the cost of general overhead and profit.
5. If a Subcontractor does the Work, there may be added an amount, to be agreed upon but not to exceed five percent of the Subcontractor's billing, to cover the cost of general overhead and profit.

It shall be expressly understood and hereby agreed to by the Contractor that no claim for Extra Work will be recognized by the City unless same has been authorized in writing by the City's Project Manager and unless claim for such added Work has been filed by the Contractor prior to preparation of the final estimate. The claim should be filed within fourteen (14) days after the need for the Extra Work is recognized.

C. CHANGES IN THE WORK

The City may, at any time as the need arises, order changes in the scope of the Work to be performed or the materials to be furnished without invalidating the Contract. If such changes are minor and have no effect on the amount due or the time required to perform the Work, they may be authorized by the City's Project Manager. The request for such minor changes shall be documented in writing by the City's Project Manager. If such changes require an increase or decrease in the amount due under the Contract or in the time required for performance of the Work, an equitable adjustment shall be authorized by written change order executed by the Mayor.

III. SCOPE OF WORK (Continued)

D. ROCK EXCAVATION

Rock Excavation shall be excavation in solid rock formations in the original bed or well defined ledges more than twelve inches in thickness, or detached solid masses of stone more than one-half (½) cubic yard in volume which cannot be excavated, loosened or removed by any process other than by drilling or by the use of pneumatic equipment. No soft or disintegrated rock, or rock that has been broken or previously blasted, or broken stone in rock fill or elsewhere, will be classified as rock excavation.

Unless indicated in the proposal, no payment will be made for "Rock Excavation." The additional cost of rock excavation shall normally be considered subsidiary to and a part of the applicable Contract bid price.

E. HAUL OR OVERHAUL

Unless specified in the proposal, no payment will be made for "Haul" or "Overhaul." The cost of hauling material to or from the Work regardless of distance shall be considered subsidiary to and a part of the applicable Contract bid price.

F. CLEAN UP

The Contractor shall at all times keep the site of the Work free from accumulations of waste materials or rubbish caused by his employees or Work, and at the completion of the Work he shall remove all rubbish from and about the Work and all tools, equipment, scaffolding and surplus materials and shall leave the site clean and ready for use.

All sewers, conduits, pipes and appurtenances, and all tanks, pump wells, chambers, buildings and other structures shall be kept clean during construction; and as the Work or any part thereof approaches completion, the Contractor shall systematically and thoroughly clean and make any needed repairs to them. He shall furnish, at his own expense, suitable tools and labor for removing all water and cleaning out all dirt, mortar and foreign substances. The City's Project Manager will not approve the final estimate of any portion of the Work until after Final Completion is achieved and the Work found satisfactory. The City may remove or cause the removal of the rubbish and surplus materials and deduct the cost from the final estimate or charge the cost to the Contractor if the cleanup is not properly performed by the Contractor within three (3) days of written notice from the City's Project Manager.

G. ACCESS TO THE SITE OF WORK

The Work included in the Contract is in the public right-of-way or easements furnished by the City of Lincoln. The City will guarantee necessary access for the Contractor to carry on the Work of his Contract. The Contractor will be permitted to use only as much of the right-of-way as shall be determined by the City's Project Manager for the Contractor to carry on his Work.

III. SCOPE OF WORK (Continued)

H. OWNERSHIP OF SALVAGED MATERIALS

Materials removed and salvaged in accordance with the plans, or as directed by the City's Project Manager, shall be the property of the City and the Contractor shall load, transport, unload, and neatly stockpile the materials at the location(s) designated in these specifications, in the special provisions, or as directed by the City's Project Manager. Salvaged materials damaged due to the Contractor's negligence will be replaced with new materials at no additional cost to the City or deducted from the final estimate by the City's Project Manager.

The Contractor shall furnish salvage receipts to the City's Project Manager if required by these specifications.

I. BORROW AND WASTE SITES

Unless borrow or waste sites are designated on the plans or specified in the special provisions, the Contractor shall be responsible for selecting an appropriate site. These sites shall be maintained by the Contractor at no cost to the City.

IV. CONTROL OF MATERIALS

A. MATERIAL STORAGE

The Contractor shall store all Materials to preserve their quality and fitness for the Work and to facilitate inspection. The Contractor shall store all material under the general supervision and direction of the City's Project Manager. The City's Project Manager, when needed, may order the Contractor to store Materials under cover or on platforms or as the City's Project Manager otherwise reasonably requires to protect the same from damage. Materials from different sources of supply shall not be stored in the same stockpile unless approved by the City's Project Manager.

B. TESTS AND SAMPLES

The Contractor shall furnish, at no expense to the City, such samples of materials as may be required by the City's Project Manager for testing. Materials having the same character, quality, and grading as the approved samples will be acceptable for the particular use for which they are intended. Samples shall be accompanied by a statement giving the type of materials, name of the producer, batch number, date, and location of the plant. The City will provide for the initial testing of materials at no expense to the Contractor. Any expense for retesting required to establish the quality or acceptability of the materials in question shall be borne by the Contractor.

The City reserves the right to retest all materials, prior to incorporation into the Work. The City may then reject all materials that, when retested, do not comply with the Contract Documents.

IV. CONTROL OF MATERIALS (Continued)

C. MATERIALS AND WORKMANSHIP

Unless otherwise stipulated in the specifications, all Workmanship, equipment, materials, and articles incorporated in the Work covered by this Contract are to be new and of the best grade of their respective kinds for the purpose. Before placing orders for equipment, the Contractor shall furnish to the City's Project Manager for his approval the name of the manufacturer of machinery, mechanical and other equipment, which he contemplates installing, together with their performance capacities and other pertinent information. If not otherwise provided, the performance called for in this Contract shall be furnished and performed in accordance with well-known established practices and standards recognized by architects, engineers, and the trade. Materials installed or used without approval shall be at the risk of subsequent rejection.

No material of any kind shall be installed in the project until the City's Project Manager verifies the materials are in compliance with the Contract documents. Any materials or Workmanship found at any time to be defective shall be remedied at once regardless of previous inspections.

All materials not conforming to the specifications shall be considered as defective, and all defective material, whether in place or not, shall be rejected, and unless remedied shall be removed from the site of the Work at the Contractor's expense. Rejected material which has been reconditioned or corrected so that it satisfactorily meets the Specifications shall not be used without written approval of the City's Project Manager.

At any time during the course of a project, when, in the opinion of the City's Project Manager, provisions of the Contract documents are being violated by the Contractor or his employees, the City's Project Manager shall have the right and authority to order all construction to cease or material to be removed, until arrangements satisfactory to the City's Project Manager are made by the Contractor for resumption of the Work in compliance with the provisions of the Contract.

D. ALTERATIONS AND SUBSTITUTIONS

The City's Project Manager shall have the right to alter and modify the plans and specifications, thus making specific changes in the Work. If such changes diminish the amount of Work, the Contractor shall not file any claim for anticipated profit from such loss of Work. If such changes increase the amount of Work, such increase shall be made by Modification to the Contract.

Whenever the drawings or specifications identify a materials, article, or piece of equipment by brand name or catalog number, such identification shall define performance, quality level, or other salient requirements. The City's Project Manager may consider other products of equal performance, capacity, quality and function upon the Contractor's written substitution request. Otherwise, the Contractor shall use the identified goods, unless the City's Project Manager approves such request for substitution in writing. Upon any substitution of lesser priced goods, the City's Project Manager shall prepare a Modification deducting any resulting price differential from the Contract Sum. Otherwise, the Contractor shall provide any incidental changes or extra component parts required to accommodate the substitute without a change in the Contract Sum or Contract Time. The Contractor guarantee that approved substitutes will not affect major changes in the function or general design.

IV. CONTROL OF MATERIALS (Continued)

E. MATERIALS SUPPLIED BY THE CITY

Material or equipment furnished by the City for installation by the Contractor will be furnished in good condition and ready for installation. This material or equipment shall be picked up by the Contractor at a location within the City of Lincoln designated by the City's Project Manager.

Excess materials supplied by the City shall be returned by the Contractor to the point of receipt. The Contractor shall be issued a receipt verifying condition and measures of material returned. Materials damaged by the Contractor will not be accepted by the City and the Contractor shall be responsible for the cost or replacement of any such materials.

F. HAZARDOUS ENVIRONMENTAL CONDITIONS

The Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Document to be within the scope of the Work. The Contractor shall be responsible for a Hazardous Environmental Condition created with any materials or equipment brought to the Site by the Contractor, Subcontractors, Suppliers, or anyone else for whom the Contractor is responsible.

If the Contractor encounters a Hazardous Environmental Condition or if the Contractor or anyone for whom the Contractor is responsible creates a Hazardous Environmental Condition, the Contractor shall immediately:

1. Secure or otherwise isolate such condition.
2. Stop all Work in connection with such condition and in any area affected thereby.
3. Notify the City's Project Manager, AND any regulatory agency required by law. The City's Project Manager shall promptly determine the necessity for the City to retain a qualified expert to evaluate such conditions or take corrective action, if any.

The Contractor shall be responsible for any and all civil or criminal penalties, fines, damages, or other charges imposed by any regulatory agency or court for sewage discharges that are in violation of applicable statutes and laws and that are a result, direct or indirect, of Work performed under this Contract. The Contractor shall also be responsible for reimbursement to the City for administration, reporting, and tracking expenses required as a result of any spill event. In the event the regulatory agency or court imposes a probationary period, the Contractor shall post bond for the probationary period to ensure that all such costs are reimbursed to the City. This responsibility shall apply whether penalties are imposed directly on the Contractor or any of its Subcontractors, or the City of Lincoln. The Contractor shall defend and indemnify the City against such penalties. Regulatory agencies may include, but are not limited to, the Department of Environmental Quality and the US EPA.

V. CONTROL OF THE WORK

A. AUTHORITY OF THE CITY ENGINEER

The City Engineer is empowered to act for the Director of Public Works in implementation of **Lincoln Municipal Code 2.35.050 "Supervise Work on Public Property; Enforcement."**

When the term City Engineer is used in these specifications, only the City Engineer or his/her duly authorized representatives, referred to as the "City Engineer," shall approve any changes or alterations. The list of duly authorized representatives shall be as enacted by Public Work's most current Directorial Order.

B. AUTHORITY OF THE CITY'S PROJECT MANAGER

The City's Project Manager in this Contract is acting as an agent of the City during the construction period. The City's Project Manager shall be the judge of the character, nature and fitness of all work done and materials furnished under this contract, and of the amount, quality, and classification of the several kinds of work for which payment is made. The City's Project Manager shall decide as to the meaning, intent, and performance of this contract. The entire work shall be done to the City's Project Manager's satisfaction. The City's Project Manager shall decide all questions that may arise as to Contract fulfillment on the part of the Contractor and the City's Project Manager's decisions thereon shall be final and conclusive. Such determination shall be a condition precedent to the right of the Contractor to receive any payments hereunder. The City's Project manager shall receive advice regarding fulfillment of the Contract and acceptability of the Work from others including, but not limited to City's Engineering Inspector, Consultants, other City divisions and departments.

The City's Project Manager will have the authority to suspend the Work wholly or in part due to the failure of the Contractor to correct conditions unsafe to the general public; for failure to carry out provisions of the Contract; for failure to carry out orders; for unsuitable weather; for conditions considered unsuitable for the prosecution of the Work; or for any other reason deemed to be in the public interest, for such periods of time as the City's Project Manager deems necessary

The City's Project Manager shall decide questions, which may arise as to quality and acceptability of materials furnished and Work performed. The City's Project Manager shall hold the Contractor strictly to the intent of the Contract Documents in regard to the quality materials, Workmanship, and execution of the Work. Inspections may be made at the factory or fabrication plant of the source of material supply.

The City's Project Manager will not be responsible for the construction means, controls, techniques, sequences, or procedures, except that those procedures specifically called for in the Contract Documents shall be strictly followed. The City's Project Manager shall not be deemed authorized to modify, alter, or waive any provisions related to the City Engineer.

V. CONTROL OF THE WORK (Continued)

C. AUTHORITY OF THE CITY'S ENGINEERING INSPECTOR

The City's Engineering Inspector is an appointed agent of the City's Project Manager to inspect all Work done. The City's Engineering Inspector will keep the City's Project Manager informed as to the progress of the Work and the manner in which it is being done. Such inspection may extend to any or all parts of the Work and materials furnished, but the City's Engineering Inspector will not be authorized to revoke, alter, enlarge, or relax the provisions of these specifications. The City's Engineering Inspector is appointed for the benefit of the City and any inspections shall be for the benefit of the City. The presence of the City's Engineering Inspector shall not be used or construed as a waiver of any of the Contractor's obligations pursuant to the Contract. Failure of an City's Engineering Inspector to call the attention of the Contractor to faulty Work or lack of compliance with the plans or specifications shall not constitute acceptance of said Work. Any advice which the Inspector may give the Contractor will in no way be construed as binding the Engineer or City in any nor releasing the Contractor from the fulfillment of the terms of the said Contract. The City's Engineering Inspector shall not be deemed authorized to accept notices or waive any of the provisions hereof or modify any order or orders of said City's Project Manager or City Engineer.

1. The City's Engineering Inspector shall be authorized to:
 - a. Call the Contractor's attention to Work or materials that do not conform to the Contract.
 - b. Reject materials until the City's Project Manager is notified and decides the questions at issue.
2. The City's Engineering Inspector shall not be authorized to:
 - a. Revoke, alter, enlarge, or relax the provisions of the Contract.
 - b. Approve or accept any portion of the completed project.
 - c. Act as foreperson or perform any duties for the Contractor.

D. PRE-CONSTRUCTION AND PROGRESS CONFERENCE

Upon receipt of notification from the City's Project Manager, the Contractor or the Contractor's authorized representative shall, at no cost to the City, appear at a location and time designated by the City's Project Manager for the purpose of discussing pre-construction scheduling, traffic control procedure or methods, and project progress during construction. The Contractor or the Contractor's authorized representative shall provide, at no cost to the City, any data sheets, construction schedules, or other information deemed necessary by the City's Project Manager.

V. CONTROL OF THE WORK (Continued)

E. PROJECT COORDINATION

Whenever prosecution of Work under the Contract involves coordination and cooperation among various agencies, such as utility companies and other City departments, Subcontractors and other Contractors, the Contractor shall make every effort to coordinate his Work with that of said agencies, in order to minimize any conflicts which may arise and to provide the minimum of inconvenience to all parties involved.

Street reconstruction, excavation, or maintenance work within the parking-metered district, which may involve the use of metered parking stall space, will require that the meter be hooded or removed by the City. The Contractor shall notify the City of Lincoln Urban Development – Parking Services at least forty-eight (48) hours prior to the time which the parking space or spaces will be occupied.

Prior to any underground work or excavation of any kind, the Contractor shall notify the appropriate agencies and owners, including the One-Call Office, and shall allow personnel access to the site of the Work in order to locate any underground facilities.

F. INSPECTION TESTING AND CORRECTING WORK

The Contractor shall conduct or arrange for any tests, inspections and approvals of portions of the Work required by the Contract Documents, ordinances, rules, regulations or orders of public authorities having jurisdiction at appropriate times. All testing shall be prompt to avoid unreasonable delay in the Work. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the City, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall secure all required Certificates of testing, inspection or approval unless the Contract Documents require otherwise. The Contractor shall promptly deliver such Certificates to the City's Project Manager.

If the City or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included in the Contract Documents, the City shall instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the City. The City shall bear such costs except as provided in this section. If such testing or inspection, reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, the Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for the City's services and expenses.

If a portion of the Work has been covered that the City's Project Manager has not specifically requested to observe prior to it's being covered, the City's Project Manager may request to see such Work. Upon such request, the Contractor shall uncover the specified Work. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs. If such Work is in accordance with the Contract Documents, the City shall pay such costs.

V. CONTROL OF THE WORK (Continued)

G. CORRECTING WORK

The Contractor shall promptly correct Work rejected by the City's Project Manager or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear costs of correcting such rejected Work, including additional testing and inspections and compensation for the City's services and expenses made necessary thereby. The Contractor shall remove immediately from the site portions of the Work that are not in accordance with the requirements of the Contract Documents.

If the Contractor fails to correct non-conforming Work within a reasonable time, fixed by written notice from the City's Project Manager, the City may correct it in accordance with the Contract Documents. If the Contractor does not proceed with correction of such non-conforming Work, the City may remove it and store the salvageable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within ten days after written notice the City may sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages owed by the Contractor, including compensation for the City's Project Manager's services and expenses made necessary thereby. If such proceeds of sale do not cover costs owed by the Contractor, the City shall automatically reduce the Contract Sum by the deficiency. If the remaining Contract amounts are not sufficient to cover such costs, the Contractor shall pay the difference to the City.

The Contractor shall bear the cost of correcting any damages caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents. If there are unremedied damages caused by the Contractor, the City may offset the remaining Contract Sums to cover those damages and/or take any measures allowed by law to remedy the damages.

If the City elects in writing to accept Work that is not in accordance with the requirements of the Contract Documents, the City may do so instead of requiring its removal and correction. Upon such election, the City and the Contractor shall reduce the Contract Sum as appropriate and equitable. The City and the Contractor shall make such adjustment whether or not the City has made final payment under the Contract Documents. The Contractor shall pay the difference, if any, to the City within 10 days from such adjustment.

H. CONTRACTOR'S USE OF PUBLIC AND PRIVATE UTILITIES

The Contractor will be responsible for arrangements for all temporary service connections for various utilities and is responsible for all necessary payments to the various utility companies for such temporary services. The City may provide a Contractor with a method or process for reimbursement of certain utility payments.

Prior to the use of any City water from a fire hydrant, the Contractor shall take out the necessary permit for a hydrant meter and valve from the Lincoln Water System.

The Contractor shall pay the permit fees which are established by the Lincoln Water System for the installation or moving of hydrant meters and valves.

The Contractor shall not operate the hydrant, but shall use the exterior valve to control the flow of water. The Contractor shall be liable for any damage to the meter and valve.

V. CONTROL OF THE WORK (Continued)

I. SHOP DRAWINGS

The Contractor, as soon as possible, shall submit to the City's Project Manager all shop or other drawings and schedules required for the Work, including those pertaining to structural and reinforcing steel. The need for more than one resubmittal or any other delay in obtaining the City's Project Manager's review of submittals will not entitle the Contractor to an extension of the Contract time. The Contractor shall make any corrections in the drawings required by the City's Project Manager and resubmit the same without delay. Catalog sheets or other descriptive data shall be furnished on all equipment to be installed. Such material shall be in sufficient detail to accurately describe the materials and method of operation of the equipment.

At least three (3) final copies of all shop or setting drawings shall be submitted to City's Project Manager who, after checking, will retain two (2) copies and return the other copy to the Contractor. The City's Project Manager's approval of shop drawings of equipment and material shall extend only to determining the conformity of such equipment and materials with the general features of the design drawings prepared by the City's Project Manager. It shall be the responsibility of the Contractor to determine the correctness of all dimensions and minor details of such equipment and materials so that, when incorporated in the Work, correct operation will result. Approval by the City's Project Manager will not relieve the Contractor of any responsibility for the proper performance or functioning of the completed project.

The Contractor shall obtain the City's Project Manager's approval before beginning any portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals.

J. COORDINATION WITH OTHERS

The City may require the Contractor to coordinate with other Contractors, Public or Private Entities at or near the Work site.

VI. LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

A. PROTECTION FROM LOSS

The Contractor shall protect all parts of the Work from loss by theft or otherwise, and shall assume all risks for repair and replacement for damage to the same, whether caused by lightning, fire, wind, water, theft, vandalism, or other causes, until completion and acceptance of the Work.

B. ASSUMPTION OF LIABILITY AND INDEMNIFICATION

The Contractor shall indemnify, defend and save harmless the City of Lincoln, Nebraska from and against all losses, claims, damages, and expenses, including attorney's fees, arising out of or resulting from the performance of the Contract that results in bodily injury, sickness, disease, death, or injury to or destruction of tangible property, including the loss of use resulting there from and is caused in whole or in part by the Contractor, any Subcontractor, any directly or indirectly employed by any of them or anyone for whose acts any of them may be liable. This section will not require the Contractor to indemnify or hold harmless the City of Lincoln for any losses, claims, damages, and expenses arising out of or resulting from the sole negligence of the City of Lincoln, Nebraska.

C. CONTRACTOR'S INSURANCE

The Contractor shall not commence Work under this Contract until he has obtained all insurance required under this article or as may be required elsewhere in the Contract Documents, until such insurance has been approved by the City. The Contractor shall not allow any Subcontractor to commence Work on his subcontract until all similar insurance required of the Subcontractor has been so obtained with the amount specified in the Contract Document.

D. PATENTED DEVICES, MATERIALS, AND PROCESSES

It is mutually understood and agreed that, without exception, Contract prices are to include all royalties and costs arising from patents, trademarks, and copyrights in any way involved in the Work. It is the intent that whenever the Contractor is required or desires to use any design device, material, or process covered by letters, patent, or copyright, the right for such use shall be provided for by legal agreement with the patentee or owner, however, whether or not such an agreement is made as noted, the Contractor and the surety in all cases shall indemnify, defend and save harmless the City from any and all claims for infringement by reason of the use of any such patented design, device, material, or process, or any trademark or copyright, in connection with the Work agreed to be performed under the Contract, and shall indemnify the City for any costs, expenses, and damages which it may be obligated to pay, by reason of any such infringement, at any time during the prosecution or after the completion of the Work.

VI. LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC (Continued)

E. INDEPENDENT CONTRACTORS

The City is interested only in the results obtained and the Contractor shall perform as an independent Contractor with the sole control of the manner and means of performing the Work required under the Contract. The Contractor shall complete the Contract according to its own means and methods of Work, which shall be in the exclusive charge and control of the Contractor and which shall not be subject to control or supervision by the City except as to the results of the Work. The Contractor is, for all purposes arising out of the Contract, an independent Contractor, and the Contractor or any Subcontractor, agent, employee or representative and employees or agents of any of them shall not be deemed an employee of the City.

It is expressly understood and agreed that the Contractor shall in no manner be entitled to any benefits to which the City's employees are entitled including, but not limited to, overtime, any retirement benefits, Workers' compensation benefits and injury leave, or other benefits.

F. PROTECTION OF WORK, PROPERTY, AND PERSONS

The Contractor shall protect and support all water, sewer, gas and other pipes and structures; telephones, cable, fiber optic or electric power lines; all railroad tracks, pavement, building walls, fences, utilities, or other properties, public or private, which may be damaged during the execution of this Work. During all operations under the Contract, the Contractor shall carefully protect all trees, shrubbery, sod, plantings, etc., not designated to be removed as part of the Work of the Contract, and he shall assume full responsibility for their damage or destruction.

In the event of any damage or injury to any property as a result of the Work under this Contract, the Contractor shall promptly have the same repaired at his expense to the satisfaction of the City's Project Manager. If there are unremedied damages to public property caused by the Contractor, the City may offset the remaining Contract Sums to cover those damages and/or take any measures allowed by law to remedy the damages. He shall take all reasonable and proper precautions to protect persons, and property from injury, and any damage. The Contractor must keep fire hydrants and inlets free from unnecessary encumbrance.

Existing sub-surface structures in the vicinity of the Work to be done are shown on the plans in accordance with the best information available to the City. The City does not, however, guarantee the completeness or accuracy of this information. Any delay or extra cost to the Contractor due to encountering structures differing from those shown on the plans shall not constitute a claim for extra payment. The location of house sewer connections, water services, underground sprinklers and gas services are not definitely known and no attempt is made, therefore, to indicate such connections and services on the plans.

G. COMPLIANCE WITH LAWS

The Contractor and his employees shall comply with all Federal, State and local laws and regulations, and shall require all Subcontractors and all their employees likewise to comply.

VI. LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC (Continued)

H. FAIR EMPLOYMENT PRACTICES

The Contractor and the Subcontractors shall not discriminate against any employee or applicant for employment, to be employed in the performance of the Contract, with respect to his hire, tenure, terms, conditions, or privileges of employment, because of race, color, religion, sex, disability, age, ancestry, marital status or national origin, pursuant to the requirements of Section 48-1122, Nebraska Reissue Revised Statutes and Section 48 as amended.

I. FAIR LABOR STANDARDS

The Contractor and the Subcontractors shall maintain Fair Labor Standards in the performance of the Contract, as required by Nebraska Revised Statutes § 73-102 through 104 as amended.

J. EQUAL EMPLOYMENT AND LIVING WAGE

Each bidder shall comply with the requirements of Lincoln Municipal Code Title 11, Equal Opportunity, in the performance of the Work under the Contract. Failure of the successful bidder to abide by the requirements during the Contract period shall be deemed to be a substantial and willful violation of the requirements of the Contract Documents, and may result in termination of the Contract.

This Contract is subject to the Living Wage Ordinance of the Lincoln Municipal Code. The Ordinance requires that, unless specific exemptions apply or a waiver is granted, all employers (as defined) under service Contracts shall provide payment of a minimum living wage to employees. Such rate shall be adjusted annually pursuant to the terms of the Lincoln Living Wage Ordinance of the Lincoln Municipal Code.

Under the provisions of the Lincoln Living Wage Ordinance, the City shall have the authority, under appropriate circumstances, to terminate this Contract and to seek other remedies as set forth therein, for violations of the Ordinance.

K. UNEMPLOYMENT CONTRIBUTION

The Contractor and Subcontractors shall pay to the Unemployment Fund of the State of Nebraska unemployment contributions and interest due under the provisions of Section 48-601 through 48-671, Nebraska Reissue Revised Statutes of 1943, on wages paid to individuals employed in the performance of the Contract.

VI. LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC (Continued)

L. ASSIGNMENT OF CONTRACTS

No assignment by the Contractor of any Contract, or any part thereof, or of the funds to be received there under by the Contractor, will be recognized unless such assignment has had the written approval of the Mayor and the Surety has been given due notice of such assignment and has furnished written consent thereto.

Such written approval by the Mayor shall not relieve the Contractor of the obligations incurred by him under the terms of this Contract. In addition to the usual recitals in assignment Contracts, the following language must be set forth:

"It is agreed that the funds to be paid to the assignee under this assignment are subject to a prior lien for services rendered or materials supplied for the performance of the Work called for in said Contract in favor of all persons, firms, or corporations rendering such services or supplying such materials."

M. PERMITS AND LICENSES

Permits and licenses necessary for prosecution of the Work shall be secured and paid for by the Contractor unless otherwise stated. Permits, licenses, easements (both permanent and temporary), and rights-of-way of a permanent nature shall be secured and paid for by the City. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn and specified. If the Contractor observes that the Contract Documents are in variance with any laws, ordinance, rules or regulations, he shall promptly notify the City's Project Manager in writing and any necessary changes shall be accomplished as provided in these specifications.

N. PAYMENT OF BILLS

The Contractor shall pay and shall indemnify and save harmless the City for all labor, materials, equipment, and supplies actually used or rented in the performance of the Work, including all insurance premiums on insurance required by the Contract Documents, and shall furnish to the City, when required, satisfactory evidence that all persons, firms, or organizations who have done Work or furnished materials, equipment, or supplies in the performance of the Work, or have provided any such required insurance, have been fully paid or satisfactorily secured. In case such evidence is not furnished, an amount necessary or sufficient shall be retained from any amounts which may be due the Contractor to meet the claims of the persons, firms, or organizations aforesaid, in addition to any other monies which are to be retained as otherwise specified in the Contract Documents, until the liabilities aforesaid shall be fully discharged or satisfactorily secured.

VI. LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC (Continued)

O. STANDARD MANUFACTURER

Wherever the terms "standard," "recognized," or "reputable" manufacturer are used, they shall be construed as meaning manufacturers who have been engaged in the business of fabricating materials, equipment, or supplies of the nature called for by the specifications for a reasonable period of time prior to the date set for opening bids, and who can demonstrate to the satisfaction of the City's Project Manager that said manufacturer has successfully installed equipment, materials, or supplies of the type proposed to be furnished in at least three instances, and that the performance of such materials, equipment, or supplies has been satisfactory. Manufacturers who have been engaged in the business of manufacturing said materials, equipment, or supplies for a period of over twelve (12) months prior to the date fixed for opening bids shall, prima facie, be deemed to have been engaged in such business for a reasonable length of time.

P. "OR EQUAL" CLAUSE

Whenever, in any section of the Contract Documents, plans, or specifications, any article, material, or equipment is defined by describing a proprietary product, or by using the name of a manufacturer or vendor, the term "or approved equal," if not inserted, shall be implied. The specific article, material, or equipment mentioned shall be understood as indicating the type, function, minimum standard of design, efficiency, and quality desired, and shall not be construed in such a manner as to exclude manufacturer's products of comparable quality, design, and efficiency. The City shall determine the acceptability of articles, materials, or equipment proposed as equals.

Q. SANITARY CONVENIENCES

The Contractor shall supply and maintain adequate sanitary facilities by providing temporary and portable units on the Work site to comply with current City-County Health Department and State Department of Health requirements and regulations. These facilities are to be made available for the Contractor's employees and project personnel.

R. EXECUTIVE ORDERS

Any Work to be performed within the limits of, crossing over, or intended to occupy the public right-of-way shall be guided and governed by these standard specifications and general conditions. The Director of Public Works and Utilities reserves the right to approve or disapprove any such Work performed within the public right-of-way, even though, as in the case of certain Executive Orders, the City is not a party to the Contract. While the City may not actually be party to the Contract, this fact shall not in any way relieve the Contractor from wholly satisfying all the standards and conditions set forth in these specifications.

VI. LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC (Continued)

S. PURCHASING AGENT APPOINTMENT AND EXEMPT SALES CERTIFICATE

The Contractor performing the Work for the City of Lincoln, Nebraska, except for Work performed for the Lincoln Water System, will be issued a Purchasing Agent Appointment and Exempt Sales Certificate signed by the Purchasing Agent of the City. It is to be used by the Contractor and his Subcontractors when purchasing tangible personal property to be actually incorporated into the Contract Work, including materials incidental but necessary to the performance of the Contract, provided that such materials are actually incorporated into the Contract Work. It does not apply to either (1) the purchase of materials to be used but not incorporated into the Contract Work, including but not limited to form lumber, scaffolding, etc., or (2) the purchase or rental of machinery, equipment, or tools owned or leased by the Contractor or his Subcontractors and used in performing the Contract Work.

Purchases qualifying as aforesaid shall be considered as being made by the City. The City shall be obligated to the vendor for the purchase price, but the Contractor or Subcontractor, as the case may be, shall handle all payments therefore on behalf of the City. The vendor shall agree to make demand or claim for payment of the purchase price from the City by submitting an invoice to the Contractor or Subcontractor. Title to all materials and supplies so qualifying shall vest in the City directly from the vendor. Regardless of the method of payment, title shall vest immediately in the City. The Contractor or Subcontractor shall not acquire title to any materials incorporated into the project. All invoices shall bear the Contractor's or Subcontractor's name as agent for the City.

The Contractor may reproduce copies of this Contract Agreement and of the original of the aforesaid Appointment and Certificate to furnish to his suppliers on each invoice or order. The Contractor shall enter the supplier's (the vendor's) name and address, the date, the invoice or order number, a description of the items, and the amount, in the spaces provided and shall sign the certificate on the line provided for the "Purchaser's Agent."

The Contractor shall provide each Subcontractor with a copy of this Contract Agreement and of said Appointment and Certificate, and on each Subcontractor's copy of said Appointment and Certificate the Contractor shall add the Subcontractor's name and address in the places provided therefore. Each Subcontractor is hereby given the authority to reproduce copies of the copy of said Appointment and Certificate thus provided him by the Contractor and to furnish the same to his (the Subcontractor's) suppliers on each invoice or order; and the Subcontractor shall complete and sign the same for his purchases in like manner as above set forth for the Contractor.

T. WEED CONTROL

During the construction of the project the Contractor shall control all vegetation so as to comply with City regulations. The areas to be controlled are the public rights-of-way within the project limits and the easements acquired for the construction or any areas (so designated on plans or specifications) as deemed necessary by the City's Project Manager.

No direct payment shall be made for this Work, but shall be considered subsidiary to other items of Work for which direct payment is made.

VI. LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC (Continued)

U. SNOW REMOVAL

During the construction of the project, the City's Project Manager will advise the Contractor of the level of maintenance that shall be required during construction. The Contractor shall be responsible for snow removal and any material spreading that may be needed to provide safe access to the residences or businesses within the limits of the project. The Contractor shall notify the Engineer regarding the manpower, equipment and material necessary to attain that level of maintenance. Payment shall be made for this work as Extra Work.

V. AUDIT BOARD

The Contractor shall be subject to audit pursuant to Chapter 4.66 of the Lincoln Municipal Code and shall make available to a contract auditor, as defined therein, copies of all financial and performance related records and materials germane to the contract/order, as allowed by law.

W. E-VERIFY

In accordance with Neb. Rev. Stat. 4-108 through 4-114, the contractor agrees to register with and use a federal immigration verification system, to determine the work eligibility status of new employees performing services within the state of Nebraska. A federal immigration verification system means the electronic verification of the work authorization program of the Illegal Immigration Reform and Immigration Responsibility Act of 1996, 8 U.S.C. 1324 a, otherwise known as the E-Verify Program, or an equivalent federal program designated by the United States Department of Homeland Security or other federal agency authorized to verify the work eligibility status of a newly hired employee pursuant to the Immigration Reform and Control Act of 1986. The Contractor shall not discriminate against any employee or applicant for employment to be employed in the performance of this section pursuant to the requirements of state law and 8 U.S.C.A 1324b. The contractor shall require any subcontractor to comply with the provisions of this section.

VII. PROSECUTION AND PROGRESS OF WORK

A. NOTIFICATION

The Contractor shall keep the City's Project Manager informed, forty-eight (48) hours in advance, of the times and places at which he intends to Work in order that inspections may be arranged, lines and grades may be furnished, detours established if needed, and necessary measurements made with the minimum of inconvenience to the City's Project Manager and delay to the Contractor.

Notice of intention to start Work in a new location or to resume Work on a job which has been suspended temporarily for any reason must be given to the City's Project Manager at least forty-eight (48) hours in advance unless otherwise approved by the City's Project Manager.

For any Work that requires construction within the public right-of-way, forty-eight (48) hours advance notice shall be given to the City's Project Manager. For any Work that requires closing of any portion of a street, permission shall be obtained from the City Engineer, thru the City's Project Manager.

Any Work done without proper notification or without being properly located and established by base lines, offset stakes, bench marks, or other basic reference points, may be ordered removed and replaced at the Contractor's expense.

B. COMMENCEMENT

The Work under the Contract shall begin after the date stated in the written Notice to Proceed. Such Work shall be completed and accepted within the limit and before the completion date stated in the Contract Agreement.

The Contractor shall begin the Work at such locations and proceed with the Work conforming to such schedules as may be approved by the City's Project Manager.

C. DELAYS

The Contractor shall not be entitled to any claims against the City for damages for hindrances or delays, from any cause whatsoever, in the progress of the Work or any portion thereof.

VII. PROSECUTION AND PROGRESS OF WORK (Continued)

D. SUPERVISION AND DISCIPLINE BY CONTRACTOR

The Contractor shall supervise and direct the Work under the supervision of a Site Supervisor, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and shall have control over construction means, methods, techniques, sequences, coordination, and procedures for all portions of the Work.

The Contractor shall be responsible to the City for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work under a Contract with the Contractor.

E. WINTER CONSTRUCTION - SUSPENSION OF WORK

Suspension of Work for the winter period is due to general unsuitable weather, conditions unsuitable for prosecution of the Work, and other reasons that are in the public interest. Suspension of Work for the winter period is not automatic and shall be requested by the Contractor.

The winter period shall be considered from December 1st to March 15th for Utility Work.

The winter period shall be considered from November 1st to April 1st for Paving Work.

1. Suspension of Work during the winter construction period may be requested by the Contractor. The request must be made in writing to the City's Project Manager and shall include the beginning date and duration. If Work is to be resumed prior to expiration of time requested, forty-eight (48) hours written notice of such intent will be required.
2. The Contractor shall be required to restore all vehicular and pedestrian facilities to full use by either permanent or temporary restoration before the suspension period will become effective.
3. Prior to suspension the City's Project Manager will advise the Contractor of the level of maintenance that shall be required during suspension. The Contractor shall be responsible for snow removal and any material spreading that may be needed to provide safe access to the residences or businesses within the limits of the project. The Contractor shall notify the City's Project Manager regarding the manpower, equipment and material necessary to attain that level of maintenance. Payment shall be made for this work as Extra Work.
4. The City's Project Manager shall state to the Contractor, in writing, the effective suspension date and the date on which the suspension expires and the new adjusted completion date. Calendar Days included in the period that Work is actually suspended shall be counted from the effective suspension date, and the governing completion date shall be adjusted accordingly. In no case shall a granted suspension of Work be cause for requesting or granting additional Calendar Days for completion of this Contract.

VII. PROSECUTION AND PROGRESS OF WORK (Continued)

F. EXTENSION OF TIME

The time for completion of the Work may be extended upon written request from the Contractor to the City's Project Manager, provided the request is based on delays or suspensions that are no fault of the Contractor; and such delays shall include, but not be limited to, acts or neglects of the City or others performing additional Work, site conditions not under the control of the Contractor, or to fires, floods, labor disputes, epidemics, abnormal weather conditions or acts of God. The length of such extension, if approval is recommended by the City's Project Manager, shall be the equivalent number of Working days, if the Contract time is expressed in Working days, or the equivalent number of Calendar Days, if the Contract time is expressed in Calendar Days or is expressed as a specific completion date, during which the Work was suspended, or in proportion to the amount of Extra Work compared to the amount of the original Contract. Requests for extensions in completion dates shall be made within twenty (20) days of occurrence.

Certain delays will not be justified for extension of time. Such delays, shall include, but not limited to:

1. Delays caused by a Subcontractor.
2. Inadequate construction force.
3. Failure to place orders for equipment or materials in a timely manner.
4. Normal periods of adverse weather.
5. Subsurface or otherwise concealed subsurface conditions which are not unusual.

VII. PROSECUTION AND PROGRESS OF WORK (Continued)

G. LIQUIDATED DAMAGES

If the Contractor fails to complete the Work in a timely manner, according to the Contract (allowing for any approved extensions of time), the Contractor shall pay Liquidated Damages for each day that the Work remains incomplete. The City shall deduct the amount of Liquidated Damages due from the money due the Contractor prior to final payment. If the remaining amount due the Contractor is less than the total amount of Liquidated Damages, the Contractor shall pay the difference within 10 days. If the Contractor fails to pay such difference, the City shall have the right to recover the difference from the Contractor or his Surety.

Unless specifically amended or modified by special provision, the daily amount of the Liquidated Damages shall be as follows:

1. Contract Sum up to and including \$100,000: \$300/day
2. Contract Sum more than \$100,000 up to and including \$500,000: \$500/day
3. Contract Sum more than \$500,000 up to and including \$1,000,000: \$750/day
4. Contract Sum more than \$1,000,000: \$1,000/day

The Liquidated Damages provided herein are not considered punitive. The Contractor agrees that such damages are predetermined and reasonable amounts to compensate for the detriment to the public and to defray expenses incurred by the City due to the delay in the completion of the Work.

H. TERMINATION FOR CAUSE

1. The City may terminate the Contract if the Contractor:
 - a. Refuses or fails to supply enough properly skilled Workers or proper materials;
 - b. Fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
 - c. Disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or
 - d. Otherwise commits a substantial breach of any provision of the Contract Documents.
2. When any of the above reasons exist, the City without prejudice to any other rights or remedies of the City may (after giving the Contractor and the Contractor's surety, if any, seven days' written notice) terminate employment of the Contractor. In addition the City may (subject to any prior rights of the surety):
 - a. Take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
 - b. Accept assignment of subcontracts; and
 - c. Finish the Work by whatever reasonable method the City may deem expedient.

VII. PROSECUTION AND PROGRESS OF WORK (Continued)

H. TERMINATION FOR CAUSE (Continued)

3. If the Contract is terminated by the City as provided in this section, the Contractor shall not be entitled to receive any further payment until the expiration of 35 days after Final Completion and acceptance of all Work by the City.

If the unpaid balance of the Contract Sum exceeds the cost of completing the Work, including all additional costs and expenses made necessary thereby, including costs for City staff time, plus all losses sustained, including any liquidated damages provided under the Contract Documents, such excess shall be paid to the Contractor. If such costs, expenses, losses, and liquidated damages exceed the unpaid balance of the Contract Sum, the Contractor shall pay such excess to the City.

If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination has been issued for the convenience of the City.

No termination or action taken by the City after termination shall prejudice any other rights or remedies of the City provided by law or by the Contract Documents upon such termination; and the City may proceed against the Contractor to recover all losses suffered by the City.

I. TERMINATION BY THE CITY FOR CONVENIENCE

1. The City may at its option, terminate this Contract in whole or in part at any time without cause by written notice thereof to the Contractor.

Upon any such termination, the Contractor agrees to waive any claims for damages, including loss of anticipated profits, on account thereof, and as the sole right and remedy of the Contractor, the City shall pay the Contractor in accordance with this Paragraph. The provisions of the Contract which by their nature survive final acceptance of the Work, shall remain in full force and effect after such termination to the extent provided in such provisions.

Upon receipt of any such notice of termination, the Contractor shall, unless the Notice directs otherwise, immediately:

- a. Discontinue the Work to the extent specified by the City;
- b. Place no further orders or subcontracts for materials, equipment, services or facilities, except as may be necessary for completion of that portion of the Work, if any, the City has directed not to be discontinued;
- c. Promptly make every reasonable effort to procure cancellation upon satisfactory terms as determined by the City of all orders and subcontracts not related to that portion of the Work, if any, the City has directed not to be discontinued;

VII. PROSECUTION AND PROGRESS OF WORK (Continued)

I. TERMINATION BY THE CITY FOR CONVENIENCE (Continued)

- d. Do only such other activity as may be necessary to preserve and protect Work already in progress and to protect materials and plants and equipment on the Project Site or in transit thereto.

Upon such termination, the obligations of the Contract shall continue as to portions of the Work already performed and as to bona fide obligations the Contractor assumed prior to the date of termination.

Upon termination, the City shall pay the Contractor the full cost of all Work properly done by the Contractor to the date of termination not previously paid for by the City.

If at the date of such termination the Contractor has properly prepared or fabricated off site any goods for subsequent incorporation in the Work, the City may direct the Contractor to deliver such goods to the Site or to such other place as the City may reasonably determine, whereupon the City shall pay to the Contractor the cost for such goods and materials.

2. Upon such termination, the City shall pay to the Contractor the sum of the following:

- a. The amount of the Contract Sum allocable to the portion of the Work properly performed by the Contractor as of the date of termination, less sums previously paid to the Contractor.
- b. Previously unpaid costs of any items delivered to the Project site which was fabricated for subsequent incorporation in the Work.
- c. Any proven losses with respect to materials and equipment directly resulting from such termination.
- d. Reasonable demobilization costs.

The above payment shall be the sole and exclusive remedy to which the Contractor is entitled in the event of termination of the Contract by the City pursuant to this provision; and the Contractor will be entitled to no other compensation or damages and expressly waives same.

J. CLAIMS & DISPUTES

The Contractor and the City shall make any Claim against the other party in writing giving a description thereof. The claimant may make a Claim only within twenty-one (21) days after occurrence of the event giving rise to such Claim or within twenty-one (21) days after the Claimant first recognizes the condition giving rise to the Claim, whichever is later.

Pending final resolution of a Claim (unless the Parties otherwise agree in writing) the Contractor shall proceed diligently with performance of the Contract and the City shall continue to make payments in accordance with the Contract Documents.

VII. PROSECUTION AND PROGRESS OF WORK (Continued)

J. CLAIMS & DISPUTES (Continued)

When the City makes final payment and the Contractor accepts the same, the City and the Contractor thereby waive all claims except those arising from:

1. Unsettled liens, Claims, security interests or encumbrances arising out of the Contract;
2. Failure of the Work to comply with the requirements of the Contract Documents; or
3. Terms of special guarantees required by the Contract Documents.

If either party encounters or discovers (1) subsurface or otherwise concealed physical conditions which differ materially from the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherently encountered in the Work, then the observing party shall give prompt notice of the condition to the City's Project Manager and the other party by giving a description thereof. The observing party shall give such notice promptly before conditions are disturbed and in no event later than twenty-one (21) days after first observance of the same.

If the Contractor wishes to make Claim for an increase in the Contract Sum, the Contractor shall provide written notice as provided herein before proceeding to execute the Work. Written notice is not necessary for emergencies endangering life or property. The Contractor may make claims for additional cost for reasons including but not limited to (1) a written opinion from the City's Project Manager, (2) an order by the City to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the City's Project Manager, (4) failure of payment by the City, (5) termination of the Contract by the City, (6) City's suspension or (7) other reasonable grounds.

If the Contractor wishes to make Claim for an increase in the Contract Time, the Contractor shall give written notice as provided herein. The Contractor's Claim shall include an estimate of cost and delay on the Work, if any. In the case of a continuing delay only one Claim is necessary.

If the Contractor bases a Claim for additional time on adverse weather, the Contractor shall substantiate such Claim with data substantiating that: (1) the adverse weather was abnormal for the period of time, (2) the Contractor could not have reasonably anticipated the adverse weather, and (3) the weather had an adverse effect on the scheduled construction.

If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, of any of the other party's employees or agents, or of others for whose acts such party is legally liable, the claimant shall give written notice of such injury or damage (whether or not insured) to the other party within twenty-one (21) days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If the claimant asserts additional cost or time related to such injury or damage, the claimant shall file a separate claim for each.

VII. PROSECUTION AND PROGRESS OF WORK (Continued)

K. RESOLUTION OF CLAIMS AND DISPUTES

The City's Project Manager shall review Claims and take one or more of the following preliminary actions within ten days after receipt of a Claim: (1) request additional supporting data from the Claimant, (2) submit a schedule to the parties indicating when the City's Project Manager expects to take action, (3) reject the Claim in whole or in part, stating reasons for rejection, (4) recommend approval of the Claim by the other party or (5) suggest a compromise. The City's Project Manager may also, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim.

If the City and the Contractor resolve the Claim, the City's Project Manager shall prepare a Change Order or other documentation accordingly.

If the City and the Contractor do not resolve the Claim after consideration of the foregoing, either party may seek a judicial resolution of any Claim. Any Claim against the City shall comply with the provisions of *Neb. Rev. Stat. § 15-840 et seq.* and other applicable laws relating to claims against the City.

VIII. GUARANTEE AND PAYMENT

A. GUARANTEE

These guarantees shall not limit the City's rights with respect to latent defects, gross mistakes, or fraud.

1. All Work

Unless specified otherwise in the Contract Documents, the Contractor shall guarantee the Work for a period of one year after: Final Completion of the Work or a designated portion thereof. Nothing contained in this paragraph shall establish a period of limitation with respect to other obligations that the Contractor might have under the Contract Documents.

2. Utility Construction

The Contractor guarantees all utility construction, against defects in material or Workmanship for a period of two (2) years from the date of the approval and acceptance by the proper authority of the Work performed under the Contract Documents; and he also guarantees against damage, during the two-year (2) guarantee period, structures, all backfilled trenches and all sidewalks, pavement, and driveways judged by the City's Project Manager to have been a part of, in close proximity to, or built subsequent to the Work performed under the Contract Documents. The Contractor guarantees all traffic and non-owner supplied street lighting materials for two (2) years from the date of approval and acceptance. The Contractor shall bear the entire expense and cost of all repairs, which may from imperfection in Work or material, become necessary within that time.

3. Asphaltic Paving and Resurfacing

The Contractor guarantees all paving construction against defects in material or Workmanship for a period of two (2) years from the date of the approval and acceptance of the Work performed under the Contract Documents. The Contractor shall bear the entire expense and cost of repairing any surface cracks that develop in the asphalt surface within such guarantee period. The cracks shall be carefully cleaned of foreign material and filled with emulsified asphalt crack filler or asphalt cement. All of this Work shall be performed at the direction and to the satisfaction of the City's Project Manager.

4. Portland Cement Concrete (PCC) Pavement

The Contractor guarantees all paving construction against defects in materials or Workmanship for a period of two (2) years from the date of the approval and acceptance of the Work performed under the Contract Documents.

The Contractor shall bear the entire expense and cost of repairing any random surface cracks or spalling that develops in the finished slab. The cracks shall be routed and filled with a joint sealer meeting the requirement as specified in Chapter 4 of these Standard Specifications. The Contractor shall reseal all transverse and longitudinal joints that are showing signs of any separation. All such joints shall be resealed with the same product that the Contract required, or a similar substitute as approved by the City's Project Manager.

VIII. GUARANTEE AND PAYMENT (Continued)

A. GUARANTEE (Continued)

5. Procedure

If at any time within the period of guarantee, any of the Work included in the guarantee shall require any repair or reconstruction, the City's Project Manager shall notify the Contractor to make the repairs required. Upon receipt of such notice, the Contractor shall proceed with such repairs and shall complete the same within a time fixed by the City's Project Manager, all at the Contractor's cost and expense.

If the Contractor shall neglect or fail to proceed with such repairs, then the City shall have the right to cause such repairs to be made in such manner as it deems best and the whole cost thereof shall be paid directly by the Contractor or reimbursed by him to the City; and if the Contractor neglects or refuses to do so, such cost shall be paid by the Contractor's Surety on the performance bond required by the Contract Documents. The liability of such bond shall continue during the full guarantee period.

It shall be the duty of the Contractor to notify the City's Project Manager in writing within thirty (30) days prior to the expiration of the guarantee period to make a final inspection of the Work. If the Contractor does not furnish such notice, the obligation to maintain such Work in proper condition shall continue in force until such notice shall have been issued as above provided. If the end of the guarantee period falls between December 1st and April 30th, then such period may not be considered as expired until May 1st following, and the thirty (30) days' notice must be served upon the City's Project Manager the month preceding that date.

B. SUBSTANTIAL COMPLETION

When the Contractor considers that the Work (or a portion thereof that the City agrees to accept separately) is substantially complete, the Contractor shall prepare and submit to the City's Project Manager a comprehensive list of items to be completed or corrected. The Contractor shall proceed promptly to complete and correct items on the list. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Upon receipt of the Contractor's list, the City's Project Manager shall make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the City's Project Manager's inspection discloses any item that does not comply with the Contract Documents (including any items on the Contractor's list) the Contractor shall complete or correct such item upon the City's Project Manager's written notification. Once corrected or completed, the Contractor may submit a request to the City's Project Manager for another inspection to determine Substantial Completion.

VIII. GUARANTEE AND PAYMENT (Continued)

B. SUBSTANTIAL COMPLETION (Continued)

When the Work or designated portion thereof is substantially complete, the City's Project Manager may prepare a Certificate of Substantial Completion. Upon the City's approval, such Certificate shall establish: (1) the date of Substantial Completion; (2) responsibilities of the Contractor for security, maintenance, heat, utilities, damage to the Work and Insurance; and (3) the time for the Contractor to finish all items on the list accompanying the Certificate.

Guarantees provided in the Contract Documents shall commence on the date of Substantial Completion unless otherwise provided in the Certificate of Substantial Completion. The Contractor shall accept the Certificate of Substantial Completion and the responsibilities assigned in such certificate by signing the same. The City's Project Manager shall submit the Certificate to the Contractor for such acceptance.

The City shall make payment for the Work as certified in the Certificate of Substantial Completion upon the Contractor's written application and the City's Project Manager's Certificate for payment as provided in the Contract Documents.

The Contractor shall secure and deliver to the City any written guarantees from Subcontractors, Sub-Subcontractors and suppliers. Such guarantees shall state the period of guarantee as required by the Contract Documents or otherwise as the City has agreed. The Contractor guarantees all of the Work regardless of separate guarantees by Subcontractors at any tier.

C. ACCEPTANCE OF WORK

All Work shall be deemed as having been fulfilled and met when the Work is accepted by the City by formal action of the City's Project Manager that the Work be finally accepted. Upon acceptance of the Work by the City, ownership of the Work shall pass to the City.

No Work shall be accepted until the City's Project Manager has completed the final inspection and notified the Contractor of satisfactory completion of same; if any areas of concern for Workmanship or materials exist at the time of final inspection, the City's Project Manager shall notify the Contractor, in writing, of remaining deficiencies.

The Contractor shall correct all deficiencies. No Work shall be accepted until the final completion of the whole; and inspection during construction or partial payment for Work or materials shall not imply any acceptance of same.

D. PROGRESS PAYMENT

Providing the Work herein contracted for is being performed in accordance with the provisions of the Contract Documents, the City's Project Manager may make an approximate estimate of the value of the Work performed during the previous month. After each estimate has been approved by the City, the City may then pay to the Contractor, in City warrants, ninety-five percent (95%) of the value of the Work completed to date. The City may, at all times, reserve and retain out of said payment all such sums as, in the judgment of the City's Project Manager, will be adequate to insure completion of the Work. Retainage amounts may be reduced with the written request of the Contractor and agreement by the City's Project Manager in advance of project completion. Consideration will be given to time frames of Work completion in relationship to the total Work.

VIII. GUARANTEE AND PAYMENT (Continued)

D. PROGRESS PAYMENT (Continued)

The City may include in progress payments the invoiced value of materials on hand and properly stored and to be used solely on the contracted project, so long as the unit bid price is not exceeded.

The Contractor may request semi-monthly progress payments. Such requests shall be made in writing to the City's Project Manager.

If the City's Project Manager certifies the project is substantially complete and provided a final payment will be delayed more than sixty (60) days because of project complexities or the determination of final costs and quantities, the City's Project Manager may authorize payment in an amount not to exceed ninety-nine percent (99%) of the value of the Work performed.

E. FINAL PAYMENT

1. Lump Sum Contracts.

The City's Project Manager shall, as soon as practicable after the completion and final acceptance of the Work, make a final payment for the amount of Work done under the Contract Documents. Final payment shall be determined and executed by change order or by executive order.

2. Unit Price Contract.

When all the Work under the Contract Documents is completed and accepted, the City's Project Manager shall determine the final quantities of the various items of Work performed. He shall have prepared a final estimate of the total amount due the Contractor, which estimate shall be based on the final quantities and Contract unit prices, together with the value of any extra Work. Final payment shall be determined and executed by change order or executive order.

3. All Contracts.

When the final payment has been approved by the City, the City will pay to the Contractor, all amounts accruing under the Contract Documents, less authorized adjustments to reflect properly the amount of Work done less liquidated damages and less all previous progress payments. All prior estimates shall be subject to correction in the final estimate and payment.

4. Waiver of Claims.

The making and acceptance of final payment shall constitute:

- a. A waiver of all claims by the City against the Contractor other than those arising from defective Work appearing after the final inspection or from failure to comply with the requirements of the Contract documents or the terms of any special guarantees specified therein, and
- b. A waiver of all claims by the Contractor against the City.

IX. MISCELLANEOUS

A. AUDIT/EXAMINATION OF RECORDS

Whenever the City enters into any type of contractual arrangement, the Contractor's records shall, upon reasonable notice, be open to inspection and subject to audit and/or reproduction during normal business Working hours. Such audits may be performed by a City's representative or an outside representative engaged by the City. The City or its designee may conduct such audits or inspections throughout the term of this Contract and for a period of five years after final payment.

The Contractor's records, as referred to in this Contract, shall include any and all information, materials and data of every kind and character, including without limitation, records, books, papers, documents, subscriptions, recordings, agreements, purchase orders, leases, contracts, commitments, arrangements, notes, daily diaries, superintendent reports, drawings, receipts, vouchers and memoranda, and any and all other agreements, sources of information and matters that may, in the City's judgment, have any bearing on or pertain to any matters, rights, duties or obligations under or covered by any Contract Document. Such records shall include (hard copy, as well as computer readable data if it can be made available), written policies and procedures; time sheets; payroll registers; payroll records; cancelled payroll checks; subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, etc.); original estimates; estimating Work sheets; correspondence; change order files (including documentation covering negotiated settlements); back charge logs and supporting documentation; invoices and related payment documentation; general ledger entries detailing cash and trade discounts earned, insurance rebates and dividends; and any other Contractor records which may have a bearing on matters of interest to the City in connection with the Contractor's dealings with the City (all foregoing hereinafter referred to as "records") to the extent necessary to adequately permit evaluation and verification of:

1. Contractor compliance with Contract requirements,
2. Compliance with ethical practices, and
3. Compliance with provisions for pricing change orders, invoices or claims submitted by the Contractor or any of his payees.

The Contractor shall require all payees (examples of payees include Subcontractors and material suppliers) to comply with the provisions of this article by including the requirements hereof in a written Contract agreement between the Contractor and payee. Such requirements to include flow-down right of audit provisions in Contracts with payees will also apply to Subcontractors and Subcontractors' material suppliers, etc. The Contractor will cooperate fully and will cause all related parties and all of the Contractor's Subcontractors (including those entering into lump sum subcontracts) to cooperate fully in furnishing or in making available to the City from time to time whenever requested, in an expeditious manner, any and all such information, materials and data.

The City's authorized representative or designee shall have reasonable access to the Contractor's facilities, shall be allowed to interview all current or former employees to discuss matters pertinent to the performance of this Contract, and shall be provided adequate and appropriate Work space, in order to conduct audits in compliance with this article.

If an audit inspection or examination in accordance with this article discloses overpricing or overcharges (of any nature) by the Contractor to the City in excess of one percent (1%) of the total Contract billings, in addition to making adjustments for the overcharges, the reasonable actual cost of the City's audit shall be reimbursed to the City by the Contractor. Any adjustments and/or payments which must be made as a result of any such audit or inspection of the Contractor's invoices and/or records shall be made within a reasonable amount of time (not to exceed ninety (90) days) from presentation of the City's findings to Contractor.

IX. MISCELLANEOUS (Continued)

B. CONTRACTOR GUARANTEES REGARDING SCHEDULING

The Contractor covenants and guarantees that the Contractor will not:

1. Misrepresent to the City it's planning, scheduling and coordination of the Work;
2. Utilize schedules materially different from those given to or made available to the City or any Subcontractors for the direction, execution and coordination of the Work, or which are not feasible or realistic;
3. Prepare schedules, updates, revisions or reports which do not accurately reflect the Contractor's actual intent or the Contractor's reasonable and actual expectations as to:
 - a. The sequences of activities;
 - b. The duration of activities;
 - c. The responsibility for activities;
 - d. Resource availability;
 - e. Labor availability or efficiency;
 - f. Expected geological conditions;
 - g. Weather, strikes or other delays or events impacting the Work;
 - h. Value associated with the activity;
 - i. The percentage complete of any activity;
 - j. Completion of any item of Work or activity;
 - k. Project Completion;
 - l. Delays, slippages or problems encountered or expected;
 - m. Subcontractor requests for time extension, or delay claims of Subcontractors.
4. The Contractor's failure to comply with the foregoing covenant and guarantee shall be a substantial and material breach of Contract which will permit the City to terminate the Contractor for default, or withhold payments under the Contract Documents, and shall entitle the City to the remedies and damages afforded for misrepresentation or fraud by these Contract Documents or applicable law.
5. Should the Contractor fail to comply with the provisions of the Contract Documents relating to scheduling and execution of the Work by the overall project schedule, the City shall have the right, at its option, to retain the services of scheduling consultants or experts (including attorneys if necessary in the opinion of the City) to prepare schedules, reports, updates and revisions of the schedule in accordance with the Contract Documents and to review and analyze same, in order to allow the City and the City's Project Manager to evaluate the progress of the Work by the Contractor to determine: a) whether the Contractor is complying with the Contract Documents, and to direct such action of the part of the Contractor, as permitted by the Contract Documents, as required to ensure, under the City's schedule prepared hereunder, that the Contractor will complete the Work within the Contract Time; and b) all costs and expenses and fees incurred by the City in preparing the schedule hereunder shall be charged to the Contractor's account. If the Contractor fails to comply with the scheduling and execution of the Work requirements of the Contract Documents, the Contractor hereby agrees, in such instance, to comply with such City-prepared schedules, if any, or directions and activity sequences, and durations as the City may reasonably require, without additional cost to the City (subject only to cost adjustments for such changes in the Work as the City may direct) to ensure completion within the Contract Time.

X. INSURANCE REQUIREMENTS

A. WAIVERS OF SUBROGATION

The City and the Contractor waive all rights against (1) each other and any of their Subcontractors, sub-Subcontractors, agents and employees, each of the other, and (2) the Consultant, separate Contractors, if any, and any of their Subcontractors, sub-Subcontractors, agents and employees, for damages caused by fire or other perils to the extent covered by property Insurance obtained pursuant to this Section X or other property Insurance applicable to the Work, except such rights as they have to proceeds of such Insurance held by the City as fiduciary. The City or the Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate Contractors, if any, and the Subcontractor, sub-Subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers for Subrogation by endorsement or otherwise. A waiver of Subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the Insurance premium direct or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

B. INSURANCE REQUIREMENTS FOR ALL CITY CONTRACTS

To obtain the current Insurance requirements for all City Contracts, go to the City's website at:

<http://www.lincoln.ne.gov/city/finance/purch/index.htm>

The duties and obligations imposed by these General Provisions and the right and remedies available hereunder, and, in particular but without limitation, the guarantees and obligations imposed upon the Contractor and the rights and remedies available to the City hereunder shall be in addition to, and shall not be construed in any way as a limitation of, any rights and remedies available to them which are otherwise imposed or available by law, by special guarantee or by other provisions of the Contract documents.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 1

GENERAL MISCELLANEOUS ITEMS

ARTICLE	TITLE	
1.00	MOBILIZATION	102
	A. GENERAL	102
	B. BASIS OF PAYMENT	102
1.01	CONSTRUCTION STAKING	102
	A. GENERAL	102
	B. BASIS OF PAYMENT	103
1.02	SURVEY MONUMENTS AND MONUMENTS BOXES	103
	A. GENERAL	103
	B. MATERIALS	103
	C. INSTALLATION	103
	D. BASIS OF PAYMENT	104
1.03	PROPERTY PIN ESTABLISHMENT	104
	A. GENERAL	104
	B. BASIS OF PAYMENT	104
1.04	PAVEMENT AND SIDEWALK REMOVAL	105
	A. GENERAL	105
	B. BASIS OF PAYMENT	105
1.05	TYPE 'A' SAWING	106
	A. GENERAL	106
	B. BASIS OF PAYMENT	106
1.06	TYPE 'B' SAWING	106
	A. GENERAL	106
	B. BASIS OF PAYMENT	106
1.07	TYPE 'C' SAWING	106
	A. GENERAL	106
	B. BASIS OF PAYMENT	106
1.08	TYPE 'D' SAWING	107
	A. GENERAL	107
	B. BASIS OF PAYMENT	107
1.09	WHEEL SAWING	107
	A. GENERAL	107
	B. BASIS OF PAYMENT	107
1.10	MAIL BOXES	107
	A. GENERAL	107

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 1

GENERAL MISCELLANEOUS ITEMS

ARTICLE	TITLE	
1.11	MANHOLES	108
	A. GENERAL	108
	B. BASIS OF PAYMENT	108
1.12	INLETS	108
	A. GENERAL	108
	B. BASIS OF PAYMENT	108
1.13	WATER VALVE BOXES AN WATER STOP BOXES	108
	A. GENERAL	108
	B. BASIS OF PAYMENT	108
1.14	CONSTRUCTION OVER NEW SEWERS	109
1.15	CULVERT REMOVAL	109

CHAPTER 1

GENERAL MISCELLANEOUS ITEMS

This chapter will cover items of a general and/or miscellaneous nature. The items may be related to multiple chapters or multiple types of Work.

1.00 MOBILIZATION

A. GENERAL

This Work shall consist of preparatory Work and operations, associated with the necessary movement of personnel, equipment, supplies and incidentals to the project site and for all the Work and operations which must be performed or costs that are necessarily incurred prior to commencing the Work. The Contractor shall include all expected costs for movement of his and any Subcontractors' equipment and material necessary to prosecute the Work to completion, including any demobilization. Additional payments will not be made for interruptions in the prosecution of the Project if the Contractor fails to adequately assess the actual costs of mobilization.

B. BASIS OF PAYMENT

No measurement is required. Fifty percent of the bid item for mobilization will be paid with the initial pay estimate. The balance of the bid item for mobilization will be paid when twenty percent of the value of the Work has been completed. The bid amount for mobilization cannot exceed ten percent of the total bid amount (including mobilization).

1.01 CONSTRUCTION STAKING

A. GENERAL

The City will provide horizontal and vertical control points as shown on the plans for the Contractor's use in establishing the exact location and elevations for the project. The Contractor shall be responsible for preserving (or re-establishing) these control points if necessary. The Contractor shall use this control to provide all construction staking that is required for the project. This shall include staking for grading, pavement construction, utility construction, retaining walls, establishment of temporary easement limits and right-of-way lines, and all other survey Work to complete the project in accordance with the details shown on the plans. The Contractor shall follow the current Lincoln Standard Plans for staking information.

The Contractor shall be responsible for the placement and preservation of adequate ties and references necessary to complete the Work. Any additional stakes, templates and other materials necessary for marking and maintaining all reference points and lines shall be the responsibility of the Contractor. The Contractor shall be solely and completely responsible for the accuracy of the line and grade for all features of the Work. All Work shall be completed to the lines, grades, and elevations indicated on the plans. The Contractor shall remove and reconstruct, at his expense, Work that is improperly located.

Construction staking shall be certified by a Registered Land Surveyor in the State of Nebraska. Staking records shall be recorded in a format approved by the City and submitted to the City at the completion of the project. This Work shall be considered subsidiary to "CONSTRUCTION STAKING."

1.01 CONSTRUCTION STAKING (Continued)

B. BASIS OF PAYMENT

Construction staking shall not be measured, but shall be paid at the Contract price bid for Lump Sum for the pay item "CONSTRUCTION STAKING." The amount of the lump sum to be included in each partial payment shall be in proportion to the value of the Work completed with respect to the total amount of the original bid. Such payment shall be full compensation for furnishing all labor, equipment, tools, materials, recording and incidental items necessary to complete the Work.

1.02 SURVEY MONUMENTS AND MONUMENTS BOXES

A. GENERAL

This section includes preservation of existing survey monuments and benchmarks, as well as the installation of new survey monuments and benchmarks. In the case of any existing permanent monuments or bench marks which out of necessity must be removed or disturbed in the construction of the Work, the Contractor shall carefully protect and preserve the same until they can be properly referenced for relocation under the direction of a Registered Land Surveyor in the State of Nebraska, and in case of damage or destruction, Contractor will be charged with the expense of their replacement.

B. MATERIALS

All materials used in the fabrication of Monument Boxes shall meet the requirements of "Specifications for Gray Iron Castings," ASTM Designation A-48, Class 30. They shall conform in all respects to the designs for such castings as shown on the Standard Plans. All frames and covers shall be machined so that each cover will fit properly in its frame with no rocking. No casting will be accepted that is warped, cracked, that has welds, or that has been plugged or filled. Monument pins shall be $\frac{3}{4}$ inch round steel bars at least 2 feet in length.

When the monument location falls outside of pavement, the monument box may be omitted at the City's Project Manager's discretion.

C. INSTALLATION

The Contractor shall install survey monument boxes and monuments at all points shown on the plans. In general, new monuments shall be located for the centerline of right-of-way at every intersection, not centerline of street pavement, including placing point-of-curvature and point-of-tangency where there is a curve in the right-of-way. All monument boxes shall be placed after the paving is complete. Monument boxes installed in paving shall be placed by use of a concrete coring machine equipped with a 7 inch O.D. bit.

All monument locations shall be established under the direction of a Registered Land Surveyor in the State of Nebraska. The Surveyor is required to prepare and file a Survey Record Drawing in accordance with Nebraska State statutes.

1.02 SURVEY MONUMENTS AND MONUMENTS BOXES (Continued)

D. BASIS OF PAYMENT

Monument boxes and survey monuments placed in accordance with these Specifications and accepted by the City's Project Manager shall be counted and paid for at the contract unit price bid per each for SURVEY MONUMENT AND BOX. Such payment shall be full compensation for furnishing all labor, equipment, tools, materials, recording and incidental items necessary to complete the Work.

1.03 PROPERTY PIN ESTABLISHMENT

A. GENERAL

The Contractor shall have a Registered Land Surveyor establish property pins for those lots where Right-of-Way boundaries have changed, property pins were removed by the project, or two or more feet of fill was placed over the property pin, as approved by the City's Project Manager. The property pins shall be established under the direction of a Registered Land Surveyor in the State of Nebraska and the Surveyor is required to prepare and file a Survey Record Drawing in accordance with Nebraska State statutes.

B. BASIS OF PAYMENT

Property pins placed in accordance with these Specifications and accepted by the City's Project Manager shall be counted and paid for at the contract unit price bid per each for PROPERTY PIN ESTABLISHMENT. Such payment shall be full compensation for furnishing all labor, equipment, tools, materials, recording and incidental items necessary to complete the Work.

1.04 PAVEMENT AND SIDEWALK REMOVAL

This Work shall include the removing of existing pavement, surface and base courses, concrete headers, combination curb and gutter, concrete curb, concrete gutter, concrete driveways, walks, steps, retaining walls, and miscellaneous masonry, as required; and shall also include salvaging and disposing of the resulting material, together with the necessary excavation and backfilling.

A. GENERAL

The City's Project Manager shall identify all areas of authorized pavement removal. The removal of existing pavement shall extend to an existing joint, or to the limits shown on the plans. When called for on the plans or by the City's Project Manager, all pavement to be removed shall be isolated from the pavement to remain by cutting a saw joint, as provided below, or by other methods specifically approved by the City's Project Manager. The pavement to be removed shall be broken into movable sizes and removed from the site. If the pavement to remain is damaged by the Contractor, the City's Project Manager will order further removal at the Contractor's expense. Pavement which is removed without authorization by the City's Project Manager shall be replaced at the Contractor's expense.

B. BASIS OF PAYMENT

When called for in the proposal, pavement, sidewalk, driveway, curb, steps, retaining wall and miscellaneous masonry items removed in accordance with these Standard Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per cubic yard for PAVEMENT AND SIDEWALK REMOVAL.

Measurement shall be made on a solid cubic yard basis prior to removal. Such payment shall be full compensation for removal, loading, hauling, disposal of all materials, all equipment, tools, labor, and incidentals necessary to completely remove the said items from the job site.

1.05 TYPE 'A' SAWING

A. GENERAL

Asphaltic Concrete pavement to be removed shall be isolated from the pavement to remain by cutting a joint with a wheel saw, through the full depth of the pavement. After the pavement base has been replaced, a 4 inch wide strip of the asphaltic concrete surface course shall be sawed and removed to provide a straight, smooth edge where the new asphaltic surfacing adjoins the existing surfacing.

B. BASIS OF PAYMENT

When called for in the proposal, sawing Asphaltic Concrete with a wheel saw, completed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per linear foot for TYPE 'A' SAWING. Such payment shall be full compensation for all Work associated with isolating the pavement to be removed and removing the 4 inch strip of asphalt, including all equipment, tools, labor, and incidentals necessary to complete this type of Work.

1.06 TYPE 'B' SAWING

A. GENERAL

Portland Cement Concrete (PCC) pavement to be removed shall be isolated from the paving to remain by cutting a full depth saw cut, using either a wheel saw or diamond blade. If a wheel saw is used, additional sawing shall be required to provide smooth, straight and true vertical faces.

B. BASIS OF PAYMENT

When called for in the proposal, sawing Portland Cement Concrete (PCC) pavement, completed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per linear foot for TYPE 'B' SAWING. Such payment shall be full compensation for all Work associated with isolating the pavement to be removed, including all equipment, tools, labor, materials, and incidentals necessary to complete this item of Work.

1.07 TYPE 'C' SAWING

A. GENERAL

Portland Cement Concrete (PCC) driveways and sidewalks to be removed shall be isolated from the driveway and sidewalk to remain by cutting a full depth saw cut.

B. BASIS OF PAYMENT

When called for in the proposal, sawing Portland Cement Concrete (PCC) driveways and sidewalks, completed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per linear foot for TYPE 'C' SAWING. Such payment shall be full compensation for all Work associated with isolating the pavement to be removed, including all equipment, tools, labor, materials, and incidentals necessary to complete this item of Work.

1.08 TYPE 'D' SAWING

A. GENERAL

Asphaltic Concrete Surface Course to be removed from concrete base shall be sawed and removed to provide a straight, smooth edge where the new asphaltic surfacing will adjoin the existing.

B. BASIS OF PAYMENT

When called for in the proposal, sawing Asphaltic Concrete Surface Course, completed in conformance with the Standard Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per linear foot for TYPE 'D' SAWING. Such payment shall be full compensation for all Work associated with isolating the surfacing to be removed, including all equipment, tools, labor, materials, and incidentals necessary to complete this item of Work.

1.09 WHEEL SAWING

A. GENERAL

Pavement to be removed shall be isolated from the pavement to remain by cutting a joint with a wheel saw, through the full depth of the pavement.

B. BASIS OF PAYMENT

When called for in the proposal, sawing pavement with a wheel saw, completed in conformance with the Standard Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per linear foot for WHEEL SAWING. Such payment shall be full compensation for all Work associated with isolating the pavement to be removed, including all equipment, tools, labor, materials, and incidentals necessary to complete this item of Work.

1.10 MAIL BOXES

A. GENERAL

Mail boxes which conflict with construction or are located on a street which is being paved shall be removed by the Contractor and set in a temporary location designated by the City's Project Manager. At the completion of construction, the Contractor shall reset all mail boxes as nearly as possible to their original locations and in conformance with Postal Regulations. The condition of the mail boxes shall be equal to their original condition or shall be replaced by the Contractor at the Contractor's expense. Mail boxes which are ornamental in nature or which, in the opinion of the City's Project Manager, cannot be temporarily relocated shall be delivered to the mailbox owner.

Removal, relocation, and resetting of mail boxes or storage and resetting of mail boxes, completed in conformance with these Standard Specifications and accepted by the City's Project Manager, shall not be measured and paid for separately. Such cost shall be considered a part of the unit prices for which direct payment is made.

1.11 MANHOLES

A. GENERAL

The adjustment of existing manholes to grade shall include furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the Work of adjusting the manhole cast iron ring and cover to an elevation as determined by the City's Project Manager.

B. BASIS OF PAYMENT

Manholes adjusted to grade in conformance with these Standard Specifications and accepted by the City's Project Manager, shall be counted and paid for at the contract unit price bid per each for ADJUST MANHOLE TO GRADE. Such payment shall be full compensation for all materials, equipment, tools, labor, and incidentals necessary to complete the Work.

1.12 INLETS

A. GENERAL

The adjustment of existing inlets to grade shall include furnishing all materials, labor, equipment, tools and incidentals necessary to complete the Work of adjusting the inlet top including the ring and cover to an elevation as directed by the City's Project Manager.

B. BASIS OF PAYMENT

Inlets adjusted to grade in conformance with these Standard Specifications and accepted by the City's Project Manager, shall be counted and paid for at the contract unit price bid per each for ADJUST INLET TO GRADE or ADJUST GRATE INLET TO GRADE. Such payment shall be full compensation for all materials, equipment, tools, labor, and incidentals necessary to complete the Work.

1.13 WATER VALVE BOXES AN WATER STOP BOXES

A. GENERAL

The adjustment of existing water valve boxes and water stop boxes shall include furnishing all labor, equipment, tools and incidentals necessary to complete the Work of adjusting the water valve box or water stop box to an elevation as determined by the City's Project Manager.

B. BASIS OF PAYMENT

Water valve and stop boxes adjusted to grade in accordance with these Standard Specifications and accepted by the City's Project Manager shall be counted and paid for at the contract unit price bid per each for ADJUST WATER VALVE BOX TO GRADE or ADJUST WATER STOP BOX TO GRADE. Such payment shall be full compensation for all equipment, tools, labor, and incidentals necessary to complete the Work. Stop boxes and valve boxes broken by the Contractor's operations shall be replaced at the Contractor's expense. Boxes broken by other than the Contractor's operations or obsolete boxes shall be replaced and paid for as an Extra Work item.

1.14 CONSTRUCTION OVER NEW SEWERS

Where pavements are being constructed over newly constructed sanitary sewers within the thirty (30) day period, the Contractor shall request TV inspection by the Lincoln Wastewater System for the reaches of sewer that may affect subgrade preparation. The Contractor shall notify the Department at least forty-eight (48) hours in advance of any paving operations. Failure to notify the Department will not exempt Contractor from repairing defective pavement which needs to be replaced as a result of sewer repair activities. There will be no TV inspection costs billed to the Contractor for TV inspection that meets these conditions.

1.15 CULVERT REMOVAL

Driveway and roadway culverts shall be removed and stored at a location on the project site designated by the City's Project Manager. Culverts which are not claimed by the respective property owners and which have a salvage value, as determined by the City's Project Manager, shall be loaded onto City trucks. Those culverts which have no salvage value shall be removed from the project site by the Contractor.

Culvert removal, loading, salvage, storage, or disposal shall be considered subsidiary to the cost of Work for which direct payment is made.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 2

EARTHWORK

ARTICLE	TITLE	
2.00	GENERAL	201
2.01	GENERAL CLEARING AND GRUBBING	201
	A. GENERAL	201
	B. BASIS OF PAYMENT	201
2.02	TREE REMOVAL	201
	A. GENERAL	201
	B. BASIS OF PAYMENT	202
2.03	TRANSPLANT TREE (SAPLINGS TO 6 INCHES)	202
	A. GENERAL	202
	B. BASIS OF PAYMENT	202
2.04	REMOVE & RESET FENCE	203
	A. GENERAL	203
	B. BASIS OF PAYMENT	203
2.05	EXCAVATION	203
	A. GENERAL	203
	B. BASIS OF PAYMENT	204
2.06	DISPOSAL OF SURPLUS MATERIALS	204
	A. GENERAL	204
	B. BASIS OF PAYMENT	204
2.07	CONSERVATION OF TOP SOIL	205
2.08	EMBANKMENT	205
	A. GENERAL	205
	B. BASIS OF PAYMENT	206
2.09	PARKING SPACE FINISH	206
	A. GENERAL	206
	B. BASIS OF PAYMENT	206
2.10	PREPARATION OF SUBGRADE	207
2.11	COLD WEATHER CONSTRUCTION	208
2.12	SUBSTANTIAL COMPLETION	208

CHAPTER 2

EARTHWORK

2.00 GENERAL

Earthwork shall include all necessary clearing, grubbing, stripping and excavation within the limits of the Work. Earthwork shall include but not be limited to removal of obstructions, removal and disposal of unsuitable materials and debris, borrow, excavation, construction of fills and embankments, park spacing, ditch excavation and any other item of Work necessary to conform to these Standard Specifications, and to conform to the line, grade and cross section shown on the plans, or as directed by the City's Project Manager.

2.01 GENERAL CLEARING AND GRUBBING

A. GENERAL

The necessary removal of all trees and stumps less than 12 inches in diameter, brush, roots, shrubs, trash, etc. within the limits of the project shall be as directed by the City's Project Manager. The debris removed shall be disposed of at an appropriate, off-site location. No burning will be allowed at the site of the Work.

Roots 2 inches in diameter or greater shall be removed to a depth of at least 12 inches below natural ground, subgrade, or finish grade elevation as directed by the City's Project Manager.

B. BASIS OF PAYMENT

General clearing and grubbing shall not be measured and paid for directly. The cost of this Work shall be considered subsidiary to other items of Work for which direct payment is made.

When called for in the proposal, clearing and grubbing shall not be measured, but shall be paid for at the contract unit price bid as a lump sum for GENERAL CLEARING AND GRUBBING. Such payment shall be full compensation for all tree and stump removal, removal of brush, roots, shrubs, trash, fencing which is not to be replaced, and for all materials, equipment, tools, labor and incidentals necessary to complete the Work in conformance with these Standard Specifications and accepted by the City's Project Manager.

2.02 TREE REMOVAL

A. GENERAL

Trees 12 inches in diameter or greater measured 24 inches above the ground shall be removed from the site of the Work together with their stumps and roots 2 inches in diameter or greater.

Existing stumps and stumps resulting from tree removal, together with roots 2 inches in diameter or greater shall be removed to a depth of at least 12 inches below natural ground, subgrade or finished grade. The resultant organic material shall be removed from the job site and the remaining hole shall be filled and compacted in accordance with these Standard Specifications.

2.02 TREE REMOVAL (Continued)

B. BASIS OF PAYMENT

Trees 12 inches in diameter and larger and their stumps, removed in conformance with these Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per each for TREE REMOVAL (____INCHES to ____INCHES) for the various sizes called for.

Such payment shall be full compensation for the removal of the tree and its stump, backfilling, disposal of organic matter, materials, equipment, tools, labor, and incidentals necessary to complete the Work.

Existing stumps 12 inches in diameter and larger, removed in accordance with these Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per each for STUMP REMOVAL (____INCHES to ____INCHES) for the various sizes called for. Such payment shall be full compensation for removal of the stump, backfilling, disposal of organic matter, materials, equipment, tools, labor and incidentals necessary to complete the Work.

2.03 TRANSPLANT TREE (SAPLINGS TO 6 INCHES)

A. GENERAL

Trees to be transplanted, as shown on the plans, shall be moved to their new locations using truck or tractor-mounted equipment designed to perform such Work. The equipment to be used and method shall be approved by the City's Project Manager prior to performing such Work. When the new location is not shown on the plans, the tree shall be transplanted to a location on the job site as designated by the City's Project Manager.

Transplanted trees shall be staked and wired to provide support and maintain the tree in a vertical position for a minimum of one full growing season.

B. BASIS OF PAYMENT

Trees which are transplanted in accordance with these Standard Specifications and accepted by the City's Project Manager shall be counted and paid for at the contract unit price bid each for TRANSPLANT TREE (SAPLINGS TO 6 INCHES). Such payment shall be full compensation for transplanting the tree, backfilling, supporting the tree, materials, tools, labor and incidentals necessary to complete the Work.

2.04 REMOVE & RESET FENCE

A. GENERAL

Where indicated on the plans or in the Special Provisions, fences to be removed and reset shall be removed by the Contractor, stockpiled during construction, and reconstructed in their original location or at locations indicated. The Contractor shall use all salvageable materials for resetting the fence whenever possible. When the material is not reusable, the Contractor shall supply new materials in order to restore the fence to at least its original condition.

B. BASIS OF PAYMENT

Fence removed and reset using new or salvaged material, constructed in accordance with these Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per linear foot for REMOVE AND RESET FENCE. Such payment shall be full compensation for all removal, excavation, stockpiling, reconstruction, new materials when required, equipment, tools, labor and incidentals necessary to remove and replace the fence.

2.05 EXCAVATION

A. GENERAL

All suitable material obtained from excavating the existing embankments shall be used as far as practicable in the formation of fills or embankments and at such other places on the Work as may be necessary. Excess excavated material shall be disposed of in appropriate areas selected by the Contractor.

When unsuitable material is encountered in the subgrade beyond the limits of the typical section, it shall be excavated as directed by the City's Project Manager. The limits of such over-excavation shall be approved by the City's Project Manager and the material removed from the subgrade, shall be hauled and deposited at an appropriate location. Additional suitable material shall be obtained by the Contractor and incorporated into the fill according to the compaction requirements specified in Chapter 2.

When over-excavation of material in a cross section is identified on the plans to establish uniform density, the excavated materials may be used in the finished section, provided that the compaction and moisture requirements in Chapter 2 are satisfied.

When the amount of suitable excavated material within the limits of the Work is not sufficient or accessible in time to complete the fills or embankments, the City's Project Manager shall be notified by the Contractor of proposed borrow location(s) at least one week in advance of construction. The use of the proposed borrow shall not be authorized until sampling and testing of the proposed borrow material(s) has been completed and suitability based on compliance with all project requirements has been determined to the satisfaction of the City's Project Manager.

When so designated on the plans, borrow shall be taken from the designated areas in accordance with lines and grades furnished by the City's Project Manager. When completed, all areas shall be left in a neat condition with no sharp breaks in contour, and shall be sloped to drain without causing damage to adjacent properties.

During progress of the Work, the excavation shall be maintained comparatively smooth and in such condition that it shall adequately drain at all times.

2.05 EXCAVATION (Continued)

B. BASIS OF PAYMENT

Final measurement of the various specified quantities of excavation shall not be made. The quantity shown on the plans shall be an established quantity and shall be the basis of payment at the contract unit price per cubic yard bid for EXCAVATION, OVER-EXCAVATION, OR EXCAVATION BORROW. EXCAVATION when called for on the plans is the quantity of material to be removed and subsequently used to construct embankments in order to complete the required section. OVER-EXCAVATION when called for on the plans shall be the quantity of material to be removed and re-compacted prior to completing the required section. EXCAVATION BORROW when called for on the plans shall be the quantity of material that must be obtained off site in order to complete the required section. All such payments shall be full compensation for all stripping of vegetation, conservation of top soil, excavation, over-excitation, compaction, incorporation of water when required, materials, equipment, tools, labor and incidentals necessary to complete the Work.

When authorized by the City's Project Manager, removal of unsuitable material shall be measured and added to the established quantities as an EXTRA WORK item.

All the aforementioned quantities are established by average end areas of the cross-sections with no balance factor used. These quantities do not include material excavated for pipe trenches, inlets, retaining wall, bridge abutments or any other appurtenances installed in the completed section. Those excavated materials shall be subsidiary to other items of Work for which direct payment is made.

2.06 DISPOSAL OF SURPLUS MATERIALS

A. GENERAL

All excavated material not required or suitable for fills or other designated purposes shall be removed from within the limits of the Work and deposited at an appropriate, off-site location. Surplus materials shall, in general, be removed and disposed of before the subgrade has been completed and before any construction materials are placed.

Surplus materials, if left on the project site and placed on public or private property, shall be dumped, spread and finished to grades as designated.

B. BASIS OF PAYMENT

Final measurement of the specified quantity of surplus material shall not be made. EXCAVATION DISPOSAL, when called for on the plans, shall be the quantity of excess material measured in cubic yards which must be removed from the site and disposed of at an appropriate, off-site location. All such payments shall be full compensation for equipment, tools, labor and incidentals necessary to complete the Work.

2.07 CONSERVATION OF TOP SOIL

Topsoil shall be carefully removed and deposited in storage piles at the job site or as directed by the City's Project Manager for the purpose of parking space finishing. Topsoil shall be kept separate from other excavated materials and shall be piled free from roots, stones and other undesirable material.

No direct payment will be made for conservation of topsoil. Topsoil conservation shall be considered subsidiary to other items of Work for which direct payment is made.

2.08 EMBANKMENT

A. GENERAL

EMBANKMENT shall be defined as the raised soil structure of the roadway and all other fill areas associated with the construction of the project.

Areas to be filled shall be stripped of all vegetation and other debris. The stripped material shall be disposed of as hereinafter specified.

Fills and embankments shall be constructed of approved material and shall not contain any large logs, stumps, brush, sod, roots, weeds, debris or other perishable matter. Thoroughly pulverized sod mixed with earth may be deposited in the fill only when authorized by the City's Project Manager.

When widening existing embankments, the side of the existing embankment shall be plowed or stepped and all stripped material may be placed at the toe of the slope before the placing of additional material. All fills shall be placed in horizontal layers which shall not exceed 6 inches in depth after rolling. Before rolling, each successive layer shall be leveled with appropriate equipment. Only approved earth which can be suitably compacted shall be used.

Each successive layer of material placed as described shall be compacted by rolling to a density of not less than ninety-five percent (95%) of the maximum density as determined by AASHTO Standard Method T99. The moisture content of the earth in each layer shall be such that the specified density can be obtained and shall be adjusted if necessary so that it will be between two percent (2%) below and four percent (4%) above the Optimum Moisture Content, as determined by the standard test specified above.

When the moisture content of the material is too low, sufficient water shall be added to the material before it is excavated or to each layer before compaction. If excessive moisture is present, the material shall not be used or the material may be aerated until such excess moisture has dissipated. If, in the opinion of the City's Project Manager, the fill has been damaged due to precipitation, retesting shall be required. If the retesting indicates excessive moisture, the material shall be reworked or replaced.

The material shall not be compacted before it is thoroughly mixed and uniform in moisture content as above specified. The compaction shall be accomplished with equipment approved by the City's Project Manager.

2.08 EMBANKMENT (Continued)

B. BASIS OF PAYMENT

Final measurement of embankment shall not be made. The quantity shown on the plans shall be an established quantity and shall be the basis of payment at the contract unit price per cubic yard bid for EARTHWORK MEASURED IN EMBANKMENT. EARTHWORK MEASURED IN EMBANKMENT is the amount of material to be placed and compacted to complete the required section. Quantities are established by average end areas of the cross-sections with no balance factor used. Such payment shall be full compensation for all loading, hauling, spreading, compacting and other materials, equipment, tools, labor and incidentals necessary to complete the Work in conformance with these Standard Specifications and accepted by the City's Project Manager.

2.09 PARKING SPACE FINISH

A. GENERAL

The parking space is hereby defined as that part of the street right-of-way within the limits of the Work, exclusive of paved roadway and exclusive of space actually occupied by sidewalks or driveways. The parking space finish shall begin after the completion of all paving, driveway and sidewalk.

The above specified areas shall be fine graded to the exact lines and elevations indicated on the plans or as directed by the City's Project Manager. In general, they shall be covered with a seed bed, 2 inches in thickness, of selected topsoil reserved for this purpose at the time grading operations were performed. In the event that the reserved material is unsuitable, the Contractor will be required to provide a suitable material. The layer of topsoil shall be hand raked and shall be free from sod, stones, roots, clods and other objectionable foreign materials. All objectionable material shall be removed and disposed of as hereinbefore provided under "Disposal of Surplus Materials".

B. BASIS OF PAYMENT

PARKING SPACE FINISH performed in conformance with the Standard Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per square yard. Such payment shall be full compensation for all materials, equipment, tools, labor and incidentals necessary to complete the Work.

2.10 PREPARATION OF SUBGRADE

The subgrade is hereby defined as that portion of the street or alley, within the limits of the Work, which forms the foundation for the pavement or the curb or curb and gutter, and which is within 6" of the surface. After all earthwork has been substantially completed as herein specified, the subgrade shall be cut or trimmed to the exact lines, grade and cross-section shown on the plans or as directed by the City's Project Manager.

The subgrade for Portland Cement Concrete Pavement and Portland Cement Concrete Base shall be constructed to a uniform density of not less than ninety-five percent (95%) of the maximum density (as determined by AASHTO Standard Method T-99) throughout its entire width. The subgrade for full depth Asphaltic Concrete Pavement shall be constructed to a uniform density of not less than one hundred percent (100%) of the maximum density (as determined by AASHTO Standard Method T-99) throughout its entire width. The moisture content of the earth in each layer shall be such that the specified density can be obtained and the moisture adjusted, if necessary, so that it will be between two percent below (-2%) and four percent above (+4%) the optimum moisture content as determined by AASHTO Standard Method T-99. All soft or yielding material and other portions of the subgrade which will not compact readily shall be removed as directed, and any loose rock or boulders found shall be removed or broken off at a depth of not less than 6 inches below the surface of the subgrade. All holes or depressions made by the removal of material, as described above, shall be filled with approved material and compacted.

Immediately prior to paving, the entire subgrade for concrete pavement must be thoroughly manipulated and recompact with the methods described above.

The elevation of the subgrade shall be carefully checked by the Contractor using a template or by such other methods as shall be approved by the City's Project Manager. No subgrade shall be accepted until it has been brought to the exact lines, grade and elevations indicated on the plans or as directed by the City's Project Manager. No pavement or foundation material shall be placed on any subgrade before the same is accepted by the City's Project Manager.

The Contractor shall maintain the subgrade to the specified section free from ruts, waves and undulations and in case any such objectionable irregularities occur for any reason, the subgrade shall be reshaped and re-rolled as necessary.

The Contractor shall protect the subgrade from damage due to precipitation and no water shall be allowed to remain on the subgrade.

If, in the opinion of the City's Project Manager, the subgrade has been damaged due to precipitation, retesting shall be required. If the testing indicates excessive moisture, the subgrade shall be reworked or replaced.

No direct payment will be made for the preparation and compaction of the subgrade. It shall be considered subsidiary to other items of Work for which direct payment is made.

2.11 COLD WEATHER CONSTRUCTION

Fills and embankments shall be laid only upon a surface that is free from frost. The material being used for fill and embankment shall not contain any frozen material and shall be placed only when proper spreading, compacting and bonding with the existing surface can be obtained.

General clearing and grubbing and tree removal or stump removal shall have no winter time restrictions; these operations may be carried on at any time of the year. Consideration should be given to inconveniencing the public as little as possible.

2.12 SUBSTANTIAL COMPLETION

All projects involving items of paving shall be considered substantially complete when all items of Work shown on the proposal or called for in any other area of the Contract documents are completed to the satisfaction of the City's Project Manager. Such items shall include but will not be limited to: curb and gutter, Asphaltic Concrete pavement/Portland Cement Concrete (PCC) pavement, driveways, sidewalks, alley returns, adjustment of manholes, valve boxes, water stop boxes, backfilling, park spacing, joint sealing, and pavement markings.

Liquidated damages shall continue to accrue until such time as the Work is deemed to be substantially completed by the City's Project Manager. However, the Contractor may submit a written request to the City's Project Manager for approval to suspend such liquidated damages to allow additional time for completion of such minor items of the Work as seeding, sodding, and survey monuments. Granting the request for additional time by the City's Project Manager shall not relieve the Contractor of the Contractor's responsibilities for completion of those items for which the suspension is requested.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 3

PORTLAND CEMENT CONCRETE (PCC)

ARTICLE	TITLE	
3.00	GENERAL	301
3.01	MATERIALS	301
	A. CEMENT	301
	B. FLY ASH MODIFIED PORTLAND CEMENT CONCRETE (PCC)	301
	C. AGGREGATE	302
	D. WATER	306
	E. CHEMICAL ADMIXTURES	306
3.02	HANDLING MATERIALS	308
3.03	WEIGHING & MIXING	308
3.04	CONSISTENCY AND PLACEMENT OF CONCRETE	309
3.05	CONCRETE TESTS	309
3.06	FLOWABLE FILL	310
	A. DESCRIPTION	310
	B. MATERIALS	310
	C. BASIS OF PAYMENT	310
3.07	HOT/COLD WEATHER CONSTRUCTION	311
	A. CONCRETE CONSTRUCTION - HOT WEATHER	311
	B. CONCRETE CONSTRUCTION - COLD WEATHER	311
TABLE	TITLE	
3.01 A	GRADATION LIMITS FOR MINERAL AGGREGATES FOR USE IN PORTLAND CEMENT CONCRETE	305
3.01 B	PORTLAND CEMENT CONCRETE MIXTURES (CUBIC YARD BATCH)	307
3.06 A	FLOWABLE FILL COMPOSITION PER CUBIC YARD	310

CHAPTER 3

PORTLAND CEMENT CONCRETE

3.00 GENERAL

Portland Cement Concrete (PCC) shall consist of an intimate mixture of Portland Cement, aggregate, and water. All Portland Cement Concrete (PCC) shall be air entrained and contain a NDOR approved water reducing admixture at the manufacturers recommended dosage rate. Portland Cement used in all concrete mixtures except L-5500, LB-3500, LB-2750 and PR shall be modified with Class F Fly Ash as described below and as indicated in Table 3.01 B. Depending on the application, other constituents or admixtures may be used with permission from the City Engineer. Materials not on the latest edition of the Nebraska Department of Roads (NDOR) "Approved Products List" shall not be used without permission from the City Engineer. The constituents of Portland Cement Concrete and their mixing, handling, and proportioning shall conform to ASTM Designation C 94 except as modified herein.

3.01 MATERIALS

A. CEMENT

Portland Cement shall be a recognized standard hydraulic cement composed primarily of hydraulic calcium silicates conforming to the requirements of ASTM Designation C 150 for Type I, II, or III cement and shall contain no more than 0.60 percent equivalent alkali. Equivalent alkali is defined as the sum of the sodium oxide (Na_2O) and the potassium oxide (K_2O) calculated as sodium oxide (equivalent alkali as $\text{Na}_2\text{O} = \text{Na}_2\text{O} + 0.658(\text{K}_2\text{O})$). Certified mill tests shall be furnished to the City's Project Manager. Different brands of cement, or the same brand from different mills, shall not be mixed during storage. Neither shall they be used alternately in any one concrete placement without permission from the City Engineer. Contractors or Subcontractors supplying concrete shall notify the City's Project Manager when changing to different cement.

The cement shall be protected from damage due to moisture. Cement so damaged will be rejected. Cement shall not be in storage at the concrete plant longer than ninety (90) days without retesting. The temperature of the cement when used shall be less than 180°F.

B. FLY ASH MODIFIED PORTLAND CEMENT CONCRETE (PCC)

Portland Cement Concrete (PCC) mixes for pavement, driveways, curb, median, and sidewalk shall be modified by the use of Type IPF cement, as specified below. Type IPF cement shall be Portland cement which is pre-blended or inter-ground by the cement manufacturer with 25 +/- 2 percent Class F fly ash and shall conform to the requirements of ASTM C 595. No additional fly ash may be added at the concrete plant.

3.01 MATERIALS (Continued)

B. FLY ASH MODIFIED PORTLAND CEMENT CONCRETE (PCC) (Continued)

An NDOR approved water-reducing admixture shall be used in all fly ash modified concrete mixes at the dosage rate recommended by the manufacturer. The water-cement ratio of all fly ash modified concrete shall not exceed the maximum limit for the various classes of concrete as shown in Table 3.01 B.

Fly ash shall conform to the requirements of Class F pozzolan of ASTM Designation C 618, except that the maximum loss on ignition for Class F pozzolan shall be six percent (6.0%). Additionally, Class F pozzolans shall have a maximum allowable free carbon content not to exceed three percent (3.0%). Class F fly ash shall not contain more than one and five-tenths percent (1.50%) of available alkalies as Na_2O . Fly ash such as is produced in furnace operations utilizing liming materials or soda ash (sodium carbonate) as an additive will not be acceptable. Certified mill tests shall be provided to the City's Project Manager.

Only brands of Type IPF Cement which are on the latest edition of the Nebraska Department of Roads Approved Products List shall be approved for use in concrete in City of Lincoln projects.

Type IPF cement shall not be used in mix designations LB-2750, LB-3500, L-5500 and PR without permission from the City Engineer.

C. AGGREGATE

1. General

Only aggregates that have been approved by the Nebraska Department of Roads and used for similar Work and have satisfactory service records will be allowed for use on City of Lincoln projects unless approved by the City Engineer.

Mineral aggregates shall be crushed rock, broken stone, gravel, sand-gravel, coarse sand, fine sand, or a mixture of these materials composed of clean, hard, durable, and un-coated particles. Crushed rock shall be crushed limestone, dolomite, granite, quartzite, or other ledge rock.

Dolomite as herein defined is a magnesium limestone containing calcium carbonate and magnesium carbonate in approximately a 4 to 3 ratio.

The calcium carbonate content of limestone shall be at least 80 percent computed as CaCO_3 from the value determined for CaO .

3.01 MATERIALS (Continued)

C. AGGREGATE (Continued)

1. General (Continued)

Aggregates shall be free from injurious quantities of dust, soft or flaky particles, loams, alkali, organic matter, paper, wood, or other deleterious matter as determined by the City's Project Manager.

The use of aggregate obtained from any reclaiming or recycling process shall not be allowed without permission from the City's Project Manager.

The gradations shown for the aggregate represent limits which shall determine suitability for use from any source of supply. The gradations from any one source shall be uniform and not subject to the extreme percentages of gradation specified below. The aggregate from different sources of supply shall not be mixed or stored in the same pile, nor used alternately in the same class of construction or mixed without permission from the City Engineer. The aggregate may be tested at any time prior to its incorporation into a mix. Aggregate sampling and testing shall conform to the following requirements:

ASTM DESIGNATIONS

C 33 Specification for Concrete Aggregates

AASHTO DESIGNATIONS

T 96 Abrasion
T 104 Sodium Sulfate Soundness
T 21 Organic Impurities
T 71 Mortar-Making Properties

NEBRASKA DEPARTMENT OF ROADS

NDR T 2 Sampling
NDR T 27 Sieve Analysis
NDR T 504 Clay Lumps, Shale, and Soft Particles
NDR T 103 Freeze and Thaw Soundness
NDR T 85 Specific Gravity and Absorption (Coarse Aggregate)
NDR T 84 Specific Gravity and Absorption (Fine Aggregate)
NDR T 89 Determining the Liquid Limit of Soils
NDR T 90 Determining the Plastic Limit and Plasticity Index of Soils
NDR T 5 Calcium Carbonate
NDR T 248 Reducing Field Samples of Aggregate to Testing Size

Fine sand shall have at least 95 percent of its particles pass the No. 10 sieve and no more than 25 percent pass the No. 200 sieve. This definition applies to the sodium sulfate soundness test.

3.01 MATERIALS (Continued)

C. AGGREGATE (Continued)

1. General (Continued)

Once an aggregate's soundness and abrasion quality has been determined, additional quality testing for soundness and abrasion loss will be at the City's Project Manager's discretion.

Aggregate shall be evaluated based upon its past performance in concrete pavement and in laboratory test results. Aggregate with adversely reactive constituents shall not be used.

During the progress of the Work, should the quality of the aggregate appear to change appreciably, the Contractor may be required to furnish satisfactory evidence of its soundness.

The City's Project Manager may, from time to time during the progress of the Work, make check tests of the gradation of the aggregates. Any materials failing to meet the requirements of the Standard Specifications shall be rejected and removed from the site of the Work.

Aggregates shall meet the gradation requirements of Table 3.01 A, for the Class of Concrete shown in Table 3.01 B, of these Standard Specifications. For all other applications such as overlay concrete or mortar and grout sands, the gradation requirements in the latest edition of the Nebraska Department of Roads "Standard Specifications for Highway Construction" shall apply.

2. Fine Aggregate

Fine aggregate shall consist of sand or sand-gravel or a combination of sand and sand-gravel.

The sand and sand-gravel shall be washed and composed of clean, hard, durable and uncoated particles. Aggregates produced from wet pits by pumping will be considered to be washed. Aggregates from a dry pit shall have the method for washing approved by the City Engineer. The fine aggregate shall be free from injurious amounts of clay, loam, alkali, organic matter and other deleterious substances.

Fine aggregate shall have a soundness loss of not more than 10 percent by weight at the end of 5 cycles using sodium sulfate solution.

The aggregate shall contain no more than one-half percent (0.5%) by weight of clay lumps.

The aggregate which produces a color darker than the standard color when subjected to the colorimetric test for organic impurities shall be tested for its mortar-making properties in accordance with AASHTO T 71.

The aggregate, when subjected to the mortar-making properties test, shall produce a mortar having a compressive strength at the age of 7 days equal to or greater than that developed by mortar of the same proportions and consistency made of the same cement and aggregate after the aggregate has been treated in a 3 percent solution of sodium hydroxide. Materials failing to produce equal or greater strength shall not be accepted, without permission from the City Engineer.

3.01 MATERIALS (Continued)

C. AGGREGATE (Continued)

3. Coarse Aggregate

Coarse aggregate shall consist of limestone composed of clean, hard, durable, and un-coated particles. These materials are natural sedimentary rock composed principally of calcium carbonate.

The calcium carbonate content of the aggregate shall be at least eighty percent (80%) (computed as CaCO_3 from value determined for CaO).

The percent of clay lumps, shale, or soft particles shall not exceed the following amounts:

Clay Lumps	0.5 percent
Shale	1.0 percent
Soft Particles	3.5 percent

Any combination of clay lumps, shale and soft particles shall not exceed three and one-half percent (3.5%).

Coarse aggregate for concrete shall be free of coatings that will inhibit bond and injurious quantities of loam, alkali, organic matter, thin or laminated pieces, chert or other deleterious substances.

Coarse aggregate for concrete shall not have a soundness loss greater than eight percent (8%) by weight at the completion of sixteen (16) cycles of alternate freezing and thawing.

The percentage of wear by the Los Angeles Abrasion test shall not exceed forty percent (40%).

**TABLE 3.01 A - GRADATION LIMITS FOR MINERAL AGGREGATES
FOR USE IN PORTLAND CEMENT CONCRETE**

Sieve	FINE AGGREGATE		COARSE AGGREGATE	
	Target	Tolerance	Target	Tolerance
1 1/2"	--	--	100	None
1"	100	None	100	-8
3/4"			78	±12
1/2"			--	--
3/8"			30	±15
# 4	87	±10	6	±6
# 10	60	±10	--	--
# 20	--	--	2 *	±2 *
# 30	28	±12		
# 50				
# 100				
# 200	1.5	±1.5	1.5	±1.5

* The percent passing may be increased to 3 ±3 provided no more than 1.5% is passing the No. 200 sieve when washed.

3.01 MATERIALS (Continued)

D. WATER

Water for concrete or mortar shall be clean and free from injurious amounts of oil, acid, alkali, salt, organic matter, and other deleterious substances. Test specimens of mortar made from the materials and water to be used in the Work shall develop a tensile or compressive strength at seven days of not less than ninety-five percent (95%) of that developed by the mixture of material and distilled water.

Wash-out water or water from the reclaiming process of Portland cement concrete shall not be allowed to be used in the mixture without permission from the City Engineer.

E. CHEMICAL ADMIXTURES

All Chemical Admixtures shall conform to the latest addition of the Nebraska Department of Roads "Standard Specifications for Highway Construction".

Portland cement concrete shall be air-entrained. Air-entraining admixtures to be used with Portland Cement Concrete shall conform to ASTM Designation C 260, except that the strength of the concrete containing the admixture shall not be less than ninety-two percent (92%) of a similar concrete without the admixture at all test ages. The air-entraining characteristics of the admixture, when combined in suitable proportions with Portland Cement, aggregate, and water, within the limits of the proportions specified, shall be such that the resulting concrete will have a satisfactory work-ability and a total air content within the limits, as specified herein, for the different classes of concrete.

If the air content of the concrete at the job site is less than the minimum specified, only one addition of air-entraining admixtures to a load is allowed. If the air content is then outside the limits specified, the load of concrete shall be rejected.

Admixtures which are not incorporated into the mix at the plant shall not be added to individual loads of concrete at the job site to enhance work-ability or pump-ability without permission from the City Engineer.

Admixtures shall not be added to individual loads of concrete at the job site to reduce either air content or slump without permission from the City Engineer.

TABLE 3.01 B - PORTLAND CEMENT CONCRETE MIXTURES (CUBIC YARD BATCH)

CLASS OF CONCRETE (1)	GENERAL USE	CEMENT (lb/cy)	CEMENT TYPE (2)	WATER CEMENT RATIO (MAX.)	SLUMP (MAX.) (inches) (3)	AGGREGATES (% BY WEIGHT)		AIR CONTENT RANGE (% BY VOLUME)	28 DAY STRENGTH MIN. PSI
						FINE	COARSE		
SG-3000	Where Specified	564	1PF	0.50	4.0	100	0	6.0 - 8.5	3000
L-3500	Pavement, Sidewalk, Structures	564	1PF	0.50	4.0	70 +/- 3	30 +/- 3	6.0 - 8.5	3500
L-3500S	Slip-form Pavement	564	1PF	0.48	2.5	70 +/- 3	30 +/- 3	7.0 - 10.0	3500
LC-3500	Machine Curb	564	1PF	0.48	2.5	70 +/- 3	30 +/- 3	6.0 - 8.5	3500
L-4500	Structures	658	1PF	0.42	4.0	70 +/- 3	30 +/- 3	6.0 - 8.5	4000
LB-2750	Pavement Base (New Construction Residential)	423	I/II	0.60	4.0	60 +/- 2	40 +/- 2	5.5 - 7.5	2750
LB-3500	Pavement Base (Reconstruction)	564	I/II	0.50	4.0	70 +/- 3	30 +/- 3	5.5 - 7.5	3500
L-5500	Pavement (High/Early Strength)	752	I/II	0.40	4.0	70 +/- 3	30 +/- 3	6.0 - 8.5	4000
PR (4)	Pavement Repair (High/Early Strength)	799	III	0.45	4.0	70 +/- 3	30 +/- 3	6.0 - 8.5	4000

NOTES:

(1) All mixtures shall contain a NDOR approved water reducer at the manufacturer's recommended dosage rate.

(2) For Temporary Pavement, Type I/II cement is allowed.

(3) The maximum slump may be exceeded by use of water reducer, high range water reducer, or both.

(4) Calcium Chloride may be added as per NDOR Standard Specifications for Highway Construction.

This table is for proportion ranges only. Actual mix design weights for specific applications will be provided by the City Engineer.

3.02 HANDLING MATERIALS

The concrete constituents, when delivered to the mixing equipment, shall meet the requirements of the above Standard Specifications.

The moisture content of the aggregate shall be reasonably uniform from batch to batch. Limestone having moisture absorption of more than one percent (1%) shall be uniformly saturated with water before it is used. The saturation shall be performed sufficiently in advance of mixing operations to permit filling of the pores of the aggregate.

3.03 WEIGHING & MIXING

The constituents of the concrete shall be weighed or measured separately at a central batch plant. The central batch plant shall be in substantial compliance with the requirements in the Quality Control Manual, Section 3, Certification of Ready Mixed Concrete Production Facilities published by the National Ready Mixed Concrete Association. The Contractor shall be responsible for the calibration of the plant on an annual basis or as deemed necessary by the City Engineer.

The concrete batch shall be either plant-mixed by the central batch plant or truck-mixed using transit mixing trucks. Mixing time shall be in accordance with ASTM C 94 and rate requirements shall be based on the size of drum and the mixing drum manufacturers' Specifications. Mixing time shall start when the cement and water are combined. The concrete shall be transported to the job site in clean, water-tight trucks. A load ticket showing the date, time, plant designation, mix designation, batch size, material quantities per batch, and aggregate moisture values used to calculate aggregate quantities shall accompany each load and be made available to the City's Project Manager.

No concrete shall be used from a batch that has exceeded ninety (90) minutes from the start of mixing time. A lesser time may be specified by the City Engineer if, in his opinion, conditions warrant it. Concrete hauled in non-agitating trucks shall be placed within thirty (30) minutes after mixing time starts.

The temperature of the concrete shall be between 50°F and 95°F when delivered to the Work. The temperature of the combined aggregate and water shall not exceed 95°F.

3.04 CONSISTENCY AND PLACEMENT OF CONCRETE

In general, the minimum amount of water shall be used which will produce the required workability. The mortar shall cling to the coarse aggregate and shall show no free water when removed from the mixer. The upper surface of the set concrete shall show a cement film upon the surface, but shall be free from laitance. In no case shall so much water be used so as to cause the collection of surplus water on the surface, or to cause segregation of the materials during transportation or placing of the concrete.

Concrete shall be plastic, cohesive and workable, and uniform from load to load. Workable concrete is defined as a concrete which can be placed without honeycomb and without surface voids. Workability shall be obtained without producing a condition such that free water appears on the surface when finished. The consistency of the mixture shall be that required for the specific conditions and methods of placement; however, the maximum water cement ratio, as specified in Table 3.01 B, shall not be exceeded.

The maximum allowable interval for placing successive concrete loads on grade for paving or into forms and excavations for structures shall be 30 minutes unless directed otherwise by the City Engineer. Concrete free fall distance shall not exceed 5 feet. This includes free fall in a discharge pipe when using a conveyor system for placement. Pumped concrete is not considered in free fall until the concrete exits the pumper hose.

3.05 CONCRETE TESTS

The City Engineer shall take such tests of the concrete as he deems necessary to determine the strength and the air, water, cement and aggregate proportions. The properties of the concrete will be determined by the tests specified in ASTM Designation C 94.

3.06 FLOWABLE FILL

A. DESCRIPTION

Flowable Fill shall be a mixture of cement, fly ash, fine sand, water, and air having a consistency which will flow under a very low head.

B. MATERIALS

The approximate quantities of each component per cubic yard of mixed material shall be as shown in Table 3.06 A.

TABLE 3.06 A - FLOWABLE FILL COMPOSITION PER CUBIC YARD

Cement (Type I or II)	60 pounds
Class C Fly Ash	200 pounds
Fine Sand (ssd)	2,700 pounds
Water (approx.)	420 pounds
Air Content (approx.)	10%

Actual quantities shall be adjusted to provide a yield of 1 cubic yard with the materials used.

Approximate compressive strength should be 85 to 175 psi.

Fine Sand shall be an evenly graded material having not less than 95 percent passing the No. 4 sieve and not more than 5 percent passing the No. 200 sieve.

Handling and mixing of the materials shall be in accordance with these Standard Specifications.

Cement must be on the latest NDOR Approved Products List.

C. BASIS OF PAYMENT

FLOWABLE FILL that has been completed in conformance with the Plans and Standard Specifications and accepted by the City's Project Manager shall be paid for at the contract unit price bid per cubic yard based on the ticketed volume of material delivered to the site. No payment shall be made for materials furnished in excess of that specified in the Contract or approved by the City's Project Manager. Such payment shall be full compensation for all materials, hauling, installing, equipment, tools, labor and incidentals necessary to complete the Work.

3.07 HOT/COLD WEATHER CONSTRUCTION

A. CONCRETE CONSTRUCTION - HOT WEATHER

To reduce plastic shrinkage and cracking, the following conditions shall be considered:

1. Concrete temperatures
2. Air temperatures
3. Humidity
4. Wind velocities

When these conditions combine to create a rate of evaporation equal to or greater than 0.2 pounds per square foot per hour (as determined by Figure 3.07), the following precautions shall be taken:

1. Dampen subgrade and forms.
2. Dampen aggregates prior to mixing.
3. Maintain cool aggregates and mixing water.
4. Finish immediately following placement.
5. Cure immediately following finishing operation.
6. Trucks must be discharged within one hour after loading (agitation shall be minimized).

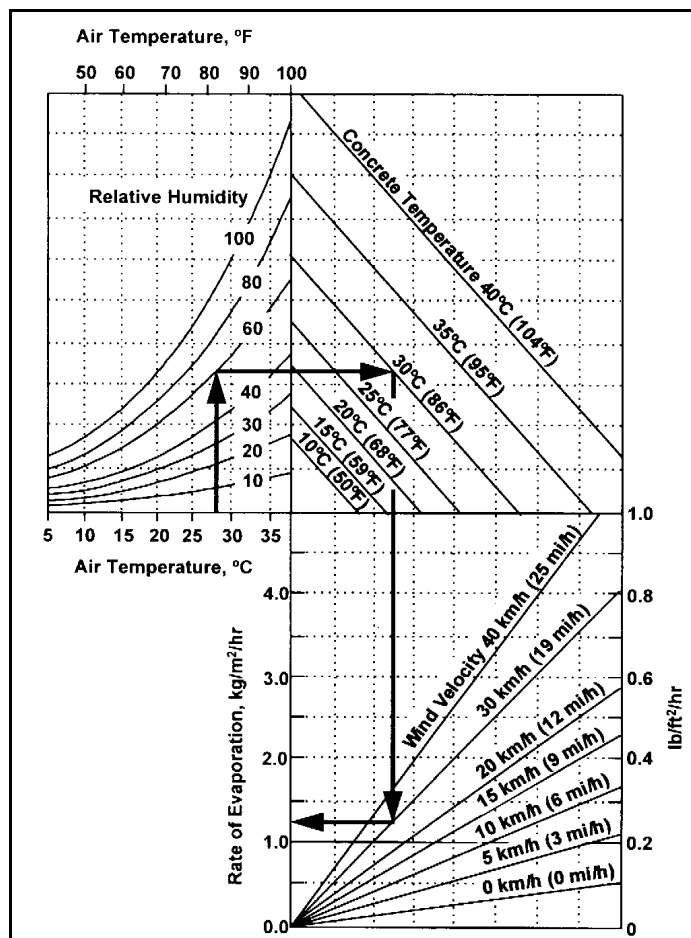


Figure 3.07
HOT WEATHER CONCRETING
EVAPORATION NOMOGRAPH

B. CONCRETE CONSTRUCTION - COLD WEATHER

Concrete shall not be placed in inclement weather except with permission of the City Engineer. The air temperature for placing concrete shall be 35°F and rising. No concrete shall be placed on a frozen sub-grade. When air temperatures can be anticipated below 35°F, the concrete shall be preheated such that the temperature of the fresh concrete in place is a minimum of 55°F and it shall be maintained for seventy-two (72) hours at a minimum of 50°F with adequate layers of burlap, plastic, insulated blankets, or other approved materials.

The concrete further shall have achieved the minimum design strength desired prior to any vehicular use of the section, as determined by the City's Project Manager. Concrete construction during cold weather shall be continued only with the specific authorization of the City Engineer, who may require special construction methods.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 4

PORTLAND CEMENT CONCRETE (PCC) PAVEMENT

ARTICLE	TITLE	
4.00	GENERAL	402
4.01	MATERIALS	402
	A. CONCRETE	402
	B. REINFORCEMENT	402
	C. REINFORCING BAR SUPPORTS	402
	D. METAL DOWEL OR EXPANSION BAR SLEEVE	402
	E. PREFORMED EXPANSION JOINT MATERIAL	403
	F. JOINT SEALER	403
	G. CURING COMPOUNDS	403
	H. METAL KEYWAY	403
4.02	PREPARATION OF SUBGRADE	403
4.03	FORMS	403
	A. GENERAL	403
	B. RIGID FORMS	404
	C. SLIP FORMS	404
4.04	PLACING REINFORCING STEEL / TIE BARS	405
4.05	CONCRETE PLACEMENT	405
	A. VIBRATING	405
	B. FINISHING	405
	C. SURFACE TESTS	407
4.06	JOINTS	408
	A. TRANSVERSE CONSTRUCTION JOINTS	408
	B. EXPANSION JOINTS	408
	C. CONTRACTION JOINTS OR PLANES OF WEAKNESS	409
	D. JOINT SEALING	409
4.07	CURING AND PROTECTION	410
	A. CURING	410
	B. PROTECTION	410
4.08	INTEGRAL CURB	411

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 4

PORTLAND CEMENT CONCRETE (PCC) PAVEMENT

ARTICLE	TITLE	
4.09	BASIS OF PAYMENT	411
	A. GENERAL	411
	B. PORTLAND CEMENT CONCRETE (PCC) PAVEMENT	411
	C. PORTLAND CEMENT CONCRETE (PCC) PAVEMENT with INTEGRALCURB	411
	D. REINFORCED PORTLAND CEMENT CONCRETE (RPCC) PAVEMENT	411
	E. CONCRETE SIDEWALK; CONCRETE DRIVEWAY; CONCRETE BIKEWAY	412
	F. COMBINED CURB AND GUTTER, CONCRETEBARRIER CURB,or CONCRETE MEDIAN CURB	412
	G. CONCRETE HEADER	412
	H. CONCRETE MEDIAN NOSE	412
	I. CONCRETE MEDIAN SURFACING, 4" THICK	412
	J. TACK-ON MEDIAN	412
4.10	ALLEY PAVEMENT AND ALLEY RETURNS	413
	A. GENERAL	413
	B. BASIS OF PAYMENT	413
4.11	ACCESS RAMPS	413
	A. GENERAL	413
	B. BASIS OF PAYMENT	413
4.12	SUBSTANTIAL COMPLETION	414

CHAPTER 4

PORTLAND CEMENT CONCRETE (PCC) PAVEMENT

4.00 GENERAL

Portland Cement Concrete (PCC) pavement shall refer to, but not be limited to, streets, roads, alleys, sidewalks, driveways, bikeways, concrete curbs and medians. All pavements to be replaced or reconstructed under each contract shall be placed at the locations shown on the plans, on an approved subgrade, in accordance with these Standard Specifications and in conformity with the lines, grades, typical cross section, and details shown on the plans and/or as directed by the City's Project Manager.

Pavement construction and reconstruction shall include all necessary removal of existing headers, pavement, sidewalks and drives; clearing, grubbing and stripping, excavation within the limits of the Work, removal of obstructions, removal and disposal of unsuitable material and debris, borrow excavation, construction of fills and embankments, haul, preparation and compaction of the subgrade; the construction of curbs, base, pavement, driveways, sidewalks; trimming, shaping and finishing of the parking space; excavation of ditches, grading and construction of approaches on intersecting or entering streets, alleys, driveways, and any other items of Work necessary to conform to these Standard Specifications and the lines, grades and cross sections shown on the plans, all as directed by the City's Project Manager.

4.01 MATERIALS

Portland Cement Concrete (PCC) pavement shall be constructed of the materials as herein specified.

All materials used in pavement construction and reconstruction shall be on the latest edition of the Nebraska Department of Roads "Approved Products List" unless otherwise approved by the City Engineer

A. CONCRETE

Portland Cement Concrete (PCC) Pavement shall be class L-3500 concrete, as defined in Chapter 3, of the thickness, and with or without reinforcement, as shown on the plans unless otherwise specified. In the case of curbs, LC3500 is also an acceptable alternative.

B. REINFORCEMENT

All reinforcement bars shall conform to the requirements of "Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement" ASTM A 615, Grade 40 (300) or grade 60 (420). Bars shall be free from excess rust, scale, or other substances, which prevent the bonding of the concrete to the reinforcement. Smooth dowel bars shall be epoxy coated and conform to the requirements of "Structural Steel", ASTM A 36.

C. REINFORCING BAR SUPPORTS

Reinforcing bar supports for use in concrete pavement shall be of a design and material satisfactory to the City's Project Manager and of sufficient strength to hold the metal reinforcement in place while the concrete is being placed.

D. METAL DOWEL OR EXPANSION BAR SLEEVE

Metal or plastic sleeves for dowel or expansion bars shall be satisfactory to the City's Project Manager and shall be of sufficient size and strength to permit the free sliding of the dowel bar after the concrete is in place.

4.01 MATERIALS (Continued)

E. PREFORMED EXPANSION JOINT MATERIAL

Expansion joint material shall conform to “Standard Specifications for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction” (non-extruding and resilient bituminous types) ASTM Designation D 1751. The joint material shall be 1 inch thick unless otherwise specified.

F. JOINT SEALER

Joint sealer shall conform to the requirements of ASTM D 6690 Type II, “Standard Specification for Joint Sealant, Hot-Applied Elastomeric-Type, for Portland Cement Concrete Pavement”, and shall meet or exceed the testing requirements of ASTM D 5329, “Standard Test Method for Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavement”. The flow as specified in ASTM D 5329 shall not exceed 3/4".

G. CURING COMPOUNDS

All curing compounds shall be of the white pigmented liquid membrane-forming type and shall conform to “Standard Specifications for Liquid Membrane -Forming Compounds for Curing Concrete”, ASTM Designation C 309, Type 2, Class A. Only curing compounds included on the latest edition of the NDOR Approved Products list shall be used unless otherwise approved by the City Engineer.

All curing compounds shall be ready for use as is without further dilution. The rate of application shall be as recommended by the manufacturer.

H. METAL KEYWAY

Metal keyway, where shown, shall conform to the gauge and cross section shown in the Lincoln Standard Plans.

4.02 PREPARATION OF SUBGRADE

No measurement or direct payment shall be made for preparation of subgrade. The cost of preparation of subgrade shall be considered subsidiary to the other items of Work for which direct payment is made.

The subgrade shall be prepared as specified in Chapter 2 of these Standard Specifications. To prevent the absorption of moisture from the newly deposited concrete, the subgrade shall be kept moist by light applications of water until the concrete has been placed.

4.03 FORMS

A. GENERAL

No direct payment shall be made for forms. The cost of form work shall be considered subsidiary to other items of Work for which direct payment is made.

Upon removal of the forms, all honeycombed areas or small defects shall be properly pointed up with an approved grout mix and the concrete previously protected by the forms shall be cured as hereinafter specified or as directed by the City’s Project Manager.

4.03 FORMS (Continued)

B. RIGID FORMS

Forms shall be of an approved steel section with a minimum base width of 6 inches and shall have adequate locking devices. The forms shall have a minimum length of 10 feet for street paving. The forms shall be built straight and true and in conformance with established line and grade. On curves having a radius of less than 150 feet, approved forms may be used. The depth of forms shall equal at least the depth of the concrete to be placed. No built up forms will be permitted without prior approval of the City's Project Manager.

All forms shall be free from bends and warps at all times. They shall be cleaned thoroughly each time they are used and adequately oiled before concrete is placed against them. The forms shall be set so that they rest firmly throughout their entire length on the thoroughly compacted subgrade. They shall be neatly and tightly joined. They shall be accurately set to line and grade and sufficiently braced to resist the pressure of the concrete. Forms shall be set at least 150 feet ahead of the paving operation.

The forms shall not be removed until new concrete is at least twelve (12) hours old unless approved by the City's Project Manager. During the operation of form removal, the edges of the concrete shall be cured as hereinafter specified.

When concrete pavement is being laid contiguous to previously finished pavement of the same finished grade elevation or contiguous to previously finished independent curb or curb and gutter, such finished pavement or curb may be made to serve as side forms.

Upon removal of the forms, all honeycombed areas or small defects shall be pointed up properly with an approved mix grout.

For Sidewalks, Driveways, and Bikeways only, the Contractor shall erect substantial forms of a material approved by the City's Project Manager. Unless otherwise shown on the plans, sidewalks and bikeways shall be constructed so that, when finished, they shall have a uniform transverse slope toward the curb of two percent (2%).

C. SLIP FORMS

Slip form equipment shall be provided with traveling side forms and screed of suitable dimensions, shapes, and strength to support the concrete for a sufficient length of time during placement to produce the required cross section. The equipment shall spread, consolidate and screed the freshly placed concrete in such a manner as to provide a dense and homogeneous product.

The slip form equipment shall have automatic sensor controls for both line and grade which operate from an offset control line.

All curbs shall be constructed using slip form paving equipment, except when specifically authorized by the City's Project Manager. At the option of the Contractor and with the approval of the City's Project Manager, slip form equipment may be used for construction of concrete sidewalks or bikeways.

4.04 PLACING REINFORCING STEEL / TIE BARS

No measurement or direct payment will be made for reinforcing steel or Tie bars. The cost of furnishing and placing reinforcing steel or Tie Bars shall be considered subsidiary to other items of Work for which direct payment is made.

All reinforcing steel shall be kept clean and free from foreign material that will prevent the proper bond with the concrete. Reinforcement steel / tie bars shall be placed as shown on the plans or Lincoln Standard Plans. Reinforcement steel / tie bars shall be placed between the concrete driveway and the pavement when a commercial drive is being constructed in conjunction with new paving. The length and location of the reinforcement steel / tie bars shall be as shown on the drawings. The Reinforcement steel / tie bars shall project equally into the driveway and pavement section. The reinforcement shall be placed so that the outside longitudinal members will be located no more than 3 inches from the edge of the slab section and the ends of all longitudinal members shall extend to within 2 inches of the ends of the slab sections. All steel reinforcing bars shall be tied securely in place at all points where the bars cross.

4.05 CONCRETE PLACEMENT

No measurement or direct payment will be made for placing and finishing the concrete. Placing and finishing the concrete shall be considered subsidiary to other items for which direct payment is made.

The concrete shall be deposited uniformly on the prepared subgrades and distributed to the required depth for the entire width by shoveling or other approved methods. The concrete then shall be consolidated thoroughly, using an approved vibrating screed or in a manner approved by the City's Project Manager. The concrete shall be so placed that no segregation of the materials occurs. It shall be struck off and finished, as hereinafter provided. Rakes shall not be used in handling concrete.

A. VIBRATING

No direct measurement or payment shall be made for vibrating or consolidation of the concrete. The cost of vibrating shall be considered subsidiary to other items of Work for which direct payment is made.

The concrete shall be well consolidated against the forms. All concrete, whether placed by machine or by hand methods, shall be thoroughly consolidated by means of mechanical vibrators approved by the City's Project Manager. The vibrator shall consolidate the full depth and width of the concrete to a uniform mass without segregation and free from excessive surface mortar at a single passage of the machine. Machine mounted vibrators shall be operated only when the machine to which they are attached is moving. The vibrators shall be placed so as to allow a minimum of overlap vibration. The vibration frequency shall be greater than 4,000 impulses per minute. The Contractor shall have a tachometer available to check the speed of the vibrators.

B. FINISHING

1. General Finishing

Finishing the concrete pavement shall not be measured and paid for directly. The cost of the finishing will be considered subsidiary to the cost of other Work for which direct payment is made.

4.05 CONCRETE PLACEMENT (Continued)

B. FINISHING (Continued)

1. General Finishing (Continued)

Whether the consolidation and finishing of the concrete is accomplished by either machine or hand methods, the following requirements shall apply and all equipment used shall meet the approval of the City's Project Manager. Unless otherwise provided in the Special Provisions or approved by the City's Project Manager, hand finishing as described herein may be employed only in cases of emergency and where mechanical methods are impractical. The consolidation and finishing of concrete sidewalk, bikeway or driveway may be accomplished by either machine or hand methods.

In general, the addition of superficial water to the surface of the concrete to assist in finishing operations will not be permitted. However, due to unavoidable delay in finishing or an unusual drying condition, a slight quantity of water may be added to the surface of the concrete as an aid in finishing. If it becomes necessary to sprinkle the surface with water to complete the finishing of the concrete, all mixing operations shall be immediately discontinued until the finishers catch up to a point where extra water for finishing is no longer required. If the application of water to the surface is permitted, it shall be applied in a fog spray by means of an approved orchard-type sprayer. Spray equipment which is attached to the mechanical finisher, or any other paving equipment, will not be permitted. The addition of superficial water to the surface of the concrete shall be at the Contractor's risk. The pavement shall be given a finish by means of a wet burlap drag. The drag shall be pulled in a longitudinal direction only. The drag shall be adequately maintained so that the resultant finish shall be uniform in appearance. On sidewalks and driveways, the final finish shall be obtained with the use of a broom. Brooming shall be transverse to the direction of pedestrian traffic.

Prior to the time the concrete takes its initial set, all expansion and construction joints and exposed edges shall be carefully finished with an edger having a radius of not less than 1/4 inch. The edge shall be left smooth and true to line and grade. The Contractor shall provide a suitable work bridge spanning the concrete placement to facilitate the edging.

2. Machine Finishing

The concrete shall be deposited in such a manner that adequate concrete remains ahead of the screed and the finish machine to provide the cross section required. The concrete will then be further consolidated and finished mechanically with a power-driven, self-propelled machine approved by the City's Project Manager. The finish machine shall be operated over the entire width of the pavement section and shall achieve uniform consolidation. The tops of the forms and the contact surfaces of the wheels of the finishing machine shall be kept free from concrete and earth.

The finishing machine shall be kept in good repair at all times and shall operate so as to give the desired finish over the entire surface of the pavement. The forward speed of the finishing machine shall be adjusted to the average progress of the concrete production, in order that the strike-off operation shall be as continuous and uninterrupted as possible.

After the final pass of the finishing machine, the surface shall be checked and corrected by using approved 10 feet long straight edges and refinished using long handled floats. The use of the long handled floats shall be held to a minimum. The straight edge shall be lapped one-half (1/2) its length on each successive position.

4.05 CONCRETE PLACEMENT (Continued)

B. FINISHING (Continued)

2. Machine Finishing (Continued)

The Contractor shall furnish and keep in a convenient place a master straight edge, made of 6 inch steel channel, for the purpose of checking all straight edges and the longitudinal float during the progress of the Work. A sufficient number of straight edges shall be kept in readiness so as not to delay the paving operations.

Hand tools that perform the function of the finishing machine shall be immediately available for use in the event of an emergency.

3. Hand Finishing

After the concrete has been placed and spread, it shall be thoroughly consolidated by the use of approved vibrating screeds and struck off to a uniform height above the finished grade to the true cross section. When a non-vibrating hand screed is used or the pavement design thickness is greater than 6 inches, the concrete shall be consolidated with an approved mechanical vibrator before the concrete is struck off.

The screed used shall be of a design and construction suitable and adequate for the purposes required. It shall be designed to ride on the side forms of the pavement. The screed shall be of metal or steel-shod wood and shall have sufficient strength and stiffness to retain its shape under all working conditions. The working or screeding edge shall be shaped to match the required cross section of the pavement. The screed shall be operated so that when riding on the side forms, the working edge will have an excess of concrete above grade to produce the required cross section after consolidation.

After the concrete has been consolidated and struck off, the surface shall be finished as specified above under machine finishing.

C. SURFACE TESTS

After the pavement has been set sufficiently to permit foot traffic, the slab will be thoroughly checked by the City's Project Manager. All variations in excess of 1/8 inch, measured from the surface of the concrete in place with a 10 foot straight edge or other device used for measuring deviations from a plane, shall be plainly marked. The Contractor shall eliminate such variations.

When the surface finish of the pavement has been disturbed by grinding, the surface shall be repaired with the use of an approved sealant. The use of mechanical grinders will be permitted if their use does not, in the opinion of the City's Project Manager, damage the pavement.

4.06 JOINTS

No direct measurement or payment will be made for joints or joint sealant. The cost of jointing and joint sealing shall be considered subsidiary to other items of Work for which direct payment is made.

A. TRANSVERSE CONSTRUCTION JOINTS

At the end of the day, or in case of an unavoidable interruption of more than thirty (30) minutes, a transverse construction joint shall be placed at the point of the Work stoppage. The joints shall conform to the requirements for construction joints as shown on the plans and as specified herein.

Whenever concrete pavement construction is stopped for a period of over 30 minutes, a transverse construction joint shall be formed by finishing the concrete to a bulkhead made of at least 2 inch material cut to the exact cross section of the pavement slab, as shown on the plans. The bulkhead shall be placed on the subgrade perpendicular to the pavement surface and at right angles to the center line of the roadway. An edging tool shall be used along the bulkhead to make the construction joint a well-defined line. Construction joints shall not be spaced closer than 10 feet. When the placing of concrete is resumed, the bulkhead shall be removed and care shall be taken not to disturb any steel or concrete placed. The new concrete shall be placed directly against the face of the concrete previously placed. The joint shall be formed and finished so the surfaces of the previously placed concrete and new concrete correspond exactly to the cross section and grade shown on the plans.

B. EXPANSION JOINTS

1. Transverse

When transverse expansion joints are indicated on the plans, they shall be constructed at the location and in accordance with details shown in the plans or Lincoln Standard Plans. The joint material shall extend entirely through the pavement and shall be placed so the top edge will be 3/8 inch below the surface of the finished pavement and curb.

During the placing and the finishing of the concrete pavement, the expansion joint material shall be held securely by means of a special holder approved by the City's Project Manager. Extreme care shall be exercised in placing concrete around the joint so the joint will remain in the true position specified herein.

After the edges have been rounded, the surface of the pavement across the joint shall be tested with a 10 foot straight edge placed parallel to the center line of the pavement and drawn from the center of the pavement to the edge. Any high spots or depressions shall be eliminated and the edges rounded as hereinbefore specified. Any surplus concrete at the ends of the joints shall be cut away when the forms are removed.

2. Other

Expansion material shall be formed around all objects that project through the pavement unless otherwise directed. When the pavement is placed against buildings, sidewalks and other unyielding objects, 1 inch expansion joint material shall be placed between the object and the new concrete.

4.06 JOINTS (Continued)

C. CONTRACTION JOINTS OR PLANES OF WEAKNESS

Contraction joints or planes of weakness called for on the plans shall be constructed at the locations indicated and in accordance with details shown on the plans or as directed by the City's Project Manager. Maximum joint spacing shall be 15 feet unless otherwise directed by the City's Project Manager.

All joints shall be made with a motor driven concrete saw to a minimum depth of one-fourth (1/4) the pavement thickness. The sawing shall be accomplished not later than forty-eight (48) hours after concrete placement nor so soon as to cause spalling of top aggregates. When "extra strength" concrete is used, the joints shall be sawed within twenty-four (24) hours after concrete placement. Transverse contraction joints generally shall be sawed within eighteen (18) hours after concrete placement. In any event, the concrete shall be sawed before random cracks develop. The sawing of any joint shall be discontinued if a crack occurs at or near the joint location prior to the time of sawing. Sawing shall be discontinued when a crack develops ahead of the saw.

Cracks developed before sawing commences or cracks developing ahead of the saw shall be routed to a depth of 3/8 inch by 3/8 inch in width. The joint between the curb and gutter section and concrete pavement shall be sawed to a depth of 1 inch and sealed.

D. JOINT SEALING

All expansion and saws joints shall be sealed as provided herein.

The joint shall be cleaned by high pressure compressed air or other approved methods to remove all residues. The joint shall be filled from the bottom to the top without formation of voids. The top of the finished joint seal shall be between 1/4 inch and 3/8 inch below the finished surface, unless shown otherwise on the plans. At the time of application of the joint sealant, the joint and pavement shall be dry and acceptable to the City's Project Manager. No sealant shall be placed during unsuitable weather or when the atmospheric temperature is below 50°F or when weather conditions indicate that the temperature may fall below 32°F within twenty-four (24) hours.

The joint sealing filler shall be melted uniformly and with constant stirring in an asphalt kettle of the double boiler design with oil being used as the heating medium. The material shall be furnished or prepared in pieces of such size and shape that the material can be melted readily to the proper pouring consistency. The Contractor shall obtain from the supplier or from the manufacturer and furnish to the City's Project Manager the manufacturer's recommendations for mixing, application and temperature restrictions. These recommendations shall be followed strictly. In no case shall the temperature exceed the maximum recommended by the manufacturer. When proper pouring consistency is attained, the joints shall be filled as shown in the plans, through the use of pressure-type applicator, of a design approved by the City's Project Manager and equipped with a nozzle which will fit into the joints.

All adjoining surfaces shall be carefully protected during the joint sealing operations, and any stains, marks or damage thereto, as a result of the Contractor's operations, shall be corrected in a manner satisfactory to the City's Project Manager.

4.07 CURING AND PROTECTION

A. CURING

No direct measurement or payment shall be made for curing and protection. The cost of curing and protection shall be considered subsidiary to other items of Work for which direct payment is made.

1. Curing With Liquid Membrane Curing Compound

Immediately after the concrete has been finished, the concrete surface and exposed vertical edges shall be sealed with a uniform application, no less than 1 gallon per 200 square feet, of a membrane curing compound as described previously in this chapter. An approved self propelled mechanical power sprayer shall be used to apply the curing compound to the concrete pavement except that approved manual spraying equipment may be employed on narrow or variable width sections where the use of a self-propelled mechanical power sprayer is impractical, and on irregular sections of street returns and alley returns.

2. Curing With Wet Burlap

Immediately after the concrete has been finished, burlap shall be carefully placed on the concrete and kept moist in a manner which will not damage the pavement surface. The burlap shall be clean, evenly woven, free of encrusted concrete or other contaminating materials, and shall be reasonably free from cuts, tears, broken or missing yarns, and thin, open or weak places.

The burlap shall be of sufficient length to cover all exposed surfaces including the vertical edges of the slab. At exposed vertical edges of the slab, earth shall be banked so that the top width of the berm shall be at least 6 inches.

The burlap shall be kept continuously saturated with water for at least 72 hours following the placing of the concrete, except that the burlap may be temporarily removed so that joints may be sawed and filled, the surface tested, and any grinding or rubbing necessary may be accomplished. While the pavement is uncovered, it shall be kept wet by sprinkling with water. Concreting operations shall be suspended when water is not available to cure the concrete.

B. PROTECTION

The Contractor shall provide and maintain substantial barricades, warning signs, and watchmen, when required, to protect the new pavement and Work site from vandalism and property destruction.

Any concrete showing injury from vandalism shall be repaired or removed and replaced at the Contractor's expense, to the City's Project Manager's satisfaction. No heavy equipment or vehicular traffic shall be allowed on the new construction until the concrete has achieved a compressive strength of 3,000 p.s.i. or seven (7) days have elapsed. A longer period of time may be required if, in the opinion of the City's Project Manager, the concrete is not of sufficient strength to support the equipment or vehicles.

4.08 INTEGRAL CURB

No direct measurement or payment shall be made for integral curb. The cost of integral curb shall be considered subsidiary to the items for which direct payment is made.

When required, integral curb shall be constructed on the edge of the concrete slab in conformance with the plans and typical cross section. The concrete for the integral curb shall be of the same mixture as used in the concrete slab.

The finish machine screed template should preferably leave enough concrete at the curb location to eliminate further carry-back and handling of the concrete. The steel curb template shall be an integral part of the finish machine with a self-contained vibrator for the curb section.

When authorized by the City's Project Manager, the curb may be placed immediately after the concrete in the pavement has been placed and finished, but before the concrete develops its initial set, by means of a curb machine equipped with a steel template and self-contained vibrator. Hand placement methods shall be finished with the aid of a metal mule template. This method shall be used only where specifically authorized by the City's Project Manager.

4.09 BASIS OF PAYMENT

A. GENERAL

Such payment shall be full compensation for all preparation of subgrade, forms or slip forming, curb and gutter, integral curb, materials, labor, tools, equipment, jointing, finishing, curing, sawing, sealing, backfilling, guarantee, cleanup and incidentals necessary to complete the Work.

Curb drops shall be constructed at locations shown on the plans or as directed by the City's Project Manager for the future construction or reconstruction of driveways or access ramps. No direct payment will be made for the Work of constructing curb drops. The cost of curb drops shall be considered subsidiary to the items for which direct payment is made.

B. PORTLAND CEMENT CONCRETE (PCC) PAVEMENT

Plain (non-reinforced) concrete pavement of the various thicknesses called for in the proposal, constructed in conformance with these Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per square yard for PORTLAND CEMENT CONCRETE (PCC) PAVEMENT, __". The final measure shall be for pavement only, excluding curb and gutter.

C. PORTLAND CEMENT CONCRETE (PCC) PAVEMENT with INTEGRAL CURB

The pavement of the dimensions and thickness called for on the plans, constructed in conformance with the Lincoln Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price per square yard for PCC PAVEMENT WITH INTEGRAL CURB, __". The final measure shall be for pavement with integral curb and measured from back of curb to back of curb.

D. REINFORCED PORTLAND CEMENT CONCRETE (RPCC) PAVEMENT

Reinforced concrete pavement of the various thicknesses called for in the proposal, constructed in conformance with these Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per square yard for REINFORCED PORTLAND CEMENT CONCRETE (RPCC) PAVEMENT, __".

4.09 BASIS OF PAYMENT (Continued)

E. CONCRETE SIDEWALK; CONCRETE DRIVEWAY; CONCRETE BIKEWAY

CONCRETE SIDEWALK, __" THICK; CONCRETE DRIVEWAY, __" THICK; CONCRETE BIKEWAY, __" THICK, that has been completed in conformance with the Plans and Standard Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per square foot. Sidewalks or bikeways constructed through future driveway locations shall be constructed to the minimum driveway thickness, and shall be measured and paid for at the appropriate unit price bid for Concrete Driveway.

F. COMBINED CURB AND GUTTER, CONCRETE BARRIER CURB, or CONCRETE MEDIAN CURB

COMBINED CURB AND GUTTER, CONCRETE BARRIER CURB, or CONCRETE MEDIAN CURB, completed in conformance with the plans and Standard Specifications and accepted by the City's Project Manager, shall be measured along the face of the curb through all inlets.

Payment shall be made at the contract unit price bid per linear foot for each type and size constructed.

G. CONCRETE HEADER

Concrete headers shall be placed at the ends of all streets and intersections when the extended street or side streets are unpaved. Concrete headers constructed in accordance with Lincoln Standard Plans and accepted by the City's Project Manager shall be paid for at the contract unit price bid per linear foot for INSTALL CONCRETE HEADER or REMOVE CONCRETE HEADER.

H. CONCRETE MEDIAN NOSE

CONCRETE MEDIAN NOSE completed in conformance with the plans and Standard Specifications and accepted by the City's Project Manager, shall be paid for at the contract unit price bid per each.

I. CONCRETE MEDIAN SURFACING, 4" THICK

CONCRETE MEDIAN SURFACING, 4" THICK, completed in conformance with the plans and Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per square foot.

J. TACK-ON MEDIAN

TACK-ON MEDIAN, completed in conformance with the plans and Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per square foot.

4.10 ALLEY PAVEMENT AND ALLEY RETURNS

A. GENERAL

The finishing of concrete alley pavement and concrete alley returns shall proceed, in general, in accordance with the methods specified above under "Hand Finishing", with the modification that after the required strike off and consolidation, the surface shall be floated longitudinally with a wooden float.

Where walls of buildings or other obstructions exist immediately adjacent to alley lines and against which the new pavement must be placed, necessary modifications of the methods specified in this section will be approved by the City's Project Manager. No essential requirements, however, relating to quality of workmanship or trueness to grade and cross sections shall be waived. In general, a temporary screed strip shall be set to the proper grade, parallel to the alley line and approximately 1 foot there from, and a somewhat shorter screed shall be used.

As soon as the necessary screeding has been completed, the screed strip shall be immediately removed and the space filled with fresh concrete. Final finishing shall then be completed as specified under machine finish of these Standard Specifications. All jointing, jointing patterns and typical sections shall conform to Lincoln Standard Plans.

B. BASIS OF PAYMENT

Alley pavement of the various thicknesses called for in the proposals, constructed in conformance with these Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per square yard for PORTLAND CEMENT CONCRETE (PCC) ALLEY PAVEMENT, __". Such payment shall be full compensation for all preparation of subgrade, forms or slip forming, curb and gutter, integral curb, materials, labor, tools, equipment, jointing, finishing, curing, sawing, sealing, backfilling, guarantee, cleanup and incidentals necessary to complete the Work.

4.11 ACCESS RAMPS

A. GENERAL

Access ramps shall be constructed at the locations shown on the plans or as directed by the City's Project Manager. All ramps shall be a minimum of 6 inches thick. All curb ramps shall be constructed with DETECTABLE WARNING PANEL material in accordance with the Lincoln Standard Plans.

B. BASIS OF PAYMENT

Access ramps shall be measured and paid for at the appropriate unit price bid for CONCRETE SIDEWALK, 6" THICK or CONCRETE BIKEWAY, 6" THICK. Such payment shall be full compensation for all preparation of subgrade, forms or slip forming, curb and gutter, integral curb, materials, labor, tools, equipment, jointing, finishing, curing, sawing, sealing, backfilling, guarantee, cleanup and incidentals necessary to complete the Work.

DETECTABLE WARNING PANELS material shall be paid for by the square foot of material in place.

4.12 SUBSTANTIAL COMPLETION

All projects involving items of paving shall be considered substantially complete when all items of Work shown on the proposal or called for in any other area of the Contract documents are completed to the satisfaction of the City's Project Manager. Such items shall include but will not be limited to: curb and gutter, Asphaltic Concrete pavement/Portland Cement Concrete (PCC) pavement, streets, roads, driveways, sidewalks, alleys, bikeways, concrete curbs, medians, adjustment of manholes, valve boxes, water stop boxes, backfilling, park spacing, joint sealing, and pavement markings.

Liquidated damages shall continue to accrue until such time as the Work is deemed to be substantially completed by the City's Project Manager. However, the Contractor may submit a written request to the City's Project Manager for approval to suspend such liquidated damages to allow additional time for completion of such minor items of the Work as seeding, sodding, and survey monuments. Granting the request for additional time by the City's Project Manager shall not relieve the Contractor of the Contractor's responsibilities for completion of those items for which the suspension is requested.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 5

PORTLAND CEMENT CONCRETE (PCC) BASE CONSTRUCTION

ARTICLE	TITLE	
5.00	GENERAL	501
5.01	MATERIALS	501
	A. CONCRETE	501
	B. LIQUID MEMBRANE CURING COMPOUND	501
5.02	PREPARATION OF SUBGRADE	501
5.03	FORMS	502
5.04	CONCRETE PLACEMENT	502
	A. GENERAL	502
	B. VIBRATING	502
	C. FINISHING	502
5.05	JOINTS	503
	A. CONSTRUCTION JOINTS	503
	B. CONTROL JOINTS	503
	C. LONGITUDINAL CONSTRUCTION JOINTS	504
5.06	CURING AND PROTECTION	504
	A. CURING	504
	B. PROTECTION	505
5.07	BASIS OF PAYMENT	505
5.08	CONCRETE HEADER	505
5.09	HOT/COLD WEATHER CONSTRUCTION	505

CHAPTER 5

PORTLAND CEMENT CONCRETE (PCC) BASE CONSTRUCTION

5.00 GENERAL

This Work shall be defined as the construction of a completely new pavement structure or the reconstruction of an existing pavement structure including earthwork, appurtenances, and all related construction required to connect to existing pavement around the limits of construction.

The concrete base shall be constructed on an approved subgrade in accordance with Chapter 2 of these Standard Specifications, in conformity with the lines, grades and typical cross sections shown on the plans

5.01 MATERIALS

A. CONCRETE

Portland Cement Concrete (PCC) for base shall be LB-2750 concrete for new construction of Residential Streets only and LB-3500 for all other applications unless otherwise specified. LB-2750 and LB-3500 concrete shall meet the requirements of Chapter 3 of these Standard Specifications. The thickness of the base shall be as shown on the plans.

B. LIQUID MEMBRANE CURING COMPOUND

Curing Compound for base construction shall be either Translucent Liquid Membrane-Forming Type or Emulsified Asphalt.

1. Translucent Liquid Membrane-Forming Type

Translucent Liquid Membrane-Forming Type curing compound shall contain no wax, resin or solvent and shall conform to “Standard Specifications for Liquid Membrane - Forming Compounds for Curing Concrete”, ASTM Designation C 309, Type 1, Class B. Only curing compounds included on the latest edition of the NDOR Approved Products list shall be used unless otherwise approved by the City Engineer.

2. Emulsified Asphalt

Emulsified Asphalt used as cure for concrete base shall conform to “Standard Specification for Emulsified Asphalt”, ASTM D 977. The Emulsified Asphalt shall be homogeneous after thorough mixing provided separation has not been caused by freezing. Emulsified Asphalts separated by freezing shall not be used. Only Emulsified Asphalts included on the latest edition of the NDOR Approved Products list shall be used unless otherwise approved by the City Engineer.

5.02 PREPARATION OF SUBGRADE

The subgrade shall be prepared as specified in Chapter 2 of these Standard Specifications. To prevent the absorption of moisture from the newly deposited concrete, the subgrade shall be kept moist by light applications of water until the concrete base has been placed.

No direct payment will be made for preparation of subgrade. Subgrade preparation shall be considered subsidiary to other items of Work for which direct payment is made.

5.03 FORMS

The outside form for the construction of concrete base shall be the combination curb and gutter. Alternate forms, when required, shall be steel or wood. Steel forms shall have a minimum base width of six inches and a minimum length of ten feet, and shall be equipped with an adequate locking device. Wood forms may be used only on curves of less than 150 feet radius. The depth of all forms shall be equal to at least the depth of the concrete being placed. No built up forms will be permitted.

All forms shall be free from bends and warps at all times. They shall be cleaned thoroughly each time they are used and adequately oiled before concrete is placed against them. The forms shall be set so that they rest firmly through their entire length on thoroughly compacted subgrade. They shall be set accurately to line and grade and sufficiently braced to resist the pressure of the concrete. Forms shall be set at least 150 feet ahead of the paving operation.

Sufficient forms shall be provided so they may remain in place 12 hours or more after the concrete has been placed.

No direct payment will be made for forms. Form work shall be considered subsidiary to other items of Work for which direct payment is made.

5.04 CONCRETE PLACEMENT

A. GENERAL

The concrete shall be deposited uniformly on the prepared subgrades and distributed to the required depth over the entire width of the pavement by approved methods, struck off and finished as hereinafter provided. The Concrete placement operation shall be carried out in such a manner as to ensure that there will be no separation of the aggregate and the mortar.

B. VIBRATING

All concrete shall be thoroughly consolidated by means of approved mechanical vibrators. The vibrator shall uniformly consolidate the full depth and width of the concrete without segregation. Vibrating frequency shall be within the manufacturers' Specifications and shall be verified by the Contractor.

Vibrators shall not contact side forms nor transmit vibration to finishing machines or spreaders.

Machine mounted vibrators shall be operated only when the machine to which they are attached is moving and shall not cause excessive surface water with a single passage of the machine. The vibrators shall be placed so as to allow a minimum of overlap vibration.

C. FINISHING

The concrete shall be deposited in such a manner that adequate concrete remains ahead of the screed and the finish machine so that they provide the cross section required. The concrete will then be further consolidated and finished mechanically with a power-driven machine approved by the City's Project Manager. The finish machine shall be operated over the entire width of the base and shall achieve uniform consolidation.

5.04 CONCRETE PLACEMENT (Continued)

C. FINISHING (Continued)

The finishing machine shall be kept in good repair at all times and shall operate so as to give the desired finish over the entire surface of the pavement. The forward speed of the finishing machine shall be adjusted to the average progress of the concrete production, in order that the strike-off operation shall be as continuous and uninterrupted as possible.

The screed on the finish machine shall be constructed of metal and shall have sufficient strength and stiffness to retain its shape under all working conditions. The working or screeding edge shall be shaped to match the required cross section of the pavement. The screed shall be operated so that when riding on the gutter pan, which shall be used as the side forms for the base, the working edge will have an excess of concrete above grade. The contact surfaces of the wheels of the finishing machine shall be kept free from concrete and earth. Hand tools that perform the function of the finishing machine shall be immediately available for use in the event of an emergency.

The pavement shall be given its final finish by means of a wet burlap drag. The drag shall be pulled in a longitudinal direction only. The drag shall be adequately maintained so that the resultant finish shall be uniform in appearance.

All small or irregular areas shall be finished by methods approved by the City's Project Manager.

No measurement or direct payment shall be made for placing, vibrating or finishing the concrete base. These items shall be considered subsidiary to other items of Work for which direct payment is made.

5.05 JOINTS

A. CONSTRUCTION JOINTS

When placing of concrete is interrupted, for any reason, for over ½ hour, the concrete base shall be finished against an approved bulkhead made of at least 2 inch material, placed in a vertical position and extending completely across the roadway. Special care shall be taken to consolidate the concrete against the surface of the bulkhead. When the placing of concrete is resumed, the bulkhead shall be removed and care shall be taken not to disturb any steel or concrete placed.

B. CONTROL JOINTS

Control joints shall be placed in the concrete base both longitudinally and transversely throughout the entire length of the construction. Longitudinal joints shall be placed at approximately the one-third (1/3) points of the slab width for pavements having a total width of 33 feet or less, and at the quarter points of the slab width for pavement having a total width greater than 33 feet but less than or equal to 44 feet. Transverse control joints shall be placed at intervals of 30 feet and shall line up with joints in the curb or combined curb and gutter.

Control joints shall be cut to a depth of at least one-third (1/3) of the concrete thickness by such methods that may be approved by the City's Project Manager.

5.05 JOINTS (Continued)

C. LONGITUDINAL CONSTRUCTION JOINTS

All longitudinal construction joints in concrete base shall be constructed with a metal keyway and tied to adjoining slabs with tie bars of a size and spacing as provided in the plans.

No measurement or direct payment shall be made for joint construction. The construction of joints shall be considered subsidiary to other items of Work for which direct payment is provided.

5.06 CURING AND PROTECTION

A. CURING

Curing shall be accomplished using either Liquid Membrane Curing Compound or Wet Burlap.

1. Curing With Liquid Membrane Curing Compound

Immediately after the concrete has been finished, the concrete surface shall be sealed with a uniform application of a membrane curing compound as described previously in this chapter. An approved self propelled mechanical power sprayer shall be used to apply the curing compound to the concrete pavement except that approved manual spraying equipment may be employed on narrow or variable width sections where the use of a self propelled mechanical power sprayer is impractical, and on irregular sections of street returns and alley returns. The self propelled mechanical power sprayer shall be of sufficient width to cover the entire width of the pavement.

2. Curing With Wet Burlap

Immediately after the concrete has been finished, burlap shall be carefully placed on the concrete and kept moist in a manner which will not damage the pavement surface. The burlap shall be clean, evenly woven, free of encrusted concrete or other contaminating materials, and shall be reasonably free from cuts, tears, broken or missing yarns, and thin, open or weak places.

The burlap shall be of sufficient length to cover all exposed surfaces.

The burlap shall be kept continuously saturated with water for at least 72 hours following the placing of the concrete.

5.06 CURING AND PROTECTION (Continued)

B. PROTECTION

The Contractor shall provide and maintain substantial barricades, warning signs, flares and, when required, watchmen to protect the new pavement and Work site from vandalism and property destruction.

Any concrete showing injury from vandalism shall be repaired or removed and replaced at the Contractor's expense and to the City's Project Manager's satisfaction. No heavy equipment or vehicular traffic shall be allowed on the new construction until the concrete has achieved a compressive strength of 2250 p.s.i. for LB-2750 or 3000 p.s.i. for LB-3500 or seven (7) days have elapsed from date of placement. A longer period of time may be required if, in the opinion of the City's Project Manager, the concrete is not of sufficient strength to support the equipment or vehicles.

No measurement or direct payment shall be made for curing and protection. Those items shall be considered subsidiary to other items of Work for which direct payment is made.

5.07 BASIS OF PAYMENT

The Portland Cement Concrete (PCC) base shall be measured and paid for at the contract unit price bid, per square yard for CONCRETE BASE, ___" for each thickness identified in the plans. Such payment shall be full compensation for subgrade preparation, forms if required, curing, jointing, materials, equipment, tools, labor, and incidentals necessary to construct and prepare the base to receive the asphaltic concrete surface course. No measurement or payment shall be made for base removed for the convenience of the Contractor which, in the opinion of the City's Project Manager, would not have had to be removed to perform the Work.

5.08 CONCRETE HEADER

Concrete headers shall be as provided for in Chapter 4 of these Standard Specifications.

5.09 HOT/COLD WEATHER CONSTRUCTION

Concrete construction in hot or cold weather shall be as provided for in Chapter 3 of these Standard Specifications.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 6

ASPHALTIC CONCRETE CONSTRUCTION

ARTICLE	TITLE	
6.00	GENERAL	602
6.01	MATERIALS	603
	A. ASPHALT BINDER	603
	B. TACK COATS	604
	C. MINERAL AGGREGATES	604
	D. RECLAIMED ASPHALT PAVEMENT (RAP)	606
	E. NON-WOVEN PAVEMENT OVERLAY FABRIC	606
6.02	ASPHALTIC CONCRETE MIXTURES	607
	A. GENERAL	607
	B. SUPERPAVE VOLUMETRIC MIX DESIGN	608
	C. PRODUCTION SAMPLING AND TESTING	613
6.03	EQUIPMENT	614
	A. GENERAL	614
	B. MIXING PLANT	615
	C. TRUCK SCALES	617
	D. DISTRIBUTORS	617
	E. ASPHALT SPREADER AND FINISHER	618
	F. ROLLERS	618
	G. SURFACE MILLING MACHINE	619
	H. TRUCKS	619
6.04	CONSTRUCTION METHODS	620
	A. SUBGRADE	620
	B. CLEANING	620
	C. SURFACE MILLING	620
	1. BASIS OF PAYMENT	620
	D. CORRECTION OF PAVEMENT FAILURES	620
	E. TACKING	621
	F. NON-WOVEN PAVEMENT OVERLAY FABRIC PLACEMENT	621
	1. BASIS OF PAYMENT	622
	G. HAULING	622
	H. JOINTING	622
	I. SPREADING	623
	J. COMPACTION	623
	K. ASPHALTIC CONCRETE CURB	624
	1. BASIS OF PAYMENT	624
	L. COLD WEATHER PLACEMENT	624
6.05	DENSITY CORE SAMPLES	625
	A. GENERAL	625
	B. COMPACTION REQUIREMENTS	625
	C. OVERLAYS	625
6.06	BASIS OF PAYMENT	626

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 6

ASPHALTIC CONCRETE CONSTRUCTION

TABLE	TITLE	
6.01 A	MINERAL FILLER REQUIREMENTS	606
6.02 A	ASPHALTIC CONCRETE MIX REQUIREMENTS SUMMARY	607
6.02 B	MINIMUM BINDER REQUIREMENTS	610
6.02 C	GYRATORY COMPACTION EFFORT	610
6.02 D	GYRATORY COMPACTION TEMPERATURE	610
6.02 E	VOIDS IN MINERAL AGGREGATE	610
6.02 F	VOIDS FILLED WITH ASPHALT	610
6.02 G	COARSE AGGREGATE ANGULARITY (ASTM D 5821)	610
6.02 H	FINE AGGREGATE ANGULARITY_(AASHTO T 304 METHOD A)	611
6.02 I	FLAT AND ELONGATED PARTICLES (ASTM D 4791)	611
6.02 J	SAND EQUIVALENT CRITERIA (AASHTO T 176)	612
6.02 K	GRADATION CONTROL POINTS FOR 0.500 (½) INCH NOMINAL SIZE	612
6.02 L	GRADATION CONTROL POINTS FOR SPR	612
6.02 M	ASPHALTIC CONCRETE PRODUCTION TOLERANCES	613
6.02 N	AGGREGATE ADJUSTMENT TOLERANCE	614
6.04 A	COLD WEATHER PLACEMENT	624
6.06 A	DENSITY ACCEPTANCE SCHEDULE	626
6.06 B	AIR VOID ACCEPTANCE SCHEDULE	626
6.06 C	AC CONTENT ACCEPTANCE SCHEDULE	627

CHAPTER 6

ASPHALTIC CONCRETE CONSTRUCTION

6.00 GENERAL

This Work shall be defined as the construction of a completely new pavement structure or reconstruction of an existing pavement including earthwork, appurtenances, and all related construction required to connect to existing pavement around the limits of construction.

Patching shall be defined as pavement replacement of areas requiring small quantities of asphaltic concrete per placement such as utility crossing repair or larger quantity placements such as longitudinal cuts for utility work not requiring curb to curb asphalt replacement, and for other similar situations.

Asphaltic Concrete Pavement shall be defined as Class 1, an asphaltic concrete wearing surface placed on a Portland Cement Concrete (PCC) base or Class 2, an asphaltic concrete wearing surface placed on an asphaltic concrete base. The pavement structure shall be designed in accordance with The City of Lincoln Standard Plans. The wearing surface and asphaltic concrete base shall be of a type or types of asphaltic concrete as shown on the plans and which meet the Mix Design and Aggregate Criteria requirements describe below unless otherwise specified.

The thickness of the wearing surface or overlay shall be as shown on the plans or approved by the City's Project Manager. The base shall be of a thickness as shown on the plans. Lift thickness of the first asphaltic concrete base lift shall be between 3 inches and 5 inches after compaction to required density. All subsequent asphaltic concrete base lifts shall be between 1 1/2 and 3 inches in thickness after compaction to required density. PCC base shall meet the requirements of Chapters 3 and 5 of these Standard Specifications.

Asphaltic Concrete shall consist of an intimate mixture of naturally occurring mineral aggregates of required gradations and asphalt binder content as hereinafter specified. Unless otherwise specified or approved by the City Engineer, neither industrial nor manufacturing byproducts will be allowed in the mixture. Reclaimed Asphalt Pavement (RAP) shall be allowed as described later in these Standard Specifications.

Asphaltic Concrete mixtures shall be classified as:

- Type 1 (for use as surface course on arterial streets)
- Type 2 (for use as surface course on non-arterial streets)
- Type 3 (for use as surface and base on streets and parking lots)
- Type 4 (for use in patching as defined above)

The factor of 141 pounds per cubic foot shall be used to compute asphaltic concrete quantities of all types for design purposes.

6.01 MATERIALS

A. ASPHALT BINDER

The suppliers for asphalt binder used in City of Lincoln projects shall be certified by the Nebraska Department of Roads (NDOR) to supply Performance Graded Binder in Nebraska.

The asphalt binder for all mixes shall conform to the requirements of AASHTO M 320 for Performance Graded Asphalt Binder and must meet all requirements for use on NDOR projects. The PG Binder shall meet or exceed both the upper and lower temperature targets of the PG Binder grades as shown in Table 6.02 A of these Standard Specifications unless directed otherwise by the City Engineer.

In addition, unless otherwise specified or directed by the City Engineer, the PG Binder shall be a binder which incorporates a blend of base asphalt and elastomeric modifiers of styrene-butadiene (SB), styrene-butadiene-styrene (SBS) or styrene-butadiene-rubber (SBR).

The composite material shall be thoroughly blended at the asphalt refinery or terminal prior to being loaded into the transport vehicle. The polymer modified binder shall be heat and storage stable and shall not separate when handled and stored per the suppliers storage and handling recommendations.

A Material Certification from the PG Binder Supplier shall be submitted prior to construction. The Material Certification must state that acid has not been used. The Material Certification must also state that the material has not been air blown or oxidized.

When moisture susceptibility testing indicates the need for an anti-stripping additive, it shall be added by the PG Binder Supplier. The Contractor shall be compensated for the cost of the anti-stripping additive at the invoice price of the additive. The bill of lading or delivery ticket shall state the binder grade, specific gravity, and the percentage of anti-strip additive.

6.01 MATERIALS (Continued)

B. TACK COATS

1. Rapid-Curing Cut-Back Asphalts

The rapid-curing cut-back asphalts to be used as tack coats shall conform to the requirements of AASHTO M 81, Cut-Back Asphalt (Rapid-Curing Type).

This Specification covers liquid petroleum products, produced by fluxing an asphaltic base with suitable petroleum distillates.

2. Emulsified Asphalts

Emulsified asphalts shall conform to the following Specifications:

ASTM Designation D 977	-	Standard Spec. for Emulsified Asphalts
ASTM Designation D 2397	-	Standard Spec. for Cationic Emulsified Asphalts
ASTM Designation D 140	-	Standard Practice for Sampling Bituminous Materials
ASTM Designation D 244	-	Standard Testing Emulsified Asphalts

Emulsified asphalts covered by these Standard Specifications shall be diluted in the distributor with sufficient potable water to reduce the asphalt residue in the mixture to approximately thirty percent (30%). Emulsified asphalt shall be homogeneous within the thirty (30) days after delivery. If separation of the emulsified asphalt has not been caused by freezing, thorough mixing shall be used to achieve a homogeneous mixture.

C. MINERAL AGGREGATES

1. General

Mineral aggregates for asphaltic concrete shall conform to the following requirements except where modified herein:

ASTM Designation D 692	-	Standard Specification for Coarse Aggregate for Bituminous Paving Mixture
ASTM Designation D 1073	-	Standard Specification for Fine Aggregate for Bituminous Paving Mixture
ASTM Designation D 242	-	Standard Specification for Mineral Filler for Bituminous Paving Mixture

6.01 MATERIALS (Continued)

C. MINERAL AGGREGATES (Continued)

1. General (Continued)

Mineral aggregates shall be crushed rock, broken stone, crushed gravel, sand-gravel, coarse sand, fine sand or a mixture of these materials composed of clean, hard, durable, and non-coated particles, free from injurious quantities of clay, dust, soft or flaky particles, loams, shale, alkali, organic matter, or other deleterious material. Chat or coal sand will not be allowed in any mix.

Crushed rock shall be crushed limestone, granite, quartzite, or other ledge rock approved for the intended purpose by the City Engineer and shall not contain deleterious substances in a quantity exceeding three and one-half percent (3.5%) of any combination of shale, clay lumps, coal, or soft particles with shale and clay lumps not to exceed one and one-half percent (1.5%).

The absorption of water by crushed rock for use in asphaltic concrete shall not exceed three and two-tenths percent (3.2%) by weight.

The mineral aggregate from different sources of supply shall not be mixed or stored in the same pile, nor used alternately in the same class of construction or mixed without permission from the City's Project Manager. All fractions of a crushed rock gradation shall be produced from the same type of material.

The chemical and physical characteristics of the fraction passing the # 4 sieve shall be substantially the same as those of the material which may be produced in the laboratory from the fraction which is retained on the # 4 sieve.

Mineral aggregates shall have a soundness loss of not more than 12 percent by weight at the end of 5 cycles using sodium sulfate solution.

Mineral aggregates shall be tested prior to use and shall conform to the above requirements based on the following test designations.

ASTM C 127	-	Specific Gravity & Absorption of Coarse Aggregates
ASTM D 75	-	Standard Practice for Sampling Aggregates
ASTM C 136	-	Standard Test Method for Sieve Analysis of Fine & Coarse Aggregates
ASTM D 546	-	Standard Test Method for Sieve Analysis of Mineral Filler for Bituminous Paving Mixtures
ASTM C 128	-	Specific Gravity & Absorption of Fine Aggregates
ASTM C 131	-	Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion Impact in the Los Angeles Machine
ASTM C 88	-	Standard Test Method for Soundness of Aggregate
ASTM D 693	-	Standard Spec. for Crushed Aggregate for Macadam Pavements

6.01 MATERIALS (Continued)

C. MINERAL AGGREGATES (Continued)

2. Mineral Fillers

Mineral filler shall consist of pulverized soil, pulverized crushed rock, broken stone, gravel, sand-gravel, sand, or a mixture of these materials that conforms to the following requirements:

TABLE 6.01 A - MINERAL FILLER REQUIREMENTS

Criteria	Minimum	Maximum
Total Percent Passing the #50 (300 µm) Sieve	95	100
Total Percent Passing the #200 (75 µm) Sieve	80	100
Plasticity Index non-soil material passing #200 (75 µm)	0	3
Plasticity Index for Soil	0	6

D. RECLAIMED ASPHALT PAVEMENT (RAP)

Reclaimed Asphalt Pavement (RAP) may come from the job site or the Contractor's stockpile. In either case, the Contractor will be responsible for testing the RAP prior to use. Tests shall include at a minimum, AC content and gradation. Test results shall be reported to the City's Project Manager for approval prior to use.

E. NON-WOVEN PAVEMENT OVERLAY FABRIC

Non-woven overlay fabric shall be furnished by an ISO approved manufacturer of polypropylene or polyester geo-synthetic fabric and shall be needle punched and heat treated on one side and shall conform to the following requirements:

PROPERTY	MINIMUM	ASTM
Mass, oz./sq. yd.	4.1	D 3776
Tensile Strength, lb.	102	D 4642
Elongation at Break, %	50	D 1682
Mullen Burst Strength, lb.	200	D 3786
Asphalt Retention, gal./sq. yd.	0.21	D 6140

Acceptance shall be based upon manufacturer's certification of conformity.

6.02 ASPHALTIC CONCRETE MIXTURES

A. GENERAL

Asphaltic concrete mixtures shall be designed by the Contractor to meet the Mix Design Criteria for the appropriate mix types as shown in these Standard Specifications.

Unless otherwise specified or approved by the City Engineer, Asphaltic Concrete for Type 1 Mix shall meet or exceed all of the requirements for “Superpave-SPH” as described in these Standard Specifications.

Unless otherwise specified or approved by the City Engineer, Asphaltic Concrete for Mix Types 2 and 3 shall meet or exceed all of the requirements for “Superpave-SPR” as described in these Standard Specifications.

Unless otherwise specified or approved by the City Engineer, Asphaltic Concrete for Type 4 Mix shall meet or exceed all of the requirements of the Asphaltic Concrete Mix Requirements Summary table shown below and all other applicable requirements of this specification.

TABLE 6.02 A - ASPHALTIC CONCRETE MIX REQUIREMENTS SUMMARY

Type (Use)	* Mix Requirements	AC Grade	Aggregate Blend		
			% RAP (Max.)	Virgin Agg.	Gradation Requirements
1 Surface Course Arterial Streets	SPH (Superpave) 5.1% Min. AC by weight of mix	PG 70-34	25%	Limestone 90% Max.	½” Band (Superpave)
2 Surface Course Non-Arterial Streets	SPR (Superpave) 5.0% Min. AC by weight of mix	PG 64-34	35%	Limestone 95% Max.	SPR Band (Superpave)
** 3 Surface and Base Lifts, Parking Lots, and Temporary Pavement	SPR (Superpave) 5.0% Min. AC by weight of mix	PG 64-34	50%	Limestone 95% Max.	SPR Band (Superpave)
*** 4 Patching	5.0% Min. AC by weight of mix	**** PG 58-28	50%	Limestone 95% Max. ***** Crushed 80% Min.	% Passing ¾” - 100% Min. #200 - 10% Max.

* % AC shall be determined by ignition oven results.

** Type 3 mixtures will not require mix design verification testing by the City but Contractor’s mix design data must be approved by the City Engineer prior to use.

*** Type 4 mix for patching must be approved by the City Engineer prior to use.

**** PG 64-22 if less than 25% RAP in mix.

***** Indicates aggregates crushing by mechanical means.

6.02 ASPHALTIC CONCRETE MIXTURES (Continued)

B. SUPERPAVE VOLUMETRIC MIX DESIGN

The Contractor will be required to define properties using a gyratory compactor that has met the Superpave evaluation test procedures, according to the gyration levels indicated for the mix type specified.

The mix formula shall be determined by the Contractor from a mix design for each mixture. A volumetric mixture design in accordance with the latest edition of the Asphalt Institute Publication, SP-2 will be required. However, the mixture for the Superpave specimens and maximum specific gravity mixture shall be short-term aged for two hours. Mixing and compaction temperatures shall be in accordance with the latest NDOR specifications.

The following test procedures shall apply:

AASHTO R 30	-	Practice for Short and Long-Term aging of Hot Mix Asphalt
AASHTO T 84	-	Specific Gravity and Absorption of Fine Aggregate
AASHTO T 85	-	Specific Gravity and Absorption of Coarse Aggregate
AASHTO PP 19	-	Practice for Volumetric Analysis of Compacted Hot Mix Asphalt
AASHTO T 312	-	Method for Preparing and Determining the Density of Hot Mix Asphalt Specimens by Means of the Superpave Gyratory Compactor
AASHTO T 209	-	Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
AASHTO T 283	-	Resistance of Compacted Bituminous Mixture to Moisture induced Damage

The optimum binder content shall be the binder content that produces required air voids, at Ndes, in the plant produced mix. The design shall have at least four points, including a minimum of two points above and one point below the optimum. The amount of un-compacted mixture shall be determined in accordance with AASHTO T 209.

Each Superpave mixture shall be tested by the Contractor for moisture susceptibility in accordance with AASHTO T 283. The loose mixture shall be short-term aged for two hours in accordance with AASHTO R30. The 6-inch specimens shall be compacted in accordance with AASHTO T 312 to 7 percent air voids at 95-mm in height and evaluated to determine if the minimum Tensile Strength Ratio (TSR) of 80 percent has been met. If the mixture has not met the minimum TSR value, the Contractor shall have the option of modifying the mixture, as approved by the City Engineer, and retesting to verify that the minimum TSR of 80 percent has been achieved or by having a an approved liquid anti-stripping additive added to the PG Binder, by the PG Binder Supplier, at a dosage rate, such that the mix will meet the minimum TSR of 80 percent.

All data shall be submitted with the mix design for approval. During production, the Contractor may be required by the City's Project Manager, to provide and test additional specimens of the plant produced asphaltic concrete for moisture susceptibility. A TSR test result of less than 80 percent will require mixture modification(s) and a sample from subsequent lots will be tested by the Contractor until a TSR value of at least 80 percent is achieved.

Changes in the types or sources of aggregates or binder may require a new job mix formula, mix design, and moisture susceptibility test. If required, the new proposed job mix formula shall be in accordance with the requirements as stated above and submitted 5 working days prior to use for approval.

6.02 ASPHALTIC CONCRETE MIXTURES (Continued)

B. SUPERPAVE VOLUMETRIC MIX DESIGN (Continued)

1. MATERIALS SAMPLING AND TESTING

At the beginning of each year and at least 14 days before production of asphaltic concrete, the Contractor shall submit, in writing, a tentative job mix formula and material samples as described below, for approval, to the City Engineer. The job mix formula shall identify the mineral aggregates and mineral filler, if needed, with the value of the percent passing each specified sieve for the individual and blended materials.

A 65 pound bag of each of the individual mineral aggregates and RAP, if used, shall also be submitted to the City Engineer at this time. Each sample shall be marked to clearly indicate the type of material, name of the producer, and the pit location.

The Contractor shall submit, to the City Engineer, three proportioned 10,000-gram samples of the blended aggregates and a 1 gallon sample of the asphalt binder to be used in the mixture. Whenever RAP is used, it shall be processed through an ignition oven and then combined proportionally with the virgin aggregate in one of the 10,000-gram samples. The remaining two 10,000-gram samples shall be made up of the unprocessed RAP combined proportionally with the virgin aggregate. Submitted with these samples shall be a copy of the mix design values obtained from tests performed by the Contractor. This mix design shall include at a minimum, the following information:

- The bulk specific gravity (G_{sb}) of the blended aggregate (The specific gravity shall be determined for the combined blend from the unwashed portion of the - #4 and the + #4 material in accordance with AASHTO T 84 & T 85 respectively)
- The target asphalt binder content by total mix
- The supplier, grade, and specific gravity of the PG Binder
- The maximum specific gravity of the combined mixture (Rice)
- The average bulk specific gravity and air voids at N initial (N_{ini}), N design (N_{des}), and N maximum (N_{max}) of the compacted gyratory specimens
- Voids in the Mineral Aggregate (VMA) and Voids filled with Asphalt (VFA) at N_{des}
- Fine Aggregate Angularity (FAA), Coarse Aggregate Angularity (CAA), Flat and Elongated Particles and Clay Content of the aggregate blend

2. MIX DESIGN CRITERIA

The design criteria for each mixture shall be determined from the following Tables.

The optimum binder content shall be the binder content that produces 4.0% air voids at N_{des} for SPH mixes and 3.0% at N_{des} for SPR mixes in the plant produced mix. Binder content shall be determined by ignition oven.

6.02 ASPHALTIC CONCRETE MIXTURES (Continued)

B. SUPERPAVE VOLUMETRIC MIX DESIGN (Continued)

2. MIX DESIGN CRITERIA (Continued)

TABLE 6.02 B - MINIMUM BINDER REQUIREMENTS

Mix Type	Minimum Binder Content (% by wt. of mix)
SPH	5.1%
SPR	5.0%

TABLE 6.02 C - GYRATORY COMPACTION EFFORT

Asphaltic Concrete Type	Nini	Ndes	Nmax
SPR	7	65	100
SPH	8	95	150

Average Design High Air Temperature = < 39 degrees C (102° F)

TABLE 6.02 D – GYRATORY COMPACTION TEMPERATURE

Mix Type	% RAP	COMPACTION TEMP. ° F
SPR	0-35	280 ± 5
	36-50	290 ± 5
SPH	0-35	300 ± 5

TABLE 6.02 E - VOIDS IN MINERAL AGGREGATE *

Nominal Maximum Aggregate Size	Recommended VMA, Percent (Criteria at Ndes)
SPR	12.0
½ (0.500) inch	14.0

* For Design purposes only.

TABLE 6.02 F - VOIDS FILLED WITH ASPHALT *

Asphaltic Concrete Type	Recommended VFA, Percent
SPR	70 - 80
SPH	65 - 75

* For Design purposes only.

3. AGGREGATE BLEND CRITERIA

a. Coarse Aggregate Angularity (CAA)

The coarse aggregate angularity value of the blended aggregate material shall meet or exceed the minimum values for the appropriate asphaltic concrete type shown in Table 6.02 G.

TABLE 6.02 G - COARSE AGGREGATE ANGULARITY (ASTM D 5821)

Asphaltic Concrete Type	CAA (minimum)
SPR	83
SPH	95/90*

* Denotes two faced crushed requirements

6.02 ASPHALTIC CONCRETE MIXTURES (Continued)

B. SUPERPAVE VOLUMETRIC MIX DESIGN (Continued)

3. AGGREGATE BLEND CRITERIA (Continued)

a. Coarse Aggregate Angularity (CAA) (Continued)

Aggregate obtained from the residue of the ignition process shall not be used for the determination of CAA for mix design approval except when RAP material is specified and must be combined with the proportioned amount of virgin aggregate as defined by the mix design.

b. Fine Aggregate Angularity (FAA)

The fine aggregate angularity value of the blended aggregate material shall meet or exceed the minimum values for the appropriate asphaltic concrete type shown in Table 6.02 H.

The specific gravity for calculation of the FAA shall be based on a combined aggregate sample of material passing the No. 8 sieve and retained on the No. 100 sieve.

**TABLE 6.02 H - FINE AGGREGATE ANGULARITY
(AASHTO T 304 METHOD A)**

Asphaltic Concrete Type	FAA (minimum)
SPR	43.0
SPH	45.0

Aggregate obtained from the residue of the ignition process shall not be used for the determination of FAA for mix design approval except when RAP material is specified and must be combined with the proportioned amount of virgin aggregate as defined by the mix design.

c. Flat and elongated particles

The coarse aggregate shall not contain flat and elongated particles exceeding the maximum value for the appropriate asphaltic concrete type shown in Table 6.02 I.

TABLE 6.02 I - FLAT AND ELONGATED PARTICLES* (ASTM D 4791)

Asphaltic Concrete Type	Percent, Maximum
SPR	10
SPH	10

* Criterion based on a 5:1 maximum to minimum ratio

d. Clay Content

The Clay Content of the blended aggregate material shall be such that the Sand Equivalent Minimum value for the appropriate asphaltic concrete type as shown in Table 6.02 J shall be met or exceeded.

6.02 ASPHALTIC CONCRETE MIXTURES (Continued)

B. SUPERPAVE VOLUMETRIC MIX DESIGN (Continued)

3. AGGREGATE BLEND CRITERIA (Continued)

d. Clay Content (Continued)

TABLE 6.02 J – SAND EQUIVALENT CRITERIA (AASHTO T 176)

Asphaltic Concrete Type	Sand Equivalent, Minimum
SPR	45
SPH	45

e. Gradation

The blended aggregate shall conform to the gradation requirements specified below for the appropriate nominal size.

The dust to binder ratio is the ratio of the percentage by weight of aggregate finer than the No. 200 sieve to the asphalt content expressed as a percent by weight of total mix.

The dust to binder ratio shall be between 0.7 and 1.7. This shall be verified during mix design approval and production sample testing.

**TABLE 6.02 K - GRADATION CONTROL POINTS
FOR 0.500 (½) INCH NOMINAL SIZE**

Sieve	Control Points (percent passing)	
	Minimum	Maximum
¾ inch	100.0	
½ inch	90.0	100.0
3/8 inch		90.0
No. 8	28.0	58.0
No. 16		
No. 30		
No. 50		
No. 200	2.0	10.0

TABLE 6.02 L - GRADATION CONTROL POINTS FOR SPR

Sieve	Control Points (percent passing)	
	Minimum	Maximum
¾ inch		
3/8 inch	81.0	96.0
No. 8	46.0	56.0
No. 50	12.0	21.0
No. 200	4.0	9.0

6.02 ASPHALTIC CONCRETE MIXTURES (Continued)

C. PRODUCTION SAMPLING AND TESTING

During production, asphaltic concrete shall be sampled and tested for acceptance by the City's Project Manager on a lot basis. A minimum of one sample shall be required for each lot of asphaltic concrete. A lot is defined as each 500 tons or fraction thereof of each day's production. The location of the required samples shall be determined by the City's Project Manager.

Tests shall include the following:

- AASHTO T 209 - Maximum specific gravity of the mix (Rice)
- ASTM C 136 - Standard Test Method for Sieve analysis of Fine and Coarse Aggregate
- AASHTO T312 - Method for Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor
- AASHTO T 166 - Bulk Specific Gravity of compacted Bituminous Mixtures using saturated surface-dry specimens
- AASHTO T 308 - Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the ignition method

TABLE 6.02 M - ASPHALTIC CONCRETE PRODUCTION TOLERANCES

Test	Mix Type	
	SPH	SPR
AC	5.1% Min. (None)	5.0% Min. (None)
Air Voids	4% (+/- 1%)	3% (+/- 1%)
FAA (cold feed)	45 Min. (-0.50)	43 Min. (-0.20)
FAA (ignition oven)	45 Min (-1.00)	43 Min. (-0.50)

If at the end of the day's production, the tolerances in Table 6.02 M are exceeded, the Contractor will not be allowed to resume production until corrective adjustments are made to the mix design.

Mix adjustments at the plant are authorized within the limits shown in Table 6.02 N without redesigning the initially approved mix.

The adjustment must produce a mix with the percent air voids and all other properties as stated in these Standard Specifications.

All adjustments must be reported to the City Engineer.

The adjustment values in Table 6.02 N will be the tolerances allowed for changes indicated by production or mix design test results, but cannot deviate from Superpave gradation criteria.

6.02 ASPHALTIC CONCRETE MIXTURES (Continued)

C. PRODUCTION SAMPLING AND TESTING (Continued)

TABLE 6.02 N - AGGREGATE ADJUSTMENT TOLERANCE

Aggregate Adjustments	
Sieve Size	Adjustment Range
1 inch, 3/4 inch, 1/2 inch, 3/8 inch, No. 4	± 6%
No. 8, No. 16, No. 30, No. 50	± 4%
No. 200	± 2%

6.03 EQUIPMENT

A. GENERAL

All equipment, tools and machinery shall be adequate for the purpose for which it is to be used, and shall be maintained in satisfactory working condition at all times. The equipment shall be at the Work site sufficiently in advance of construction operations to be thoroughly examined and approved by the City's Project Manager. The Contractor shall furnish the necessary accessories, equipment data, and assistance required by the City's Project Manager for making tests and calibrations on equipment.

The Contractor shall furnish the necessary accessories and personnel and shall perform calibrations on the equipment. Copies of the calibration data shall be provided to the City's Project Manager before production of Asphaltic Concrete. In the event problems are encountered during the calibrations, the Contractor shall arrange for a trained technician or company representative of the company from which the equipment was obtained to make the necessary repairs and/or adjustments to the equipment. Calibrations shall be made as often as is deemed necessary by the City's Project Manager to ensure accuracy of the equipment.

In the event that a Contractor elects to obtain asphaltic concrete from a commercial plant not under his direct control, he shall reach agreement with the commercial producer to perform the above functions in the same manner as though the plant was under his direct control. The Contractor shall also reach agreement with the producer to furnish or shall arrange to have furnished an approved building for use by the City Engineer if deemed necessary by the City's Project Manager.

6.03 EQUIPMENT (Continued)

B. MIXING PLANT

1. General

The equipment that is used for heating, proportioning, and mixing the aggregates and asphalt cement shall be able to produce a uniform mixture.

The dryers shall be able to dry and heat all aggregates to the required temperatures with positive control. Aggregates shall be agitated continuously during the process of heating. Damage to the asphalt cement in dryer-drum type mixing plants shall be avoided.

Salvaged bituminous material shall not be exposed to open flame.

Continuous temperature and time readings of the asphaltic materials shall be electronically recorded whenever the plant is operated. A copy of the temperature reading shall be made available to the City's Project Manager. Temperature and time displays shall be easily accessible. Temperature and time sensors will be provided at the following locations:

- a. Inside the asphaltic concrete mixture discharge chute.
- b. Inside the surge bin.
- c. Inside the asphalt cement storage tank.

During storage, the asphalt cement temperature shall be maintained between 250F and 350F or at the storage temperature range recommended by the binder supplier. All plants shall be equipped with a circulating system for asphalt cement which is designed to assure proper and continuous circulation during the operating period. Storage tanks shall have sufficient capacity to provide for continuous operation. The tanks shall be situated and constructed to allow the volume of the asphalt cement to be safely and accurately determined at any time.

If the plant is equipped with a surge bin for the temporary storage of asphaltic concrete, the asphaltic concrete taken from the surge bin will not differ significantly from the material taken directly from the plant. The first material entering the bin will be the first material removed. The surge bin shall be completely emptied at the end of each operating day unless insulated or heated.

All plants shall be equipped with a continuously operated dust collector. The collected material may be wasted or returned to the mix.

Mineral filler bins shall be protected from moisture.

2. Pug-mill Plants

a. General

Pug-mill plants shall include cold aggregate feeders, oversize screens, storage bins for dried aggregate, ingredient proportioning devices, and all other equipment necessary to produce the specified mixture. The pug-mill blades shall have a minimum clearance of 3/4 inch from all fixed and moving parts. The mixer shall be equipped with a discharge hopper holding approximately 1 ton of hot mixture and capable of intermittent discharge.

6.03 EQUIPMENT (Continued)

B. MIXING PLANT (Continued)

2. Pugmill Plants (Continued)

b. Batch Plants

Batch plants shall have an accurate time lock to control the operations during a complete mixing cycle. They shall lock the scale box gate after the charging of the mixer until the closing of the mixer gate at the completion of the cycle. They shall lock the bituminous material bucket throughout the dry mixing period and shall lock the mixer gate throughout the dry and wet mixing periods.

The dry mixing period is defined as the time between the opening of the scale box gate and the addition of bituminous material. The wet mixing period is the interval of time between the addition of bituminous material and the opening of the mixer gate.

The control of the timing shall be flexible and capable of being set at 5-second intervals or less throughout a total cycle of not less than 3 minutes. A mechanical batch counter shall be installed as a part of the timing device and shall be designed and constructed to register only upon the release of the bituminous material. It shall not register any dry batches or any material wasted through the bins. The timing device shall have a suitable case with a locking door that shall always be kept closed and locked except when adjustments or repairs are required.

All batch plants shall be equipped with an asphalt cement volume meter or a heated or insulated asphalt bucket with scales.

Scale hoppers and scales for proportioning aggregates and asphalt to the batch plant's mixer shall be accurate within 0.5 percent; and they shall be sensitive within 0.2 percent or 2 pounds, whichever is greater, throughout the range of use.

c. Continuous Type

Plants shall be equipped with a pump synchronized to the feeding mechanism so that the required percentage of asphalt cement is applied continuously and uniformly. The feeding system shall be synchronized to the rest of the plant.

3. Dryer-Drum Plants

These plants shall include cold aggregate feeders, vibratory screening units for removing oversize material from both virgin and reclaimed material, proportioning devices for controlling the quantity of each ingredient in the mixture, and any other equipment necessary to produce the mixture as specified.

Plants shall be equipped with a pump synchronized to the feeding mechanism so that the required percentage of asphalt cement is applied continuously and uniformly. The feeding system shall be synchronized to the rest of the plant.

6.03 EQUIPMENT (Continued)

C. TRUCK SCALES

Truck scales shall be furnished by the Contractor for weighing loaded trucks at the plant site, and shall be installed on adequate foundations and in accordance with the manufacturer's recommendations. The scales shall have sufficient capacity to weigh the maximum axle, combination of axles or gross load used and shall be accurate to one-half percent (0.5%) of the total axle load or total load.

Scales shall be properly calibrated by the Contractor in the presence of the City's Project Manager unless the scales have current Nebraska Department of Agriculture inspection approval or unless calibration and adjustment by a recognized scale company service crew has been performed during the current season, and attested to by the City's Project Manager. The scales shall be periodically cross-checked for accuracy during the course of the Work by checking the net weight of loads of the material being produced on commercial scales in the vicinity of the project which have current agriculture inspection approval. The Contractor shall furnish at least ten (10) 50 pound weights for checking the accuracy of the scales. If the scale is not capable of weighing all axles at one time, the approaches shall be extended so the entire hauling unit will be level during weighing. Chuck holes, ruts or high spots in the approaches which develop during hauling operations shall be immediately repaired as directed by the City's Project Manager.

All weighing shall be done with the hauling unit stationary, level, and out of gear. Suitable protection shall be provided against wind currents that may affect the accuracy of the scales. The platform of the scale shall be kept clean and free from accumulations of materials, as directed by the City's Project Manager.

Serially numbered duplicated scale tickets shall be furnished to accompany each truck load of material to the unloading point. Scale tickets shall reflect the date, time, load number, total weight, tare weight, project number, mix type, destination, and net weight.

D. DISTRIBUTORS

Whenever the use of a distributor is required, that piece of equipment shall be manufactured expressly for the purpose of applying heated asphaltic materials by pressure spray applications. Improvised equipment, such as converted road oilers, will not be acceptable. The distributor shall be so designed as to permit the application of heated asphaltic material in a uniform spray without atomization at the rate, temperature, and pressure required. The distributor shall be equipped with a tachometer registering revolutions per minute and so located as to be visible to the driver in order that the driver may maintain the constant speed required for the specified rate of application. The distributor shall be mounted on a motor truck or trailer, equipped with pneumatic tires. The pump shall be equipped with a meter registering the number of gallons (liters) per minute passing through the nozzle and this meter must be visible to the operator. The distributor shall be equipped with an accurate thermometer which indicates the temperature of the asphaltic materials at all times. The distributor shall be equipped with a full circulating spray bar and shall be provided with hand nozzles to permit application to areas not accessible to the spray bar. The distributor shall be equipped with a drip tray or other suitable means of preventing the dripping of material after the flow has been shut off.

6.03 EQUIPMENT (Continued)

E. ASPHALT SPREADER AND FINISHER

The mechanical asphalt spreader and finisher shall be self-propelled and shall be designed and equipped to spread upon the prepared surface without segregation of the mixture, a tamped and finished wearing surface of asphaltic concrete free from hollows and humps.

The machine shall be equipped with a hopper to receive the asphaltic concrete as it is dumped from the trucks and shall be designed so as to prevent the mixture from being deposited directly on the base or previously laid courses. The hopper shall have a suitable device to distribute the mix evenly across the full width of the screed. The machine shall be equipped with means of adjusting the thickness of the mat, and the transverse and longitudinal grade. It shall be equipped with a tamping or vibrating screed which shall be operated during the lay-down process to compact the applied material to a uniform density. No part of the machine shall travel on the freshly laid material. There shall be auxiliary attachments for the machine so that it may be adjusted to lay widths as approved by the City's Project Manager.

F. ROLLERS

The number and type of rollers furnished shall be adequate to produce the specified density and a satisfactory surface.

Wheels of all rollers shall be smooth and free from openings or projections which would mar the surface of the Work. They shall be equipped with suitable devices necessary to prevent adhesion of bituminous material to the tires and wheels. The rollers shall be equipped with water tanks for wheel sprinkling devices that extend the full width of each roller, and drip pans designed so as to prevent oil, grease, gas or diesel oil from spilling or dripping onto the asphaltic concrete surface.

6.03 EQUIPMENT (Continued)

G. SURFACE MILLING MACHINE

The milling shall be done with a commercially manufactured machine able to perform this work to the City's Project Manager's satisfaction. The milling machine shall be self-propelled and shall have sufficient power, traction, and stability to maintain an accurate depth of cut. Pavement removal by scarifying, motor grading or heating will not be allowed as milling.

The milling machine shall be equipped with automatic controls for establishing profile grades at each edge of the machine. The reference shall be the existing pavement or taut reference lines erected and maintained by the Contractor true to line and grade. A single reference may be used if the machine can maintain the designated transverse slope.

When referenced from existing pavement, the cold milling machine shall be controlled by a self-contained grade reference system provided by the machine's manufacturer for that purpose. The sensing point shall react to compensate for 25 percent of the actual change in elevation due to a hump or dip that is 3 feet (900 mm) or less in length. The self-contained grade reference system shall be used at or near the centerline of the roadway. On the adjacent pass with the milling machine, a joint matching shoe may be used.

Broken, missing, or worn teeth shall be replaced if the machine is unable to maintain the surface texture requirements.

The machine shall be equipped with a loading elevator to remove the milled material from the roadway surface.

The machine shall be equipped with means to effectively control dust generated by the cutting operation.

H. TRUCKS

Numbered trucks having tight, clean, smooth beds shall be used for transporting the freshly prepared asphaltic concrete to the site of the Work. The beds shall be sprayed, when necessary, to prevent the asphaltic concrete mixture from adhering to the bed, with a minimum quantity of approved lubricant. The equipment used and the frequency of spraying shall be determined by the City's Project Manager.

All trucks shall be equipped with a suitable waterproof canvas cover to protect the material as required by the City's Project Manager. Any truck that causes excessive segregation of materials by the action of its spring suspension or other contributing factors, or that causes undue delays, shall not be used for transporting the asphaltic concrete mixtures. All truck beds shall be so constructed that they may be insulated, when necessary. All truck boxes shall be equipped with box vibrators.

6.04 CONSTRUCTION METHODS

A. SUBGRADE

Subgrade shall be prepared as described in Chapter 2 of these Standard Specifications.

B. CLEANING

Prior to the application of asphaltic materials on existing base, the surface on which the asphalt is to be placed shall be thoroughly cleaned by means of mechanical sweepers, street flushers, shovels, scrapers, and hand brooms as is necessary to remove all mud, matted earth, dust and other foreign materials. Power sweeping shall be conducted in such a manner as to keep dust and debris under control and cause a minimum of disturbance to surrounding areas. Material cleaned from the surface shall be removed and disposed of by the Contractor.

The cost of cleaning the existing surfaces to which asphalt is to be applied shall be considered subsidiary to other items for which payment is made.

C. SURFACE MILLING

Surface milling, where required, shall consist of removing and salvaging existing surfacing material to a depth and width as shown in the plans or as directed by the City's Project Manager. The Contractor shall remove all pavement millings which result from the performance of this work and dispose or transport them to locations as provided in the Contract or as approved by the City's Project Manager.

The interface between the surface milled area and the concrete gutter pan shall be cleaned of all old asphalt and maintained to provide a smooth, straight, and vertical surface.

The Contractor shall be responsible for location and protection of all manholes, valve boxes, and all other appurtenances, some of which may be below the surface of the street, and to protect equipment from the danger of striking same. Claims for any and all damages arising from hitting these appurtenances shall be the Contractor's responsibility. The Contractor shall have access to applicable records; however, the Contractor shall not rely upon these records to reveal all such hidden appurtenances.

The Contractor shall be held responsible for all appurtenances in the pavement surface which have been damaged or disturbed by the Contractor. The cost of repairing or replacing these damaged appurtenances shall be made at the Contractor's expense.

1. BASIS OF PAYMENT

SURFACE MILLING, completed in conformance with the plans and Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per square yard. Such payment shall be full compensation for all surface preparation, milling, removal of materials, labor, tools, equipment, clean up and incidentals necessary to complete the Work.

D. CORRECTION OF PAVEMENT FAILURES

After the surface milling and cleaning have been accomplished, the City's Project Manager shall examine the pavement structure to which the asphaltic concrete is to be applied. Any pavement failures shall be repaired as designated by the City's Project Manager. The cost of repairing pavement failures shall be measured and paid for at the appropriate unit prices or shall be accomplished as an Extra Work Item.

6.04 CONSTRUCTION METHODS (Continued)

E. TACKING

This Work shall consist of the application of asphaltic materials to previously prepared bases or existing surfaces.

After the surface is completely cleaned and dry it shall have a tack coat of rapid curing cut-back asphalt or emulsified asphalt applied sufficiently in advance of the laying operation to break or cure prior to the application of the surface coat.

Traffic shall not be permitted on the tack coat without the permission of the City's Project Manager, and the asphalt surface course shall be applied as soon as the tack breaks and the water has evaporated. The rate of application generally should be from 0.05 to 0.2 gallons per square yard, with the rate of application to be approved by the City's Project Manager. Tack or asphaltic cement shall be applied by hand to all vertical edges.

The cost of supplying and applying tack coat will not be measured for payment. It shall be considered subsidiary for other items to which direct payment is made.

F. NON-WOVEN PAVEMENT OVERLAY FABRIC PLACEMENT

Non-woven pavement overlay fabric and asphaltic cement sealant shall be placed at locations called for on the plans. This Work shall consist of the application of an asphalt sealant and the placement of a non-woven pavement overlay fabric over the entire prepared surface of the pavement to be surfaced or resurfaced with asphalt. Sealants are applied both to seal the existing surface and to provide a cement to adhere to the fabric. Emulsified asphalts are not acceptable for sealant.

Sealant and fabric shall be placed only when the ambient air temperature is 50°F or above. The pavement surface on which the sealant fabric is to be placed shall be dry and free of dirt, debris and other foreign matter. Joint and crack openings of 1/8 inch and larger shall be filled with a suitable material as directed by the City's Project Manager. The asphalt sealant shall be applied with distributor equipment at a rate of 0.25 to 0.30 gallons per square yard. The width of the asphalt sealant application shall be the fabric width plus 2 to 6 inches or the entire width of the pavement to be surfaced. Temperature of the sealant shall be not less than 280°F at the time of application to ensure a uniform spray pattern.

No drilling or skipping shall be permitted. Asphalt drools or spills shall be cleaned from the pavement surface to avoid flushing and possible fabric movement at these asphalt rich areas. Fabric lay-down equipment shall be used for placement of the fabric. Overlap of fabric joints shall be 1 to 3 inches.

Immediately after the placement, the fabric shall be embedded into the asphalt cement sealant with a pneumatic roller, unless otherwise directed by the City's Project Manager. The construction of the asphaltic concrete overlay shall follow closely the placement of the fabric. In the event the sealant bleeds through the fabric before the overlay is placed, the Contractor shall be required to spread a thin layer of sand or asphaltic concrete over the affected areas in order to prevent the fabric from being picked up by the construction equipment. The application of tack coat will not be required on the fabric prior to the placement of the asphaltic concrete unless a delay in the placement of the overlay results in the fabric becoming dry or dirty.

6.04 CONSTRUCTION METHODS (Continued)

F. NON-WOVEN PAVEMENT OVERLAY FABRIC PLACEMENT (Continued)

1. BASIS OF PAYMENT

Placement of the non-woven pavement overlay fabric shall be measured and paid for at the contract unit price bid per square yard for the item NON-WOVEN PAVEMENT OVERLAY FABRIC. Such payment shall be full compensation for cleaning and preparing the pavement surface, filling joint and crack openings; for furnishing, heating, and applying the asphalt sealant; for placement and rolling of the fabric; for furnishing and applying material for blotting the surface of the fabric as required; and for all equipment, labor, tools, and incidentals required to complete the Work.

G. HAULING

Clean trucks fully fueled shall be weighed in the morning when starting up and then again in the early afternoon to obtain accurate tare weights. The City's Project Manager may also require re-weighing at any time to obtain new tare weights.

H. JOINTING

Longitudinal and transverse joints shall be made in such a manner that well bonded and sealed joints are achieved. Joints between old and new pavement shall be made in such a manner as to insure a thorough and continuous bond between the old and new surface.

Cold joints shall be painted with a light application of asphalt cement before the adjacent material is placed. When placing surface course, a hot joint between lane placements shall be maintained as directed by the City's Project Manager.

Joints in the surface course shall be formed by any approved method that will produce a dense vertical joint; otherwise the previously laid surface course shall be cut back to its full depth so as to expose a fresh surface, after which the hot mixture shall be placed in contact with it and raked to proper depth and grade.

6.04 CONSTRUCTION METHODS (Continued)

I. SPREADING

Asphaltic concrete used in the construction of sections having a uniform width as shown in the typical cross section of the plans, shall be spread and finished with an approved mechanical spreading and finishing machine. The operation of placing mixtures shall be continuous, as nearly as possible.

The asphaltic concrete mixture shall be dumped in the center of the hopper of the spreading machine. Care shall be exercised to avoid overloading and slopping over of the mixture on the base, pavement, or previously laid asphaltic concrete. The operating speed and depth of strike-off of the spreading and finishing machine shall be regulated so as to produce a well knit, uniform layer of the required compacted thickness.

The asphaltic concrete mixture shall be laid only upon a surface which is dry and free from frost.

When the asphaltic concrete mixture is placed in irregular or narrow sections, intersections, or other areas where it is impractical to spread and finish the mixture by methods previously specified, the Contractor may use other equipment or acceptable hand methods for spreading the mixtures, as approved by the City's Project Manager.

The cost of hauling, jointing and spreading the asphaltic concrete mixture shall be considered subsidiary to other items for which payment is made.

J. COMPACTION

Immediately after spreading, the mixture shall be compacted thoroughly by rolling. The number, weight, types of rollers, sequence of rolling operations and compaction procedures shall be such that the required density and a satisfactory surface are attained consistently while the mixture is in a workable condition.

The initial rolling shall begin as soon as the material will bear the weight of the roller without displacing the material. The final compaction and finishing shall be performed by rollers while the material is still hot and responds to the action of the roller. Rolling shall not be carried on in such a manner or at such a time as will cause shoving or cracking. No additional rolling or compaction will be allowed after final compaction.

The asphaltic concrete shall be compacted to required density such that the completed surface is slightly above the surface of the concrete at the gutter pan joint. This compaction shall be attained without the roller coming into contact with the concrete gutter pan and shall be smooth, true and conform to the grade, cross section and contour required without any irregularities that exceed 1/8 inch when tested with a 10 foot straightedge.

All areas not accessible to the equipment specified shall be compacted and finished by other equipment and methods that will provide a satisfactory surface and the specified density. Any areas determined by the City's Project Manager to be defective, shall be immediately reworked to the satisfaction of the City's Project Manager.

No measurement or direct payment shall be made for the operation of rolling asphaltic concrete pavement. The cost thereof shall be considered subsidiary to other items for which direct payment is made.

6.04 CONSTRUCTION METHODS (Continued)

K. ASPHALTIC CONCRETE CURB

Asphaltic concrete curb shall be constructed of a mix as shown on the plans or approved by the City's Project Manager. The curb shall conform to the shape and dimensions that are shown on the plans.

Whenever possible the asphaltic concrete curb shall be shaped and compacted with a curb machine capable of constructing the curb true to line, grade, and cross section and to a density and with a surface texture which is satisfactory to the City's Project Manager.

Special precautions shall be taken to provide a proper bond between the surface course and the curb. The surface shall be thoroughly cleaned and tacked with hot asphalt cement. If performed during cool weather, the surface course shall be heated so that it is sufficiently plastic to form a bond with the hot asphaltic concrete curb.

1. BASIS OF PAYMENT

ASPHALTIC CONCRETE CURB shall be paid for at the contract unit price bid per linear foot.

L. COLD WEATHER PLACEMENT

Asphaltic concrete shall not be placed on frozen or frost covered sub-grade or base. The Cold Weather Placement table shown below shall be used by the City's Project Manager to restrict the routine placement of asphaltic concrete as a result of cold temperatures. Wind velocity, cloud cover, and other project specific conditions will be considered by the City's Project Manager if deviating from this Table.

TABLE 6.04 A – COLD WEATHER PLACEMENT

Lift Thickness	Minimum Surface Temperature
Less than 2 inches	45°F
2 to 3 inches	37°F
Greater than 3 inches	35°F

6.05 DENSITY CORE SAMPLES

A. GENERAL

During the construction of asphaltic concrete pavement, the Contractor shall obtain core samples from each pavement lift for the determination of density. A minimum of one sample shall be required for each lot of asphaltic concrete. These samples shall be taken not later than two working days after the date of placement of the asphaltic concrete at locations designated by the Engineer. Cores shall be a minimum of 4 inches in diameter and shall be taken under direct supervision of the City's Project Manager and given to him/her immediately after removal from the pavement. The surfaces from which the samples have been taken shall be cleaned, dried, filled and compacted by the Contractor with hot asphaltic concrete mixture immediately after core removal. Density samples shall be tested in accordance with the Nebraska Standard Method of Tests for specific gravity of compressed bituminous mixtures, NDR T 166.

B. COMPACTION REQUIREMENTS

Asphaltic concrete shall be compacted to a density of not less than ninety-two and one half percent (92.5%) of the void-less density for that mixture. The void-less density for each lot sample shall be tested in accordance with the Nebraska Standard method of test for Maximum Specific Gravity of Bituminous Paving Mixtures, NDR T 209. If any density test result indicates a compaction value of less than ninety-two and one half percent (92.5%) of the void-less density, two additional cores will be obtained from that lot by the Contractor at points designated by the City's Project Manager. These samples shall be taken and the surface restored as described above not later than seven days after the date of placement of the asphaltic concrete. The average density of the three samples shall be considered the density of the lot.

C. OVERLAYS

Overlays shall be sampled and tested for density when the average thickness of the overlay is greater than 1 inch. The average overlay thickness shall be determined from the core samples located by the City's Project Manager as described above. The thickness of the samples shall be the average of four measurements made at four equally spaced locations on the perimeter of the sample. When the average thickness is 1 inch or less the testing of density for this layer shall be waived.

6.06 BASIS OF PAYMENT

Asphaltic concrete shall be paid for on a lot basis, as described above, at the contract unit price bid per ton for ASPHALTIC CONCRETE, TYPE ____ and subject to the payment tables for production density and air voids as described below. The amount of asphaltic concrete to be paid for shall be the net weight of the material actually incorporated into the work. Such payment shall be full compensation for all mixing, hauling, tack coats, spreading, compacting to required density, materials, equipment, tools, labor, and incidentals necessary to construct the asphaltic concrete surface course to the required thickness or as directed by the City's Project Manager.

TABLE 6.06 A – DENSITY ACCEPTANCE SCHEDULE

Average Density	Min. # Samples	% of Payment
92.5 and above	1	100
92.0 to 92.4	3	95
91.5 to 91.9	3	90
91.0 to 91.4	3	85
90.5 to 90.9	3	80
90.0 to 90.4	3	70
89.9 or less	3	40 or reject

TABLE 6.06 B – AIR VOID ACCEPTANCE SCHEDULE *

Air Voids Type 1 (SPH)	% of Payment
Less than 1.5	50 or reject
1.5 to 1.9	50
2.0 to 2.4	95
2.5 to 2.9	98
3.0 to 5.0	100
5.1 to 5.5	98
5.6 to 6.0	95
6.1 to 6.5	90
6.6 to 7.0	50
More than 7.0	50 or reject

* Air Void Acceptance Schedule Table only applies to Type 1 Arterial surface course.

TABLE 6.06 C – AC CONTENT ACCEPTANCE SCHEDULE

% Below Minimum AC	% of Payment
0.2	80
0.3	70
0.4	60
Greater than 0.4	50 or reject

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 7

RETAINING WALLS AND STEPS (Minor Structures at or under 47")

ARTICLE	TITLE	
7.00	GENERAL	702
7.01	MATERIALS	702
	A. CONCRETE	702
	B. REINFORCEMENT STEEL	702
	C. PREFORMED JOINT FILLER MATERIAL	703
	D. WATERPROOFING	703
	E. CURING COMPOUNDS	703
	F. HANDRAIL	703
	G. CONCRETE UNITS	704
	H. GEOGRID	704
	I. BASE LEVELING PAD MATERIALS	704
7.02	EXCAVATION AND BACKFILL	704
7.03	REINFORCED CONCRETE INSTALLATION	705
	A. FORMS	705
	B. REINFORCING STEEL	705
7.03	REINFORCED CONCRETE INSTALLATION	706
	A. CONCRETE PLACEMENT	706
	D. JOINTS	707
	E. WATERPROOFING	708
	F. WEEPHOLE / DRAINAGE COLLECTION PIPE	708
	G. CURING AND PROTECTION	709
	H. HOT AND COLD WEATHER CONSTRUCTION	709
7.04	MODULAR BLOCK INSTALLATION	710
	A. PREPARATION	710
	B. FOUNDATION SOIL PREPARATION	710
	C. BASE LEVELING PAD	710
	D. UNIT INSTALLATION	710
	E. CAP INSTALLATION	711
	F. GEOGRID INSTALLATION	711
	G. FILL PLACEMENT	711
	H. WEEPHOLE / DRAINAGE COLLECTION PIPE	711
7.05	FENCE PLACEMENT	711
7.06	HANDRAIL PLACEMENT	712
7.07	SUBSTANTIAL COMPLETION	712

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 7

**RETAINING WALLS AND STEPS
(Minor Structures at or under 47")**

ARTICLE	TITLE	
7.08	BASIS OF PAYMENT	713
	A. CONCRETE FOR STEPS AND RETAINING WALLS, IN PLACE	713
	B. REINFORCING STEEL FOR RETAINING WALLS AND STEPS	713
	C. MODULAR BLOCK RETAINING WALL	713
	D. HANDRAILS, COMPLETE	713

CHAPTER 7

RETAINING WALLS AND STEPS (Minor Structures at or under 47")

7.00 GENERAL

The Work covered in this Chapter includes the construction of both reinforced concrete retaining walls/steps and modular block concrete retaining walls/steps at or under 47 inches in height with or without a surcharge as per Lincoln Standard Plans except when the surcharge is caused by a building.

The Work shall include furnish and install retaining walls and all related materials required for the construction to lines and grades as shown on the plans and as specified herein. Prepare foundation soils, leveling pad, and backfill to lines and grades as required.

Examples of all products used in the work of this section, including available colors and texture, shall be provided to the City's Project Manager, if required, for selection ahead of the Work being completed.

7.01 MATERIALS

A. CONCRETE

Unless otherwise specified, all concrete for reinforced, poured-in-place walls and steps shall be L3500 as described in Chapter 3 of these Standard Specifications.

B. REINFORCEMENT STEEL

Reinforcement steel shall be free from excess rust, scale or other substances and shall be protected at all times from damage. All reinforcements shall be placed in the exact position shown in the plans, and shall be held securely in position by suitable means so they will not displace during the process of depositing or consolidating the concrete.

1. Reinforcement Bars

All reinforcement bars shall meet the requirements of "Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement", ASTM Designation A 615 (A 615M), Grade 40 (300) or Grade 60 (420).

2. Reinforcement Bar Supports

Reinforcement bar supports shall be of a satisfactory design and of sufficient strength to hold the metal reinforcement in place while the concrete is being placed.

7.01 MATERIALS (Continued)

C. PREFORMED JOINT FILLER MATERIAL

1. Bituminous joint fillers shall conform to the requirements for “Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)”, ASTM Designation D 1751.
2. Sponge rubber and cork expansion joint filler shall conform to the requirements of “Standard Specifications for Preformed Rubber Sponge and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction”, ASTM Designation D 1752.
3. Synthetic rubber or neoprene water stops of approved type shall be installed as indicated on the plans.

D. WATERPROOFING

Waterproofing shall conform to the “Standard Specification for Asphalt Used in Dampproofing and Waterproofing”, ASTM Designation D 449 Type I, or other commercially produced products intended for this use and approved by the City’s Project Manager. The provisions in the above referenced Standard Specifications relating to felt, asbestos felt, and cotton fabrics shall not apply.

Primer for use with asphalt in waterproofing shall conform to the “Standard Specifications for Asphalt Primer Used in Roofing, Dampproofing and Waterproofing” ASTM Designation D 41.

E. CURING COMPOUNDS

All curing compounds shall conform to the requirements of Chapter 3 of these Standard Specifications.

F. HANDRAIL

Handrail systems shall conform to “Standard Specification for Permanent Metal Railing Systems and Rails for Buildings”, ASTM Designation E 985. Handrail shall consist of a rail element supported by metal brackets (wall type) or rail elements supported by posts (post type). Posts and rails shall be commercial quality structural steel tubing conforming to “Standard Specification for Carbon Structural Steel”, ASTM Designation A 36. Brackets, bolts, nuts, washers and other fittings shall be commercial quality structural steel, except where shown otherwise on the plans.

Handrail shall be galvanized or painted to resist corrosion as approved by the City’s Project Manager.

7.01 MATERIALS (Continued)

G. CONCRETE UNITS

Modular Block Retaining Walls shall be retaining wall units designed to create a block wall. Concrete retaining wall units shall have a minimum net 28 day compressive strength of 3,000 psi. The concrete shall have a maximum moisture absorption of 6 to 8 lbs/ft. Exterior dimensions may vary in accordance with ASTM C90 "Standard Specification for Loadbearing Concrete Masonry Units." Unless otherwise specified, full-size units shall have a minimum of 1 square foot face area each. Partial units shall have a minimum ½ square foot face area each. Units shall have angled sides capable of concave and convex alignment curves with a minimum radius of 10 feet. NOTE: Where applicable, for straight walls use non-angled straight side cap units. Reference: ASTM C 140 – Standard Specification for Sampling and Testing Concrete Masonry Unit and Related Units and ASTM C 1372 – Standard Specification for Dry-Cast Segmental Retaining Wall Units

H. GEOGRID

Geogrid to be used as soil reinforcement shall be a regular grid structure of high density polyethylene (HDPE), High-Tenacity PET Geogrids, or geotextiles manufactured for soil reinforcement applications. Geogrid shall be a horizontal layer of high strength high modulus grid capable of creating a composite soil/geogrid mass that acts as a monolithic gravity structure. Reference: ASTM D 638 – Standard Test Method for Tensile Properties of Plastic; ASTM D 4439 – Standard Terminology for Geosynthetics; ASTM D 4595 – Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method; ASTM D 5262 – Standard Test Method for Evaluating the Unconfined Tension Creep and Creep Rupture Behavior of Geosynthetics; ASTM D 5321 – Standard Test Method For Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic by Direct Shear Method; ASTM D 6706 – Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil.

I. BASE LEVELING PAD MATERIALS

Material shall consist of compacted crushed stone (¾ inch or smaller), well-compacted gravel, or coarse sand, and underdrains as required. Minimum thickness is 6 inches.

Concrete LB-2750 conforming to the requirements of Chapter 3 may be used also with underdrains as required. Minimum thickness is 3 inches.

7.02 EXCAVATION AND BACKFILL

All earthwork shall conform to the requirements of Chapter 2 of these Standard Specifications.

When called for on the Proposal, the established quantity of excavation (as provided in Chapter 2) shall include all earthwork necessary for the placement of the retaining walls and steps at the locations shown on the plans and cross sections.

When retaining walls or steps are called for on the Contract and no earthwork is bid on the proposal, all excavations and compacted backfill required for the completion of the retaining walls and steps shall be considered subsidiary to other items of Work for which direct payment is made.

Where additional fill is required, the Contractor shall submit sample to the City's Project Manager to determine if acceptable. Backfill zone shall extend to encapsulate all Geogrids.

7.03 REINFORCED CONCRETE INSTALLATION

A. FORMS

Forms shall be of suitable material and of a type, size, shape, quality, and strength to insure construction as designed. The forms shall be true to line and grade, mortar tight, and sufficiently rigid to resist deflection during placing of the concrete. The responsibility for their adequacy shall rest with the Contractor. All dirt, chips, sawdust, nails, and other foreign matter shall be removed completely from forms before any concrete is deposited therein. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes that would deface the finished surfaces. Forms previously used shall be thoroughly cleaned of all dirt, mortar, and foreign matter before being reused. Before concrete is placed in forms, all inside surfaces of the forms shall be thoroughly treated with an approved releasing agent which will leave no objectionable film on the surface of the forms that can be absorbed by the concrete. Care shall be exercised that no releasing agent is deposited on previously placed concrete.

1. BRICK FACED FORMS

Forms used for brick facing shall be cast aluminum or approved equal, unless otherwise specified by the City's Project Manager. The forms shall have a simulated brick face and be of a size, type, shape, quality and strength to insure construction as designed.

2. SMOOTH FINISH FORMS

Forms requiring a smooth finish shall be fabricated of wood, metal or other approved materials to insure construction as designed. Wood forms shall be constructed and maintained to prevent warping and opening of joints due to shrinkage of lumber.

No direct payment will be made for forms. Forming shall be considered subsidiary to other items of Work for which direct payment is made.

B. REINFORCING STEEL

All reinforcing steel shall be furnished in full length, except where splices are indicated in the plan or permitted by the City's Project Manager. Splices in adjacent bars shall be staggered. Unless otherwise shown in the plans, bars shall be spliced by lapping the ends. Laps shall be a minimum length of thirty-six (36) bar diameters for Grade 40 (300) and twenty-four (24) bar diameters for Grade 60 (420) steel. Lapped splices shall be made by securely wiring the bars in contact, maintaining alignment and clearances.

When bending is required, it shall be done accurately without the use of heat, and bars having cracks or splits at the bends shall be rejected. Stirrups and tie bars shall be bent around a pin of not less than six (6) times the least dimension of the bar. Where there is a delay in depositing the concrete, the reinforcement shall be reinspected and, where necessary, cleaned.

7.03 REINFORCED CONCRETE INSTALLATION

A. CONCRETE PLACEMENT

Before placing any concrete, all dirt and other debris shall be removed from the forms. Concrete shall be handled by methods which will prevent the separation or loss of ingredients and the formation of laitance. Concrete free fall distance shall not exceed 5 feet. This includes free fall in a discharge pipe when using a conveyor system for placement. Pumped concrete is not considered in free fall until the concrete exits the pumper hose. The concrete shall be placed in its final position, as nearly as possible, to avoid re-handling. The concrete shall be placed and thoroughly consolidated in level layers not exceeding 12 inches in thickness. Suitable means shall be provided to permit concrete to be placed in a manner which will avoid accumulations of dry or hardened concrete on the forms or reinforcement.

1. VIBRATING

All concrete shall be thoroughly consolidated by means of approved mechanical vibrators. The vibrator shall consolidate the full depth and width of the concrete to a uniform mass without segregation. Care must be exercised to insure the coating of all surfaces of the reinforcement with concrete and the thorough consolidation of concrete around the reinforcement. Equal care shall be taken to insure that all concrete is consolidated against the face of the forms.

No direct payment will be made for vibrating. Vibrating shall be considered subsidiary to other items of Work for which direct payment is made.

2. SURFACE FINISH

After removal of the forms all smooth finished exposed surfaces of the concrete shall be rubbed starting as soon as conditions permit. Immediately before starting this Work the concrete shall be thoroughly saturated with water.

Sufficient time shall have elapsed before the wetting is done to allow the mortar used in the pointing of tie wire or tie rod holes and defects to be thoroughly set. Surfaces to be finished shall be rubbed with a medium coarse Carborundum stone using a small quantity of mortar on its face. The grout shall be composed of cement and fine sand mixed in the proportion used in the concrete being finished. Rubbing shall be continued until all form marks, projections and irregularities have been removed, all voids filled and a uniform surface finish has been obtained. The paste produced by this rubbing shall be left in place at this time.

The final finish shall be obtained by rubbing with a fine Carborundum stone and water. This rubbing shall be continued until the entire surface is of a smooth texture and uniform color. After the final rubbing is completed and the surface dried, it shall be rubbed with burlap to remove loose powder and shall be left free from all unsound patches, paste, powder and objectionable marks. Epoxy or latex sealant may be used in lieu of the above, with the approval of the City's Project Manager.

After removal of brick-faced forms, all irregularities in the finish shall be corrected to the satisfaction of the City's Project Manager. All tie wire and tie rod holes shall be pointed up with grout. All ridges at form joints shall be chipped off and pointed up. These and all other irregularities in the finish shall be made to match the configuration of the simulated brick surface, as nearly as possible.

7.03 REINFORCED CONCRETE INSTALLATION (Continued)

C. CONCRETE PLACEMENT (Continued)

2. SURFACE FINISH (Continued)

No direct payment will be made for surface finish. The cost of the Work required to provide the surface finish shall be considered subsidiary to other items of Work for which direct payment is made.

D. JOINTS

Joints shall be square and normal to the forms unless otherwise provided. Bulkheads shall be provided for all except horizontal joints. When shown in the plans or specified in the Special Provisions, joints shall be sealed.

1. CONSTRUCTION JOINTS

Construction joints shall consist of the joints in which no provision is made for movement of abutting surfaces. All construction joints shall be keyed and shall be made only where located in the plans, unless otherwise provided in these Standard Specifications and approved by the City's Project Manager. When not detailed in the plans, or in case of emergency, construction joints shall be placed as directed by the City's Project Manager.

2. SURFACE FINISH

The surface of the hardened concrete shall be roughened as required by the City's Project Manager, in a manner that will not leave loosened particles of aggregate or damaged concrete at the surface. It shall be thoroughly cleaned of foreign matter and laitance, and saturated with water. A thin layer of grout shall be applied to the cleaned and saturated surface immediately prior to placing the fresh concrete.

The placing of concrete shall be carried continuously from joint to joint. The face edges of all joints which are exposed to view shall be carefully finished true to line and elevation.

3. EXPANSION JOINTS

Expansion and fixed joints shall be constructed according to the details shown in the plans. Expansion joints shall include those in which provision, in some manner or other, is made for movement by sliding or by deflection.

When preformed expansion joints are specified, the material shall be placed in correct position as the concrete on one side of the joint is placed. When the form is removed, the concrete on the other side shall be placed.

7.03 REINFORCED CONCRETE INSTALLATION (Continued)

D. JOINTS (Continued)

4 WATER STOPS

Water stops shall be furnished and placed as provided in the plans. They shall be synthetic rubber or other approved material. They shall form continuous watertight joints.

No direct payment will be made for joints or water stops. The construction of joints and water stops shall be considered subsidiary to other items of Work for which direct payment is made.

E. WATERPROOFING

The back face of all retaining walls over 2 feet high shall be damp-proofed above the top of the footing. The surfaces to be damp-proofed shall be free from dust, sand, mud, mortar and other loose particles, all grease spots or marks of soil shall be removed by washing with an approved solvent.

After the surfaces have been thoroughly cleaned and dried, and if asphalt is the intended waterproofing, they shall be uniformly coated with one coat of primer and two coats of hot waterproofing asphalt.

The primer may be applied cold, but the asphalt shall be applied at a temperature of at least 250° Fahrenheit. Each coating shall be allowed to dry before the next coating is applied.

The primer shall be applied in quantities sufficient to thoroughly cover the surfaces to be treated. The waterproofing asphalt shall be applied at a rate of not less than 5 gallons per 100 square feet of surface.

If using other approved commercially produced products, the waterproofing shall be applied as per manufacturers' Specifications and directions.

Care shall be exercised to confine all damp-proofing materials to the area being treated and to prevent disfigurement of any exposed part of the structure by dripping or spreading of asphalt.

No direct payment for waterproofing will be made. Waterproofing shall be considered subsidiary to other items of Work for which direct payment is made.

F. WEEPHOLE / DRAINAGE COLLECTION PIPE

Weep-holes shall be constructed in all retaining walls as shown on the plans or as directed by the City's Project Manager.

No direct payment for the placement of weep-holes will be made. Placement of weep-holes shall be considered subsidiary to other items of Work for which direct payment is made.

7.03 REINFORCED CONCRETE INSTALLATION (Continued)

G. CURING AND PROTECTION

1. CURING

As soon after the completion of the specified finishing operation as the condition of the concrete will permit without danger of consequent damage thereto, all exposed surface shall be cured by the water method, the form-in-place method, or by the membrane curing compound method.

a. Water Method

The concrete shall be kept continuously wet by application of water for a minimum period of seven (72) hours after the concrete has been placed. Burlap, earth, or sand may be used as a curing medium to retain the moisture. The entire surface of the concrete shall be kept damp such that the concrete is covered with the curing medium.

b. Form-In-Place Method

Formed surfaces of concrete may be cured by retaining the forms in place. The forms shall remain in place for a minimum period of seven (72) hours after the concrete has been placed.

c. Membrane Curing Compound Method

All surfaces which are exposed to the air shall be sealed with a uniform application of a membrane curing compound applied at a rate of 1 gallon per 200 square feet of surface area. The curing compound shall be applied using an approved mechanical power sprayer of a size and capacity to complete the Work. The curing compound shall meet the requirements of Chapter 3 of these Standard Specifications.

2. PROTECTION

The Contractor shall provide protective measures at their own expense to prevent damage to the Work. The Contractor shall be responsible for any damage caused by the construction operation. Any concrete showing injury from vandalism shall be repaired or removed and replaced at the Contractor's expense.

No direct payment will be made for curing and protection. The cost of curing and protection shall be considered subsidiary to other items of Work for which direct payment is made.

H. HOT AND COLD WEATHER CONSTRUCTION

Concrete Work on retaining walls and steps shall not be performed during inclement weather except with specific permission of the City's Project Manager. During hot or cold weather the Work may proceed in accordance with Chapter 3 of these Standard Specifications.

7.04 MODULAR BLOCK INSTALLATION

Installation shall be according to the latest edition of manufacturer's Specifications for methods of installation. Contractor shall arrange a meeting with the authorized technical representative, the Contractor, and the City's Project Manager to review the manufacturer's recommendation prior to construction. In-lieu of this meeting the authorized technical representative and Contractor shall sign off agreement to the following Standard Specifications:

A. PREPARATION

Contractor shall excavate to the lines and grades shown on the construction drawings. Over excavation shall not be paid for and replacement with compacted fill and/or wall system components will be required at contractor expense. Contractor shall be careful not to disturb embankment materials beyond lines shown.

B. FOUNDATION SOIL PREPARATION

Foundation soil shall be excavated as required for footing dimensions shown on the construction drawings or as directed by the City's Project Manager. Foundation soil shall be examined by the City's Project Manager to assure that the actual foundation soil strength meets or exceeds assumed design strength. Soils not meeting required strength shall be removed and replaced with acceptable material. Over-excavated areas shall be filled with approved compacted granular fill backfill material. Foundation shall be proof rolled prior to fill and geogrid placement.

C. BASE LEVELING PAD

Leveling pad materials shall be placed upon undisturbed in-situ soil. Material shall be compacted so as to provide a level hard surface on which to place the first course of units. Mechanical Compaction shall be to 95% of standard proctor. Leveling pad shall be prepared to insure complete contact of retaining wall unit with base. Leveling pad materials shall be to the depths and widths required. Well-graded sand can be used to smooth the top ¼ inch to ½ inch of the leveling pad. In no case shall the compacted leveling pad shall be less than a minimum 6 inches thick if well-compacted gravel, crushed stone or coarse sand or 3 inches thick if LB-2750 Concrete.

D. UNIT INSTALLATION

First course of concrete wall units shall be placed on the base leveling pad. The units shall be checked for level and alignment. The first course is the most important to insure accurate and acceptable results. Insure that units are in full contact with base. Units are placed side by side for full length of wall alignment. Alignment may be done by means of a string line or offset from base line. Install connecting devices and fill all voids at units with unit fill material. Tamp fill. Sweep all excess material from top of units and install next course. Insure each course is completely unit filled, backfilled and compacted prior to proceeding to next course. Lay up each course insuring that connectors protrude into adjoining courses above a minimum of one inch. Pull each unit forward, away from the embankment, against connectors in the previous course and backfill as the course is completed. Repeat procedure to the extent of wall height. The top two courses of wall units below the cap shall also have an adhesive or epoxy to provide a permanent bond of the upper blocks. As appropriate where the wall changes elevation, units can be stepped with grade or turned into the embankment with a convex return end. Provide appropriate buried units on compacted leveling pad in area of convex return end.

7.04 MODULAR BLOCK INSTALLATION (Continued)

E. CAP INSTALLATION

Place Modular Block Cap units over projecting connectors from units below. Pull forward to set back position. Back fill and compact to finished grade. As required, provide permanent mechanical connection to wall units with construction adhesive or epoxy. Apply adhesive or epoxy bottom surface of cap units and install on units below.

F. GEOGRID INSTALLATION

The geogrid soil reinforcement shall be laid horizontally on compacted backfill. Connect to the concrete wall units by hooding geogrid over connector units. Pull taut, and anchor before backfill is placed on the geogrid. Slack in the geogrid at the wall unit connections shall be removed. Geogrid shall be laid at the proper elevation and orientation as shown on the construction drawings or as directed by the City's Project Manager. Correct orientation (roll direction) of the geogrid shall be verified by the contractor. To pretension geogrid, pull pinned geogrid taut to eliminate loose folds. Stake or secure back edge of geogrid prior to and during backfill and compaction. The Contractor shall follow manufacturer's guideline relative to overlap requirement of uniaxial and biaxial geogrids.

G. FILL PLACEMENT

Backfill material shall be placed in 8 inch lifts and compacted to 95% of Standard Proctor. Backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack or loss of pretension of the geogrid. Only hand-operated compaction equipment shall be allowed within 3 feet of the back surface of the Modular Block units. Backfill shall be placed from the wall rearward into the embankment to insure that the geogrid remains taut. Tracked construction equipment shall not be operated directly on the geogrid. A minimum backfill thickness of 6 inches is required prior to operation of tracked vehicles over geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid. Rubber-tired equipment may pass over the geogrid reinforcement at slow speeds, less than 10 MPH. Sudden braking and sharp turning shall be avoided. Fill placed one foot behind the geogrid units shall be wrapped in filter fabric as shown on the plans. A 6" overlap of the filter fabric shall be provided at the top of each layer of stone backfill. The fill placement shall be coordinated with the installation of handrails, fences, or guiderails. There shall be 12 inches of topsoil on the surface.

H. WEEPHOLE / DRAINAGE COLLECTION PIPE

Weep-holes shall be constructed in all retaining walls as shown on the plans or as directed by the City's Project Manager. No direct payment for the placement of weep-holes will be made. Placement of weep-holes shall be considered subsidiary to other items of Work for which direct payment is made.

7.05 FENCE PLACEMENT

Fences shall be placed along the tops of retaining walls where shown on the plans. These fences shall be constructed in accordance with the provisions of Chapter 8 of these Standard Specifications.

7.06 HANDRAIL PLACEMENT

Handrails shall be placed at the locations and in accordance with the details shown on the plans, and as specified in these Standard Specifications and the Special Provisions, and as directed by the City's Project Manager. The type of railing to be constructed shall be specified in the special provisions or shown on the plans. All handrails, posts, and paint shall be of the size and materials as shown on the plans, Standard Specifications, or as directed by the City's Project Manager.

The railing shall be erected true to line and grade. Posts shall be set vertical. All welds shall conform to the latest requirements of the American Welding Society. All welds on exposed surfaces shall be ground flush with the adjacent surfaces.

Primer paint shall be applied to a dry thickness of 2.0 to 3.5 mils and two (2) coats of enamel shall be applied to a dry thickness of 1.5 to 2.5 mils for each coat.

7.07 SUBSTANTIAL COMPLETION

Retaining walls and steps will be considered substantially complete when all elements of the wall are placed and finished, backfill completed, and handrail completed.

7.08 BASIS OF PAYMENT

A. CONCRETE FOR STEPS AND RETAINING WALLS, IN PLACE

Payment for CONCRETE FOR STEPS AND RETAINING WALLS, IN PLACE, shall be based on the contract unit price bid per cubic yard, based upon the quantity of concrete required for the Design Section, unless otherwise specified. No actual measurement of the volume of concrete will be made. Such payment shall be full compensation for furnishing, preparing, transporting, delivering and placing all materials, except those for which the contract provides that direct payment shall be made, for work and materials for forms, falsework, bracing, etc.; incidental excavation and compacted backfill; and for all labor, equipment, tools and incidentals necessary to complete the Work.

B. REINFORCING STEEL FOR RETAINING WALLS AND STEPS

Payment for REINFORCING STEEL FOR RETAINING WALLS AND STEPS, IN PLACE, constructed in conformance with the plans and Standard Specifications, and accepted by the City's Project Manager, shall be based on the contract unit price bid per pound, based upon the quantity of reinforcing steel required for the Design Section, unless otherwise specified. No actual weighing of steel will be made. Such payment shall be full compensation for furnishing, bending, fabricating and placing the reinforcements; for all clips, spacers, ties, wire or other material used for fastening reinforcement, in place; and for all tools, labor, equipment and incidentals necessary to complete the Work.

C. MODULAR BLOCK RETAINING WALL

MODULAR BLOCK RETAINING WALL constructed in conformance with the manufacturer's Specifications and installation instructions, and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per square foot, based on the total area of the retaining wall installed. Such payment shall be full compensation for furnishing, preparing, transporting, delivering, placing and installing all materials including retaining wall units, geogrid reinforcement, fill, backfill, foundation preparation, and furnishing/installing leveling pad except those for which the contract provides that direct payment shall be made, incidental excavation and compacted backfill; and for all labor, equipment, tools and incidentals necessary to complete the Work. Modular Block Retaining Wall Systems shall be constructed according to the manufacturer's specifications.

D. HANDRAILS, COMPLETE

HANDRAILS, COMPLETE, constructed in conformance with the plans and Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per foot, based on the total length of the top rail. Said payment shall be full compensation for the top rail, post or mounting brackets, erection, paint and all other tools, materials, labor and incidentals necessary to complete the Work.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 8

CHAIN LINK FENCE AND PIPE RAILING FENCE

ARTICLE	TITLE	
8.00	GENERAL	801
8.01	MATERIALS	801
	A. CHAIN LINK FENCE	801
	B. PIPE RAILING FENCE	801
	C. RIGID CELLULAR PLASTIC BACKFILL	802
	D. POLYURETHANE SEALANT	802
8.02	CHAIN LINK FENCE INSTALLATION	802
	A. GENERAL	802
	B. BASIS OF PAYMENT	803
8.03	PIPE RAILING FENCE INSTALLATION	803
	A. GENERAL	803
	B. BASIS OF PAYMENT	803

CHAPTER 8

CHAIN LINK FENCE AND PIPE RAILING FENCE

8.00 GENERAL

The Work covered in this chapter shall include the installation of chain link fence and pipe railing fence.

8.01 MATERIALS

A. CHAIN LINK FENCE

Materials for chain link fence shall be standard commercial products which meet the general requirements of these Standard Specifications.

Chain link fence fabric shall be No. 9 gauge wire woven in a 2 inch mesh. Fabric shall be the height indicated on the plans with both edges selvaged, twisted and barbed and shall be zinc-coated by the hot-dip process after fabrication.

End, corner, pull posts and intermediate posts shall be round tubular steel having a nominal outside diameter of 2 3/8 inches and weight of 3.65 pounds per foot.

Post braces and top rail shall be round tubular steel having a nominal outside diameter of 1 1/2 inches and weight of 2.72 pounds per foot.

Reinforcing wire shall be No. 7 gauge coiled spring wire.

Stretcher bars shall not be less than 3/16" x 3/4" x the length required for the height of the fabric supplied, but in no case less than 6 inches shorter than the height of the specified fabric.

Post tops shall be ornamental.

Zinc coating shall be applied to all steel and iron parts after fabrication.

Pipe sleeves shall be round, galvanized steel, have a nominal inside diameter of 2 1/2 inches and a minimum length of 12 inches.

B. PIPE RAILING FENCE

Materials for pipe railing fence shall be standard commercial products which meet the general requirements of the Standard Specifications.

All pipe used for railing shall be round tubular steel (Schedule 40) galvanized pipe having a nominal outside diameter of 1 3/8 inches.

8.01 MATERIALS (Continued)

B. PIPE RAILING FENCE (Continued)

All end, corner and intermediate posts shall be round tubular steel (Schedule 40) galvanized pipe having a nominal outside diameter of 1 3/8 inches.

The tee, cross, elbow and flange connectors shall be malleable iron connectors as approved by the City's Project Manager. The connectors are not to be welded or threaded type, but shall be of the reusable type having case hardened set screws to provide connection.

Pipe sleeves shall be round, galvanized steel, have a nominal inside diameter of 1 1/2 inches and a minimum length of 12 inches.

Zinc coating shall be applied to all steel and iron parts after fabrication.

C. RIGID CELLULAR PLASTIC BACKFILL

Rigid cellular plastic backfill shall be manufactured for the intended purposes and conform to the test requirements of "Standard Test Method for Compressive Properties of Rigid Cellular Plastic" ASTM Designations D 1621, and "Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics" D 1623.

D. POLYURETHANE SEALANT

Polyurethane sealant shall be one-part, self leveling, conforming to the requirements of "Standard Specifications for Elastomeric Joint Sealants" ASTM Designation C 920, Type S, Grade P, Class 25.

8.02 CHAIN LINK FENCE INSTALLATION

A. GENERAL

New chain link fence shall be installed at the locations shown and as dimensioned and detailed on the plans.

Post spacing for posts not to be on concrete walls shall not exceed 10 feet and shall be set in 3 feet of concrete base 12 inches in diameter. The exposed surface of concrete shall be crowned to shed water.

Post spacing for posts to be set on concrete wall shall not exceed 10 feet or shall be at intervals shown on the plans. Posts shall be set into pipe sleeves cast into the wall and shall extend a minimum of 12 inches into the sleeve.

Posts in wall shall be set using rigid cellular plastic foam backfill. Sufficient material shall be placed in the pipe sleeve to completely fill the annular space to within 3/16 inch below the top of the sleeve. Care shall be taken to insure that the annular space is filled in such a manner as to prevent voids in the plastic foam. Excess material shall be cut off and removed so as to leave a 3/16 inch reservoir. The resulting reservoir shall be filled with one-part, self-leveling polyurethane sealant installed in accordance with the manufacturer's recommendations.

End, corner, and pull posts shall be braced to nearest point with tubular steel post brace with a 3/8 inch galvanized steel truss rod with a turnbuckle for adjustment.

8.02 CHAIN LINK FENCE INSTALLATION (Continued)

A. GENERAL (Continued)

Fastening to all terminal posts shall be with stretcher bars and fabric bands at 16 inch intervals. Fastening to line posts shall be tie wire or other approved method at 16 inch intervals.

Fastening to top rail shall be with wire ties at intervals not exceeding 20 inches. Fastening to bottom tension wire shall be with wire ties at intervals not exceeding 2 feet.

B. BASIS OF PAYMENT

Chain link fence installed in accordance with the plans and these Standard Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per foot for CHAIN LINK FENCE, ___" for the various sizes called for in the proposal. Such payment shall be full compensation for materials, equipment, tools, labor and incidentals necessary to complete the Work as indicated on the plans.

8.03 PIPE RAILING FENCE INSTALLATION

A. GENERAL

New pipe railing fence shall be installed at the locations shown and as dimensioned and detailed on the plans. All Work shall be performed by competent and experienced fence erection workers, whose experience record is satisfactory to the City's Project Manager.

Post spacing shall not exceed 10 feet or shall be at intervals shown on the plans. Posts installed in concrete walls shall be set into pipe sleeves cast into the wall and shall extend a minimum of 12 inches into the sleeve.

Posts in walls shall be set using rigid cellular plastic foam backfill. Sufficient materials shall be placed in the pipe sleeve to completely fill the annular space to within 3/16 inch below the top of the sleeve. Care shall be taken to insure that the annular space is filled in such a manner as to prevent voids in the plastic foam. Excess material shall be cut off and removed so as to leave a 3/16 inch reservoir. The resulting reservoir shall be filled with one-part, self-leveling polyurethane sealant installed in accordance with the manufacture's recommendations.

The tee, cross, elbow and flange connectors shall be set such that the set screw side of the connectors shall be installed on the side opposite the pedestrian traffic.

B. BASIS OF PAYMENT

Pipe railing fence, installed in accordance with the plans and these Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per linear foot for PIPE RAILING FENCE, ___". Such payment shall be full compensation for all castings, pipe, sleeves, plastic backfill, sealant, caulking, posts, rails, and connectors, materials, equipment, tools, labor and incidentals necessary to complete the Work as indicated on the plans.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 9

CRUSHED ROCK SURFACING

ARTICLE	TITLE	
9.00	GENERAL	901
9.01	MATERIALS	901
	A. CRUSHED ROCK	901
	B. GRAVEL	902
9.02	EQUIPMENT	902
9.03	ROADWAY SURFACING	903
	A. GENERAL	903
	B. PLACEMENT AND COMPACTION	903
	C. BASIS OF PAYMENT	903
9.04	BIKEWAY SURFACING	903
	A. GENERAL	903
	B. BASIS OF PAYMENT	903

CHAPTER 9

CRUSHED ROCK SURFACING

9.00 GENERAL

The Work of Crushed Rock Surfacing and of Crushed Rock Bikeway shall include the scarification of the subgrade, the furnishing, hauling, spreading and manipulating of the crushed rock and gravel.

Sources for crushed rock and gravel shall be on the latest edition of the Nebraska Department of Roads "Gravel and Rock Producers" list unless otherwise approved by the City's Project Manager.

9.01 MATERIALS

A. CRUSHED ROCK

1. General

Crushed rock for surfacing shall consist of clean, hard particles of crushed limestone, quartzite or dolomite.

2. Gradation

Crushed rock for surfacing shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>Percent Passing</u>
1"	100
#4	20-60
#10	0-30
#200	0-10

Crushed rock for bikeway surfacing shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8"	100
#4	85-100
#8	53-83
#16	33-53
#30	20-40
#50	16-28
#100	13-23
#200	12-20

3. Soundness

Crushed rock for surfacing shall have a percent loss of not more than 30 at the end of 16 cycles of freezing and thawing in accordance with AASHTO Method T-103.

9.01 MATERIALS (Continued)

A. CRUSHED ROCK (Continued)

4. Abrasion

Crushed rock, when tested for abrasion by AASHTO Method T-96, Grade B, shall have a percentage of wear of not more than 45 percent.

B. GRAVEL

1. General

Gravel for surfacing shall consist of durable particles of stone and sand.

2. Gradation

Gravel for surfacing shall meet the following gradation requirements:

<u>Sieve Size</u>	<u>Percent Passing</u>
1"	100
#4	61-95
#10	0-30
#200	0-6

3. Soundness

The fraction of gravel contained on the No. 16 sieve shall have a soundness loss not to exceed ten percent (10%) at the end of five (5) cycles, except that the material having a soundness loss greater than ten percent (10%) may be accepted at the discretion of the City's Project Manager, subject to an adjustment of the quantity for which payment will be made. Soundness shall be determined in accordance with AASHTO Method T-104, using sodium sulfate (Na_2SO_4), except that the soundness loss shall be determined and reported only on the fraction of the aggregate that is retained on the No. 16 sieve.

4. Sampling

Sampling of the material shall be done in accordance with AASHTO Method T-2.

9.02 EQUIPMENT

The Contractor shall furnish adequate equipment necessary for the completion of the Work which shall include, but not be limited to, motor grader with scarifying equipment, sheepsfoot roller, pneumatic tire roller and water truck.

Each load of material shall be weighed on an approved calibrated scale. Serially numbered duplicated scale tickets shall be furnished to accompany each truck load of material to the unloading point. Scale tickets shall show the date, time, load number, total weight, tare weight, project number, destination, net weight and type of material.

9.03 ROADWAY SURFACING

A. GENERAL

In general, this construction shall include combining three inches of crushed rock in the upper layer of the subgrade and the application of a one-inch gravel surface to the crushed rock base, to the widths and cross section as provided by the plans or directed by the City's Project Manager.

B. PLACEMENT AND COMPACTION

The crushed rock material shall be deposited uniformly upon an approved subgrade in straight, single or double lines, followed immediately thereafter by scarification of the rock and subgrade to produce a uniform soil-rock mixture six inches thick. The mixture shall be spread into a uniform layer and compacted using sheepsfoot roller and water as required. The gravel material shall then be delivered and uniformly spread, followed immediately by compaction using an approved roller and water as required, to the satisfaction of the City's Project Manager.

C. BASIS OF PAYMENT

CRUSHED ROCK ROADWAY SURFACING and GRAVEL SURFACING that has been completed in conformance with the Plans and Standard Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per ton based on total weight of material delivered. No payment shall be made for materials furnished in excess of that specified in the Contract or by the City's Project Manager. Such payment shall be full compensation for all materials; hauling, spreading, scarifying, and compacting; application of water; and materials, equipment, tools, labor and incidentals necessary to complete the Work.

9.04 BIKEWAY SURFACING

A. GENERAL

In general, bikeways constructed of crushed rock shall consist of a layer of compacted, crushed rock placed on a prepared subgrade to the width, thickness, and cross section as provided by the plans, indicated in the special provisions, or as directed by the City's Project Manager.

B. BASIS OF PAYMENT

CRUSHED ROCK BIKEWAY SURFACING that has been completed in conformance with the Plans and Standard Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per ton based on total weight of material delivered. No payment shall be made for materials furnished in excess of that specified in the Contract or by the City's Project Manager. Such payment shall be full compensation for all materials; hauling, spreading, scarifying, and compacting; application of water; and materials, equipment, tools, labor and incidentals necessary to complete the Work.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 13

TRAFFIC PAVEMENT MARKING

ARTICLE	TITLE	
13.00	GENERAL	1302
	A. MATERIALS	1302
	B. GENERAL INSTALLATION METHODS	1302
	C. GROOVED INSTALLATION METHODS	1304
	D. CLEANUP	1305
13.01	REMOVAL	1305
	A. GENERAL	1305
	B. BASIS OF PAYMENT	1305
13.02	PREFORMED PLASTIC	1306
	A. MATERIAL SPECIFICATIONS	1306
	B. INSTALLATION METHODS	1307
	C. BASIS OF PAYMENT	1308
13.03	THERMOPLASTIC MOLTEN	1308
	A. MATERIAL SPECIFICATIONS	1308
	B. INSTALLATION METHODS	1313
	C. BASIS OF PAYMENT	1314
13.04	LIQUID POLYUREA - TYPE I	1314
	A. MATERIAL SPECIFICATIONS	1314
	B. INSTALLATION METHODS	1316
	C. BASIS OF PAYMENT	1318
13.05	LIQUID POLYUREA - TYPE II	1319
	A. MATERIAL SPECIFICATIONS	1319
	B. INSTALLATION METHODS	1321
	C. BASIS OF PAYMENT	1323
13.06	LIQUID POLYUREA - TYPE III	1324
	A. MATERIAL SPECIFICATIONS	1324
	B. INSTALLATION METHODS	1324
	C. BASIS OF PAYMENT	1324
13.07	PAINT	1325
	A. MATERIAL SPECIFICATIONS	1325
	B. INSTALLATION METHODS	1325
	C. BASIS OF PAYMENT	1326
13.08	RAISED PAVEMENT MARKERS	1326
	A. MATERIAL SPECIFICATIONS	1326
	B. INSTALLATION METHODS	1327
	C. BASIS OF PAYMENT	1327

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 13

TRAFFIC PAVEMENT MARKING

ARTICLE	TITLE	
13.09	TUBULAR MARKERS	1328
	A. MATERIAL SPECIFICATIONS	1328
	B. INSTALLATION METHODS	1328
	C. BASIS OF PAYMENT	1328
13.10	GLASS BEADS	1329
13.11	TEMPORARY MARKING	1330
	A. GENERAL	1330
	B. PAINT	1330
	C. TEMPORARY TAPE MARKING	1330
	D. FLEXIBLE RAISED PAVEMENT MARKER	1331
	E. BASIS OF PAYMENT	1331
13.12	GUARANTEE PERIOD	1332

CHAPTER 13

TRAFFIC PAVEMENT MARKING

13.00 GENERAL

The Contractor shall use a crew experienced in the Work of installing the type of pavement marking material designated and shall supply all the equipment and materials necessary for pavement preparations and the placement of the pavement markings. At least one member of the crew installing the pavement marking or the on site crew supervisor shall have a current ATSSA (American Traffic Safety Services Association) or IMSA (International Municipal Signal Association) certification as a Pavement Marking Technician or Pavement Marking Specialist. A copy of certification shall be submitted to the City's Project Manager prior to the beginning of the project.

The Contractor shall install pavement marking materials as specified on the plans and these Standard Specifications. When the temperature or humidity conditions prevent the installation of the specified marking material, the Contractor shall install and maintain temporary paint marking or other traffic pavement marking approved by the City's Project Manager, at the Contractor's cost, until conditions are adequate for installation of permanent markings.

The properties of each marking material, the type of pavement surface, and the manner of marking determine which types of marking material may be applied on each project.

A. MATERIALS

Durable traffic pavement marking materials as used in this Standard Specification are materials which have a normal life of at least two years beyond initial application. The following materials are considered durable marking materials:

1. Preformed Plastic
2. Thermoplastic (molten)
3. Thermoplastic (preformed)
4. Liquid Polyurea (two component)

Certificate of Compliance

The Contractor shall furnish manufacturer's certifications for each marking material to be supplied and to be used on the project. Certificates shall indicate compliance with the provisions of the Standard Specifications.

B. GENERAL INSTALLATION METHODS

All pavement markings shall be installed in accordance with the material manufacturer's recommended application procedures or instructions. The pavement upon which the pavement markings are to be placed shall be cleaned and prepared in a manner and to the extent recommended by the manufacturer, prior to placement of the markings. Cleaning shall be by any effective method, approved by the City's Project Manager, which completely and effectively removes old pavement marking, contaminants, loose materials and conditions deleterious to proper adhesion.

New Portland Cement Concrete (PCC) pavement surfaces which have been open to traffic less than three (3) months shall be sandblasted, shot blasted or high-pressure water blasted to remove all latence and curing compound residue prior to installation of any pavement marking.

13.00 GENERAL (Continued)

B. GENERAL INSTALLATION METHODS (Continued)

All permanent or temporary pavement markings on new surfaces shall be installed on any segment of the roadway before that segment or roadway is opened to traffic.

All markings shall be pre-marked by the Contractor. The pre-marking shall be reviewed and approved by the City's Project Manager prior to the application of any marking material. The City's Project Manager will review the pre-marking on any City workday, if requested twenty-four (24) hours in advance.

When deemed necessary by the City's Project Manager, the Contractor, at the Contractor's expense, shall place any additional temporary markings required to achieve the alignment as specified throughout both straight and horizontally curved sections of roadway. Any additional temporary markings placed on the roadway for alignment purposes shall not establish a permanent marking on the roadway. Materials used for alignment markings and equipment used to place such markings shall be approved by the City's Project Manager.

The pavement markings shall be installed at the approved pre-marked alignment. Deviation from the approved alignment shall not exceed 1 inch, and the total of all deviations from the approved alignment shall not exceed 2 inches per 100 feet of roadway length.

Longitudinal pavement markings shall generally be offset at least 2 inches from construction joints.

1. Longitudinal Marking

All longitudinal traffic pavement markings shall be white or yellow material placed in accordance with the pavement marking plan.

Lines shall be visually straight and shall have overall widths as shown on plan. Skip lines shall be 4 inch wide material segments 6 feet in length separated by 18 foot gaps. Double yellow lines shall be two parallel 4 inch wide lines separated by a 4 inch space.

Existing markings are not to be used as guides for the layout of new markings, except when plans specify "Match Existing Markings".

The traffic lane width and other transverse dimensions on the marking plan indicate the nominal distance from back of curb to center of marking line, and between centers of marking lines.

2. Transverse Marking

Stop bars shall be 12 inch wide lines unless otherwise noted.

Word and symbol marking, including letters and arrow, are considered transverse marking. Transverse marking layout shall comply with the current MUTCD). Symbolic markings shall be preformed plastic unless otherwise noted.

13.00 GENERAL (Continued)

B. GENERAL INSTALLATION METHODS (Continued)

3. Crosswalks

Permanent crosswalks shall be “Continental” style, which is a series of 2 feet by 10 feet markings located generally parallel to the curb line. These markings shall have a gap between each other of not more than 5 feet.

This spacing shall avoid the vehicle tire paths as much as possible. If there is a crosswalk on opposite sides of the intersection, the stripes shall line up with each other.

4. Cross Hatching

Cross hatching shall be 12 inches wide.

C. GROOVED INSTALLATION METHODS

Grooved marking consists of the installation of marking material in grooves or recesses cut into the pavement surface to allow the material to be partially embedded below the general surface of the pavement.

The specified marking material shall be applied to the pavement surface within the grooved area following the standard installation method specified for that type of marking material.

All longitudinal or curved intersection grooved marking shall be premarked by the Contractor. All curved intersection markings in concrete shall be grooved. The pre-marking shall be reviewed and approved by the City’s Project Manager prior to the cutting of any grooves in the pavement surface.

The grooves shall be cut into the pavement with a unit designed and developed to saw cut recessed grooves into pavement. The unit shall have a fully articulated cutter head design that follows the contour of the pavement surface and ensures proper cutting depth of the groove. All cut material shall be removed from the groove and the pavement surface.

The pavement marking shall be placed in the grooves the same day as they are cut. Grooves shall be clean and dry prior to marking application. All conflicting pavement markings remaining after marking installation shall be removed; this removal shall be subsidiary to the pavement marking.

Groove width:	Line width + 1 inch +/- 1/8 inch
Groove depth:	100 mils +/- 10 mils for 125 mils thick material 45 mils +/- 10 mils for 60 mils thick material 40 mils +/- 10 mils for 25 mils thick material
Groove length:	Marking material length + required grooving transition
Groove position:	Minimum of 2 inches from any joint line, where applicable

When pre-existing markings are grooved and new markings follow the same alignment, grooving shall not be done. Instead, the existing groove shall be thoroughly cleaned before the application of new material.

13.00 GENERAL (Continued)

D. CLEANUP

No pavement marking equipment shall be purged in the public right of way.

The City will provide a location to dump grindings if the Contractor requests it.

Any material used to clean or prepare the surface for application of markings shall be cleaned up or removed by the Contractor.

13.01 REMOVAL

A. GENERAL

Existing traffic pavement markings which are in alignment with approximately the same location as proposed new pavement marking must be removed to the extent necessary to prepare the roadway surface for the installation of the new pavement marking material in accordance with these Standard Specifications and the material manufacturer's recommendations. This type of pavement marking removal is considered part of pavement marking preparation and is not a separate pay item.

Existing traffic pavement marking which is NOT in alignment with the proposed new pavement marking, normally because of a change in pavement marking design or layout, must be removed to avoid conflicting marking. This type of marking will not be removed by the preparation of the roadway surface at the location of the proposed new marking. The removal of this marking is a separate pay item.

Methods of pavement marking removal include grinding, scraping, sandblasting, shot blasting, high-pressure water jetting, or other methods approved by the City's Project Manager. The removal method used should not significantly damage the pavement surface and should be determined after consideration of the type of marking material to be removed and the type of pavement surface. The pavement marking shall be removed to the satisfaction of the City's Project Manager.

Any residue remaining after removal of the marking shall be collected and removed from the project by the Contractor.

At no time shall the depth of the groove exceed the depth specified in Chapter 13 of these Standard Specifications.

B. BASIS OF PAYMENT

The removal of existing pavement marking to allow a change in pavement marking layout, or location and to remove conflicting marking shall be measured or counted and paid for at the Contract unit price bid per linear foot or each for REMOVE PAVEMENT MARKING, _____ of various widths. Such payment shall be full compensation for removing and disposing of all material, and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work.

13.02 PREFORMED PLASTIC

A. MATERIAL SPECIFICATIONS

1. General

White and yellow preformed retroreflective plastic pavement marking materials shall be suitable for use as reflective pavement markings on Portland Cement Concrete (PCC) or asphaltic concrete. The preformed marking material shall be 60 mils thick, retroreflective, pliant polymer tape.

Preformed plastic marking material installed for crosswalks and stop-bars shall be State of Nebraska Department of Roads Type III (intersection grade) material.

Preformed plastic marking material installed for longitudinal lines, arrows, legends and gores shall be State of Nebraska Department of Roads Type IV (improved retroreflectivity retention) material.

The retroreflective plastic pavement marking material shall consist of a mixture of high quality plastic materials, pigments, and glass beads uniformly distributed throughout its base cross-sectional area, with a reflective layer of beads bonded to the top surface. The material shall be capable of conforming to pavement contours, breaks, faults, etc., through the action of traffic at normal pavement temperatures.

The material, when applied according to the recommendations of the manufacturer, shall provide a neat, durable marking that will not flow or distort due to temperature, provided the pavement surface remains stable. The material shall provide a cushioned, resilient substrate that reduces bead crushing and loss. The material shall be weather resistant, and through normal traffic wear, shall show no appreciable fading, lifting, or shrinkage throughout the useful life of the marking, and shall show no significant tearing, roll back, or other signs of poor adhesion.

Preformed legends and symbols shall conform to the applicable shapes and sizes as outlined in the current edition of the “Manual on Uniform Traffic Control Devices for Streets and Highways” (MUTCD).

13.02 PREFORMED PLASTIC (Continued)

A. MATERIAL SPECIFICATIONS (Continued)

2. Approved Material

The City reserves the right to conduct whatever tests are deemed necessary to identify and determine the quality, characteristics, and uniformity of any material. Preformed plastic pavement marking materials which have not been tested and given prior approval for the project by the City Engineer will not be permitted on the project.

3. Adhesives

The preformed plastic material shall have a pressure sensitive, precoated, factory applied adhesive capable of adhering the materials to Portland Cement Concrete (PCC) or asphaltic concrete pavements. The material must be capable of being applied to pavement without the use of heat, solvent, activator, or additional adhesives. A primer may be used to precondition the pavement surface. Any primer necessary or recommended to precondition Portland Cement Concrete (PCC) or asphaltic concrete pavement shall be identified by the plastic material supplier. The adhesive shall permit repositioning of the preformed markings on the pavement surface before being placed in a final position by the application of pressure.

3. Adhesives (Continued)

The adhesive shall be a thin, non-asphaltic type which will not leave a noticeable residue on the pavement after the plastic material wears away. After application, the marking shall be immediately ready for traffic.

B. INSTALLATION METHODS

Grooving shall be performed as per Grooved Installation Methods in Ch. 13.

Solid preformed plastic lines shall be applied to clean, dry pavement surface with a roll tape applicator capable of applying solid or continuous lines. Pavement primer or adhesive shall be used in accordance with the material manufacturer's recommendations.

During preformed plastic marking installation, air temperature shall be a minimum of 60° F and rising, and pavement surface temperature shall be a minimum of 70° F and rising.

Preformed plastic marking material applied to asphaltic concrete surface shall be applied as soon as possible to the hot asphalt surface and inlaid by rolling with the steel finishing roller.

When preformed material is laid over construction joints, surface cracks 1/4 inch wide or greater, then the material shall be removed for a distance of 1/4 inch on each side of the joint or crack.

13.02 PREFORMED PLASTIC (Continued)

C. BASIS OF PAYMENT

Pavement markings installed in conformance with the Plans and Standard Specifications and acceptable to the City's Project Manager shall be measured as actual material applied to the pavement and paid for at the contract unit price bid per each for GROOVED PREFORMED PLASTIC MARKING of various types.

Such payment shall be full compensation for preparation of pavement surface, removing and disposing of all existing material, furnishing and installing marking materials, and for all labor, equipment, tools materials, and incidentals necessary to complete the Work.

13.03 THERMOPLASTIC MOLTEN

A. MATERIAL SPECIFICATIONS

The adhesive surface of preformed plastic material precut to standard shapes, legends, or symbols shall be covered by a protective liner for the prevention of premature adhesion or contamination before application. Preformed plastic material supplied in rolls may be supplied with or without a protective liner on the adhesive surface. The protective liner shall be readily removable by peeling at the time of application.

1. General

White and yellow reflectorized thermoplastic molten pavement marking material shall be of a type that is applied only to asphaltic concrete in a molten state by mechanical means with surface application of glass beads which, upon cooling to under normal pavement temperature, produces an adherent reflectorized marking of specified thickness and width and capable of resisting deformation by traffic.

The material shall have resealing characteristics such that it is capable of fusing with itself and previously applied marking material of the same composition to patch worn areas of previously applied material.

The material shall not deteriorate upon contact with sodium chloride, calcium chloride, or other chemicals used to prevent formation of ice on roadways or streets, or because of the content of pavement materials, and shall be impervious to oil and grease drippings from traffic. In the molten state, the material shall not give off fumes which are toxic or otherwise injurious to persons or property.

The material shall not break down, deteriorate, scorch, or discolor if held at the molten temperature for a period of four (4) hours, or by reason of four (4) reheatings to the molten temperature. The temperature versus viscosity characteristics of the plastic material shall remain constant through up to four (4) reheatings, or from batch to batch. The material shall be free from all skins, dirt, foreign objects, or such ingredients as will cause bleeding, staining, or discoloration.

2. Formula

The manufacturer shall have the option of producing the thermoplastic pavement marking materials according to the manufacturer's own formulas. Regardless of the formula used in the manufacture, the material shall contain not less than thirty percent (30%) by weight of glass beads, not less than eighteen percent (18%) by weight of resin binder. The white material shall have not less than ten percent (10%) by weight of titanium dioxide.

13.03 THERMOPLASTIC MOLTEN (Continued)

A. MATERIAL SPECIFICATIONS (Continued)

2. Formula (Continued)

The binder shall contain not less than eight percent (8%) by weight of maleic-modified glycerol ester resin. The filler shall be white calcium carbonate or equivalent with a compressive strength of 5,000 psi. The pigment, beads, and filler shall be evenly dispersed in the resin binder.

The yellow pigment for thermoplastic material applied to asphaltic concrete shall be double encapsulated lead chromate. The thermoplastic material must comply with Resource Conservation and Recovery Act (RCRA) Federal Standard of 5 mg/L maximum lead content as determined by Toxicity Characteristic Leaching Procedure (TCLP) evaluation.

3. Suitability

The thermoplastic material shall be a product especially compounded for traffic markings. The markings shall not show appreciable deformation or discoloration under normal traffic conditions at temperatures below 140° F. Markings shall have a uniform cross-section. The density and character of the material shall be uniform throughout its thickness. The stripe shall maintain its original dimensions and placement.

The exposed surface shall be free from tack and shall not be slippery when wet. The material shall not lift from the pavement in freezing weather. Cold ductility of the material shall be such as to permit normal movement with the road surface without chipping or cracking.

When applied at the maximum bond temperature certified by the material manufacturer and thickness of 125 mils, the material shall set to bear traffic in not more than five minutes when the air temperature is 50° F, and not more than fifteen minutes when the air temperature is 90° F. The thermoplastic material shall readily extrude at temperatures below 450° F from the equipment used to produce a cross-section of line 125 mils thick which shall be continuous, uniform in shape, and have clear and sharp dimensions.

4. Reflectorization

During manufacture, reflectorizing glass beads shall be mixed into the material to the extent of not less than thirty percent (30%) nor more than forty percent (40%) by weight of material.

13.03 THERMOPLASTIC MOLTEN (Continued)

A. MATERIAL SPECIFICATIONS (Continued)

5. Physical Requirements of Material

a. Color: White

As demonstrated by a standard color difference meter, the white thermoplastic material shall show deviations from a magnesium oxide standard not greater than the following after the material has been heated for four hours at 425°:

Reflectance (Rd)	75% Minimum
Redness-Greenness (a)	0 +/- 5%
Yellowness-Blueness (b)	0 +/- 10%

White thermoplastic material shall contain a minimum of 10% titanium dioxide by weight and, after setting, shall be pure white and free from dirt or tint.

Color: Yellow

The color of the yellow thermoplastic material shall visually match Federal Test Standard Number 595-Color 13538. The daytime reflectance shall be forty-five percent (45%) minimum.

b. Color Retention

Retention of the initial color shall be determined by exposing a test specimen to an ultra-violet light source similar to a General Electric 275-watt sun lamp, type RS, with a built-in reflector. After one hundred (100) hours of exposure the test specimen shall show no perceptible color change (as indicated by comparison with an unexposed specimen).

c. Water Absorption

Material shall have not more than one-half percent (0.5%), by weight, of retained water when tested by "Standard Test Method for Water Absorption of Plastic" ASTM D 570/D 570M, procedure (A).

d. Softening Point

Material shall have a softening point of not less than 200° F after the material has been heated for four (4) hours at 425° F, as determined by "Standard Test Method for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus" ASTM E 28/E 28M.

e. Specific Gravity

Specific gravity of thermoplastic compound at 77° F shall be from 1.6 to 2.15.

13.03 THERMOPLASTIC MOLTEN (Continued)

A. MATERIAL SPECIFICATIONS (Continued)

5. Physical Requirements of Material (Continued)

f. Impact Resistance (IZOD)

Impact resistance shall not be less than 10 inch-pounds at 77° F after the material has been heated for four (4) hours at 425° F and cast into bars of 1 inch cross-sectional area, 3 inches long and placed with 1 inch extending above the vise in a cantilever beam (IZOD Type) tester using the 25 inch pound scale. This device is described in “Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics” ASTM D 256.

For application to asphaltic cement concrete pavement without sealer or primer, impact resistance shall be not less than 11 inch-pounds when tested in accordance with “Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics” ASTM D 256. When tested by the Gardner Falling Weight method, impact resistance shall be not less than 80 inch-pounds with no visible surface cracks after the material has been heated for four (4) hours at 425° F and applied to a Portland Cement Concrete (PCC) block, allowed to cool and tested in accordance with “Standard Test Method for Impact Resistance of Flat Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)” ASTM D 5420, Section II.

g. Flowability

After heating four (4) hours at 425° F, the material shall have a maximum flow residue of eighteen percent (18%). After heating for two (2) hours and subsequently stirring for six (6) hours at two hundred revolutions per minute (200 rpm) at 425° F, the material shall have a maximum flow residue of twenty-eight percent (28%).

h. Bond Strength

When two concrete blocks, 2 x 3 ½ x 7 inches are bonded together on the 3½ x 7 inch faces with a 1/16 inch to 1/8 inch layer of the thermoplastic pavement marking material together with any primer that is to be used in field application and tested in accordance with “Standard Test Method for Bond Strength of Thermoplastic Traffic Marking Materials” ASTM D 4796, the bonded strength shall be not less than 180 psi. The material must also retain a 180 psi minimum bond strength when tested by the Freeze-Thaw Test (Texas Transport Institute Method).

When applied to asphaltic concrete pavement without sealer or primer, minimum bond strength shall be not less than 275 psi when tested in accordance with “Standard Test Method for Bond Strength of Thermoplastic Traffic Marking Materials” ASTM D 4796.

13.03 THERMOPLASTIC MOLTEN (Continued)

A. MATERIAL SPECIFICATIONS (Continued)

5. Physical Requirements of Material (Continued)

i. Indentation Resistance

The material when tested with a Shore Durometer, Type A2, in accordance with “Standard Test Method for Rubber Property - Durometer Hardness” ASTM D 2240, shall have hardness readings not less than the amounts specified below when tested for fifteen (15) seconds using a 2 pound weight after heating for four (4) hours at 425° F and cooled to the following temperatures:

At 115° F, the reading for asphaltic pavement shall be 65 +/- 2%. At 77° F, the reading shall be 95 +/-2%.

j. Abrasion Resistance

The material shall show a maximum loss of one-half (0.5) gram when subjected to two hundred (200) revolutions on a Taber abraser at 77° F, using H-22 calibrase wheels weighted to 1.2 pounds. The wearing surface should be kept wet with distilled water throughout the test. The panel for this test shall be prepared by forming a representative lot of material at a thickness of 1/8 inch on a 4 inch square model panel by 0.05 inch thick on which a suitable primer has been previously applied.

k. Low Temperature Stress Resistance

For application to asphaltic concrete pavement without sealer or primer, the material shall show no cracking when tested according to AASHTO T250, Section 7 with Section 7.2.3 modified for an extended cold temperature (15° +/- 3° F) exposure period of 72 hours.

6. Approved Material

The City reserves the right to conduct whatever tests are deemed necessary to identify and determine the quality, characteristics, and uniformity of any material. Thermoplastic (molten) pavement marking materials intended for application to aged asphaltic concrete pavement without sealer or primer, and which have not been tested and give prior approval for the project by the City Engineer, will not be permitted on the project.

13.03 THERMOPLASTIC MOLTEN (Continued)

B. INSTALLATION METHODS

1. Pavement Preparation

Dirt, grease, or any foreign materials that would reduce the adhesion of thermoplastic to the pavement must be removed by the Contractor before the application of thermoplastic material.

A moisture check shall be made each day prior to the application of the material by applying a thermoplastic line on a piece of tar paper (approximately 6 feet long) over the area to be marked. After thirty (30) seconds, visually inspect the underside of the tar paper. If the underside is wet, **do not** install the thermoplastic. If test fails, after one hour, perform test again. After 2 failed tests, material may not be applied for 24 hours.

If specified, grooving shall be performed as per Grooved Installation Methods in Ch. 13.

2. Procedures

In no case shall thermoplastic molten pavement marking material be applied when the pavement or air temperatures are less than 50°F unless otherwise approved by the City's Project Manager.

Thermoplastic material must be installed at a thickness not less than 125 mils and shall not exceed 135 mils. The initial measurement should be made above the pavement surface. In some cases, however, primarily on fresh asphaltic concrete, the material may sink slightly into the pavement.

If the material appears to be less than 125 mils thick above the pavement surface, the line shall be 'chipped' and checked to determine the actual thickness. If the actual thickness is found to be less than 125 mils, the deficient portions of the line shall be ground down to no more than 30 mils above the pavement surface and sufficient thermoplastic and glass beads placed over the line to bring it up to the specified thickness.

Existing paint, preformed plastic, and polyurea shall be removed prior to placement of the thermoplastic markings. Existing thermoplastic pavement markings shall be removed or prepared in a manner and to the extent recommended by the thermoplastic manufacturer, prior to placement of the new thermoplastic markings.

3. Equipment

Thermoplastic pavement marking material may be installed by the extrusion method or ribbon extrusion method.

Equipment used for placing markings shall be manufactured for that purpose and of sufficient size and stability to ensure a smooth and straight application of pavement marking.

A self-propelled, self-contained, riding type unit is required for longitudinal lines, unless approved by the City's Project Manager. It must have the capability of automatically placing intermittent as well as continuous lines from either the left or right side of the vehicle. The vehicle shall be capable of applying either extrusion or ribbon thermoplastic in uniform dimensions and accurately follow pavement irregularities.

13.03 THERMOPLASTIC MOLTEN (Continued)

B. INSTALLATION METHODS (Continued)

3. Equipment (Continued)

The City's Project Manager may allow the use of a hand-operated or small riding machine where transverse markings or a limited quantity of edge and lane lines are required, provided sufficient traffic control is in place to close the lane adjacent to the marking operations.

4. Drop-on Beads

Immediate reflectivity is accomplished by the application of glass beads to the surface of the marking through a gun that is located directly behind the thermoplastic applicator. The beads shall be dropped or sprayed into the material in a manner that will result in the surface beads being buried to about their midpoint. Glass beads shall be applied uniformly at a minimum rate of 10 pounds per 100 square feet. These beads are in addition to those that are provided as part of the thermoplastic mixture.

C. BASIS OF PAYMENT

Pavement markings installed in conformance with the Plans and Standard Specifications and acceptable to the City's Project Manager shall be measured as actual material applied to the pavement and paid for at the contract unit price bid per linear foot for THERMOPLASTIC MOLTEN MARKING or GROOVED THERMOPLASTIC MOLTEN MARKING of various widths.

Such payment shall be full compensation for preparation of pavement surface, removing and disposing of all existing material, furnishing and installing marking materials, and for all labor, equipment, tools materials, and incidentals necessary to complete the Work.

13.04 LIQUID POLYUREA - TYPE I

A. MATERIAL SPECIFICATIONS

1. General

- a. Type I polyurea markings consist of transverse markings and crosswalks. The material shall be 3M Liquid Pavement Marking 1500 or approved equivalent. The markings shall be comprised of a polyurea coating adhered to the pavement surface and reflective media adhered to the polyurea coating. The polyurea coating shall consist of a mixture of high-quality resins, curing agent and pigments. The reflective media shall consist of glass beads.

2. Materials

a. Polyurea

The polyurea coating shall be formed by the reaction of two components. Neither component shall contain appreciable amounts of dilutents. The polyurea coating shall be essentially 100% solids. Volatile content of the mixed components determined by ASTM D2369 shall be less than 2%.

13.04 LIQUID POLYUREA - TYPE I (Continued)

A. MATERIAL SPECIFICATIONS (Continued)

2. Materials (Continued)

a. Polyurea (Continued)

The polyurea coating materials shall be manufactured without the use of lead chromate pigments or other similar, lead-containing chemicals.

The white polyurea coating shall contain not less than 20% by weight rutile titanium dioxide pigment to ensure adequate opacity, hiding power and reflective properties.

The polyurea coating shall contain pigments which enable the markings to conform to highway color standards.

b. Polyurea Properties and Testing

The retroreflective pavement markings shall consist of a mixture of high-quality resins, curing agent and pigments, with a reflective layer of glass beads bonded to the top surface.

The markings shall consist of white or yellow films with pigments selected and blended to conform to standard highway colors. The daytime luminance (CAP Y) of the coating without reflective media shall not be less than 80% white and 50% yellow when tested using a spectrophotometer with a 45 degree circumferential/ 0 degree geometry, illuminant D65, and 2 degree observer angle in accordance with ASTM E1349.

The polyurea coating, when applied to aluminum panels at 20 +/- 2 mils in thickness with no glass beads, allowed to cure for at least 72 hours, and exposed in a Q.U.V. Environmental Testing Chamber, as described in ASTM G-154-00, Cycle #2 for 1000 hours, shall conform to the following minimum requirements.

The daytime color of the white and yellow polyurea systems shall conform to ASTM D6628. The daytime luminance (CAP Y) after exposure shall differ no more than 1% when compared to the initial measurement.

The polyurea pavement marking materials, when tested according to ACI Method 503, shall have such a high degree of adhesion to the specified concrete surface that there shall be a 100% concrete failure in the performance of this test. The prepared specimens shall be conditioned at 75 degrees +/- 2 degrees for a minimum of 24 hours and maximum of 72 hours prior to performance of the tests indicated.

When tested in accordance with ASTM D711, the polyurea marking material shall reach no-track condition in 8 minutes or less for a 20 +/- 2 mils thickness. This test shall be performed with AASHTO Type 1 beads coated at a coverage of 0.119 pounds per square foot. The drying time shall not increase substantially with decreasing temperature.

The polyurea pavement marking materials when tested according to ASTM D2240, shall have a shore D hardness of between 70 and 100. The mixed polyurea coating, when applied to aluminum panels of 20+/-2 mils in thickness, shall be allowed to cure at room temperature for at least 72 hours before testing.

13.04 LIQUID POLYUREA - TYPE I (Continued)

A. MATERIAL SPECIFICATIONS (Continued)

2. Materials (Continued)

c. Reflective Media Properties

The reflective media shall be comprised of glass beads capable of being applied onto the polyurea coating with good and even uniformity by appropriate particle coating equipment.

The size and quality of the beads shall be such that the performance requirements for the markings shall be met. These beads, when properly applied at the specified coating weights will provide immediate and continuing retroreflection.

The required glass beads shall be a 90/10 blend (90% sinkers and 10% floaters) of AASHTO M247 Type 1 gradation 1.5 index glass beads.

Microscopic examination (20X) shall show no more than 15% of the beads having a formation of very distinct opaque white (corroded) layer on their entire surface.

d. Finished Markings

Because of normal variance in roads, application, and measurement, the properties of markings made from materials specified herein will vary from one installation to the next. When the materials are applied according to the Standard Specifications, they shall be capable of forming markings with the following reproducibility of properties.

When installed at 77 degrees and at a wet film thickness of 20+/- 2 mils with proper application, the marking shall reach a no-track condition in 8 minutes or less. Dry to "no-tracking" shall be considered as the condition where no visual deformation of the polyurea marking is observed when viewed from a distance of 50 feet, after a traveling vehicle's tires have passed over the line. The drying time shall not increase substantially with decreasing temperature.

The surface of the retroreflective marking shall provide an initial average skid resistance value of 35 BPN when tested according to ASTM E303.

B. INSTALLATION METHODS

1. Application

The Contractor shall furnish equipment and apply the materials according to the following Standard Specifications.

a. Equipment

The equipment shall be capable of producing markings that meet the Standard Specifications contained herein.

The equipment shall be capable of spraying the mixed polyurea components onto the pavement surface. It shall be capable of proportioning and mixing the liquid components continuously to ensure proper cure.

13.04 LIQUID POLYUREA - TYPE I (Continued)

B. INSTALLATION METHODS (Continued)

1. Application (Continued)

a. Equipment (Continued)

The equipment shall include individual material reservoirs, or space, for the storage of both liquid components. The material reservoir for one of the parts shall be provided with a means to exclude moisture, such as nitrogen blanket or air input that has been dried with a desiccant.

The equipment shall be capable of heating and maintaining the liquid component at separate, controllable temperatures to enable proper pump loading, mixing, and spraying of the material.

The applicator may be equipped with mechanical glass bead dispensing equipment capable of dispensing glass beads with air pressure after the mixed polyurea has been applied. If the applicator is not equipped to dispense beads, an alternative means of dispensing glass beads shall be required.

At any time throughout the duration of the project, the Contractor shall provide free access to his application equipment for inspection by the City's Project Manager or a materials representative.

b. Application Conditions

The markings shall only be applied during conditions of dry weather and when the pavement is dry and free of moisture. The road and air temperatures shall be above 40 degrees F and rising.

Marking operations shall not begin until applicable surface preparation Work is completed and approved by the City's Project Manager.

Grooving shall be performed as per Grooved Installation Methods in Ch. 13.

The reflectorized pavement markings shall be placed only on properly prepared surfaces and at the widths and patterns as designated on the contract plans. The marking shall be applied in accordance with the current MUTCD and in accordance with the plans.

The City's Project Manager shall determine further restrictions and requirements of weather and pavement conditions necessary to meet all other application Standard Specifications and produce markings that perform to the satisfaction of the City's Project Manager.

The polyurea coating shall be applied at rates to achieve 20-25 mils thickness.

The specified glass beads shall be applied onto the liquid pavement marking, within 1-2 minutes after spraying the liquid onto the pavement surface, at 0.119 lb/ft². Application rates of the bead coating shall account for beads applied directly on binder.

13.04 LIQUID POLYUREA - TYPE I (Continued)

B. INSTALLATION METHODS (Continued)

1. Application (Continued)

b. Application Conditions (Continued)

The Contractor shall ensure proper proportioning and mixing of the polyurea components so that the markings are adequately hardened throughout and are free of soft uncured or “blackened” spots.

The Contractor shall ensure the polyurea coating does not exhibit excessive overspray.

The Contractor shall ensure that the polyurea coating is well adhered to the road surface, and that the beads are well adhered to the binder. The Contractor shall ensure that the beads are properly set in the polyurea coating, evenly applied according to the specified application rates. The exposed portions shall be free of the polyurea coating material.

2. Inspection and Testing

During the application of the polyurea material, the City’s Project Manager may require the Contractor to verify application rate in conformance with the parameters required in this Standard Specification.

Equipment for applying material to the roadway shall be equipped with a pump stroke counter or material metering device to allow the recording of gallons of material applied through the spray gun. The Contractor shall provide this information as required and shall have the conversion factors for gallons pumped per pump stroke if necessary, as provided by the equipment manufacturer. After a measured quantity of area applied to the roadway is complete, this total shall be compared against the metered flow through the spray gun converted to theoretical coverage based on the recommended binder thickness provided in this Standard Specification.

C. BASIS OF PAYMENT

Pavement markings installed in conformance with the Plans and Standard Specifications and acceptable to the City’s Project Manager shall be measured as actual material applied to the pavement and paid for at the contract unit price bid per linear foot for LIQUID POLYUREA MARKING - TYPE I, 8”, 12” or 24” or GROOVED LIQUID POLYUREA MARKING - TYPE I, 8”, 12”, or 24”.

Such payment shall be full compensation for preparation of pavement surface, removing and disposing of all existing material, furnishing and installing marking materials, and for all labor, equipment, tools materials, and incidentals necessary to complete the Work.

13.05 LIQUID POLYUREA - TYPE II

A. MATERIAL SPECIFICATIONS

1. General

Type II materials consist of specified longitudinal markings. The material shall be 3M Liquid Pavement Marking 1200 or approved equivalent. The markings shall be comprised of a polyurea coating adhered to the pavement surface, and reflective media adhered to the polyurea coating. The polyurea coating shall consist of a mixture of high-quality resins, curing agent, and pigments. The reflective media shall consist of glass beads and composite reflective elements. The composite reflective elements shall contain microcrystalline ceramic beads bonded to an opacified ceramic core.

2. Materials

a. Polyurea

The components shall not contain appreciable amounts of volatile diluents. The polyurea coating shall be essentially a 100% solids product.

The polyurea coating materials shall be manufactured without the use of lead chromate pigments or other similar, lead-containing chemicals.

The white polyurea shall contain not less than 13% by weight rutile titanium dioxide pigment to ensure adequate opacity, hiding power and reflective properties.

b. Polyurea Properties and Testing

The preformed markings shall consist of white and yellow films with pigments selected and blended to conform to standard highway colors.

The mixed polyurea combined, both white and yellow, when applied to a 3" x 6" aluminum panel at 15 +/- 1 mil in thickness with no glass beads or elements and exposed for 500 hours in a Q.U.V. Environmental Testing Chamber, as described in ASTM G154, Cycle #1, shall conform to the following minimum requirements.

The color of the white polyurea system shall not be darker than Federal Standard No. 595A-17778. The color of the yellow polyurea system shall be reasonably close to Federal Standard No. 595A-13538.

When tested in accordance with ASTM D711, the polyurea marking material shall reach a track-free condition in 5 minutes or less for a 15 mil thickness. This test shall be performed with AASHTO Type 1 beads coated at a rate of 0.099 pounds per square foot. The track-free time shall not increase substantially with decreasing temperature.

The polyurea coating, when tested according to ACI Method 503, shall have such a high degree of adhesion to the specified concrete or asphalt surface that there shall be a 100% asphalt failure in the performance of this test. The prepared specimens shall be conditioned at 75 +/- 2 degrees for a minimum of 24 hours and maximum of 72 hours prior to the performance of the tests indicated.

13.05 LIQUID POLYUREA - TYPE II (Continued)

A. MATERIAL SPECIFICATIONS (Continued)

2. Materials (Continued)

c. Reflective Media Properties

The reflective media shall be made up of reflective elements and glass beads for drop-on application and shall conform to the following requirements.

The glass beads shall be a 60/40 blend (60% sinkers and 40% floaters) of AASHTO M 247 Type 1 gradation 1.5 index glass beads. The glass beads shall have a minimum of 70% Rounds as measured according to ASTM D1155. Crush resistance shall be measured according to the procedure of ASTM D1213 and shall be a minimum of 30 pounds retained on US #40 Mesh.

A sample of glass beads supplied by the manufacturer shall show resistance to corrosion of their surface after exposure to a 1% solution (by weight) of sulfuric acid. Microscopic examination (20x) shall show not more than 15% of the beads having a formation of very distinct opaque white (corroded) layer on their entire surface.

The composite reflective elements shall be composed of a titania opacified ceramic core having clear and/or yellow tinted microcrystalline ceramic beads embedded to the outer surface.

All microcrystalline ceramic beads bonded to reflective elements shall have a minimum index of refraction of 1.8 when tested using the liquid oil immersion method.

The size and quality of the beads shall be such that the performance requirements for the retroreflective material shall be met.

d. Finished Markings

Because of normal variance in road surfaces, application processes, and measurement, properties of markings made from the materials specified herein will vary from one installation to the next. When the materials are applied according to these Standard Specifications, they shall be capable of forming markings with the following reproducibility of properties.

When installed at 77 degrees F and at a wet film thickness of 15 +/- 1 mils, the markings shall reach a no-track condition where no visual deformation of the polyurea markings is observed when viewed from a distance of 50 feet, after a traveling vehicle's tires have passed over the line. The track-free time shall not increase substantially with decreasing temperature.

The average initial skid resistance shall be 45 BPN or greater when tested according to ASTM E303.

The initial retroreflectance averaged over a minimum of 10 locations at each installation shall be at least 900 [mcd (ft⁻²) (fc⁻¹)] for white and 700 [mcd (ft⁻²) (fc⁻¹)] for yellow. The standard deviation of initial retroreflectance for many installations shall be no more than 130 [mcd (ft⁻²) (fc⁻¹)] for both white and yellow.

13.05 LIQUID POLYUREA - TYPE II (Continued)

A. MATERIAL SPECIFICATIONS (Continued)

2. Materials (Continued)

d. Finished Markings (Continued)

The initial retroreflectance of a single installation shall be the average value determined according to the measurement and sampling procedures outlined in the ASTM D6359, using a 30-meter retroreflector meter. The 30-meter retroreflectometer shall measure the coefficient of retroreflected luminance, R_L , at an observation angle of 1.05 degrees and an entrance angle of 88.76 degrees. R_L shall be expressed in units of millicandelas per square foot-candle [$\text{mcd (ft}^{-2}) \text{ (fc}^{-1})$].

Initial performance of pavement markings shall be measured within 7 days after application. The readings shall be delivered to the City's Project Manager.

B. INSTALLATION METHODS

1. Application

The Contractor shall furnish equipment and apply the materials according to the following Standard Specifications:

a. Equipment

The equipment shall be capable of producing markings that meet the Standard Specifications contained herein.

The pavement marking equipment shall be mobile, truck mounted and self-contained. It shall be designed to maintain a uniform rate of speed at increasing or decreasing road grades. The equipment shall be capable of air-blasting the pavement, spraying the mixed polyurea components, and dropping the reflective elements and glass beads in a single pass. It shall be capable of proportioning and mixing the liquid components continuously to ensure proper cure. The equipment shall be capable of heating and maintaining the heated temperature of the liquid components to enable mixing and spraying of the material.

At any time throughout the duration of the project, the Contractor shall provide free access to their application equipment for inspections by the City's Project Manager or a materials representative.

b. Application Conditions

The markings shall only be applied during conditions of dry weather and when the pavement is dry and free of moisture. The road surface and air temperatures shall be minimum 40 degrees F and rising.

Marking operations shall not begin until applicable surface preparation Work is completed and approved by the City's Project Manager.

Grooving shall be performed as per Grooved Installation Methods in Ch. 13.

13.05 LIQUID POLYUREA - TYPE II (Continued)

B. INSTALLATION METHODS (Continued)

1. Application (Continued)

b. Application Conditions (Continued)

The reflectorized pavement markings shall be placed only on properly prepared surfaces and at the widths and patterns as designated on the contract plans. The marking shall be applied in accordance with the current MUTCD and in accordance with the plans.

The City's Project Manager shall determine further restrictions and requirements of weather and pavement conditions necessary to meet all other application Standard Specifications and produce markings that perform to the satisfaction of the City's Project Manager.

The polyurea coating shall be applied at rates to achieve 20-25 mils thickness.

The Contractor shall ensure that the beads and elements are properly set in the polyurea coating so that their exposed portions are free of polyurea coating material. The specified reflective media shall be dropped at rates to achieve 0.033 lb/ft² coating weight.

The Contractor shall ensure proper proportioning and mixing of the polyurea components so that the markings are adequately hardened throughout and are free of soft or uncured material. Typically, such areas will darken over time from dirt and tire residue.

The Contractor shall ensure the polyurea coating does not exhibit excessive overspray.

The Contractor shall ensure that the polyurea coating is well adhered to the road surface, and that the beads are well adhered to the binder.

The typical average initial retroreflectance of the markings shall be 900 mcd (ft⁻²)(fc⁻¹) for white and 700 mcd (ft⁻²)(fc⁻¹) for yellow.

The average initial retroreflectance shall be determined according to the measurement and sampling procedures outlined in ASTM D 6359, using a 30 meter retroreflectometer. The 30 meter retroreflectometer shall measure the coefficient of retroreflected luminance; R_L shall be expressed in units of millicandelas per square foot per foot-candle [mcd (ft⁻²)(fc⁻¹)].

Initial performance of pavement markings shall be measured within 7 days after application.

c. Inspection and Testing

During the application of the polyurea material, the City's Project Manager may request the following tests to verify application to the parameters required in this Standard Specification.

13.05 LIQUID POLYUREA - TYPE II (Continued)

B. INSTALLATION METHODS (Continued)

1. Application (Continued)

c. Inspection and Testing (Continued)

During the application, at appropriate locations along the alignment of the project site, the City's Project Manager may obtain a sample of polyurea material applied onto a test card or silicone coated paper for the purposes of checking for proper binder thickness. The polyurea material shall be applied without reflective elements or glass beads. Upon cure of the binder material, the binder thickness shall be verified by the City's Project Manager. The Contractor shall provide to the City's Project Manager the application speed of the equipment during the time of the sample.

When required by the City's Project Manager, the Contractor shall demonstrate to the City's Project Manager the proper calibration of reflective elements and glass beads compared with the manufacturer's requirement. The calibration shall be conducted with a graduated cylinder or other similar device. Reflective elements or glass beads shall be collected, measured and compared with the manufacturer's requirements.

The Contractor shall provide to the City's Project Manager at least one completed Application Card with typical binder and reflective media applied onto the surface. This Application Card will serve as a record of the project application conditions and settings. Application Cards are available from the manufacturer.

C. BASIS OF PAYMENT

Pavement markings installed in conformance with the Plans and Standard Specifications and acceptable to the City's Project Manager shall be measured as actual material applied to the pavement and paid for at the contract unit price bid per linear foot for LIQUID POLYUREA MARKING - TYPE II, 4", 6", or 8", or GROOVED LIQUID POLYUREA MARKING - TYPE II, 4", 6", or 8".

Such payment shall be full compensation for preparation of pavement surface, removing and disposing of all existing material, furnishing and installing marking materials, and for all labor, equipment, tools materials, and incidentals necessary to complete the Work.

13.06 LIQUID POLYUREA - TYPE III

Type III materials consist of all longitudinal markings unless otherwise specified. The material shall be 3M Liquid Pavement Marking 1000 or approved equivalent. The markings shall be comprised of a polyurea coating adhered to the pavement surface, and reflective media adhered to the polyurea coating. The polyurea coating shall consist of a mixture of high-quality resins, curing agent, and pigments. The reflective media shall consist of glass beads.

A. MATERIAL SPECIFICATIONS

The Standard Specifications for this type of pavement marking material shall be the same as Liquid Polyurea - Type II except the composite reflective elements shall not be applied.

B. INSTALLATION METHODS

The installation method for this type of pavement marking material shall be the same as Liquid Polyurea - Type II except the composite reflective elements will not be applied.

The typical average initial retroreflectance of the markings shall be 350 mcd (ft⁻²)(fc⁻¹) for white and 250 mcd (ft⁻²)(fc⁻¹) for yellow.

C. BASIS OF PAYMENT

Pavement markings installed in conformance with the Plans and Standard Specifications and acceptable to the City's Project Manager shall be measured as actual material applied to the pavement and paid for at the contract unit price bid per linear foot for LIQUID POLYUREA MARKING – TYPE III, 4", 6", or 8", or GROOVED LIQUID POLYUREA MARKING - TYPE III, 4", 6", or 8".

Such payment shall be full compensation for preparation of pavement surface, removing and disposing of all existing material, furnishing and installing marking materials, and for all labor, equipment, tools materials, and incidentals necessary to complete the Work.

13.07 PAINT

A. MATERIAL SPECIFICATIONS

White and yellow paint marking material shall be acrylic waterborne white and yellow traffic paint suitable for use as a reflective pavement marking on Portland Cement Concrete (PCC) or asphaltic concrete pavement when applied at temperatures of 50° to 150° F and covered with drop-on glass beads.

The paint shall not contain lead or chromium and shall have a Volatile Organic Compound (VOC) content of less than 1.25 lbs/gal.

The traffic paint shall conform to State of Nebraska Department of Roads “General and Detail Requirements for Acrylic Waterborne White and Yellow Traffic Paint”.

B. INSTALLATION METHODS

1. Pavement Preparation

The surface areas of Portland Cement Concrete (PCC) pavement and bridge decks that are to receive paint markings shall be sandblasted or shot blasted in the amount necessary to sufficiently removal all dirt, latence, and curing compound residue. Surface areas of asphaltic pavement and concrete pavement that are to receive paint markings shall be cleaned to remove dirt, grease, or any foreign material that would reduce the adhesion of the paint to the pavement.

2. Procedures

Paint shall be applied to clean, dry pavement at a thickness of 15 mils when wet, which is equivalent to 16 gallons of paint applied per mile of painted 4 inch line. Painted lines shall have sharply defined edges at the overall line width shown on the plan.

Permanent paint marking shall not be installed at pavement, air, or paint temperature less than 50° F. Waterborne paint may be heated to a maximum of 150° F.

3. Equipment

Longitudinal paint marking lines shall be applied with a self-propelled, riding-type line striper capable of applying solid or continuous lines and broken or skip lines at regular intervals, and capable of mechanically applying a regulated amount of glass beads directly to the wet film surface of the marking paint. The glass bead nozzles or guns shall be mounted directly behind the paint guns.

The City’s Project Manager may allow the use of a walk behind type machine with a limited quantity of markings, provided sufficient traffic control is in place.

4. Drop-on Beads

Glass beads shall be mechanically and uniformly applied to the wet paint line in the amount of 6 pounds of beads per gallon of paint applied. Beads shall be applied so that they receive maximum capture and binding by the paint to produce a highly reflective, weather, and wear resistant traffic line.

13.07 PAINT (Continued)

C. BASIS OF PAYMENT

Pavement markings installed in conformance with the Plans and Standard Specifications and acceptable to the City's Project Manager shall be measured as actual material applied to the pavement and paid for at the contract unit price bid per linear foot for PAINT MARKING, ____ of various widths.

Such payment shall be full compensation for preparation of pavement surface, removing and disposing of all existing material, furnishing and installing marking materials, and for all labor, equipment, tools materials, and incidentals necessary to complete the Work.

13.08 RAISED PAVEMENT MARKERS

A. MATERIAL SPECIFICATIONS

1. General

Markers shall consist of an acrylic plastic shell filled with a tightly adherent potting compound. The shell shall contain one or two prismatic retroreflective faces as required to reflect incident light from a single or opposite direction.

2. Design

The overall dimensions shall be 4 inches by 4 inches by 0.70 inches. The slope of reflecting face shall be 30 degrees to base. The area of each reflecting surface shall be 3.25 square inches.

The shell shall be molded of methyl methacrylate conforming to ASTM D788 Grade 8. The filler shall be a potting compound selected for strength, resilience, and adhesion adequate to pass physical requirements as outlined below.

The outer surface of the shell shall be smooth except for purposes of identification. The base of the marker shall be substantially free from gloss and substances that may reduce its bond to adhesive.

3. Optical Requirements

Horizontal entrance angle shall mean the angle in the horizontal plane between the direction of incident light and the normal to the leading edge of the marker. Observation angle shall mean the angle at the reflector between the illumination axis and the observation axis.

Coefficient of luminous intensity shall mean the ratio of the luminous intensity of the retroreflector in the direction of observation to the illuminance at the retroreflector on a plane perpendicular to the direction of the incident light.

For each lot consisting of 10,000 markers or less, select 20 markers at random for coefficient of luminous intensity check. Coefficient of luminous intensity of each retroreflecting surface shall be not less than shown in the following Table when the incident light is parallel to the base of the markers. Failure of more than 10% of the retroreflecting faces shall be cause for rejection of the lot.

13.08 RAISED PAVEMENT MARKERS (Continued)

A. MATERIAL SPECIFICATIONS (Continued)

3. Optical Requirements (Continued)

COEFFICIENT OF LUMINOUS INTENSITY (SPECIFIC INTENSITY) REQUIREMENTS

Observation Angle (degrees)	Horizontal Entrance Angle (degrees)	Coefficient of Luminous Intensity (mcd/lux)					Specific Intensity (cd/ft)				
		White	Yellow	Red	Green	Blue	White	Yellow	Red	Green	Blue
0.2	0	279	167	70	93	23	3.0	1.8	0.75	1.0	0.28
0.2	20	112	67	28	37	10	1.2	0.7	0.3	0.4	0.11

A random lot of retroreflectors shall be tested. Specific intensity shall be measured at 100 feet test distance, spacing between source center and receptor center shall be 2.1 inches, receptor diameter and source diameter shall each be 1.0 inch. Other test distances 50 feet and above may be used provided that the angular aperture requirements are met.

4. Color

Color shall conform to the color requirements of ASTM D4280. Test method is provided in ASTM 4280.

5. Physical Properties

Markers conditioned to 73 +/- 4 degrees F shall support a load of 2000 pounds.

B. INSTALLATION METHODS

The type of adhesive to be used shall be designated by the Contractor bearing in mind that the raised pavement marker shall remain bonded to the raised median for a period of 1 year from date of installation.

The marker shall have the reflector face positioned as designated by the City's Project Manager.

The Contractor shall use a wire brush to remove all dirt, concrete sealants and paint, on the area where the Raised Pavement Marker is to be placed.

Surface preparation for installation of prismatic reflective pavement markers shall not be paid directly but shall be considered subsidiary to this item. Unsound pavement or other materials which could adversely affect the bond of the adhesive shall not be an acceptable surface.

C. BASIS OF PAYMENT

Markers installed in conformance with the Plans and Standard Specifications and acceptable to the City's Project Manager shall be measured as actual material applied to the pavement and paid for at the contract unit price bid per each for RAISED PAVEMENT MARKERS.

Such payment shall be full compensation for preparation of pavement surface, removing and disposing of all existing material, furnishing and installing marking materials, and for all labor, equipment, tools materials, and incidentals necessary to complete the Work.

13.09 TUBULAR MARKERS

A. MATERIAL SPECIFICATIONS

Tubular markers shall be 4 feet in length, have a 2 1/4 inch outside diameter, with two 6 inch High Intensity reflective material sheets located 1 inch down from top and spaced 4 inches apart. The yellow tubular markers shall have yellow High Intensity reflective material sheets; the white tubular markers shall have silver. The markers shall be SAFE-HIT flexible Post System Part No. SH348SMA or approved equivalent.

Tubular markers shall be attached to a ground sleeve adapter using a 3 inch by 5/16 inch grade II bolt and nylon locking nut. Adapters shall consist of 2 pieces of pipe welded together; the tops shall be even. One piece shall be 2 inches in length with a 2 1/4 inch inside diameter, and a 3/8 inch hole drilled 3/4 inch up from the bottom of the pipe, through both sides. The second piece shall be 6 inches in length with a 1 7/8 inch outside diameter. The pieces shall be welded together on both sides, forming a one piece unit. This complete unit shall be galvanized.

B. INSTALLATION METHODS

1. Channel Mount

Tubular markers that are installed in concrete medians shall be mounted on breakaway anchors made of steel. The anchors used shall be installed using Foresight V-loc or approved equivalent.

The Contractor shall be responsible for installing the anchor described in the LSP prior to installation of the concrete. No coring shall be allowed to install the anchor. In the event the anchor is not installed, the concrete shall be removed to the nearest joint and reinstalled with the anchor in place.

All installations shall have a new galvanized wedge installed, Part No. SW1 manufactured by Tapco or approved equivalent. The wedge shall be installed until tight.

2. Surface Mount

In certain instances, if an adapter is not appropriate, a SAFE-HIT surface mounted base installed with epoxy, butyl pad, bituminous adhesive or approved equivalent must be used. This base shall remain bonded to the surface for a period of 1 year from date of installation.

C. BASIS OF PAYMENT

Pavement markings installed in conformance with the Plans and Standard Specifications and acceptable to the City's Project Manager shall be measured as actual material applied to the pavement and paid for at the contract unit price bid per each for TUBULAR MARKERS, CHANNEL MOUNT or TUBULAR MARKERS, SURFACE MOUNT.

Such payment shall be full compensation for preparation of pavement surface, removing and disposing of all existing material, furnishing and installing marking materials, and for all labor, equipment, tools materials, and incidentals necessary to complete the Work.

13.10 GLASS BEADS

1. General

Glass beads shall be Type 1, free flowing glass spheres suitable for use on pavement marking materials to provide reflectorized traffic pavement marking. The beads shall be transparent, clean, colorless glass, smooth, and spherically shaped, and free of imperfections of all types including film, scratches, pits, clusters, milkiness, or excessive air bubbles. The beads shall have appropriate adherence and moisture resistant coatings to allow the beads to be properly embedded in the pavement marking material with sufficient capillary action to provide good anchorage and refraction.

2. Crushing Resistance

The average crushing resistance of glass beads shall be 40 pound dead weight for #20 to #30 sieve beads.

3. Roundness

A minimum of eighty percent (80%) of the beads of each sieve size shall be true spheres as determined by "Standard Test for Roundness of Glass Spheres" ASTM D 1155.

4. Index of Refraction

The glass beads shall have a refractive index of not less than 1.50 when tested by the liquid immersion method at 77°.

5. Gradation

Glass beads intermixed in the thermoplastic material and glass beads dropped on the applied thermoplastic, epoxy, or paint material shall have the following gradations when tested in accordance with "Standard Test for Sieve Analysis of Glass Spheres" ASTM D 1214:

a. Intermixed glass beads (thermoplastic material)

<u>SIEVE SIZE</u>	<u>PERCENT PASSING</u>
#14	95-100
#16	80-95
#20	40-70
#40	0-10

b. "Drop-on" glass beads

<u>SIEVE SIZE</u>	<u>PERCENT PASSING</u>
#14	100
#16	95-100
#20	10-50
#40	0-5

13.10 GLASS BEADS (Continued)

6. Chemical Resistance

The glass beads shall withstand immersion in water and acids without undergoing noticeable corrosion or etching and shall not be darkened or otherwise noticeably decomposed by sulfides. The test for chemical resistance shall consist of one (1) hour immersion in water and in solutions of corrosive agents followed by microscopic inspection. A three (3) to five (5) gram portion of the sample shall be placed in each of three (3) Pyrex-glass beakers or porcelain dishes; one sample shall be covered with distilled water, one with a 3N solution of sulfuric acid and the other with a 50% solution of sodium sulfide. After one hour of immersion, the glass beads of each sample shall be examined microscopically for evidence of darkening and frosting.

7. Flow Properties

The glass beads shall flow freely through the dispensing equipment in any weather suitable for marking.

13.11 TEMPORARY MARKING

A. GENERAL

Temporary pavement marking may be used to provide guidance through construction work zones or to provide temporary pavement marking on completed roadways until date, temperature, or humidity conditions allow the installation of specified permanent marking material.

Temporary marking on completed roadways is normally provided by traffic paint, temporary marking tape, or raised pavement markers. Temporary markings shall be maintained until such time that conditions allow the installation of the specified permanent marking material.

When the Contractor is unable to install the specified marking material because of failure to complete the project by the original project completion date or approved extensions, the installation, maintenance, and removal of the temporary pavement marking shall be at the Contractor's expense.

B. PAINT

Paint applied as a temporary marking shall generally comply with the paint material and installation method section of this Standard Specification except for the pavement and air temperature restrictions.

C. TEMPORARY TAPE MARKING

Temporary pavement marking tape shall be a retroreflective plastic material suitable for use as a temporary marking on Portland Cement Concrete (PCC) or asphaltic concrete pavement. The tape shall have a pressure sensitive adhesive which allows application to the pavement surface without additional adhesive. Tape intended to be removed from the pavement surface shall be capable of being removed by hand from the pavement surface intact or in large pieces at temperatures above 40° F.

13.11 TEMPORARY MARKING (Continued)

D. FLEXIBLE RAISED PAVEMENT MARKER

Flexible raised pavement markers shall be made of a polyurethane body formed in an "L" shape. The marker shall be approximately 4 inches wide and the vertical portion of the marker shall be at least 1.5 inches high. The base of the marker shall be at least 1 inch deep. A cube-corner microprism reflective tape material shall be placed horizontally along both sides of the top of the vertical section of the marker. The reflective material shall be recessed in an "I-Beam" design to protect the reflective material from aggregate. A clear flexible polyvinyl chloride plastic cover is to be attached to the vertical section of the marker with a heavy-duty staple to cover the reflective material during surfacing operations. The flexible raised pavement marker must be readily visible at night when viewed with high beam automobile headlights. The marker shall be the same color as the material it is to replace or supplement. The marker shall be approved by the City Engineer prior to use.

Flexible raised pavement markers shall be installed on the pavement surface by methods recommended by the manufacturer but shall be able to be removed by the Contractor without damage to the pavement surface.

Flexible raised pavement markers shall have a spacing of 5 feet when used as a solid line. A skip line shall consist of 3 markers spaced 2 feet apart with an 18 foot gap between sets of markers.

Flexible raised pavement markers shall be removed by the Contractor when no longer needed.

E. BASIS OF PAYMENT

Temporary pavement markings installed in conformance with the Plans and Standard Specifications and acceptable to the City's Project Manager shall be measured as actual material applied to the pavement and paid for at the contract unit price bid per linear foot or per each for TEMPORARY MARKING, _____ of various widths.

Such payment shall be full compensation for preparation of pavement surface, removing and disposing of all existing material, furnishing and installing marking materials, and for all labor, equipment, tools materials, and incidentals necessary to complete the Work.

13.12 GUARANTEE PERIOD

Following initial completion of all pavement marking, there shall be a 1 year observation period, except for paint which shall be a 180 day observation period, during which the Contractor, at no expense to the City of Lincoln, shall replace any marking that the City's Project Manager determines is not performing satisfactorily. At the end of the observation period, the minimum required retention percentage for marking installed shall be 90% and shall meet all millicandelas requirements for retroreflectivity of material.

The percentage retained shall be calculated as the nominal area of the marking less the area loss, divided by the nominal area and expressed as a percentage of the nominal area. Zones of measurement shall be 1000 feet in roadway length or between intersections, whichever is shorter. Within a zone of measurement, marking retained shall be measured as follows:

Solid line of one width and color	Total length of solid line retained
Skip segments of one color	Total number of marking segments retained (each at least 80% complete)

A claim, made by the City against the Contractor, shall be submitted to the Contractor in writing no later than 30 days after the 180 day observation period for paint or a 1 year observation period for all other material listed above.

Marking replacement shall be performed in accordance with requirement specified herein for the initial application, including but not limited to surface cleaning and sealer or adhesive application.

When the Contractor is required to replace pavement marking material but the date, temperature, or humidity conditions do not allow the use of the permanent marking material, the Contractor shall install and maintain temporary paint marking or other traffic pavement marking approved by the City's Project Manager until such time that the date, temperature, and humidity allow the installation of the permanent replacement marking material.

The installation, maintenance, and removal of the temporary pavement marking shall be the Contractor's expense.

Temporary pavement marking required by the City's Project Manager shall be installed within one week of notification.

Final acceptance of all marking will include an inspection of the appearance of the markings during daylight and darkness. Any markings that fail to have a satisfactory appearance during either period, as determined by the City's Project Manager, shall be reapplied at no expense to the City.

Final acceptance of the pavement marking shall be 180 days for paint or 1 year for all other materials listed above after the initial completion of all Work, or upon completion of all corrective Work, whichever occurs last. Said final acceptance shall be included in the guarantee.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 14

TRAFFIC SIGNS

ARTICLE	TITLE	
14.00	GENERAL	1401
14.01	SIGNS	1401
	A. GENERAL	1401
	B. FABRICATION	1401
	C. INSTALLATION AND REMOVAL	1402
	D. INSPECTION AND WARRANTY	1402
	E. BASIS OF PAYMENT	1403
14.02	MOUNTING AND HARDWARE	1404
	A. "U" CHANNEL SIGN POSTS	1404
	B. STREET NAME SIGN POSTS	1404
	C. WOOD POLES	1404
	D. OTHER POLES	1404
	E. BASIS OF PAYMENT	1404
14.03	"U" CHANNEL SIGN POSTS	1405
	A. GENERAL	1405
	B. MATERIAL	1405
	C. FABRICATION	1405
	D. INSTALLATION	1405
	E. BASIS OF PAYMENT	1406
14.04	STREET NAME SIGN POSTS	1406
	A. GENERAL	1406
	B. MATERIAL	1406
	C. FABRICATION	1406
	D. INSTALLATION	1406
	E. BASIS OF PAYMENT	1407
14.05	DEAD END BARRICADE	1407
	A. GENERAL	1407
	B. FABRICATION	1407
	C. INSTALLATION	1407
	D. BASIS OF PAYMENT	1407

CHAPTER 14

TRAFFIC SIGNS

14.00 GENERAL

This Work shall consist of all materials and labor necessary to provide, fabricate, and install traffic signs at the locations shown in the plans.

Traffic signs shall conform to the requirements of the current edition of the Manual on Uniform Traffic Control Devices for Street and Highways (MUTCD), Standard Highway Signs, and the Lincoln Standard Plans (LSP).

It shall be the Contractor's responsibility to utilize the "One-Call" system when required.

14.01 SIGNS

A. GENERAL

These signs are regulatory, warning, guide, object markers, and information signs composed of a flat aluminum blank surfaced with reflective sheeting. The message shall be either directly applied or screened on the sign face, in the colors, size, and layout specified in the plans and Standard Highway Signs.

Reflective background sheeting for all signs shall meet the requirements of ASTM D4956. The following types shall be used when specified: Type III for High Intensity, and Type IX for VIP Grade. Refer to the LSP for required sheeting type. Adhesive shall conform to Class 1.

B. FABRICATION

All blanks shall be new aluminum meeting ASTM Specifications B209, Alloy 5052-H38 of the sizes as shown in the Standard Highway Signs and the MUTCD. The gauges shall be as follows. Signs less than 4 square feet shall be 0.063 inches thick, 4 square feet to less than 9 square feet shall be 0.08 inches thick, and 9 square feet or greater shall be 0.10 inches thick.

Signs 18 inches tall or more (Metro Street Name signs) shall be 0.125 inches thick, with 2 ½ inch radius corners.

All signs shall be smooth and free of burrs. Both sides of the blank shall be treated with an Alodine 1200 process or approved equivalent.

The Contractor shall apply the reflective sheeting without visible seams or joints. Reflective sheeting shall be mechanically applied as per manufacturer's recommended procedures and equipment.

The message, legend, and border of signs shall be applied by either screening or electronic cuttable (EC) film.

14.01 SIGNS (Continued)

C. INSTALLATION AND REMOVAL

The bottom height of all signs shall generally be 7 feet above the ground or surface, unless otherwise specified in the MUTCD. If using a utility pole, the Contractor shall get approval from the appropriate pole owner to install a traffic control sign.

All signs on the roadway shall be mounted so that any edge of the sign which is adjacent to a roadway shall be a minimum of 2 feet from the face of curb. This distance shall be as close as possible to 2 feet from the face of curb.

The back of each sign shall have the month and year (MM/YY) that the sign was installed, in ¾ inch black stenciled letters.

All signs that are installed shall have a fabrication date of no more than 6 months prior to the installation date and will not have been used previous to this installation.

The removal of the existing signs shall be coordinated with the City's Project Manager to assure required signs are in place during all construction phases. These traffic signs, fastening hardware, and posts shall be returned to 901 North 6th Street. All material damaged during removal, relocation, storage or reinstallation shall be repaired or replaced by the Contractor at their expense. The Contractor is responsible to prove if any material was damaged prior to removal.

D. INSPECTION AND WARRANTY

Each sign installation will be reviewed by the City's Project Manager. If a sign does not meet the standards shown in this document, MUTCD, or the LSP, it shall be replaced or relocated at the Contractor's expense.

All Street Name sign layouts shall be reviewed and approved by City staff prior to fabrication.

Upon completion of a roadway project, a Sign Inspection shall be completed by the City. The Contractor is allowed 30 Calendar Days to complete the following: correct any items as listed on Sign Inspection Form, return Sign Inspection Form back to City, and correct any subsequent deficiencies identified by inspections until City accepts all work. The definition of days is as follows: 30 Calendar Days are allowed for the entire Sign Inspection and Correction process. The City is allowed 7 Calendar Days for the initial inspection and 4 Calendar Days for each additional inspection needed thereafter. If the Contractor has not corrected all items on the Sign Inspection form to the satisfaction of the City and has not received final acceptance from the City within the allotted time, the Contractor shall be assessed liquidated damages of \$500 per Calendar Day until all work is completed and deemed acceptable.

Following initial completion of all traffic sign inspections, there will be a 1 year observation period during which the Contractor, at no expense to the City of Lincoln, shall replace or reinstall any traffic sign that the City's Project Manager determines is not installed properly or does not follow this Standard Specification.

14.01 SIGNS (Continued)

E. BASIS OF PAYMENT

Signs shall be paid for at the contract unit price bid based on size. The three sign categories are small (signs less than 4 square feet), medium (4 square feet to less than 9 square feet), and large (9 square feet or larger). These bid amounts shall be full compensation for installing a new sign, connecting and mounting hardware, and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work in accordance with the plans and these Standard Specifications. Signs that are constructed from the fluorescent yellow green (FYG) material shall be paid for at a separate contract unit bid price per sign.

Removal of signs shall be paid for at the contract unit price bid based on unit price for each assembly. Multiple signs on a single post shall be considered one assembly. This bid amount shall be full compensation for removing existing signing, post, connecting and mounting hardware, and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work in accordance with the plans and these Standard Specifications.

Relocated signs during construction shall be subsidiary to the project. Any temporary signs needed throughout the project shall be the responsibility of the Contractor. All signs shall be reinstalled in the same location where they existed prior to removal unless plans show otherwise.

14.02 MOUNTING AND HARDWARE

A. “U” CHANNEL SIGN POSTS

The Contractor shall use 5/16 inch Grade 5 cadmium plated bolts of appropriate length and nuts with a 5/16 inch cadmium plated washer. A nylon washer between the steel washer and sign face shall be used.

B. STREET NAME SIGN POSTS

The Contractor shall refer to the LSP to install the Street Name assembly. All hardware shall be Lyle E450 or approved equivalent.

When installing two 6 inch signs, the North/South Street shall be installed on top. When installing three 6 inches signs, the signs shall alternate, with each sign being perpendicular to the next. When installing one 9 inch and one 6 inch sign, the 9 inch sign shall be on top. If there is NO “Stop” or “Yield” sign below the assembly, the top sign shall be the North/South street. If there is a “Stop” or “Yield” sign below the assembly, the bottom sign should align with the “Stop” or “Yield” sign.

If there is an additional sign below the Street name signs, the Contractor shall use a Pelco U-bolt Sign Clamp, SH-0206 or approved equivalent. A nylon washer shall be against the sign face to attach the sign.

C. WOOD POLES

No signs shall be installed on poles with climbing pegs.

Identification (tag) on pole shall not be covered by the sign or mounting hardware.

The Contractor shall use 2 inch by 5/16 inch cadmium lag bolts and cadmium plated washer. A nylon washer shall be between the lag bolt and the sign face. A Street Name bracket, as shown in the LSP, shall use a 5 inch by 3/8 inch cadmium plated lag bolt. The Contractor shall drive the lag bolts in half way with a hammer and then screw in until tight.

D. OTHER POLES

The Contractor shall use stainless steel Band-It banding, 3/4 inch by 0.03 inch, Part No. C206, or approved equivalent. Stainless steel Band-It Buckles, Part No. C256, or approved equivalent shall also be used. The sign shall be secured to the banding with stainless steel Band-It Flared Leg Brack-It, Part No. D021, and its supplied stainless steel bolt or approved equivalent. Only stainless steel material shall be allowed.

E. BASIS OF PAYMENT

All mounting materials used are subsidiary to installing the sign and shall not be paid for separately.

14.03 “U” CHANNEL SIGN POSTS

A. GENERAL

The post shall be “U” in shape and be the appropriate length and weight. If the post is 8 foot long it shall weigh 1.5 pounds per foot; if 9 foot long, it shall weigh 2.5 pounds per foot. If the post is 11 foot long, it shall weigh 2 pounds per foot; if 12 feet or longer, it shall weigh 3 pounds per foot.

B. MATERIAL

Posts shall be fabricated from hot-rolled steel conforming to the requirements specified in ASTM A 499 for Grade 60 steel, and conform to the chemical requirements specified in ASTM A 1 from rails having nominal weights of 90 pounds per yard and heavier when manufactured.

The ground sleeve shall be Foresight 19-VR18 or approved equivalent.

C. FABRICATION

The posts shall have holes from end to end. All holes shall be 3/8 inch diameter which shall be punched, with a spacing of one inch from center to center, +/- 1/16 inch, beginning with the first hole at one inch from the top of the post.

The punching shall be done so that there will be no cracks radiating from the holes.

All posts shall be cleaned of all loose scale prior to finishing and painted with one or more coats of green alkyd resin, gloss enamel baked on or approved equivalent. This finish shall produce a glossy appearance with satisfactory elastic and adhering properties of not less than 1.5 mils in thickness.

After drying, the finish shall not crack or chip from the metal when struck a light blow with a hammer. It shall show no appreciable change in adhesion or appearance when immersed in water at room temperature for a period of 72 hours.

D. INSTALLATION

Posts that are installed in concrete shall be mounted on breakaway ground sleeves made of steel.

The Contractor shall be responsible for installing the ground sleeve described in the LSP 78 prior to installation of the concrete. No coring shall be allowed to install the ground sleeve. In the event the ground sleeve is not installed, the concrete shall be removed to the nearest joint and reinstalled with the ground sleeve in place.

The 11 and 12 foot posts shall be installed 2 feet 6 inches into the ground.

The Contractor shall use U-channel posts except for street name signs. All signs shall be mounted such that there is no extra post above the sign.

14.03 “U” CHANNEL SIGN POSTS (Continued)

E. BASIS OF PAYMENT

Payment for installation of the posts shall be made for the measured quantity at the contract bid price per linear foot. These bid amounts shall be full compensation for connecting and mounting hardware, and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work in accordance with the plans and these Standard Specifications.

Payment for installation of the ground sleeve shall be made for the measured quantity at the contract bid price. The bid amounts shall be full compensation for the ground sleeve and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work in accordance with the plans and these Standard Specifications.

14.04 STREET NAME SIGN POSTS

A. GENERAL

This Standard Specification describes the minimum acceptable requirements for round sign posts with anti-rotation wing, as per the LSP, used for the installation of street name signs. Posts shall be the appropriate length with one piece wing welded to the round pipe.

B. MATERIAL

The posts shall be fabricated from new, round, ASTM tested, 2-inch I.P.S. black pipe. The post wings shall be 1/4-inch thick high strength metal.

The Street name brackets can be seen in the LSP.

C. FABRICATION

The round post shall have a wing welded at a distance of 26 inches to bottom of wing from one end of the post.

The wing shall be formed from a 12-inch by 4-inch by 1/4 - inch thick piece of flat metal, bent to the radius of the pipe at the center of the 12-inch length, to provide two wings at 90 degrees from each other, and extend approximately 5 inches from the centerline of the pipe. The wing shall be welded to the pipe with a high strength, full length, continuous fillet weld, along all exposed contact points between the pipe and wings.

All ends, edges, and welds of the pipe and wings shall be smooth and free of sharp edges or burrs which could injure the hands of a person handling the post.

The posts shall be powder painted gloss black with a high quality enamel paint.

D. INSTALLATION

The Contractor shall use round posts when installing street name signs, which shall be installed 2 feet, 6 inches into the ground. Round posts shall be installed into holes augered to the proper depth. Protective cap shall be used when driving posts to protect end of post from deformation. Deformed posts shall be replaced, not cut.

The posts shall be 10 foot long if there is no “Stop” sign to be installed. If there is a “Stop” sign to be installed, the post shall be 12 foot long. The post shall be 13 foot long if there is a “Stop” sign and two “One-Way” (back to back) signs installed.

14.04 STREET NAME SIGN POSTS (Continued)

E. BASIS OF PAYMENT

Payment for installation of the posts shall be made for the measured quantity at the contract bid price per linear foot. These bid amounts shall be full compensation for the anti-rotation wing, all labor, equipment, tools, materials, and incidentals necessary to complete the Work in accordance with the plans and these Standard Specifications.

14.05 DEAD END BARRICADE

A. GENERAL

The Type III Dead End Barricade shall consist of three horizontal rails mounted to supports in such a manner that the entire assembly is capable of remaining upright and entirely free standing.

B. FABRICATION

Dead End Barricades shall consist of three horizontal rails of nominal 2" x 10" painted/treated white lumber with a minimum length of 4 feet and a maximum length of 12 feet. The horizontal rails shall be bolted to nominal 4" x 4" posts 8 feet in length. The bolts shall be a minimum of 5/8 inch diameter and shall be of a sufficient length to securely tie the horizontal rails to the posts.

Each horizontal rail shall be marked with alternating high intensity grade red and white stripes, 6 inch wide at an angle of 45 degrees with the vertical slanting downward opposite the center of the roadway. The color shall conform to the current Manual on Uniform Traffic Control Devices (MUTCD).

C. INSTALLATION

The posts for the Dead End Barricade shall be installed 3 feet into the ground, with a maximum distance of 10 feet between the centers of the posts.

The horizontal rails shall be installed with 20 inches between the vertical center of the rails, and the top rail shall be mounted flush with the top of the posts. The rails shall be horizontally centered on the two posts, with at least 12 inches extending beyond the posts at each end.

Dead End Barricades shall not be installed until such time as all grading and pavement construction has been completed. Dead End Barricades shall extend the full width of the pavement. For wide roadways, multiple barricades may be necessary.

D. BASIS OF PAYMENT

Payment for installation of DEAD END BARRICADE shall be paid for at the contract bid price per each regardless of width. These bid amounts shall be full compensation for connecting and mounting hardware, and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work in accordance with the plans and these Standard Specifications.

Payment for REMOVE DEAD END BARRICADE shall be paid for at the contract bid price per each regardless of width. These bid amounts shall be full compensation for all labor, equipment, tools, materials, and incidentals necessary to complete the Work in accordance with the plans and these Standard Specifications.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 15

TRAFFIC CONTROL

ARTICLE	TITLE	
15.00	GENERAL	1501
15.01	TRAFFIC CONTROL SUPERVISOR (TCS)	1502
15.02	TRAFFIC CONTROL PLAN (TCP)	1503
15.03	TRAFFIC CONTROL DIARY (TCD)	1504
15.04	TRAFFIC CONTROL DEVICES	1504
15.05	DYNAMIC MESSAGE SIGNS (DMS)	1505
	A. GENERAL	1505
	B. BASIS OF PAYMENT	1505
15.06	TRAFFIC CONTROL FLAGGING	1505
15.07	ACCESS TO ADJACENT PROPERTIES	1506
15.08	PUBLIC USE OF RIGHT-OF-WAY	1506
15.09	BASIS OF PAYMENT	1506
	A. LUMP SUM	1506
	B. EACH PER DAY	1506
15.10	NON-COMPLIANCE	1508

CHAPTER 15

TRAFFIC CONTROL

15.00 GENERAL

This Work shall consist of furnishing and maintaining in place all barricades, warning signs, lights, and other safety devices required to protect the Work, divert traffic, warn of open excavations, and other areas or conditions which might be hazardous or dangerous during daylight or darkness.

The Contractor shall maintain traffic during construction and provide, install, maintain and remove all traffic control devices in accordance with these Standard Specifications, the Project Special Provisions, the City of Lincoln Traffic Control Guidelines for Street Construction, Maintenance and Utility Operations (LTCG), the ordinances and regulations of the City of Lincoln, the Manual on Uniform Traffic Control Devices (MUTCD), the standards of the American Disabilities Act (ADA) and the approved Traffic Control Plan (TCP). Failure of the Contractor to erect and maintain approved traffic control devices shall be reason to suspend the Work.

There shall be no lane closures on any Arterial Street during peak hours (7:00-8:00 AM and 3:30-6:00 PM) or from noon the day before to noon the day after a University of Nebraska home football game, without prior approval from Public Works and Utilities Department. The Contractor shall strictly adhere to all time limits and other restrictions as specified.

The Contractor shall utilize complete and proper traffic controls and traffic control devices, as per ADA and MUTCD requirements, during all operations. Signs for temporary operations shall be removed from view during periods of inactivity. When not in use, all temporary traffic control devices shall be removed from the public right-of-way. Any temporary traffic control devices within the public right-of-way and not in use for more than 36 hours, may be removed by the City and will be held until the costs of their removal are reimbursed by the Contractor. The Contractor is required to maintain the project in a manner that is safe to the traveling public.

Pedestrian and ADA access shall be maintained throughout the period the construction or maintenance activity disrupts or causes the closure of existing sidewalks, curb ramps or crosswalks. Safe, clearly marked routes shall be maintained through or around the construction activity at all times. The use of temporary walkways with width, slope, and cross-slope compliant to ADA Standards shall be incorporated on the job site. Surfaces must be firm (non-granular), stable, and slip resistant. Channeling and barricading shall be used to separate pedestrians from traffic when pedestrians and traffic share the roadway. Special attention shall be given to placing barricades to prevent visually impaired pedestrians from entering work zones and provide a detectable route.

Alternate pedestrian circulation routes shall have signage to clearly and safely direct pedestrians along a temporary or alternate path. The alternate circulation path shall have a minimum width of 3 feet (5 feet in central business district) and parallel the disrupted pedestrian access route when practicable. Barricades and channelizing devices shall comply with the current MUTCD. A solid toe rail shall be attached such that the bottom edge is 6 inches maximum above the walkway surface. The top rail shall be parallel to the toe rail and shall be located 36 inches minimum and 42 inches maximum above the walkway surface. If drums, cones, or tubular markers are used to channelize pedestrians, they shall be located such that there are no gaps between the bases of the devices in order to create a continuous bottom, and the height of each individual device shall be no less than 36 inches.

15.01 TRAFFIC CONTROL SUPERVISOR (TCS)

Before Work begins on a project, the TCP shall designate in writing an International Municipal Signal Association (IMSA) or American Traffic Safety Services Association (ATSSA) Certified Traffic Control Supervisor (TCS) to be responsible for the traffic control on the project. The Contractor shall designate a TCS who shall perform the Traffic Control Management and shall be responsible for maintaining all Traffic Control Devices in compliance with the TCP.

The Contractor shall have a TCS available 24 hour per day. The Contractor shall furnish to the City the name and telephone number of the TCS responsible for emergency service. The Contractor shall maintain a 24 hour, 7 days a week (including weekends and holidays) emergency service to remove, install, relocate, and maintain warning devices.

In the event the TCS does not respond immediately or the City deems it necessary to call out other forces to accomplish emergency services, the Contractor shall be held responsible for the cost of such emergency services.

The Traffic Control Supervisor's duties shall include, but not be limited to:

- Preparing, revising, and submitting the TCP as required.
- Direct supervision of certified flaggers. Documentation of all certifications shall be sent to the City's Project Manager.
- Coordinating all Traffic Control operations, including all Contractors, Subcontractors and suppliers.
- Coordinating project activities with appropriate police and fire control agencies.
- Maintaining a project Traffic Control Diary which shall become a part of the project records.
- Inspecting all traffic control items prior to installation to insure that the materials meet the plan and specification requirements.
- Inspecting the installation of the traffic control devices at least twice each calendar day, to determine that they are being properly maintained and cleaned. During these inspections, it is important that the Contractor has covered or removed all traffic control devices that are no longer needed or are no longer applicable. More frequent inspections may be required due to inclement weather; vandalism; or other times when more frequent inspections are warranted.
- Reporting to the City's Project Manager in writing, all known traffic incidents which occur on the project. The TCS shall, to the best of his/her ability, analyze the circumstances involved in the incidents and advise the City's Project Manager of recommended changes in the TCP. An effort will be made by the City's Project Manager to obtain accident reports prepared by law enforcement officers having jurisdiction in the project area.

15.02 TRAFFIC CONTROL PLAN (TCP)

The Traffic Control Plan (TCP) shall be prepared by a Traffic Control Supervisor (TCS) and shall include detailed drawing(s), showing all traffic control devices or reference to a standard drawing found in the LTCG or the MUTCD. The TCP shall meet or exceed the LTCG, ADA and MUTCD, provided the referenced standard drawing properly depicts the Work area and completely addresses the needed traffic control. The TCP shall consider, but not be limited to, the following items:

- Signing, Barricades, Drums, Cones, Dynamic Message Boards, and/or any other traffic control devices.
- Worker protection and safety.
- Minimizing delays and economic impacts to traffic.
- Pedestrian protection and safety.
- Meet ADA requirements
- Construction scheduling and hours of Work.
- Flagging.
- Methods and devices for delineation and channelization.
- Placement and design of barriers and barricades.
- Storage of equipment and materials.
- Removal of construction debris.
- Length of time for lane closures.
- Access for emergency vehicles.
- Clear roadside recovery areas.
- Movement of construction equipment.
- Length of project under construction at any one time.
- Methods of minimizing construction time consistent with safety.
- Construction Speed Zones.
- Modification of the above-noted items as well as any other related items under conditions of darkness or inclement weather.
- Congestion and Incident management techniques.

The Contractor shall submit a signed TCP in writing and/or drawing for the review by the City one (1) week prior to the proposed Work beginning. No phase of construction shall commence until the TCP has been approved with the City Engineer's signature. The approved TCP shall not be revised without prior approval of the City's Project Manager. TCP revisions shall be submitted a minimum of 3 City business days prior to implementation.

TCPs shall include detailed signing, barricading, pedestrian and traffic detouring information for each phase or stage of construction including as a minimum: type and number of devices, working hours, number and location of flaggers, and time restrictions.

Copies of the approved TCP shall be available on-site at all times. The Contractor shall provide (4) copies to the City's Project Manager.

The Contractor shall not exceed the work limits specified for each phase or stage of construction, unless approval to do so is granted by the City's Project Manager.

Should the Contractor fail to maintain the work within the specified limits, the City's Project Manager shall direct that all operations be suspended until the work is returned to the specified limits. Any costs incurred by the Contractor due to such suspension shall be at the Contractor's expense with no additional compensation or time extensions.

The Contractor shall provide any project status changes or updated information to the City's Project Manager on a daily basis.

15.03 TRAFFIC CONTROL DIARY (TCD)

A Traffic Control Diary (TCD) is a daily record of events for the project. The daily entries shall be signed by the Traffic Control Supervisor making the entry. The TCD shall be a complete record of devices and traffic control sets used, as well as documenting any issues or concerns arising in connection with the flow of traffic or pedestrians through the work zone.

The TCD shall be a hardbound book. The following information shall be placed on the cover: project name and number; General Contractor's name, TCS's name and the company providing traffic control.

As a minimum, the following information shall be recorded during the daily entries into the TCD: name of the traffic control inspector; time and date of daily inspections; TCP being used; roadway and sidewalk conditions; construction activity occurring; a list of devices in place; any permanent or temporary signing changes made; any permanent or temporary pavement marking changes made; names of flaggers and why they were used; a log of devices that were cleaned, maintained and/or replaced; conversations regarding traffic control; any calls requiring a work site visit and actions taken; incidents that occur within the work zone, including time, a description of what happened, a police case number, and any action that was taken in regard to the traffic control; and any law enforcement occurring within or adjacent to the work zone.

At the completion of the project, the TCD shall be given to the City's Project Manager as a record of the traffic control on the project. The TCD shall be provided prior to final payment being made.

15.04 TRAFFIC CONTROL DEVICES

The Contractor shall take all necessary precautions for the protection of the Work and the safety of the public. The initial placement, replacement, and removal of the lane dividers and other traffic control devices shall be done with extreme care and consideration for the traveling public, including bicycles and pedestrians, as shown in the plans. The Contractor shall be alert at all times to any and all deficiencies in the placement and maintenance of any traffic control devices and shall take immediate action to correct any deficiencies.

Prior to commencing Work in the vicinity of any existing Traffic Control Devices, the Contractor shall coordinate with the Traffic Operations Section for devices which need to be removed or relocated to accommodate the Work. The Contractor shall store all devices in a safe and secure manner throughout the period of Work and assume responsibility for temporary devices if necessary. Existing traffic control devices shall not be removed without the City's Project Manager's approval.

The Contractor shall remove conflicting permanent pavement markings as shown in the plans or as required by the City's Project Manager. Temporary markings no longer needed shall be removed prior to opening to traffic.

Upon completion of the contracted Work the Contractor shall reinstall the existing signing and pavement markings as approved by the City's Project Manager. Any Traffic Control Devices damaged during removal, relocation, storage, or reinstallation shall be repaired or replaced by the Contractor at their expense. The Contractor is responsible to document the condition of all existing devices prior to removal.

The removal, relocation, storage, and reinstallation of existing devices shall not be paid for separately, but shall be considered as incidental to the project.

15.04 TRAFFIC CONTROL DEVICES (Continued)

The Contractor shall maintain complete visibility of signs, barricades, and other warning devices at all times. All lights on traffic control devices shall be turned on during periods of darkness. Lenses shall be kept clean, and light intensity shall be such that the device is visible as per MUTCD. Sand bags shall be used at all times to secure devices in a position for the public to observe.

15.05 DYNAMIC MESSAGE SIGNS (DMS)

A. GENERAL

The Contractor shall be required to furnish, install and maintain Dynamic Message Signs (DMS) to alert traffic to the construction and traffic configuration during the various construction phases of the project. The DMS will be placed a minimum of 5 calendar days in advance of the disruption or shifting of traffic through the work zone or as directed by the City's Project Manager. The signs shall be left up for at least 3 calendar days once construction has begun to inform the public of the current traffic configuration. Sign placement shall be shown on the TCP for each phase of the construction and must be approved by the City's Project Manager. All messages displayed on the signs shall be approved by the City's Project Manager.

The Contractor shall check messages at least twice per day to verify the message is readable and accurate. The Contractor shall check messages each night or in time of darkness, to verify the message is readable and accurate.

Protection of the public from the DMS to be in compliance with the LTCG and MUTCD when used in or near the roadway. High visibility cones shall be placed at each corner of the DMS when used behind the curb.

B. BASIS OF PAYMENT

DYNAMIC MESSAGE SIGN shall be a fixed cost item and will be paid at the set contract unit price per day for the each item. Such payment shall be full compensation for furnishing, placement, maintenance, removal, high visibility cones, and all other incidentals required to provide a fully operational DMS.

15.06 TRAFFIC CONTROL FLAGGING

IMSA or ATSSA Certified flaggers are required.

Traffic movements through temporary lane closures on roads with one lane, two way traffic shall be controlled by flaggers. In situations where sight distance is limited, the Contractor shall provide additional means of controlling traffic, including, but not limited to, two-way radios, pilot vehicles, or additional flaggers. Flaggers shall position themselves appropriately and according to MUTCD flagging procedures.

Flagger(s) shall be used when any construction equipment or personnel may occasionally encroach upon roadway. Flagger(s) shall be used when equipment is moving in or out of work zones.

Flagger(s) shall be properly attired with vest, head gear and stop/slow paddles. They shall be provided properly installed advance warning signs, and they shall be otherwise equipped in accordance with the requirements of the MUTCD.

15.07 ACCESS TO ADJACENT PROPERTIES

The Contractor shall notify all affected adjacent properties a minimum of 48 hours prior to restricting normal access from public streets to adjacent properties. The Contractor shall inform each resident and/or property owner of the nature of the access restriction, the approximate duration of the restriction, and the best alternate access route for that particular property. Any closure of access to or from adjacent property shall be submitted to the City's Project Manager and approved prior to implementation. The Contractor shall minimize the duration of access restrictions.

15.08 PUBLIC USE OF RIGHT-OF-WAY

Before opening any portion of the public right-of-way to vehicles or pedestrians, the Contractor shall provide a hard surfaced route and set all necessary approved traffic control devices.

15.09 BASIS OF PAYMENT

Payment for Traffic Control and Work Zone Safety items shall be made either under the lump sum or each per day pay item.

A. LUMP SUM

TRAFFIC CONTROL FOR CONSTRUCTION shall be paid for at the contract unit price bid per lump sum. The Contractor shall be responsible for determining the Traffic Control needs for the project, including all devices and personnel, and to develop the bid amount accordingly. This payment includes the TCS, the TCD, the TCP, set-up, maintenance, removal, and any traffic control devices required. Payment shall be made as a percentage of the Traffic Control Lump Sum amount equal to the percent-complete-to-date of the balance of the total contract amount. In no case shall the total amount paid for Traffic Control exceed the Lump Sum shown in the bid schedule. Payment is full compensation for all Work prescribed in this section.

B. EACH PER DAY

When Traffic Control is bid on the Each Per Day method, individual traffic control items will be paid for based on the maximum number of each device used during the course of the day's construction work. These amounts shall include the cost of the TCS, the TCD, the TCP, set-up, maintenance, and removal. Traffic Control must be installed in accordance with the plans or as directed by the City's Project Manager.

The quantity of items for payment shall be the number of devices in place multiplied by the number of calendar days that the respective devices are in place. A calendar day for traffic control devices shall be defined as the 24-hour period from midnight to midnight, or any portion of it, when the device is installed and maintained.

Payment will not be made for those calendar days when devices are not in use, such as for folded signs, temporarily covered signs, signs temporarily positioned so that the message is not readable by the traveling public or devices placed along the roadway that are not necessary for proper traffic control.

Payment for any traffic control device paid for by the day will not extend beyond the last working day or calendar day allowed by the contract. Payment will be made for any approved extension of the contract time allowance. Beyond the end of the contract time and any extensions, the traffic control devices paid by the day that are required shall remain in service at no cost to the City.

15.09 BASIS OF PAYMENT (Continued)

B. EACH PER DAY

Each sign shall be paid for separately, even if more than one sign is installed on the same post or device. Signs shall be classified and paid for based on area of the sign face:

SMALL WORK ZONE SIGN is less than 4 square feet,
MEDIUM WORK ZONE SIGN is 4 square feet to less than 9 square feet,
LARGE WORK ZONE SIGN is 9 square feet or greater.

The price for work zone signs shall include posts, mounting hardware, banding material or anything else needed to accomplish the Work.

Type II Barricade shall include the use of reflectorized drums or vertical panels and shall be counted and paid for at the contract unit price bid per each per day for TYPE II BARRICADE. Vertical panels will be paid at ½ the contract unit price for Type II Barricade. Lighting on barricades is required and included in the cost of barricades.

Type III barricades in place and positioned as shown in the plans or as directed by the City's Project Manager shall be counted and paid for at the contract unit price bid per each per day as TYPE III BARRICADE. Lighting on barricades is required and included in the cost of barricades.

FLASHING ARROW PANELS are measured by each calendar day they are in use.

Warning Lights shall not be measured separately but shall be subsidiary to the device with which they are installed.

FLAGGING will be measured for payment for each flagger location per day. Operation of one flagger for 4 hours or less will be considered as one-half day and operation for more than 4 hours will be considered as one full day. This price shall be full compensation for furnishing properly trained, attired, and equipped flaggers, for furnishing, installing, maintaining and removing proper signs per flagger situation and for all labor, tools, equipment, material, and incidentals necessary to complete the Work.

CONCRETE PROTECTION BARRIER is measured by the length in feet based on the nominal length of the individual units. RELOCATE CONCRETE PROTECTION BARRIER applies to repositioning the concrete protection barrier for subsequent phases of construction and shall be measured by the length of the concrete barriers relocated based on the nominal length of the individual units.

EXISTING PAVEMENT MARKING REMOVAL shall be measured by the linear foot along the line for each existing permanent (not "temporary") line removed.

TEMPORARY PAVEMENT MARKINGS ____" shall be measured by the linear feet of each line applied. Gaps are not measured for payment. Maintenance of temporary pavement markings is subsidiary to the appropriate pay item. Maintenance includes replacement of lines worn by traffic or covered by surfacing material or any other substance. The City's Project Manager will determine when the lines are no longer effective and direct the Contractor to replace the lines at no additional cost to the City. Temporary marking removal is subsidiary to the pay item.

15.09 BASIS OF PAYMENT (Continued)

B. EACH PER DAY

Grabber Cones 42" in height shall be counted and paid for at the contract unit price bid per each per day as GRABBER CONE, 42". The repositioning, re-attachment, maintenance, removal and/or replacement of a cone shall be subsidiary.

Tubular Markers 42" in height shall be counted and paid for at the contract unit price bid per each per day as TUBULAR MARKER, 42". The repositioning, re-attachment, maintenance, removal and/or replacement of a tubular marker shall be subsidiary.

15.10 NON-COMPLIANCE

Failure to comply with any of the requirements for safety and traffic control of this contract shall result in suspension of Work and/or Payment Reduction for Non-Compliance. The Contractor may be given notice, either written or verbal, of failure to install, replace, remove, or maintain a traffic control device. Upon notification by the City's Project Manager, the Contractor shall respond to any site and take immediate steps to correct the deficiency.

Failure to install, replace, remove, or maintain a device in a timely manner as determined by the City's Project Manager shall result in no payment being made for any traffic control devices on the project until the requested installation, replacement, removal, or maintenance is performed. The City's Project Manager may also suspend all other Work until the problem is corrected. The City's Project Manager may elect at any time to correct a traffic control deficiency and bill the Contractor for all costs necessary to correct the problem.

Any action on the part of the Contractor which results in non-compliance with the approved TCP and/or the requirements of this section may be cause for reduction in payment. Non-compliance shall include failure to have the TCP on the job site at all times and failure to be able to produce the TCP upon request.

The payment shall be reduced by an amount equal to the Traffic Control Lump Sum amount divided by the total number of contract days as stated in the bid documents multiplied by the number of days when the Contractor is not in compliance with the approved TCP and/or the requirements of this section. In no case shall the amount of the reduction in payment per day be less than 1 percent of the total contract amount for Traffic Control.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 20

CONSTRUCTION FOR UTILITIES AND STRUCTURES

ARTICLE	TITLE	
20.00	GENERAL	2002
20.01	MATERIALS	2002
	A. SMOOTH STEEL PIPE CASING	2002
	B. CORRUGATED METAL PIPE	2002
	C. FOUNDATION	2002
	D. BEDDING	2002
	E. GROUT	2003
	F. FLOWABLE FILL	2003
20.02	EARTHWORK	2003
	A. CLEARING AND GRUBBING	2003
	B. TREE REMOVAL	2003
	C. EXCAVATION	2003
	D. BACKFILL	2004
	E. BASIS OF PAYMENT	2005
	F. MAINTENANCE AND PROTECTION OF EXCAVATIONS	2005
	G. DISPOSAL OF SURPLUS MATERIAL	2006
	H. SOIL EROSION CONTROL	2006
20.03	UTILITY ALIGNMENT AND GRADE	2006
20.04	GROUND WATER	2006
20.05	FOUNDATION AND BEDDING	2007
	A. GENERAL	2007
	B. BASIS OF PAYMENT	2007
20.06	HORIZONTAL DIRECTIONAL DRILLING	2008
	A. GENERAL	2008
	B. SUBMITTALS	2008
	C. MATERIALS	2009
	D. INSTALLATION	2010
	E. REJECTION	2011
	F. TOLERANCES	2011
	G. CLEAN UP AND DISPOSAL OF MATERIALS	2012
	H. BASIS OF PAYMENT	2012

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 20

CONSTRUCTION FOR UTILITIES AND STRUCTURES

ARTICLE	TITLE	
20.07	CONCRETE AND REINFORCING STEEL FOR STORM DRAINAGE	2013
	A. GENERAL	2013
	B. BASIS OF PAYMENT	2013
20.08	CONCRETE AND REINFORCING STEEL FOR SANITARY SEWER	2013
	A. GENERAL	2013
	B. BASIS OF PAYMENT	2013
20.09	CONCRETE AND REINFORCING STEEL FOR WATER MAIN	2014
	A. GENERAL	2014
	B. BASIS OF PAYMENT	2014
20.10	PAVEMENT CONSTRUCTION AND RECONSTRUCTION	2014
20.11	FINAL CLEANUP	2015
	A. GRAVEL OR ROCK ROADWAY SURFACE	2015
	B. FINAL CLEANUP AND PARKING SPACE FINISH	2015
	C. SODDING AND SEEDING	2015
20.12	COLD WEATHER CONSTRUCTION	2015
	A. LIMITS OF CONSTRUCTION	2015
	B. SUSPENSION OF WORK	2016
20.13	SUBSTANTIAL COMPLETION	2016
20.14	FINAL ACCEPTANCE	2016
20.15	GUARANTEE	2016

CHAPTER 20

CONSTRUCTION FOR UTILITIES AND STRUCTURES

20.00 GENERAL

Construction for utilities and structures shall include the excavation and backfill of all materials necessary to complete the Work in accordance with the plans and these Standard Specifications; all necessary sheeting, shoring and bracing; and any pumping that may be necessary to keep the trench free from water. Construction for utilities and structures shall also include the removal and replacement of pavement, driveways and sidewalks; disposal of surplus materials, borrow, maintenance and protection of excavation, and the restoration of all surfaces to a satisfactory condition.

These Standard Specifications shall apply to all utility and structure work regardless of the type of Work being performed.

20.01 MATERIALS

The following materials are approved for use in the City of Lincoln pursuant to the Standard Specifications described herein. Alternate materials maybe requested in writing to the Director of Public Works and Utilities.

A. SMOOTH STEEL PIPE CASING

Smooth steel pipe used for encasement shall be of the diameter, length, and wall thickness shown on the Plans. The encasement shall be new welded steel pipe conforming to ASTM Designation A 139, Grade B. All joints shall be welded.

B. CORRUGATED METAL PIPE

Corrugated metal pipe used for encasement shall be copper steel galvanized and shall conform to the requirements of AASHTO "Standard Specifications for Corrugated Metal Culvert Pipe", Designation M-36, and shall be of the diameter, length and gauge as shown on the Plans.

C. FOUNDATION

Foundation material shall conform to the requirements of ASTM "Standard Specifications for Concrete Aggregates", Designation C-33. The gradation for foundation material shall be size Number 357 (2" to #4).

D. BEDDING

Bedding material shall be a well graded "crusher run" crushed rock or crushed concrete with a percent passing gradation range of 1" - 100, #4 - 20 to 60, #10 - 0 to 30 and #200 - 0 to 10 unless otherwise designated on the plans or Special Provisions or approved by the City's Project Manager.

20.01 MATERIALS (Continued)

E. GROUT

The grout shall be mixed in the volumetric proportions of two (2) parts Portland cement, one (1) part fly ash, and not to exceed six (6) parts sand. Enough water shall be used to produce a pumpable grout.

F. FLOWABLE FILL

Flowable fill material shall meet the requirements of Chapter 3 of these Standard Specifications.

20.02 EARTHWORK

A. CLEARING AND GRUBBING

Clearing and grubbing shall be accomplished as provided in Chapter 2 of these Standard Specifications.

B. TREE REMOVAL

The removal of trees and stumps shall be accomplished as provided in Chapter 2 of these Standard Specifications.

C. EXCAVATION

In general, all excavation shall be made by open cut from the surface of the ground and at the width and to the depth necessary for the proper construction of the utility and its appurtenances, according to the plans and these Standard Specifications. The Work shall be performed in accordance with Occupational Safety and Health requirements. Nothing contained in these Standard Specifications or Contract Documents shall relieve the Contractor from complying with any Local, State, or Federal safety requirements. The Work shall be performed within the limits of construction as shown on the plans. All necessary precautions must be made to prevent slides and cave-ins. Bracing or sheeting, shall be provided to maintain the sides and bottom of the trench in unstable material.

The excavated material shall be handled in such a manner as to cause a minimum of inconvenience to public travel and to permit safe and convenient access to public and private property along the line of Work.

Access shall be provided at all times to fire hydrants and water valves in the vicinity of the Work and firefighting equipment shall have access to any structure at all times. Trenches shall not be opened more than 100 feet in advance of the installed utility or as directed by the City's Project Manager. All trenches shall be backfilled as soon as practical after the pipe is in place, or as ordered by the City's Project Manager. Unless otherwise specified or authorized by the City's Project Manager, all excavated material shall be placed on the roadway side of the trench.

Holes for pipe bells shall be provided at each joint, but shall be no larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. Other than the bell holes, the trench bottom shall be true and even in order to provide support for the full length of the pipe barrel.

20.02 EARTHWORK (Continued)

C. EXCAVATION (Continued)

Excavation below subgrade with subsequent refilling with loose earth will not be permitted. Should the Contractor inadvertently excavate below subgrade, such over excavation shall be filled and brought up to grade with compacted soil, crushed rock, or sand or gravel as approved by the City's Project Manager.

The width of the utility trench at the top of the pipe shall be no greater than the width specified in the standard bedding details. Excessive trench width may be cause for providing a higher class bedding at no cost to the City. The width of excavation for utility lines 6 inches or greater in diameter shall be a minimum of 3 feet. In no case shall the excavation be less than 2 feet greater than the outside diameter of the pipe or the outside dimensions of the structure to be built. The bottom of all excavations shall be finished to the true profile grade, of full width, and cleared of any rocks, clods, roots, or other material that may interfere with properly placing the pipe or structure.

No measurement or direct payment will be made for any excavation required as part of the Work. The costs of excavation will be considered subsidiary to other items for which direct payment is made.

D. BACKFILL

Backfilling and compaction of excavations shall follow as closely after the construction as possible. All excavations shall be backfilled with approved material up to the original surface of the ground unless otherwise indicated on the plan. No backfill shall be made with material containing stone, large clods, frozen earth or debris of any kind. The backfill shall be placed in loose lifts not to exceed the thickness required to attain 12 inch thick compacted layers or as noted in a geotechnical report signed and sealed by an Engineer registered in the State of Nebraska.

Backfilling shall not be done in freezing weather, except by permission of the City's Project Manager, nor shall any fill be made where the material already in the trench is frozen. If construction proceeds at any time when frozen material is encountered and frozen material is placed in the trench line, all such trenches shall be re-compacted in the spring after frost conditions are no longer present in the ground. This re-compaction of the trench shall include the removal of all material to a depth of 12 inches below the depth of the frozen material and the replacement and re-compaction of the trench to the proper grade with suitable material.

Care shall be exercised in backfilling so as not to damage any finished Work. The backfill shall be brought up evenly on both sides of the utility or structure.

Backfilling against any concrete structure shall not be started until test specimens of the concrete develop a compressive strength of at least 2000psi.

Unless otherwise directed by the City's Project Manager, compaction of backfill within 3 feet of all structures and utility appurtenances, including but not limited to, valves, hydrants, manholes, and inlets, shall be accomplished by mechanical compaction using hand operated tampers, rammers, or other approved devices for the soil type(s) encountered.

20.02 EARTHWORK (Continued)

D. BACKFILL (Continued)

Jetting or hydro-flushing of the backfill shall not be permitted. Care shall be taken to ensure that the utility is properly bedded with material of an approved density or in accordance with these Standard Specifications. The initial 12 inches of backfill above the top of the pipe shall be carefully placed to protect the pipe bedding from further backfilling operations.

Backfill shall be mechanically compacted to a minimum density of ninety-five percent (95%) of the maximum dry density of the material as determined by AASHTO Method T-99. The moisture content of the soils shall be between two percent (2%) below and four percent (4%) above the optimum moisture content as determined by the above test.

When the moisture content of the material is too low to obtain specified density, sufficient water shall be added to the material and/or lift thickness shall be decreased before compaction.

After backfilling, the Work area shall be kept maintained in a smooth and well drained condition.

E. BASIS OF PAYMENT

No measurement or direct payment will be made for any backfilling or compaction required as a part of this Work. The costs of backfilling and compaction will be considered subsidiary to other items for which direct payment is made. When directed by the City's Project Manager, additional water shall be mixed in with backfill materials to allow compaction to be completed. Such water quantities shall be paid as a fixed cost "**EXTRA WORK**" item at the current price indicated in the Lincoln Standard Plans. Lincoln Water System hydrant meter readings immediately before/after the addition of water shall establish the volume of water used.

F. MAINTENANCE AND PROTECTION OF EXCAVATIONS

Temporary support, adequate protection and maintenance of all underground and surface utilities, structures, drains, sewers, and other obstructions encountered in the progress of the Work shall be furnished by the Contractor at Contractor's own expense. Contractor shall take all reasonable precautions to prevent movement of the sides of such excavations. The Contractor shall protect all excavations from surface water by the construction of adequate dikes. The Contractor shall furnish and put in place such sheeting and bracing as may be required to support the sides of the excavations and the Contractor shall remove such sheeting and bracing as the trenches or excavations are filled. The City's Project Manager may order the sheeting be left in place if, in the City's Project Manager's opinion, the utility or structure might be damaged by its being removed.

In lieu of sheeting and bracing, the Contractor may use a trench box of adequate design during the construction of the utility to protect the utility and all personnel.

The Contractor shall satisfy the City's Project Manager that the proposed methods of bedding and foundation material placement is in compliance with the requirements of the Standard Drawings for pipe bedding details when the trench box is moved. The Contractor shall protect the integrity of the pipe embedment zone when utilizing or moving the trench box.

20.02 EARTHWORK (Continued)

F. MAINTENANCE AND PROTECTION OF EXCAVATIONS (Continued)

No measurement or direct payment shall be made for maintenance and protection of excavations, except for sheeting left in place as required above. Payment for sheeting left in place shall be made as an Extra Work item. Such payment shall be the value of the sheeting minus the cost of removal. The cost of maintaining and protecting excavations shall be considered subsidiary to the other items for which direct payment is made.

G. DISPOSAL OF SURPLUS MATERIAL

The Contractor shall dispose of all surplus excavated material not needed for fills or other designated purposes. All material deemed unsuitable by the City's Project Manager shall be disposed of properly and replaced with approved material.

No measurement or direct payment shall be made for disposal or stock piling surplus materials. The costs of disposal or stock piling surplus materials shall be considered subsidiary to the other items for which direct payment is made.

All material deemed unsuitable by the City's Project Manager and required to be removed from the job site, as well as approved replacement material not readily available at the job site, shall be measured and paid for as an Extra Work item.

H. SOIL EROSION CONTROL

Soil Erosion Control shall be accomplished as provided in Chapter 32 of these Standard Specifications.

20.03 UTILITY ALIGNMENT AND GRADE

Prior to excavation, investigation shall be made to the extent necessary to determine the location of underground structures and utilities. Care shall be exercised by the Contractor during excavation to avoid damage to existing structures or utilities. Where shown on the plans, or as requested by the City's Project Manager, the Contractor shall make such excavation as may be necessary to ascertain the vertical and horizontal location of existing utilities.

The utilities and structures shall be constructed and maintained to the lines and grades established by the plans and Standard Specifications. When crossing existing utilities or other structures, alignment and grade may be adjusted by the City's Project Manager to provide clearance as required or deemed necessary to maintain minimum clearance, or to prevent future damage or contamination of either utilities or structures.

20.04 GROUND WATER

The Contractor shall provide and maintain adequate equipment to remove and dispose of ground water entering the excavations, trenches, or other parts of the Work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation or other cause will result.

20.04 GROUND WATER (Continued)

All excavations for concrete structures or trenches which extend down to or below ground water shall be dewatered by lowering and keeping the ground water below the bottom of the pipe or as required to maintain a stable foundation.

The Contractor will be held responsible for the condition of any existing storm sewer system which may be used for drainage purposes on this contract, and all storm sewers shall be left clean and free of sediment. The Contractor shall not pump or drain any ground water or surface runoff into any part of the sanitary sewer system.

No measurement or direct payment shall be made for removal and disposal of ground water unless otherwise provided in the proposal or Special Provisions. The costs of removal and disposal of ground water shall be considered subsidiary to the other items of Work for which direct payment is made.

20.05 FOUNDATION AND BEDDING

A. GENERAL

Foundation and bedding materials shall meet the requirements of these Standard Specifications.

Foundation materials generally will be required where unstable soil conditions exist at the bottom of the trench. Foundation material shall be placed to the satisfaction of the City's Project Manager.

Bedding material shall be placed and compacted as called for on the plans. After the pipe has been properly placed to grade and line on the initial bedding course, additional bedding material shall be placed in 6 inch lifts and thoroughly settled by mechanical compaction in order to fill all voids below, around and above the top of the pipe as shown on the Standard Plans details for pipe bedding.

B. BASIS OF PAYMENT

Foundation material when placed in conformance with these Standard Specifications as directed by the City's Project Manager shall not be measured, but shall be paid as a fixed cost item; FOUNDATION MATERIAL, at the current price indicated in the Lincoln Standard Plans. Weight tickets for material installed shall be submitted prior to any payment for this Extra Work item. This Extra Work payment shall be full compensation for furnishing all materials, installation, labor, equipment, tools and incidentals necessary to create a stable foundation.

No measurement or direct payment shall be made for bedding material, except that all weight tickets for bedding material shall be submitted prior to any payment for pipe being installed. The cost of bedding materials, in the appropriate classes for the type of pipe material utilized, as shown on the drawings or for the structures constructed, shall be considered subsidiary to the other items of Work for which direct payment is made.

20.06 HORIZONTAL DIRECTIONAL DRILLING

A. GENERAL

Horizontal directional drilling (HDD) is a trenchless excavation method which is accomplished in three phases. The first phase consists of drilling a small diameter pilot hole along a designed directional path. The second phase consists of enlarging the pilot hole to a diameter suitable for installation of the pipe. The third phase consists of pulling the pipe into the enlarged hole. The Contractor shall furnish all labor, materials, tools, equipment, drilling fluids, and other items as necessary for a complete and functional installation as required, to the lines and grades shown on the Drawings and as specified.

B. SUBMITTALS

1. Shop drawings, catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of new pipe, fittings and drilling fluids. Include manufacturer's recommendation for handling, storage, and repair of pipe and fittings damaged.
2. The proposed phasing and schedule of the Work including location of launching and receiving pits, services affected, length of pipe effected during each phase, and proposed traffic disruptions. The phasing and schedule of the Work must be approved by the City's Project Manager prior to Work starting.
3. The proposed methods for monitoring, prevention, containment, and clean-up of drilling fluid surface returns at unauthorized locations.
4. The tabulation of pilot hole survey coordinates.
5. Written record of the installation pullback loads on the utility during the installation process.
6. Plan and profile drawings of the documented as-built location of the installed utility.

20.06 HORIZONTAL DIRECTIONAL DRILLING (Continued)

C. MATERIALS

1. Water main installed by HDD shall use Certa-Lok C900 RJ, Class 200 DR 14 pipe as manufactured by Certainteed, or approved equal. Pipe material other than Certa-Lok must be approved prior to ordering. Restrained joint pipe shall also meet all performance requirements of AWWA C900.
2. The Contractor shall at all times provide and maintain instrumentation which will accurately locate the pilot hole, measure drill string axial and torsional loads, and measure drilling fluid discharge rate and pressure. The City's Project Manager shall have access to these instruments and their readings at all times. A log of all recorded readings shall be maintained by the Contractor and will become a part of the Project Record Documents supplied by Contractor. Instrumentation systems shall be calibrated immediately prior to beginning the work.
3. The Drilling Fluid System shall be capable of mixing and delivering the drilling fluid to the drill head or the reamer in the volumes and pressures required. Contractor shall maximize recirculation of drilling fluid surface returns. Contractor shall provide solids control and fluid cleaning equipment of a configuration and capacity that can process surface returns and produce drilling fluid suitable for reuse.
4. The Drilling Fluid shall be used as required during the installation of the pilot hole, enlarging of the pilot hole, and installation of the water pipe. No drilling fluid will be accepted or utilized that does not comply with permit requirements and environmental regulations.
5. Drill Pipe (drill stem) shall be of sufficient size and strength to resist all installation loadings including tensile, compressive, bending, and torsional loads. An appropriate safety factor shall be used by the Contractor in sizing the drill pipe.
6. Drill Head configuration shall be as selected by Contractor and compatible with requirements for location system.
7. Reamer and Swivels shall be as selected by Contractor. Reamer and swivel assembly shall be capable of enlarging borehole while preventing damage due to rotation of the pipe during its pullback into its final position.

20.06 HORIZONTAL DIRECTIONAL DRILLING (Continued)

D. INSTALLATION

1. BORING OF THE PILOT HOLE

Install pilot hole using steerable drilling head. Pilot hole shall be drilled along the path shown on the Drawings to the tolerances listed herein. Listing of tolerances shall not relieve Contractor from responsibility for safe operations or damage to adjacent utilities and structures.

Monitor location of drill head as required to install pilot hole to indicated lines and grades, but in no instance shall the interval between locating the drilling head exceed fifteen (15) feet in length along the alignment.

Use drilling fluids as required to lubricate and support the pilot hole excavation.

Pilot hole shall be free from abrupt changes in line or grade that could result in unacceptably high loadings on the drill pipe or the water pipe during installation.

After completion of pilot hole drilling, Contractor shall provide a tabulation of coordinates, referenced to the drilled entry point, which accurately describe the location of the pilot hole. This tabulation shall be in addition to the log of recorded readings required.

2. PRE-REAMING OF THE PILOT HOLE

Subsequent to the City's Project Manager's acceptance of pilot hole, Contractor may, at his option, pre-ream the pilot hole as necessary for installation of the water pipe.

Pre-reaming operations shall be conducted at the discretion of the Contractor. Contractor shall insure that a hole sufficient to accommodate the pull section of water pipe has been produced. Any damage to the water pipe resulting from inadequate pre-reaming shall be the responsibility of the Contractor. All provisions of this Specification relating to simultaneous reaming and pulling back operations shall also pertain to pre-reaming operations.

Use drilling fluids as required to lubricate and to support the reamed pilot hole.

Use of pre-reaming shall be at the option of the Contractor; however, lack of pre-reaming shall not result in excessive installation loads on the water pipe.

3. REAMING AND PULLBACK OF THE MAIN

Contractor shall utilize a reamer to enlarge the pilot hole to sufficient size for installation of the main without imposing excessive installation loadings on the water pipe.

Grippers used on the water pipe shall not damage adjacent sections of the pipe. Sections of the pipe utilized by the grippers shall be removed from the pipe after installation.

Contractor shall handle and support the pull section of water pipe so as to prevent damage and minimize pullback forces. Pull section of water pipe shall be supported as it proceeds during pull back so that it moves freely and the pipe is not damaged.

20.06 HORIZONTAL DIRECTIONAL DRILLING (Continued)

D. INSTALLATION (Continued)

Contractor shall use drilling fluids as required to lubricate and support the reamed pilot hole, lubricate installation of the water pipe, and completely fill all overcut of the reamed pilot hole.

The pull section of water pipe shall be installed in the reamed hole in such a manner that external pressures are minimized and an appropriate counter-balancing internal pressure is maintained. Any damage to the pipe resulting from external pressure during installation shall be the responsibility of Contractor. The pipe shall be filled with water as it enters the ground to insure that adequate internal pressure is maintained at all points to counter balance external collapse pressures. Contractor shall submit pipe filling procedure proposed for use to the City's Project Manager for review and acceptance.

Contractor shall continuously monitor the pulling loads imposed upon the water pipe. The maximum allowable tensile load imposed on the water pipe shall not exceed the recommendations of the pipe manufacturer. Contractor shall take all required measures necessary to prevent installation loads on the water pipe from exceeding those recommended by the pipe manufacturer. If necessary, Contractor shall at his own expense, stop the pullback of the water pipe, remove the section of pipe installed within the enlarged pilot hole, and pre-ream the pilot hole as required to allow installation of the water pipe without exceeding the allowable pullback forces.

After the installation, Contractor shall determine and log the installed location and depth of the water pipe. Contractor shall submit to the City's Project Manager a drawing detailing the installed location of the water pipe in both plan and profile view.

E. REJECTION

1. If the pilot hole is rejected by the City's Project Manager, the Contractor shall, at his own expense, backfill the rejected pilot hole with bentonite, and install a pilot hole acceptable to the City's Project Manager.
2. Monitoring records indicate that pullback loads exerted on pipe exceeded the loadings recommended by pipe manufacturer.
3. Installation outside of the allowable tolerances.

F. TOLERANCES

Tolerances for the pilot hole and the installed water pipe shall be as listed below.

1. For vertical tolerance, the water pipe shall be installed at the grade indicated on the plans. Minor deviations from the grade indicated on the plans may be allowed, provided that:
 - a. The soil cover above the top of the water pipe shall not be less than shown on the drawings.
 - b. Except at crossings under water courses, the water pipe shall maintain downward slope towards all blowoff points to provide for positive drainage of the water pipe.

20.06 HORIZONTAL DIRECTIONAL DRILLING (Continued)

F. TOLERANCES (Continued)

- c. The water pipe shall maintain upward slope towards all venting points to provide for positive venting and air release from the water pipe.
2. For horizontal tolerance, the water pipe shall be installed at the locations indicated on the plans. Minor deviations from the locations indicated on the plans may be allowed, provided that:
 - a. The horizontal deviation of the water pipe from the location required on the drawings shall not exceed five feet at any location along the water pipe without prior authorization of the City's Project Manager.
 - b. The horizontal deviation shall not cause the water pipe to interfere with existing structures, utilities, or result in any part of the finished work being installed outside of the permanent easements.

G. CLEAN UP AND DISPOSAL OF MATERIALS

1. Contractor shall remove all construction debris and spoil material and dispose of it at an acceptable location.
2. Drilling fluid shall be removed from pits and then the pits backfilled as required.
3. Disposal of excess drilling fluids shall be the responsibility of the Contractor and shall be conducted in compliance with all environmental regulations, right-of-way and workspace agreements, and permit requirements. Disposal of drilling fluids shall not be allowed on the project site.
4. Contractor shall employ his best efforts to maintain full annular circulation of drilling fluids. Drilling fluid returns at location other than the entry and exit points shall be minimized. In the event that annular circulation is lost, Contractor shall take steps to restore circulation. If inadvertent surface returns of drilling fluids occur, they shall be immediately contained as required and collected. If the amount of the surface return is not great enough to allow practical collection, the affected area shall be diluted with fresh water and the fluid will be allowed to dry and dissipate naturally. If the amount of the surface return exceeds that which can be contained and collected using practical methods, drilling operations shall be suspended until surface return volumes can be brought under control.

H. BASIS OF PAYMENT

Directional Drilling for carrier pipes completed in conformance with these Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per linear foot for **DIRECTIONAL DRILLING FOR __" WATER MAIN**, for each size and type called for in the Contract Documents. Such payment shall be full compensation for all materials, equipment, tools, labor and incidentals necessary to produce the directional drill and install the carrier pipe as required in the Contract Documents.

20.07 CONCRETE AND REINFORCING STEEL FOR STORM DRAINAGE

A. GENERAL

When called for on the plans, the Contractor shall construct reinforced concrete collars, elbows, plugs and headwalls for storm drainage at the locations indicated. The collars, elbows, plugs and headwalls shall conform to the details shown in the Lincoln Standard Plans.

B. BASIS OF PAYMENT

When called for in the proposal, concrete for storm water collars, elbows, plugs and headwalls placed in conformance to these Standard Specifications and accepted by the City's Project Manager shall be paid for at the contract unit price bid per cubic yard for **CONCRETE FOR COLLARS, ELBOWS, PLUGS AND HEADWALLS, IN PLACE**. The concrete shall not be measured separately for payment, but the quantities shall be established based upon the volume of concrete required for the Design Section, unless otherwise specified. Such payment shall be full compensation for all mixing, hauling, forming, placing, jointing, curing, finishing, excavation, backfill, materials, equipment, tools, labor, and incidentals necessary to complete the structure.

When called for in the proposal, payment for reinforcing steel for collars, elbows, plugs and headwalls placed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be made at the contract unit price bid per pound for **REINFORCING STEEL FOR COLLARS, ELBOWS, PLUGS AND HEADWALLS, IN PLACE**. The reinforcing steel shall not be measured separately for payment, but the quantities shall be established based upon weight of steel required for the Design Section, unless otherwise specified. Such payment shall be full compensation for all placing, tying, chairs, materials, equipment, tools, labor, and incidentals necessary to place the steel in the proper locations in accordance with the plans.

20.08 CONCRETE AND REINFORCING STEEL FOR SANITARY SEWER

A. GENERAL

When called for on the plans, the Contractor shall construct reinforced concrete plugs and collars for sanitary sewer at the locations indicated. The plugs and collars shall conform to the details shown in the Lincoln Standard Plans.

B. BASIS OF PAYMENT

When called for in the proposal, concrete for sanitary sewer plugs and collars placed in conformance to these Standard Specifications and accepted by the City's Project Manager shall be paid for at the contract unit price bid per cubic yard for **CONCRETE FOR PLUGS AND COLLARS, IN PLACE**. The concrete shall not be measured separately for payment, but the quantities shall be established based upon the volume of concrete required for the Design Section, unless otherwise specified. Such payment shall be full compensation for all mixing, hauling, forming, placing, jointing, curing, finishing, excavation, backfill, materials, equipment, tools, labor, and incidentals necessary to complete the structure.

20.08 CONCRETE AND REINFORCING STEEL FOR SANITARY SEWER (Continued)

B. BASIS OF PAYMENT (Continued)

When called for in the proposal, payment for reinforcing steel for sanitary sewer plugs and collars placed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be made at the contract unit price bid per pound for REINFORCING STEEL FOR PLUGS AND COLLARS, IN PLACE. The reinforcing steel shall not be measured separately for payment, but the quantities shall be established based upon weight of steel required for the Design Section, unless otherwise specified. Such payment shall be full compensation for all placing, tying, chairs, materials, equipment, tools, labor, and incidentals necessary to place the steel in the proper locations in accordance with the plans.

20.09 CONCRETE AND REINFORCING STEEL FOR WATER MAIN

A. GENERAL

When called for on the plans, the Contractor shall construct reinforced concrete thrust collars, thrust blocks, anchorages, gravity blocks, tee blocks and plug blocks for water main at the locations indicated. The thrust blocks, anchorages, tee blocks and plug blocks shall conform to the details shown in the Lincoln Standard Plans.

Concrete shall be L3500 conforming to Chapter 3 of these Standard Specifications. Reinforcing steel shall conform to "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement" ASTM Designation A615, Grade 40 or 60, or "Standard Specification Axle-Steel Deformed and Plain Bars for Concrete Reinforcement" ASTM Designation A617, Grade 60.

B. BASIS OF PAYMENT

When called for in the proposal, concrete for water main thrust collars, thrust blocks, anchorages, gravity blocks, tee blocks and plug blocks placed in conformance to these Standard Specifications and accepted by the City's Project Manager shall be paid for at the contract unit price bid per cubic yard for CONCRETE FOR COLLARS, BLOCKS AND ANCHORAGES, IN PLACE. The concrete shall not be measured separately for payment, but the quantities shall be established based upon the volume of concrete required for the Design Section, unless otherwise specified. Such payment shall be full compensation for all mixing, hauling, forming, placing, jointing, curing, finishing, excavation, backfill, materials, equipment, tools, labor, and incidentals necessary to complete the structure.

When called for in the proposal, payment for reinforcing steel for water main thrust collars, thrust blocks, anchorages, gravity blocks, tee blocks and plug blocks placed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be made at the contract unit price bid per pound for REINFORCING STEEL FOR COLLARS, BLOCKS AND ANCHORAGES, IN PLACE. The reinforcing steel shall not be measured separately for payment, but the quantities shall be established based upon weight of steel required for the Design Section, unless otherwise specified. Such payment shall be full compensation for all placing, tying, chairs, materials, equipment, tools, labor, and incidentals necessary to place the steel in the proper locations in accordance with the plans.

20.10 PAVEMENT CONSTRUCTION AND RECONSTRUCTION

Pavement reconstruction and miscellaneous masonry reconstruction shall be accomplished in conformance as described in these Standard Specifications.

20.11 FINAL CLEANUP

A. GRAVEL OR ROCK ROADWAY SURFACE

Where the Work of the Contract crosses or is parallel to any unpaved roadway and where the roadway surface is affected in any way by operations under the contract, the Contractor shall repair and restore the same to at least its original condition. Such restoration shall include, but not be limited to, regrading ditches and roadway surface, restoration of culverts and drives, and placement of rock or gravel surfacing as directed by the City's Project Manager.

The cost of regrading ditches, roadway surfaces, and drives shall not be paid for directly but shall be considered subsidiary to other items of Work for which direct payment is made.

Culverts required to be removed and re-laid shall be measured and paid for as provided in Chapter 21 of these Standard Specifications. Crushed rock or gravel surfacing shall be measured and paid for as provided in Chapter 9 of these Standard Specifications.

B. FINAL CLEANUP AND PARKING SPACE FINISH

When all other Work has been completed, the Contractor shall thoroughly clean all pavement, parking spaces, sidewalks, rights-of-way, storage areas, access roads, and private property of all earth and other debris by use of approved equipment. All pavement, parking spaces, sod, sidewalks, storage areas, access roads and private property shall be restored to a condition at least equal to that existing prior to any operations under this Contract.

No measure or direct payment shall be made for cleanup or parking space finish. The costs of cleanup and parking space finish shall be considered subsidiary to other items for which direct payment is made.

C. SODDING AND SEEDING

Sodding and seeding shall be accomplished as provided in Chapter 30 of these Standard Specifications.

20.12 COLD WEATHER CONSTRUCTION

A. LIMITS OF CONSTRUCTION

Work to be performed in developed areas, or Work affecting the operation, capacity, and safety of arterial and collector streets, between December 1 and March 15, shall be limited by the following provisions:

1. A maximum of 650 linear feet within the limits of the project may be under construction at one time.
2. A maximum of two (2) intersections may be closed at one time within project limits, even though the third intersection may not violate the 650 foot limit described in Paragraph 1 above.
3. "Under Construction" shall include all operations which disrupt or limit the use of public facilities, such as pavement removal, sidewalk removal, excavation, backfilling, pipe laying, material storage, equipment storage, and/or any other operation deemed by the City's Project Manager as a disruption of normal ingress and egress to the public right-of-way within project limits.

20.12 COLD WEATHER CONSTRUCTION (Continued)

A. LIMITS OF CONSTRUCTION (Continued)

4. Temporary restoration will be required to reduce long-term disruptions and inconvenience during construction. Two (2) weeks after beginning Work in an area, the City's Project Manager shall require temporary restoration of facilities by the Contractor. The entire cost of installation, maintenance, and removal of such temporary installations shall be the Contractor's responsibility.

B. SUSPENSION OF WORK

Suspension of Work during the winter construction period, December 1 to March 15, may be requested by the Contractor under the following conditions:

1. The request must be made in writing to the City's Project Manager and shall include the beginning date and duration. If Work is to be resumed prior to expiration of time requested, forty-eight (48) hours written notice of such intent will be required.
2. The Contractor shall be required to restore all vehicular and pedestrian facilities to full use by either permanent or temporary restoration before the suspension period will become effective.
3. Calendar days included in the period that Work is actually suspended shall be counted from the effective suspension date, and the governing completion date shall be adjusted accordingly.

In no case shall a granted suspension of Work be cause for requesting or granting additional calendar days for completion of this Contract.

The City's Project Manager shall state to the Contractor, in writing, the effective suspension date and the date on which the suspension expires.

In addition, following the suspension period, the City's Project Manager shall notify the Contractor, in writing, of the new completion date of the Contract as provided above.

20.13 SUBSTANTIAL COMPLETION

Refer to Chapters 21 through 23 for a specific definition of Substantial Completion for each type of utility Work.

20.14 FINAL ACCEPTANCE

Refer to Chapters 21 through 23 for a specific definition of Final Acceptance for each type of utility Work.

20.15 GUARANTEE

Refer to Chapters 21 through 23 for a specific definition of guarantee for each type of utility Work.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 21

STORM SEWERS

ARTICLE	TITLE	
21.00	GENERAL	2102
21.01	MATERIALS	2102
	A. CONCRETE	2102
	B. REINFORCED CONCRETE PIPE	2102
	C. RUBBER GASKET	2102
	D. IRON CASTINGS	2103
	E. CONCRETE REINFORCEMENT	2103
	F. BRICK	2103
	G. MORTAR	2103
	H. PRECAST MANHOLE SECTIONS	2103
	I. PRECAST BOX CULVERTS	2104
	J. WIRE GABION	2104
	K. GABION STONE	2105
	L. GROUT FILLED FABRIC	2105
	M. GEOTEXTILE FILTER FABRIC	2107
21.02	EXCAVATION AND BACKFILL	2108
21.03	LAYING PIPE	2109
	A. GENERAL	2109
	B. BASIS OF PAYMENT	2110
21.04	CURVED REINFORCED CONCRETE PIPE STORM SEWER	2110
21.05	CONNECTIONS TO EXISTING STORM SEWERS	2112
	A. GENERAL	2112
	B. BASIS OF PAYMENT	2112
21.06	REINFORCED CONCRETE BOX STORM SEWERS AND STRUCTURES	2113
	A. GENERAL	2113
	B. FORMS	2113
	C. STEEL REINFORCEMENTS	2113
	D. CONCRETE	2114
	E. BASIS OF PAYMENT	2115
21.07	STORM SEWER MANHOLES	2116
	A. BRICK MANHOLES	2116
	B. REINFORCED CONCRETE MANHOLES	2116
	C. PRECAST CONCRETE MANHOLES	2116
	D. BASIS OF PAYMENT	2116
21.08	STORM SEWER INLETS	2117
	A. BRICK INLETS	2117
	B. REINFORCED CONCRETE INLETS	2117
	C. BASIS OF PAYMENT	2117

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 21

STORM SEWERS

ARTICLE	TITLE	
21.09	CONVERT INLET TO MANHOLE	2117
	A. GENERAL	2117
	B. BASIS OF PAYMENT	2117
21.10	OPEN DITCHES	2118
	A. GENERAL	2118
	B. BASIS OF PAYMENT	2118
21.11	CONCRETE LINERS	2118
	A. GENERAL	2118
	B. BASIS OF PAYMENT	2118
21.12	REINFORCED CONCRETE FLARED END SECTIONS (RC FES)	2119
	A. GENERAL	2119
	B. BASIS OF PAYMENT	2119
21.13	REMOVAL OF EXISTING STRUCTURES	2119
	A. GENERAL	2119
	B. BASIS OF PAYMENT	2119
21.14	RIP-RAP	2120
	A. GENERAL	2120
	B. BASIS OF PAYMENT	2120
21.15	GABION INSTALLATION	2121
	A. GENERAL	2121
	B. CONSTRUCTION	2121
	C. BASIS OF PAYMENT	2121
21.16	GEOTEXTILE FILTER FABRIC INSTALLATION	2122
	A. GENERAL	2122
	B. CONSTRUCTION	2122
	C. BASIS OF PAYMENT	2122
21.17	SUBSTANTIAL COMPLETION	2123
21.18	FINAL ACCEPTANCE	2123
21.19	GUARANTEE	2123
TABLE	TITLE	
21.04 A	CURVED REINFORCED CONCRETE STORM SEWER PIPE	2111
21.14 A	ROCK RIP-RAP GRADATION REQUIREMENTS	2120

CHAPTER 21

STORM SEWERS

21.00 GENERAL

The Work covered in this chapter shall include the laying and jointing of storm sewer pipe, concrete box construction, concrete channel liners, and construction of storm sewer appurtenances.

21.01 MATERIALS

A. CONCRETE

Concrete used in storm sewer construction and reconstruction shall conform to the requirements of Chapter 3 of these Standard Specifications.

B. REINFORCED CONCRETE PIPE

1. Reinforced concrete pipe shall be circular in cross section, unless otherwise indicated, with tongue and groove joints, and shall be manufactured in accordance with the requirements of "Standard Specifications for Reinforced Concrete Culvert Pipe, Storm Drain and Sewer Pipe", ASTM Designation C 76 for Class III Pipe with Wall B, unless otherwise specified on the plans or in the Special Provisions.
2. When so indicated on the plans, reinforced concrete elliptical pipe shall be supplied and shall be manufactured in accordance with the requirements of "Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe", ASTM Designation C 507.

C. RUBBER GASKET

Rubber gaskets shall be from extruded closed cell rubber.

1. The base polymer shall be a blend of neoprene and EPDM meeting the physical requirements of "Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber", ASTM D 1056, Class 2C2.
2. The closed cell rubber shall meet the ozone testing requirement of "Standard Test Method for Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)", ASTM D 1171, of seventy (70) hours at a forty degrees Celsius (40° C) at 100 PHM, bent loop with no cracks.
3. Each seal shall be completely covered with a natural skin and shall be assembled into a continuous ring which shall conform to the joint size and shape.
4. Cross sectional dimensions shall conform to RMA Class II tolerances and installation shall be in accordance with the manufacturer's recommendations.

21.01 MATERIALS (Continued)

D. IRON CASTINGS

All iron castings shall meet the requirements of “Standard Specification for Gray Iron Castings”, ASTM Designation A 48, Class 30. They shall conform in all respects to the designs for such castings as shown on the Standard Plans. All frames and covers shall be machined so that each cover will fit properly in its frame with no rocking. No casting will be accepted that is warped, cracked, has swells, or that has been plugged or filled.

E. CONCRETE REINFORCEMENT

1. **REINFORCEMENT BARS:** All reinforcement bars shall meet the requirements of “Standard Specifications for Deformed and Plain Billet Steel Bars for Concrete Reinforcement”, ASTM Designation A 615, Grade 40 or Grade 60. Bars shall be free from excess rust, scale, or other substances which prevent the bonding of the concrete to the reinforcement.
2. **REINFORCEMENT BAR SUPPORTS:** Reinforcement bar supports shall be of a satisfactory design and of sufficient strength to hold the metal reinforcement in place while the concrete is being placed.

F. BRICK

All brick shall be clean, hard burned brick having true shape and sharp edges for their whole length. Unless otherwise specified, all brick shall be new brick. Broken brick shall be used only to close joints and no bats smaller than half a brick shall be used. In addition to the foregoing, all brick shall meet all the requirements of “Standard Specification for Sewer and Manhole Brick Made From Clay or Shale”, ASTM Designation C 32; all sewer brick shall be Grade SS and all manhole brick shall be Grade MS. Concrete brick conforming to “Standard Specification for Concrete Brick”, ASTM Designation C 55, Grade N 1, may be used in lieu of the clay or shale brick specified above.

G. MORTAR

Mortar used in the construction of manholes or other appurtenant structures shall be Type S as specified in “Standard Specification for Mortar for Unit Masonry”, ASTM Designation C 270. Proportions of the mixture shall conform to either of the two following alternatives:

<u>Alternate</u>	<u>Portland Cement</u>	<u>Masonry Cement</u>	<u>Hydrated Lime or Lime Putty</u>	<u>Aggregate Loose & Damp</u>
1	½	1	0	Not less than 2¼ nor more than
2	1	0	1/4-1/2	3 times the sum of the volume of the cements and lime used

H. PRECAST MANHOLE SECTIONS

Precast manhole sections shall be manufactured in accordance with the requirements of “Standard Specification for Precast Reinforced Concrete Manhole Sections”, ASTM Designation C 478.

21.01 MATERIALS (Continued)

I. PRECAST BOX CULVERTS

When so indicated on the plans, precast box culverts shall be supplied and shall be manufactured in accordance with the requirements of "Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains and Sewers", ASTM Designation C 1433.

J. WIRE GABION

GABION shall be supplied as specified, in various lengths and heights. The lengths shall be multiples of the horizontal width. The heights shall be fractions of the horizontal width. The horizontal width shall not be less than 3 feet. However, all gabion furnished by a manufacturer shall be of uniform width. Dimensions for heights, lengths and widths are subject to a tolerance limit of ± 5 percent of manufacturer's stated sizes.

GABION shall be fabricated in such a manner that the sides, ends, lid, and diaphragms can be assembled at the construction site into a rectangular basket of the specified sizes. GABION shall be of single unit construction. The base, lid, ends, and sides shall be either woven into a single unit or one edge of these members connected to the base section of the gabion in such a manner that strength and flexibility at the point of connection is at least equal to that of the mesh.

Where the length of the gabion exceeds its horizontal width, the gabion shall be equally divided by diaphragms of the same mesh and gauge as the body of the gabion into cells whose length does not exceed the horizontal width. The gabion shall be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying at this juncture will be necessary.

GABION shall be made of hexagonal triple twist mesh $3\frac{1}{4}$ inches by $4\frac{1}{2}$ inches. The wire mesh shall be made of galvanized steel wire having a diameter of 0.1181 inches $\pm 2.5\%$. The tensile strength of the wire shall be in the range of 60,000 to 85,000 p.s.i. The minimum zinc coating of the wire shall be 0.80 ounces per square foot of uncoated wire surface in accordance with Federal Specification QQ-W-461g, Class 3.

All perimeter edges of the mesh forming the gabion shall be securely salvaged so that the joints formed by tying the selvages have at least the same strength as the body of the mesh.

Tie wire or connecting wire shall be supplied in sufficient quantity for securely fastening all edges of the gabion and diaphragms. The tie wire shall meet the same Standard Specifications as the wire used in the mesh, except that it shall have a diameter of 0.0866 inches $\pm 2.5\%$. Tie wire and connecting wire used for assembling or connecting to PVC coated gabion shall be PVC coated wire provided by the gabion manufacturer for that purpose.

The wire mesh for PVC coated baskets shall be made of galvanized steel wire and shall conform to all Standard Specifications for galvanized baskets except that the mesh wire exclusive of PVC coating may be 0.0118 inches smaller in diameter.

The PVC coating shall be a minimum of four-tenths millimeter in thickness. The PVC coating shall be applied prior to weaving of the baskets.

21.01 MATERIALS (Continued)

J. WIRE GABION (Continued)

The PVC protective coating shall be resistant to the air and sea water and shall comply with the following test requirements:

1. Immersion of the wire for twenty (20) hours in Hydrochloric acid (solution composed fifty percent (50%) H₂O and fifty percent (50%) HCL concentration 21 Baume-Test temperature fifteen degrees Celsius (15°C) or immersion for sixty (60) hours in a saturated solution of salt water at fifteen degrees (15°C) without noticeable loss of weight due to corrosion of the coating material and without reduction of the wire's diameter.
2. After immersion of a length of the coated wire in a three and one-half (3.5%) solution of Potassium Permanganate (KMnO₄) for a continuous period of fifty hours (50) at an ambient temperature, the maximum penetration between the coating and the core wire from a square cut end shall be 0.472 inches .
3. The protective coating shall not be altered or deformed by temperatures ranging between 150.0°F and -40°F.

K. GABION STONE

The stone used to fill the gabion shall be from sources approved by the City's Project Manager. The size of the stone shall be such that not more than five percent (5%) by mass shall pass the 4-inch sieve. The maximum weight for any one stone shall not exceed 50 pounds. The maximum length of stone shall not exceed 12-inches. Each stone shall have one dimension that has a measurement of 4-inches. The approved stone shall conform to the soundness requirements of "Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate", ASTM Designation C 88.

L. GROUT FILLED FABRIC

Grout shall consist of a mixture of Portland cement, fine aggregate, and water so proportioned and mixed as to provide a pumpable slurry. Pozzolan and grout fluidifier conforming to these Standard Specifications may be used at the option of the Contractor. The mix shall exhibit a compressive strength of 2000 p.s.i. at twenty-eight (28) days when made and tested in accordance with "Standard Practice for Making and Curing Concrete Test Specimens in the Field", ASTM C 31 and "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens", ASTM Designation C 39, or "Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in Laboratory", ASTM Designation C 942 if a grout fluidifier is used.

21.01 MATERIALS (Continued)

L. GROUT FILLED FABRIC (Continued)

Grout components shall conform to the following:

1. Portland cement: Federal Specifications SS-C 192 or “Specification for Portland Cement”, ASTM Designation C 150.
2. Pozzolan, if used: “Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete”, ASTM Designation C 618/C 618 M.
3. Water shall be fresh, clean, and free from injurious amounts of sewage, oil, acid, alkali, salts, or organic matter.
4. Aggregate: “Standard Specification for Concrete Aggregates”, ASTM Designation C 33, except as to grading. Aggregate grading shall be reasonably consistent and shall be well graded from the maximum size which can be conveniently handled with available pumping equipment.
5. Grout fluidifier, if used: “Standard Specification for Grout Fluidifier for PrePlaced-Aggregate Concrete”, ASTM C 937.

The average compressive strength of the grout-filled fabric test cylinders shall be at least twenty percent (20%) higher at seven days than that of companion test cylinders made in accordance with “Standard Practice for Making and Curing Concrete Test Specimens in the Field”, ASTM Designation C 31, or “Standard Test Method for Compressive Strength of Grouts for Preplaced Aggregate Concrete in the Laboratory”, ASTM Designation C 942 if grout fluidifier is used, and not less than 2500 p.s.i. at twenty-eight (28) days.

Fabric forming material shall be “Fabriform” or approved equal.

Fabric forming material shall consist of specially-woven multiple panels of double-layer, open-selvage fabric joined in a mat configuration. The two fabric layers shall each be no lighter than 18 x 18 count per inch, one thousand (1000) denier nylon or one thousand (1000) denier polyester tire cord, of which at least 50% by weight shall be producer-bulked continuous multi filament tire cord nylon. Fabric of equal or greater strength and porosity may be used with the approval of the City’s Project Manager. Fabric containing film type polypropylene fiber shall not be considered as an acceptable alternate by reason of its low strength, low bond to mortar and extreme sensitivity to ultraviolet degradation.

1. Filter Point fabric (designated as FP on drawings) shall consist of multiple panels of double layer fabric joined together in such a manner as to provide Filter Points on spaced centers for the relief of hydrostatic uplift pressure. Filter Points shall be woven in such a manner as to permit passage of ground water through the Filter Points. Filter Points shall be on approximately five inch or eight inch or 10 inch centers as woven and as indicated on drawings.

21.01 MATERIALS (Continued)

L. GROUT FILLED FABRIC (Continued)

2. Uniform Cross Section Fabric (designated as UCS on drawings) shall consist of multiple panels of double layer fabric joined together by interwoven ties of a uniform length spaced no further apart than 3 inch centers. Hydrostatic uplift relief, where required, shall be provided by sewing together the two fabric layers at locations and in the manner indicated on the drawings or by inserting plastic tubes through the mat on specified centers. Filter cloth shall be placed beneath the mat if plastic or other type tubes are used to prevent passage of fines through the tubes. These tubes shall be installed in such a manner as to insure that no damage to filter cloth occurs.
3. Individual mill width panels shall be cut to suitable length and the two layers of fabric separately joined edge to edge by means of nylon thread. The tensile strength of stitched joints shall be not less than 100 pounds per inch.
4. Fabric porosity is essential for the successful execution of this Work. At the direction of the City's Project Manager, the Contractor shall demonstrate the suitability of fabric design by injecting the proposed grout into six inch diameter sleeves under a pressure of 10 to 15 p.s.i. which shall be maintained by means of air pressure or a standpipe for ten (10) minutes. The sleeves shall be constructed of the same fabric used in the individual layers of fabric. Six inch by twelve inch test cylinders shall be cut from each specimen and tested in accordance with "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens", ASTM Designation C 39.

M. GEOTEXTILE FILTER FABRIC

Geotextile filter fabric shall be of nonwoven needle punched construction and consist of continuous long chain polymeric fibers composed of polyester polypropylene, polyethylene, or polyamide. The fibers shall be oriented into a multi-directional stable network which retains their positions relative to each other and allows the passage of water as specified. The fabric shall be free of any chemical treatment or coating which reduces permeability. The fabric shall be puncture and tear resistant; mildew, rodent, insect, and rot resistant; freeze and thaw stable; and shall be inert to chemicals commonly found in acid or alkaline soils. The fabric shall be resistant to deterioration due to ultraviolet light and/or heat exposure. The geotextile shall conform to typical physical properties, as shown below:

<u>Physical Property</u>	<u>Test Procedure</u>	<u>Minimum Test Results</u>
Tensile Strength, wet, lbs.	ASTM D 1682	175 (80)
Elongation, wet, %	ASTM D 1682	65
Coefficient of Water Permeability, cm/sec.	Constant head	0.10
Puncture Strength, lbs.	ASTM D 751*	90
Mullen Burst Strength, psi	ASTM D 3786	335
Abrasion Resistance, lbs.	ASTM D 3884	55 (min.)
	Taber Test	
	(1000 revolutions, 1 kg. load/wheel)	
Pore Size – EOS	Corps of Engineers CW-02215	70-100
Ultraviolet Resistance	ASTM D-1682	70
% Strength Retention	(After 500 Xenon Weatherometer Hours)	

*Tension testing machine with ring clamp; steel ball replaced with a 5/16 inch diameter solid steel cylinder with hemispherical tip centered within the ring clamp.

21.01 MATERIALS (Continued)

M. GEOTEXTILE FILTER FABRIC (Continued)

The fabric shall have a minimum weight of 5 ounces per square yard.

The geotextile shall be furnished in a protective wrapping which shall protect the fabric from ultraviolet radiation and from abrasion due to shipping and handling.

21.02 EXCAVATION AND BACKFILL

Excavation and backfill shall conform to the requirements of Chapter 20 of these Standard Specifications.

21.03 LAYING PIPE

A. GENERAL

For all ordinary laying conditions in firm soils, the Contractor shall lay each pipe to line and grade, taking care to provide depressions for jointing of each pipe.

All pipe shall be laid to line and grade as indicated on the plans. The laying of pipe shall begin at the lowest point in the line and proceed upgrade. Spigot ends shall be laid in the direction of flow. All pipe shall be so laid, fitted, and matched as to form a sewer with a smooth, uniform, and continuous interior surface throughout.

After each pipe has been laid and firmly bedded in place, the entire joint space and lift hole shall be completely filled with mortar composed of one (1) part Portland Cement and two (2) parts of clean sand by volume. If the pipes are of 36 inches in diameter or larger, the joint space shall also be filled on the inside surface of the pipe. The mortar shall be cured and protected as directed by the City's Project Manager.

In lieu of the mortar joint specified above, joints may be made of approved rubber gaskets or cold mix asphalt jointing compound. The methods of making the joints and filling of lift holes shall be approved by the City's Project Manager.

The open end of the pipes shall be protected at all times against the entrance of earth or other foreign material.

Tight bulkheads shall be placed in all open ends when pipe laying is stopped. The ditch or swale shall be graded as necessary to permit the proper entrance of surface runoff into or out of the system.

When called for on the plans, the Contractor shall remove and relay reinforced concrete storm sewer pipes to the lines and grades indicated. The Contractor shall exercise care in the removal so as not to damage the existing pipe or the pipe removed. Where pipes are unavoidably damaged, the Contractor shall replace the damaged pipe with new material and be compensated as provided below. Where, in the opinion of the City's Project Manager, pipes are damaged due to neglect of the Contractor, the pipe shall be removed and replaced with new materials at the Contractor's cost.

When the plans or Contract Documents call for removal and salvage of storm sewer pipes, the Contractor shall remove and reuse the salvaged pipes. Where pipes are to be removed and salvaged but are, in the opinion of the City's Project Manager, damaged beyond their usefulness, the Contractor shall be compensated for removal only and separately be compensated for new. When the plans or Contract Documents call for removal of storm sewer pipes, the Contractor shall remove and dispose of the pipes off the job site.

21.03 LAYING PIPE

B. BASIS OF PAYMENT

Reinforced concrete storm sewer pipe removed, removed and re-laid, or removed and salvaged in accordance with these Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per linear foot for:

REMOVE STORM SEWER PIPE, __"

REMOVE AND RELAY RCP STORM SEWER, __"

REMOVE AND SALVAGE RCP STORM SEWER, __"

Such payment shall be full compensation for all excavation, removal, bedding if required, relaying, loading salvaged pipe, backfill disposal, materials, equipment, tools, labor, and incidentals necessary to perform the Work called for as per plan.

Reinforced Concrete Pipe (RCP) storm sewer pipe, elliptical Reinforced Concrete Pipe (RCP), and precast reinforced concrete (RC) box storm sewers, constructed in conformance with these Standard Specifications and accepted by the City's Project Manager, shall be measured from inside face of structure to inside face of structure, or to the end of the pipe or precast box for each size of pipe or precast box.

Payment for pipes and precast boxes shall be made at the contract unit price bid per linear foot for:

RCP STORM SEWER, CLASS __, __"

ELLIPTICAL RCP STORM SEWER, __" x __";

PRECAST RC BOX STORM SEWER for the various sizes shown on the proposal. Such payment shall be full compensation for all excavation, bedding, jointing, backfill, materials, equipment, tools, labor, and incidentals necessary to complete the items of Work called for as per plan.

Grading required as a part of storm sewer construction shall not be measured or paid for separately. The costs of such grading shall be considered as subsidiary to the costs of the items for which direct payment is made.

21.04 CURVED REINFORCED CONCRETE PIPE STORM SEWER

Straight sections of reinforced concrete pipe may be installed on curves by opening the outside of the joints in accordance with this Standard Specification. Where reinforced concrete pipe is to be installed on radii smaller than those shown in this Standard Specification, radius or beveled pipe shall be used only with the prior approval of the City's Project Manager.

Reinforced concrete pipe with mortar or mastic-packed joints shall have a maximum joint opening of not more than three-fourths (3/4) of the tongue length.

No separate measurement or payment shall be made for beveled or radius pipe. The measurement and payment for beveled and radius pipe shall be included in the measurement and payment for standard storm sewer pipes as provided in Chapter 21 of these Standard Specifications.

TABLE 21.04 A - CURVED REINFORCED CONCRETE STORM SEWER PIPE

Nominal Diameter inches	Tongue Length inches	Maximum Joint Opening inches	Minimum Radius in feet for Given Laying Length (LL) (using unbeveled round pipe)			
			4 ft. LL	6 ft. LL	7.5 ft LL	8 ft. LL
15	2	1 ½	52	78	98	-----
18	2 ¼	1 ¾	53	79	99	-----
21	3 ½	2 ⅝	41	61	76	-----
24	2 ¾	2 1/16	59	88	110	-----
30	3 ½	2 ⅝	57	85	-----	108
36	3 ½	2 ⅝	67	101	-----	129
42	4	3	68	102	-----	130
48	4 ½	3 3/16	73	110	-----	140
54	5	3 ¾	70	104	-----	131
60	5	3 ¾	77	115	-----	146
66	5	3 ¾	85	127	-----	161
72	5	3 ¾	92	138	170	174
78	5	3 ¾	100	149	184	188
84	4 ½	3 3/8	119	178	222	227

21.05 CONNECTIONS TO EXISTING STORM SEWERS

A. GENERAL

The Contractor shall make all connections and taps of the new storm sewers to existing storm sewer systems as shown on the plans. Tapping pipe should not extend more than 2" into existing pipe. Existing manhole or inlet bottoms shall, if necessary, be reconstructed in substantially the same manner as herein specified.

B. BASIS OF PAYMENT

Connections to existing storm sewer systems, constructed in accordance with these Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per each for TAP EXISTING STORM SEWER MANHOLE AND REPLACE INVERT; TAP EXISTING STORM SEWER INLET AND REPLACE INVERT; TAP EXISTING RCP; or TAP EXISTING RC BOX, for each item called for in the proposal. No classification shall be made as to sizes of pipes being tapped or sizes of connecting pipes. Such payment shall be full compensation for all tapping, shaping the connecting pipes, brick, mortar, concrete, materials, equipment, tools, labor, and incidentals necessary to complete the taps and seal the resulting voids in the walls of the storm sewers in accordance with the details shown on the drawings.

No direct measurement or payment shall be made for connections or taps of various parts of the Work to other parts of the Work performed under the same contract. The cost of these taps and connections shall be considered subsidiary to the other items for which direct payment is made.

21.06 REINFORCED CONCRETE BOX STORM SEWERS AND STRUCTURES

A. GENERAL

Reinforced concrete box storm sewers and structures shall be complete, including box section, wing walls, apron, manholes, taps, connections, etc. Steel reinforcement shall be placed as indicated on the plans.

B. FORMS

Forms shall be true to the required shapes and sizes, properly braced, and strong and stiff enough to withstand, without springing or warping, all operations incidental to laying the mat of steel reinforcement and placing the concrete. They shall be mortar tight, and the form surfaces in contact with the concrete shall be smooth and clean. To prevent adhesion to the concrete, the contact surfaces of all forms shall be coated with soap, mineral oil, or other substances, and they shall be thoroughly wetted before the concrete is placed.

Tie wires and tie rods may be left in the concrete, providing the end portions are removed to within approximately two inches of any exposed face. All holes left after removal of the rod or wire ends shall be completely filled with cement mortar immediately after the concrete curing forms have been removed. Such mortar shall be kept moist until thoroughly bonded to the concrete. Before depositing any concrete in the forms, the City's Project Manager shall make an observation of the condition of the forms and the placing of the reinforcing steel. All imperfections in either shall be remedied before any concrete is placed.

During the process of placing the concrete in any formed section, a taut line shall be kept in place by the Contractor at the back side of the forms. Competent workers shall keep a constant check to determine any deflection of the forms. Any such deflection shall be corrected immediately.

The Contractor shall use great care in the removal of forms so as not to injure the concrete in any way, and he shall be wholly responsible for any injury due to premature removal of forms. Wall forms, normally, may be removed twelve to twenty-four (12 to 24) hours after placement of the concrete. Roof forms shall remain in place until tests show that the concrete has developed a compressive strength of 3000 p.s.i. Test specimens and tests shall comply with current ASTM Standards. Test specimens shall be cured under job conditions. In the absence of such tests, roof forms shall remain in place seven (7) days when the average ambient temperature has been 55° F for twelve (12) hours or more. Forms shall not be removed without permission of the City's Project Manager.

C. STEEL REINFORCEMENTS

The exact position and bar size of the reinforcements are shown on the plans. Information for purchasing, cutting and bending the bars shall be furnished by the Contractor. The bars shall be secured in position by suitable means, so they will not be displaced during the process of depositing or consolidating the concrete.

Steel reinforcement shall be stored on the Work site in such a manner as to protect it from any damage or surface deterioration.

Cold bends shall be made around a pin having a diameter of not less than six (6) times the nominal diameter of the bar.

All reinforcing steel shall be furnished in full length, except where splices are indicated in the plan or permitted by the City's Project Manager. Splices in adjacent bars shall be staggered.

21.06 REINFORCED CONCRETE BOX STORM SEWERS AND STRUCTURES (Continued)

C. STEEL REINFORCEMENTS (Continued)

Unless otherwise shown in the plans, bars shall be spliced by lapping the ends. Laps shall be thirty-six (36) bar diameters for Grade 60 (420), and twenty-four (24) bar diameters for Grade 40 (300). Lapped splices shall be made by securely wiring the bars in contact, maintaining alignment, and clearance.

D. CONCRETE

1. Placing Concrete

Before depositing any concrete, all dirt and other debris shall be removed from the forms.

Concrete shall be handled by methods which will prevent the separation or loss of ingredients and the formation of laitance. The concrete shall be deposited in the Work as nearly as possible in its final position to avoid rehandling. The concrete shall be deposited in level layers not exceeding 12 inches in thickness. Suitable means shall be provided to permit concrete to be placed in a manner that will avoid accumulation of dry or hardened concrete on the forms or reinforcement. Concrete, during and immediately after depositing, shall be thoroughly consolidated by the use of vibrators specified below.

The greatest care must be exercised to ensure the coating of all surfaces of the reinforcement. Equal care shall be taken to ensure that all concrete is consolidated against the face of the forms.

2. Keyed Construction Joints

All keyed joints shall be of the raised type, and shall be thoroughly cleaned prior to successive concrete placements.

3. Curing Concrete

Precautions shall be taken to prevent excess loss of water from the concrete. The top of the floor slab and the top of the roof shall be sealed immediately after finishing by wet burlaps, plastic, or by spraying thereon a uniform application of membrane compound conforming to "Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete" ASTM Designation C 309 for Type 2, and at approximately the rate of one (1) gallon to each 150 square feet of surface. The area of the floor slab that will support the walls shall be cured with wet burlap or plastic sheeting. All exposed dowels in the floor slab shall be protected during the curing operation. When forms are removed before the concrete has reached an age of seven (7) days, the exposed concrete shall be cured as specified above.

4. Surface Finish

The upper surface of the floor slab and the top of the roof and end walls shall be finished straight and smooth to the designated lines and slopes. They shall be finished with floats and/or steel trowels. Exposed edges shall be chamfered a minimum of one inch or as otherwise directed by the City's Project Manager. All exposed surfaces shall be finished with a Carborundum stone and water as soon as forms are removed. Upon removal of the forms, should any voids or other defects exist in the concrete surfaces, such defective concrete shall be removed at once and the space refilled with concrete and finished in a neat and workmanlike manner.

21.06 REINFORCED CONCRETE BOX STORM SEWERS AND STRUCTURES (Continued)

D. CONCRETE (Continued)

5. Backfill for Reinforced Concrete Box Storm Sewers and Structures

Backfill along the sides of the reinforced box or structure shall not be made until tests show that the concrete has developed a compressive strength of 2000 p.s.i. Backfill over the top of the reinforced concrete box or structure shall not be made until tests show that the concrete has developed a compressive strength of 3000 p.s.i. Tests and test specimens shall comply with current ASTM standards. In the absence of tests, the following times shall elapse prior to backfilling:

MINIMUM AVERAGE AMBIENT <u>TEMPERATURE</u>	<u>TIME</u>
45° F	17 Days
55° F	8 Days
73° F	5 Days

E. BASIS OF PAYMENT

When called for in the proposal, payment for reinforcing steel for reinforced concrete box storm sewers and structures placed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be made at the contract unit price bid per pound for REINFORCING STEEL FOR BOX STORM SEWER, IN PLACE, or for REINFORCING STEEL FOR STRUCTURES, IN PLACE. The reinforcing steel shall not be measured separately for payment, but the quantities shall be established based upon weight of steel required for the Design Section, unless otherwise specified. Such payment shall be full compensation for all placing, tying, chairs, materials, equipment, tools, labor, and incidentals necessary to place the steel in the proper locations in accordance with the plans.

When the plans or Special Provisions provide for unit price bids per linear foot or lump sum complete for box storm sewers or structures, the reinforcing steel shall not be paid for separately. The cost of the reinforcing steel shall be considered subsidiary to the costs for the items bid on the linear foot or lump sum basis as provided in Chapter 21 of these Standard Specifications.

When called for in the proposal, concrete for box storm sewers or structures placed in conformance to these Standard Specifications and accepted by the City's Project Manager shall be paid for at the contract unit price bid per cubic yard for CONCRETE FOR BOX STORM SEWER, IN PLACE, or for CONCRETE FOR STRUCTURES, IN PLACE. The concrete shall not be measured separately for payment, but the quantities shall be established based upon the volume of concrete required for the Design Section, unless otherwise specified. Such payment shall be full compensation for all mixing, hauling, forming, placing, jointing, curing, finishing, excavation, backfill, materials, equipment, tools, labor, and incidentals necessary to complete the structure.

When called for in the proposal, reinforced concrete box storm sewers constructed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be paid for at the contract unit price bid per linear foot for ____ X ____ REINFORCED CONCRETE BOX STORM SEWER, COMPLETE, for the various sizes required. Such payment shall be full compensation for all excavation, bedding where required, forming, placing reinforcement, placing concrete, jointing, curing, finishing, backfill, materials, equipment, tools, labor, and incidentals necessary to construct the box and its appurtenances.

21.06 REINFORCED CONCRETE BOX STORM SEWERS AND STRUCTURES (Continued)

E. BASIS OF PAYMENT (Continued)

When called for in the proposal, reinforced concrete structures constructed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be paid for at the contract unit price bid per lump sum for REINFORCED CONCRETE TRANSITION STRUCTURE @ STA. ____, COMPLETE, or REINFORCED CONCRETE STRUCTURE @ STA. ____, COMPLETE. Such payment shall be full compensation for all excavation, bedding where required, forming, placing reinforcement, placing concrete, jointing, curing, finishing, backfill, materials, equipment, tools, labor, and incidentals necessary to construct each structure and its appurtenances in a manner acceptable to the City's Project Manager.

21.07 STORM SEWER MANHOLES

A. BRICK MANHOLES

Brick manholes shall be built where and as indicated on the plans. Their form and dimensions shall be in accordance with the drawings included with these Standard Specifications. The brick in each course shall break course with those in the adjoining courses. Mortar shall be mixed in the proportions of one (1) part of Portland or mortar cement and two (2) parts of sand, by volume. Every brick shall have full mortared joints on the bottom, sides and ends which shall be formed in one operation by placing sufficient mortar on the bed and forcing the brick into it. All joints shall be carefully filled and struck as the manhole is built up. The entire space between adjacent bricks shall be filled solidly with mortar. The entire inside and outside surface of the brick masonry shall be carefully plastered with mortar applied at a thickness of not less than one-half inch.

B. REINFORCED CONCRETE MANHOLES

Reinforced concrete manholes shall be built in accordance with Chapter 21 of these Standard Specifications.

C. PRECAST CONCRETE MANHOLES

Concrete manholes may also be constructed of precast sections as provided in the Lincoln Standard Plans. In the assembly of the wall rings, mortar joints, rubber gaskets, or cold-formed asphalt, joints shall be used to make the walls watertight.

D. BASIS OF PAYMENT

Storm sewer manholes constructed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be counted and paid for at the contract unit price bid per each for STORM SEWER MANHOLE, ____ INCHES, COMPLETE, for the various sizes required. Size of the manhole shall be identified as the largest nominal size of its intersecting storm sewers. Such payment shall be full compensation for all excavation, brick, mortar, castings, precast sections, reinforcement, concrete, backfill, materials, equipment, tools, labor, and incidentals necessary to complete each manhole.

21.08 STORM SEWER INLETS

A. BRICK INLETS

Storm sewer inlets shall be constructed where and as indicated on the plans. Walls shall be of brick masonry laid as above specified for manholes. The inside and outside of the walls shall be plastered with mortar one-half inch thick.

Each inlet bottom shall be fully formed so as to make the curves of the tributary sewers, and all corners shall be filled with concrete as directed by the City's Project Manager. All inlet rings, covers, grates, and the forms and dimensions of all inlets shall comply with the City of Lincoln Standard Plans.

B. REINFORCED CONCRETE INLETS

Reinforced concrete inlets shall be built as provided above and in accordance with Chapter 21 of these Standard Specifications. The concrete inlet tops shall be set to grade and sealed with mortar. The ring and cover shall be adjusted to grade with brick and mortar and shall be sealed inside and out with mortar.

C. BASIS OF PAYMENT

Storm sewer inlets constructed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be counted and paid for at the contract unit price bid per each for:

STORM SEWER INLET, COMPLETE, 72"

CANTED STORM SEWER INLET, COMPLETE, 72"

RADIUS STORM SEWER INLET, COMPLETE, 72"

GRATE INLET, TYPE ___, COMPLETE; for the various sizes and types required. Such payment shall be full compensation for all excavation, brick, mortar, concrete, inlet top, castings, curb as called for on the Standard Plans, backfill, materials, equipment, tools, labor, and incidentals necessary to complete each inlet.

21.09 CONVERT INLET TO MANHOLE

A. GENERAL

When called for on the plans, existing inlets shall be converted to manholes by removing the inlet top, throat and adjacent curbs, bricking up the throat, removing and reshaping the invert if necessary, placing a new inlet top, and installing a new manhole ring and cover as directed by the City's Project Manager.

B. BASIS OF PAYMENT

Inlets converted to manholes shall be paid for at the contract unit price bid per each for CONVERT INLET TO MANHOLE, COMPLETE. Such costs shall be full compensation for all excavation, backfill, curb removal, curb replacement, materials, equipment, tools, labor, and incidentals necessary to complete each conversion.

21.10 OPEN DITCHES

A. GENERAL

Open ditches shall be constructed in accordance with the lines and grades indicated on the plans and/or as directed by the City's Project Manager.

B. BASIS OF PAYMENT

Open ditches constructed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be measured using the end area method and shall be paid for at the contract unit price bid per cubic yard for CHANNEL EXCAVATION. The quantity to be used as the basis for payment shall be the quantity called for in the proposal, unless otherwise specified. Such payment shall be full compensation for all excavation, preparation of the banks for seeding when required, disposal of surplus materials, other materials, equipment, tools, labor, and incidentals necessary to complete the ditch or channel.

When indicated on the plans but not called for in the proposal, the cost of grading small ditches or reshaping ditches, as directed by the City's Project Manager, shall not be measured or paid for directly. The cost of this Work shall be considered subsidiary to the cost of the other items for which direct payment is made.

21.11 CONCRETE LINERS

A. GENERAL

Concrete liners for open ditches shall be built to lines, grades, and sections as shown on the plans.

B. BASIS OF PAYMENT

Concrete ditch and channel liners constructed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per linear foot for RC LOW FLOW LINER,____', for the various sizes required. Such payment shall be full compensation for all excavation, forming, reinforcement, concrete, finishing, jointing, curing, sealing, backfill, materials, equipment, tools, labor, and incidentals necessary to complete the liners.

21.12 REINFORCED CONCRETE FLARED END SECTIONS (RC FES)

A. GENERAL

When called for on the plans, reinforced concrete flared end sections, with or without grates, shall be installed at the locations and grades indicated.

When called for on the plans, flared end sections shall be removed and salvaged to a location on the job site as directed by the City's Project Manager.

When called for on the plans, the Contractor shall remove existing flared end sections from the existing system, store the end sections on the job site, and reset the end sections at new locations as a part of the Work.

Flared end sections required to be removed and salvaged or removed and reset but damaged by the Contractor shall be replaced with new materials at the Contractor's cost.

Flared end sections to be removed and not salvaged or reset shall be disposed of by the Contractor.

B. BASIS OF PAYMENT

Flared end sections to be removed or removed and reset, in accordance with these Standard Specifications and accepted by the City's Project Manager, shall be counted and paid for at the contract unit price bid per each for REMOVE RC FES, __" or REMOVE AND RESET RC FES, __". Such payment shall be full compensation for all excavation, backfill, bedding, jointing, materials, equipment, tools, labor and incidentals necessary to install the end sections at the locations shown on the plans, or to remove and salvage, remove and reset, or remove and dispose of the end sections.

Flared end sections and flared end sections with grates, placed in conformance with these Standard Specifications and accepted by the City's Project Manager, shall be counted and paid for at the contract unit price bid per each for RC FES, __" and RC FES, w/GRATE, __" ; for the various sizes called for in the proposal.

21.13 REMOVAL OF EXISTING STRUCTURES

A. GENERAL

When called for on the plans the Contractor shall remove appurtenant structures from the existing system. The resultant exposed ends of the system shall be either made ready to connect system extensions or plugged with permanent or temporary plugs, as indicated.

B. BASIS OF PAYMENT

The removal of existing appurtenant structures as called for on the plans, completed in conformance with these Standard Specifications and accepted by the City's Project Manager, shall be counted and paid for at the contract unit price bid per each for REMOVE EXISTING MANHOLE, COMPLETE; REMOVE EXISTING INLET, COMPLETE; REMOVE EXISTING JUNCTION BOX, COMPLETE; REMOVE EXISTING GRATE INLET, COMPLETE; or REMOVE EXISTING HEADWALL, COMPLETE. No classifications shall be made as to size of the structure or appurtenance. Such payment shall be full compensation for all excavation, removal to the line indicated, salvage of inlet tops if required, plugging, preparation of existing surfaces, backfill, materials, equipment, tools, labor, and incidentals necessary to complete the removal.

21.14 RIP-RAP

A. GENERAL

Concrete or stone rip-rap shall be placed on prepared slopes and channel bottoms at locations shown on the plans. The materials used shall be hard stone, broken concrete, or prepackaged material, free from earth, clay, asphalt or refuse and of such quality that it will not disintegrate from action of water or wind. Sizes of the material shall be graded as shown in Table 21.14 A.

The rock shall be angular in shape to allow interlocking between the various rock sizes. Soundness Standard Specifications shall not apply to concrete rip-rap.

TABLE 21.14 A – ROCK RIP-RAP GRADATION REQUIREMENTS

Size of Rock	Percent of Total Weight Smaller than the Given Size	Approx. Rock Size D50	Approx. Rock Size Dmax
Type A		0.77ft	1.28ft
150 lbs	100		
35 lbs	50		
2 lbs	Not to exceed 10		
Type B		1.02 ft	1.61 ft
300 lbs	100		
80 lbs	50		
5 lbs	Not to exceed 10		
Type C		1.28 ft	2.12 ft
700 lbs	100		
150 lbs	50		
10 lbs	Not to exceed 10		

Rock Rip-Rap can be place with or without geotextile filter fabric as directed by the Engineer. Geotextile conforming to the requirements of Chapter 32 of these Standard Specifications shall be placed on the prepared slopes prior to placement of the rip-rap.

Concrete or other masonry produced as a result of removal of such items at the job site may be used only with prior approval of the City's Project Manager.

The rip-rap shall be placed at the locations and thicknesses indicated on the plans. Any appreciable variation from specified thickness shall be corrected by redistributing the rip-rap.

B. BASIS OF PAYMENT

Rip-rap placed in conformance with these Standard Specifications and accepted by the City's Project Manager shall be measured by weighing the truck. Net weight shall be the basis of payment. Payment shall be made at the contract unit price bid per ton for RIP-RAP. When using filter fabric, payment shall be made at a contract unit price bid per ton for RIP RAP WITH FILTER FABRIC. Placement of the geotextile filter fabric shall be considered subsidiary to the placement of the rip-rap. No measurement or payment shall be made for rip-rap produced as a result of removal of other items on the project. Such payment shall be full compensation for furnishing, preparation of slopes and subgrades, hauling, placing, excavation, backfill, materials, equipment, tools, labor, and incidentals necessary to complete the Work.

21.15 GABION INSTALLATION

A. GENERAL

The Contractor shall furnish, assemble, tie, and fill gabion constructed in accordance with these Standard Specifications and placed in conformity with the lines, grades, and dimensions shown on the plans or as directed by the City's Project Manager. The location for installation of each type of gabion is indicated on the plans.

B. CONSTRUCTION

1. Assembly

Each gabion unit shall be assembled by binding together all vertical edges with wire ties on approximately six inch (6") spacing or by a continuous piece of connecting wire stitched around the vertical edges with a coil about every four inches (4").

2. Placement

Prior to placement of gabion, the surface on which the gabion will bear shall be compacted and trimmed. Empty gabion units shall be set to line and grade as shown on the plans. Wire ties or connecting wire shall be used to join the units together. The units shall be tied together at all edges of their contact perimeters. Internal tie wires shall be uniformly spaced and securely fastened in each outside cell of the structure or where ordered by the City's Project Manager. A standard fence stretcher, chain fall, or iron rod may be used to stretch the wire baskets and hold alignment.

3. Filling and Closing

The gabion shall be filled with the approved stone carefully placed by hand or machine to assure alignment and avoid bulges with a minimum of voids. Hand placing of the rock fill shall be used in the exposed faces of the gabion so that a pleasing and orderly arrangement of fill will result. The gabion shall be overfilled approximately two inches above the sides prior to closing the lids. The lid shall then be secured to the sides, ends, and diaphragms with the wire ties or connecting wire. Special attention shall be given to see that all projections or wire ends are turned into the baskets.

C. BASIS OF PAYMENT

The Contractor shall be paid for the actual number of baskets placed and filled at the contract bid price per each for WIRE GABION, TYPE ____, IN PLACE or WIRE GABION PVC COATED, TYPE ____, IN PLACE. Such payment shall constitute full compensation for all costs of labor, equipment, tools, and materials for furnishing, assembling, filling with stone, closing, all channel excavation, backfilling, and all incidental Work necessary to complete the construction in accordance with these Standard Specifications and as shown on the Plans.

21.16 GEOTEXTILE FILTER FABRIC INSTALLATION

A. GENERAL

The Work covered by these Standard Specifications shall consist of furnishing all labor, materials, and equipment necessary for installing geotextile filter fabric as shown on the plans.

B. CONSTRUCTION

1. Weep Holes

Geotextile filter fabric shall be placed at weep holes for channel liners and retaining walls as shown on the plans.

2. Gabion/Embankment Stabilization

The gabion/embankment stabilization fabric shall be placed in the manner and at the locations shown on the project plans. The surface to receive the geotextiles shall be prepared to a smooth condition free of obstructions, depressions and debris. The fabric shall be placed loosely, not in a stretched condition. The gabions shall be placed so that the geotextile is not punctured. The gabions shall completely cover the fabric.

The fabric shall be placed on the slopes so as to provide a minimum overlap of 18 inches.

The geotextile shall be placed parallel to the direction of the flow and the upstream or higher panel shall overlap the downstream or lower panel. At the top of the embankment the fabric shall be keyed into the ground a minimum of 18 inches.

The filter fabric shall be placed in the manner and at the locations shown on the project plans. The fabric shall be placed loosely, on and/or behind the gabion, not in a stretched condition. The backfill shall be placed so that the fabric is not punctured.

C. BASIS OF PAYMENT

No additional payment shall be made for filter fabric used in constructing weephole filter pockets for R.C. Channel Liner. The filter fabric and placement shall be considered subsidiary to the cost of the R.C. Channel Liner of the various depths.

Unless shown in the schedule of quantities as a bid item, no additional payment shall be made for filter fabric placed on, behind, or under gabion. All costs of materials, labor, and equipment for furnishing and placing the filter fabric with the gabion, as shown on the plans, shall be considered subsidiary to the cost of the Gabion, In Place, of the various types.

When shown in the schedule of quantities as a bid item, geotextile filter fabric, placed in accordance with the plans and these Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per square yard for GEOTEXTILE FILTER FABRIC, IN PLACE, with no allowance for laps or toe-in anchorage. Such payment shall be full compensation for all filter fabric, slope preparation, installing the fabric, equipment, materials, tools, labor, and incidentals necessary to complete the Work.

21.17 SUBSTANTIAL COMPLETION

Storm sewer Work shall be considered substantially complete when all pipe is laid and backfilled; all manholes, inlets, and structures completed and backfilled; paving, sidewalks, and driveways replaced.

21.18 FINAL ACCEPTANCE

The project shall be considered eligible for final acceptance by the City when all required Work is complete and accepted by the City's Project Manager, all items on plan completed, final cleanup is complete, park space finished, and correction of all deficiencies found as a result of testing and/or final inspection by the City's Project Manager.

21.19 GUARANTEE

At any time during the two year guarantee period, and within the time period allowed, the Contractor shall correct any defect in material or workmanship which has been brought to his attention. Such items shall include but not be limited to trench settlement including subsequent pavement damage, pipe leaks, and failures.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 22

SANITARY SEWERS

ARTICLE	TITLE	
22.00	GENERAL	2202
22.01	MATERIALS	2202
	A. VITRIFIED CLAY SEWER PIPE AND JOINTS	2202
	B. CENTRIFUGALLY CAST FIBERGLASS MORTAR PIPE (CCFMP)	2202
	C. POLYVINYL CHLORIDE (PVC) NON-PRESSURE PIPE	2203
	D. REINFORCED CONCRETE SEWER PIPE	2203
	E. PRESSURE PIPE MATERIALS	2205
	F. OTHER SEWER PIPE	2206
	G. MANHOLES AND APPURTENANCES	2206
	H. SEWER SERVICE PIPE	2207
22.02	EXCAVATION AND BACKFILL	2208
22.03	CONNECTION TO EXISTING SEWERS	2208
	A. TAP MANHOLE AND REPLACE INVERT	2208
	B. CONNECTING DISSIMILAR PIPE	2208
	C. TEMPORARY SEWER PLUGGING REQUIREMENTS	2208
	D. MANHOLE REMOVAL AND ABANDONMENT	2209
	E. BASIS OF PAYMENT	2209
22.04	ABANDONMENT OF SANITARY SEWER MAIN	2209
	A. GENERAL	2209
	B. BASIS OF PAYMENT	2209
22.05	PIPE INSTALLATION	2210
	A. HAULING, DELIVERY AND STORAGE OF PIPES	2210
	B. LAYING THE PIPE	2210
	C. JOINTING THE PIPE	2210
	D. CURVILINEAR ALIGNMENT	2211
	E. BASIS OF PAYMENT	2212
22.06	HIGHWAY, STREET, RAILROAD AND UTILITY CROSSINGS	2213
22.07	SANITARY MANHOLE CONSTRUCTION	2213
	A. MANHOLE BOTTOM	2213
	B. MANHOLE ADJUSTING RINGS	2214
	C. POURED CONCRETE MANHOLES	2214
	D. PRECAST CONCRETE MANHOLE SECTIONS	2214
	E. COLD WEATHER CONSTRUCTION	2214
	F. BASIS OF PAYMENT	2214

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 22

SANITARY SEWERS

ARTICLE	TITLE	
22.08	SEWER SERVICES - CONSTRUCTION AND RECONSTRUCTION	2215
	A. GENERAL	2215
	B. CONSTRUCTION OF SEWER SERVICES	2215
	C. RECONSTRUCTION OF SEWER SERVICES	2215
	D. BASIS OF PAYMENT	2216
22.09	TESTING	2217
	A. GENERAL	2217
	B. LINE ACCEPTANCE TESTS	2217
	C. MANHOLE PERFORMANCE TESTS	2220
22.10	SUBSTANTIAL COMPLETION	2222
22.11	FINAL ACCEPTANCE	2222
22.12	GUARANTEE	2222
 TABLE	 TITLE	
22.05 A	MINIMUM RADIUS (FEET) FOR GIVEN LAYING LENGTHS USING UNBEVELED PIPE	2212
22.09 A	ALLOWABLE MANHOLE LEAKAGE RATES FOR MANHOLE EXFILTRATION TEST	2221
22.09 B	MINIMUM TEST TIMES FOR VARIOUS MANHOLE DIAMETERS	2222

CHAPTER 22

SANITARY SEWERS

22.00 GENERAL

The Work covered in this chapter shall include the laying and jointing of sanitary sewers and the construction of their appurtenances.

22.01 MATERIALS

The following pipe materials are approved for use in the City of Lincoln pursuant to the Standard Specifications described herein:

Vitrified Clay Sewer Pipe (VCP)
Centrifugally Cast Fiberglass Mortar Pipe (CCFMP)
Polyvinyl Chloride Sewer Pipe (PVC)
Reinforced Concrete Pipe with PVC Lining (RCP)

Developers, consultants, and Contractors may request consideration of alternate pipe materials to the Director of Public Works and Utilities.

A. VITRIFIED CLAY SEWER PIPE AND JOINTS

Vitrified clay sewer pipe shall be of the best quality of hard-burned, vitrified clay or shale pipe conforming to the requirements of “Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated” ASTM Designation C-700 for extra strength pipe. Clay pipe shall be joined with factory pre-molded joints. The joints shall conform to “Specification for Compression Joints for Vitrified Clay Pipe and Fittings” ASTM Designation C-425, except that the joint gasket must be secured to one of the other joining faces prior to socketing.

B. CENTRIFUGALLY CAST FIBERGLASS MORTAR PIPE (CCFMP)

1. Pipe and Fittings

Centrifugally Cast Fiberglass Mortar Pipe (CCFMP) shall be of high quality conforming to the requirements of ASTM D2412 “Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading”, ASTM D3262 “Standard Specification for Reinforced Plastic Mortar Sewer Pipe”, and ASTM D3681 “Method for Determining Chemical resistance of Reinforced Thermosetting Resin Pipe in Deflected Condition.” The joints shall conform to ASTM D4161 “Specification for Fiberglass (Glass-Fiber-Reinforced) Thermosetting Resin Pipe Joints Using Flexible Elastomeric Seals”.

22.01 MATERIALS (Continued)

C. POLYVINYL CHLORIDE (PVC) NON-PRESSURE PIPE

1. Pipe and Fittings

PVC pipe and fittings for 15 inch and smaller sizes shall meet the requirements of “Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings” ASTM D-3034, Type PSM, SDR 35 minimum. PVC pipe and fittings for 18 inch through 27 inch sizes shall meet the requirements of “Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings” ASTM F-679. PVC pipe and fittings manufactured under “Standard Specification for Type PS-46 and Type PS-115 Poly (Vinyl Chloride) (PVC) Plastic Gravity Flow Sewer Pipe and Fittings” ASTM F-789, Type PS-46 or “Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings” ASTM F-679 with T-2 wall thickness shall not be acceptable. All pipe shall be furnished in standard laying lengths. Shorter field cut lengths for curvilinear alignment may be used, provided that spigot ends are carefully cut to a perpendicular cross section and the ends beveled to permit proper jointing.

2. Joints for Pipe and Fittings

Joints for PVC non-pressure pipe and fittings shall meet the requirements of Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals” ASTM D-3212 for integral bell, single synthetic rubber gasket push-on joints. Joints using separate couplings or couplings solvent welded to one end of the pipe shall not be acceptable. Lubricants, if required, shall have no deteriorating effects on the gasket and pipe materials.

3. Manhole Water Stops

Water stops shall be required for all connections of PVC pipe with manholes. Water stops shall be of a type approved by the City’s Project Manager, consisting of specifically manufactured synthetic elastomeric rings or boots stretched around the pipe and clamped, if applicable, with stainless steel clamps.

4. Transition Joints

Joints between PVC and other pipe materials shall be made with special transition adaptor fittings or stainless steel clamped elastomeric couplings factory fabricated specifically for the use intended and approved by the City’s Project Manager.

D. REINFORCED CONCRETE SEWER PIPE

1. Reinforced concrete sewer pipe, 18 inch or larger, shall conform to Standard Specification for Reinforced Concrete Culvert , Storm Drain, and Sewer Pipe ASTM Designation C-76 or Standard Specification for Concrete D-Load Culvert, Storm Drain, and Sewer Pipe” C-655, as specified on the plans or Special Provisions, except as herein provided.

The coarse aggregate used in the manufacture of the pipe shall conform to the requirements of Article 11.01. The concrete used in the manufacture of the pipe shall contain at least 6 sacks of cement per cubic yard of concrete. All pipe shall not be less than 7.5 feet in length, with the exception of fittings and closure pieces and on curvilinear alignments as described in Chapter 22 of these Standard Specifications.

22.01 MATERIALS (Continued)

D. REINFORCED CONCRETE SEWER PIPE (Continued)

2. Joints and Gaskets

Reinforced concrete sewer pipe shall be circular in cross-section with a tongue and groove joint and shall be furnished with an "O" ring-type gasket. The joints shall be capable of passing the standard infiltration/exfiltration tests as prescribed in the Standard Specifications for sanitary sewers. The gaskets shall conform to "Standard Specification for Reinforced Concrete Low-Head Pressure Pipe" ASTM C-361, Section 6.9, except minimum tensile strength shall be 1500 p.s.i. hardness shall be 40 \pm 5, maximum water absorption shall not be greater than 10%, and the polymer shall be neoprene or other synthetic rubber. Natural rubber gaskets will not be accepted. Lifting holes will not be allowed.

3. Polyvinyl Chloride (PVC) Liner

RCP for sanitary sewer shall be lined with Polyvinyl Chloride (PVC) sheet liners covering two hundred seventy degrees (270°) of the interior surface of the pipe. Liner shall be T-lock as manufactured by Ameron Protective Linings Division, Brea, California or prior approved equal.

Tensile specimens shall be prepared and tested in accordance with "Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension ASTM Designation D 412 using die B. Weight change specimens shall be 1 inch by 3 inch samples of the sheet thickness. Specimens may be taken from sheet and strip at any time prior to final acceptance of the Work.

All PVC plastic liner plate sheets, joint, corner, and welding strips shall have the following physical properties when tested at 77° F \pm 10° F.

Property	Initial	After Conditioning
Tensile Strength, psi	22,000 min.	21,000 min.
Elongation at Break	200% min.	200% min.
Shore durometer, Type D	1-sec. 50-60 10-sec. 35-50	+/- 5 after 112 day @25° C +/- 3° +/- 5 initial test result
Weight Change		+/- 1.5%

22.01 MATERIALS (Continued)

D. REINFORCED CONCRETE SEWER PIPE (Continued)

3. Polyvinyl Chloride (PVC) Liner (Continued)

Chemical Solution	Concentration
Sulfuric Acid	20%
Sodium hydroxide	5%
Ammonium hydroxide	5%
Nitric Acid	1%
Ferric chloride	1%
Soap	0.1%
Detergent (linear alkyl benzyl sulfonate or LAS)	0.1%
Bacteriological	BOD not less than 700 ppm

Liner sheets shall be a minimum of 0.065 inch in thickness. Locking extension (T-shaped) of the same material as that of the liner shall be integrally extruded with the sheet. Locking extensions shall be approximately 2 ½ inches apart and shall be at least 3/8 inch high.

All pipe shall have a two hundred seventy degree (270°) liner coverage with the longitudinal edges of the sheet butt welded. When pipe tubes are furnished, these shall be shop-welded joints. Installation of the liner, including preheating of sheets in cold weather and the welding of all joints, shall be accomplished in accordance with the manufacturer's recommendations. Pipe with damaged lining which has been repaired shall be accepted only upon approval of the City's Project Manager.

E. PRESSURE PIPE MATERIALS

Where pressure pipe materials are required for special sanitary sewer construction, such as in cases involving minimum clearance between water mains and sanitary sewer mains, the Contractor shall use polyvinyl chloride pressure pipe as specified below. Ductile iron pipe shall only be used where specifically designated on the plans or as directed by the City's Project Manager to meet severe structural loading conditions.

1. Polyvinyl Chloride (PVC) Pressure Pipe

PVC pressure pipe shall be cast iron pipe size O.D., meeting the requirements of the latest revision of AWWA C900 for DR 18 (pressure rating 150 p.s.i.) pipe. Pipe shall be furnished in 20 foot standard lengths with beveled male ends and a painted ring for checking the seating depth. Joints shall be push-on type, integral bell with single synthetic elastomer gaskets.

22.01 MATERIALS (Continued)

E. PRESSURE PIPE MATERIALS (Continued)

2. Ductile Iron Pipe (DIP)

Ductile iron pipe, joints, and polyethylene encasement shall meet the applicable requirements of the same under Chapter 23 of these Standard Specifications. All DIP shall be Class 52 minimum unless otherwise indicated on the plans.

3. Transition Joints

Joints between PVC pressure pipe or DIP and other sanitary sewer pipe materials shall be made with special transition adaptor fittings or stainless steel clamped elastomeric couplings, factory fabricated specifically for the use intended and approved by the City's Project Manager.

F. OTHER SEWER PIPE

Other sewer pipe material may be authorized only by special permission from Lincoln Wastewater.

G. MANHOLES AND APPURTENANCES

1. Concrete

Concrete used in the construction of manholes, concrete collars, and other incidental Work shall conform to the requirements of Chapter 3 of these Standard Specifications.

2. Brick

All brick shall be clean, hard-burned cored type brick having true shape and sharp edges for their whole length. Unless otherwise specified, all brick shall be new. Bats shall be used only to close joints and no bats smaller than a half brick shall be used. The brick shall meet all the requirements of "Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)" ASTM Designation C-216, Type FBA, Grade SW.

3. Iron Castings

Manhole covers and frames shall be iron castings which shall meet all the requirements of "Specifications for Gray Iron Castings", ASTM Designation A-48, Class 30. They shall in every respect conform to Lincoln Standard Plans. Dimensions as detailed on the Lincoln Standard Plans shall deviate by no more than plus or minus 1/16 inch. All frames and covers shall be furnished with horizontal bearing surfaces machined and fitted so as to prevent any rocking in the frame when installed. No casting will be accepted that is warped, cracked, that has swells, or that has been plugged or filled.

22.01 MATERIALS (Continued)

G. MANHOLES AND APPURTENANCES (Continued)

4. Mortar

Mortar used in the construction of manholes or other appurtenant structures shall be Type S as specified in "Standard Specification for Mortar for Unit Masonry" ASTM Designation C-270. Proportions of the mixture shall conform to either of the two following alternates:

<u>Alternate</u>	<u>Portland Cement</u>	<u>Masonry Cement</u>	<u>Hydrated Lime or Lime Putty</u>	<u>Aggregate Loose & Damp</u>
1	1/2	1	0	Not less than 2-1/4 nor more than 3 times the sum of the volume of the cements and lime used.
2	1	0	1/4-1/2	

5. Precast Manhole Sections, Risers, and Adjusting Rings

Precast concrete manhole sections and risers shall conform to the requirements of "Standard Specification for Precast Reinforced Concrete Manhole Sections" ASTM Designation C-478. Precast manhole base sections shall be manufactured using rubber gasket seals meeting the requirements of "Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals" ASTM Designation C-923. When adjusting manhole rim elevations less than 4 inches, the Contractor shall use brick masonry construction. When adjusting rim elevations more than 4 inches, the Contractor shall use precast concrete adjusting rings to bring the manhole cover and frame to proper grade. Precast concrete adjusting rings shall conform to "Standard Specification for Precast Reinforced Concrete Manhole Sections" ASTM Designation C-478.

6. Manhole Joints

Joints between precast manhole sections, risers, and adjusting rings shall be made using either mastic type gaskets or synthetic elastomer type gaskets. Mortar joints shall not be acceptable for manhole sections and risers. Mortar joints shall only be used in conjunction with adjusting rings and brick masonry Work in bringing manhole covers and frames to proper grade.

Mastic type gasket joints shall be K.T. Snyder "Ram-Nek", Hamilton-Kent "Kent Seal No. 2", Sheller-Globe "Tac-Tite", or equal. The size of mastic type gaskets shall be as recommended by the manhole manufacturer.

Synthetic elastomer type gasket joints shall meet the same Standard Specification set forth for reinforced concrete pipe in this chapter.

H. SEWER SERVICE PIPE

Sewer service pipe for new or reconstructed sanitary sewer services shall conform to the material requirements as provided in Title 24 of the Lincoln Municipal Code.

22.02 EXCAVATION AND BACKFILL

Trench excavation, backfill, pipe bedding, and pipe foundation materials and methods shall conform to Chapter 20 of these Standard Specifications, except as hereinafter modified for sanitary sewer construction.

Unless otherwise shown on the plans, modified by Special Provisions, or directed by the City's Project Manager, all plastic pipe shall be bedded with approved materials as per Lincoln Standard Plans.

22.03 CONNECTION TO EXISTING SEWERS

A. TAP MANHOLE AND REPLACE INVERT

The Contractor shall make all connections to existing sanitary sewers as shown on the plans. Existing manhole bottoms shall, if necessary, be reconstructed in substantially the same manner specified for new manhole bottoms. The manhole walls shall be reconstructed as directed by the City's Project Manager. No pipe less than 8 inches in diameter shall be tapped into the manhole.

B. CONNECTING DISSIMILAR PIPE

When any dissimilar pipes are joined together, a factory-made adaptor specifically made for the purpose of connecting sewer pipes of differing materials or outside diameters shall be used to make the connection, as provided by the manufacturer's recommendations or as directed by the City's Project Manager. Concrete collars may also be required to prevent lateral or vertical separation at the joint. Reinforced concrete collars shall conform to the Standard Plans.

Unless specifically designated on the Plans as Extra Work items for payment, factory-made adaptors, connectors, and concrete collars shall not be paid for separately. The cost of these items shall be considered subsidiary to the other items for which direct payment is made.

C. TEMPORARY SEWER PLUGGING REQUIREMENTS

The Contractor shall install plugs in the appropriate locations of all new sanitary sewers prior to, or during construction, and remove the plugs after construction using approved plugging methods and types to prevent any and all storm runoff, ground water and other foreign material from entering existing wastewater collection lines. Construction Work shall not proceed until the necessary plugging has been accomplished.

Prior to line acceptance testing, any and all water and other foreign material must be removed by the Contractor from the new lines by pumping or other means approved by the City's Project Manager.

The Contractor shall be responsible for checking each plug daily and, if maintenance is required, shall immediately take corrective action by repairing or replacing the plugs, as applicable to the situation.

Temporary plugging during construction shall not be measured or paid for separately but shall be considered subsidiary to the items for which direct payment is made.

22.03 CONNECTION TO EXISTING SEWERS (Continued)

D. MANHOLE REMOVAL AND ABANDONMENT

Where called for on the plans, the Contractor shall plug and abandon existing sewer pipes, and either completely remove existing manholes or fill and abandon existing manholes in place. Manholes to be removed shall be totally removed from the existing location and disposed of. The tops of manholes to be filled and abandoned shall be removed, and approved material shall be compacted in the abandoned manhole to the densities required in Chapter 20.

E. BASIS OF PAYMENT

Reconstructed manholes built in conformance with these Standard Specifications and accepted by the City's Project Manager shall be counted and paid for at the contract unit price bid per each for TAP EXISTING MANHOLE AND REPLACE INVERT, or for CONVERT EXISTING MANHOLE TO DROP MANHOLE. Such payment shall be full compensation for all excavation, backfill, materials, equipment, tools, labor and incidentals necessary to complete the Work.

Plugging of existing sewer pipes shall be considered subsidiary to other items of Work for which direct payment is made. REMOVE EXISTING SANITARY SEWER MANHOLE shall be counted and paid for at the contract unit price bid per each. FILL AND ABANDON EXISTING MANHOLE shall be counted and paid for at the contract unit price bid per each. Such payments shall be full compensation for all excavation, backfill, materials, equipment, tools, labor and incidentals necessary to complete the Work in accordance with these Standard Specifications and as accepted by the City's Project Manager.

22.04 ABANDONMENT OF SANITARY SEWER MAIN

A. GENERAL

When existing sanitary sewer mains are shown to be abandoned, the Contractor shall plug each end of the abandoned sanitary sewer main with concrete or as specified on the plans. Abandoned sanitary sewer mains shall be grout filled if required in the plans and Standard Specifications.

B. BASIS OF PAYMENT

ABANDONMENT OF SANITARY SEWER MAIN shall be measured and paid for at the contract unit price per lump sum. Such payment shall be full compensation for all labor, tools, materials, and incidentals necessary to complete the work in a manner acceptable to the City's Project Manager.

22.05 PIPE INSTALLATION

A. HAULING, DELIVERY AND STORAGE OF PIPES

The Contractor shall haul and deliver along the site all pipe, fittings, and appurtenant appliances. In all handling operations, care shall be exercised to avoid damage to the pipes and fittings.

All pipe shall be stored according to manufacturer's recommendation.

The Contractor shall use care when handling and moving pipe. Pipe shall be thoroughly inspected for cracks and other defects. Any pipe which, in the opinion of the City's Project Manager, has been damaged in any way shall be rejected and immediately removed from the job site.

B. LAYING THE PIPE

Only one type of pipe shall be used on each project unless specifically called for on the plans or authorized by the City's Project Manager. The laying of pipe in the finished trenches shall begin at the lowest point in the line with the spigot end laid in the direction of flow. Single pipe lengths shall be lowered into the trench in an approved manner. The pipes shall be laid to the lines and grades indicated on the plans. The line and grade of the pipe shall be controlled by methods approved by the City's Project Manager. The Contractor shall maintain the following tolerances from true alignment and grade:

Alignment	+/- 3 inches
Grade	+/- 1 inch

Sanitary sewer service wyes shall be located and constructed to the line and grade as indicated on the plans. Construction, marking, and plugging of service stub outs shall be in accordance with the City of Lincoln Standard Plans.

When flexible pipe is used, the Contractor shall construct and install the pipe in accordance with "Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe" ASTM Designation D 2321. Pipes should be set solidly on a firm, uniform bedding, being careful to prevent soil migration and loss of bottom and lateral support of trench boxes, so as to not disturb the pipe and the integrity of the pipe embedment zone already in place. Voids created by movement of trench boxes or supports shall be properly filled and compacted to densities specified herein. Care shall be taken in preventing excessive point loads on pipe during backfill operations.

All pipe bells shall be in bell holes excavated for this purpose. If the bottom of the trench should, for any reason, be excavated and finished too low, it shall be refilled to the proper point with crushed rock and thoroughly compacted by mechanical tamping, as specified in Chapter 20 of these Standard Specifications. Filling and ramming earth beneath the pipe to raise it to grade will not be permitted. Pipe shall be laid through the location where manholes are to be constructed.

C. JOINTING THE PIPE

1. General

Pipes shall be joined in an approved manner. Open ends of pipes and fittings shall be effectively sealed. When pipe laying is suspended for any reason, watertight bulkheads shall be placed at the end of the pipe.

22.05 PIPE INSTALLATION (Continued)

C. JOINTING THE PIPE (Continued)

2. Jointing Pipe

Gasketed joint pipe shall be joined in the following manner: All dirt, mud and foreign substances should be removed from the spigot and bell. Gaskets should be placed in proper position in the bell of the previously installed pipe. Lubricate gasket, bell and spigot ends with an approved lubricant. Home the pipe and check gasket with feeler gauge to ensure proper sealing. All pipe shall be joined per manufacturer's recommendations.

D. CURVILINEAR ALIGNMENT

Except where otherwise authorized by the City's Project Manager, the recommended manufacturer's guidelines concerning the minimum radius of sanitary sewer pipe shall be followed.

1. Where curvilinear alignment is required using PVC sanitary sewer pipe, the method of forming curves shall be by using uniform joint deflections not to exceed one degree (1°) per joint (unless indicated otherwise by manufacturer's information) and/or using factory-made three degree (3°) couplings in accordance with the table below. Bending of the pipe barrel to achieve curvilinear alignment shall not be permitted.

Pipe Size Inch	Laying Length	Minimum Radius, Feet	
		1° Jt. Defl. Alone	1° Jt. Defl. +3° Cpigs
8-15	6.25*	360	95
	12.5	720	170
	20	1150	255
18	6.25*	360	120
	12.5	720)	190
	19.5	1120	270
21, 24	6.25*	345	115
	12.5	690	185
	19.5	1120	270
27	5.75*	330	115
	11.5	660	180
	19	1090	265

*Half lengths cut and beveled in the field.

Straight sections of reinforced concrete sewer pipe may be installed on curves by opening the outside of the joints in accordance with this Standard Specification. Where reinforced concrete pipe is to be installed on radii smaller than those shown in this Standard Specification, radius or beveled pipe may be used with prior approval of the City's Project Manager. On curvilinear alignments only, 4 foot and 6 foot lengths of pipe may be used on shorter radii, rather than beveled or radius pipe, at the option of the Contractor.

Reinforced concrete sewer pipe shall have a maximum joint opening of not more than ½ inch.

22.05 PIPE INSTALLATION (Continued)**TABLE 22.05 A - MINIMUM RADIUS (FEET) FOR GIVEN
LAYING LENGTHS USING UNBEVELED PIPE**

Pipe Diameter (Inches)	4 Feet	6 Feet	7.5 Feet	12 Feet
18	184	276	345	552
21	212	318	397	636
24	240	360	450	720
27	268	402	502	804
30	296	444	555	888
33	324	486	607	972
36	352	528	660	1056
42	408	612	765	1224
48	464	696	870	1392
54	520	780	975	1560
60	576	864	1080	1728
66	632	948	1185	1896
71	688	1032	1290	2064
78	744	1116	1395	2232
84	800	1200	1500	2400
90	856	1284	1605	2568

E. BASIS OF PAYMENT

All pipe of the various types shall be measured and paid for at the contract unit price bid for each size per linear foot for SANITARY SEWER PIPE, ____". All pipe shall be measured (center to center) through manholes. Said payment shall be full compensation for all excavations, backfill, testing, materials, equipment, tools, labor and incidentals necessary to install the pipe in a workmanlike manner acceptable to the City's Project Manager. Special measurement and payment for all fittings and pipe materials necessary to achieve desired radius, including beveled or radius pipe, will not be considered. The extra costs, if any, shall be merged with and considered subsidiary to the cost of the various sizes of pipe called for in the plans and in the proposal.

SANITARY SEWER PLUG, ____" shall be measured and paid for at the contract unit price bid per each for each type and size of sanitary sewer plug. This price shall be full compensation for all excavations, backfill, testing, labor, materials, tools, equipment and incidentals necessary to complete each type and size of sanitary sewer plug in a manner acceptable to the City's Project Manager.

22.06 HIGHWAY, STREET, RAILROAD AND UTILITY CROSSINGS

Highway, street, railroad and utility crossings shall be constructed as indicated on the plans or as specified in the Special Provisions. The City will obtain the necessary permits. Encasements shall conform to Chapter 20 of these Standard Specifications.

In laying pressure type sewer pipe under a railroad track or over/under a water main, the center of a standard length of pipe shall be centered with the centerline of the rails or water main. (See Chapter 23)

22.07 SANITARY MANHOLE CONSTRUCTION

A. MANHOLE BOTTOM

The bottom of each manhole shall be constructed of concrete or precast concrete manhole base sections, as specified in Chapter 22 of these Standard Specifications. The manhole bottom and inverts shall be constructed as indicated in the plans. The pipe shall be adequately supported during the construction of the base.

When constructing a poured concrete manhole floor, manhole water stops shall be installed on all plastic pipes entering manhole walls. The water stop gasket shall be placed within 1 inch of the center of the manhole wall. The top of the poured manhole floor shall be as indicated on the LSP for type of sanitary manhole being constructed.

Place water stops according to manufacturers' recommendation.

Pipe shall be laid through manholes. The upper portion of the pipe shall be removed after other manhole construction is complete and all debris is removed from the manhole. Where plugs are required on pipe stubs, solvent weld caps shall be installed on all plastic pipe. Follow manufacture's recommendations for sealing cut sections of pipe.

Integral precast concrete manhole bottom sections are acceptable. If utilized, all pipe entrance and exit locations shall have water tight compression joints made of rubber which are integrally cast into manhole wall (A-loc or equal). The flexible joints shall meet "Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals" ASTM Designation C 923 for manufacture and meet performance and test requirements of "Standard Specification Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines" ASTM Designation C 969 or "Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure ASTM Designation C 1244. In no case, will the Contractor be allowed to construct pipe enter/exit points on new manholes by breaking out precast to the elevations and deflection angle as shown on the plans. Pipes shall not be laid through manholes when utilizing integral precast manhole base sections. Following placement of the manhole base section and insertion of pipes through manhole wall, the manhole floor and concrete fillet Work shall proceed as shown on the plans.

22.07 SANITARY MANHOLE CONSTRUCTION (Continued)

B. MANHOLE ADJUSTING RINGS

Precast concrete grade rings shall be used to adjust the manhole ring and cover to the required grade when the vertical adjustment is greater than 4 inches. At least one (1) 4 inch grade ring shall be used to allow for future adjustments. Approved mastic type gaskets shall be used to seal the joints between precast adjusting rings, the upper manhole riser, and the cast iron manhole frame (ring). The outside of the cast iron manhole frame shall be finished off with mortar as shown on the Standard Plans.

Brick adjusting rings are only to be used when the vertical adjustment of the ring and cover is less than what a standard precast adjusting ring can provide.

C. POURED CONCRETE MANHOLES

The Contractor shall construct concrete manholes in accordance with the Lincoln Standard Plans.

Reducing sections shall be eccentric, as indicated on the Standard Details. Cast-in-place concrete manholes shall be constructed as specified in Chapter 3. Forms shall have adequate bracing, be in good repair and of a manufacture approved by the City's Project Manager. Concrete shall be carefully placed and thoroughly consolidated to the greatest density possible. All holes, joints, or honeycombed sections shall be carefully filled and sealed with mortar.

D. PRECAST CONCRETE MANHOLE SECTIONS

Concrete manholes may also be constructed of precast sections. In the assembly of the wall sections, exercise care in the placement of gaskets to ensure watertight joints. Bottom precast sections shall be placed on top of a double ring of approved mastic type gaskets. All lift holes in precast sections shall be completely filled with an approved non-shrink grout

E. COLD WEATHER CONSTRUCTION

The Contractor shall take all reasonable precautions to protect all parts of the Work from damage due to freezing or as a result of winter weather conditions. The Contractor shall cover and protect all brick and concrete masonry and shall supply artificial heat, if necessary, in order that the temperature of such masonry Work shall not fall below 45° degrees F for a period of at least seventy two (72) hours after the structure has been constructed.

F. BASIS OF PAYMENT

Standard manholes and standard drop manholes shall be measured and paid for at the contract unit price bid per each for STANDARD MANHOLE, TYPE ___ and STANDARD DROP MANHOLE, TYPE ___. This price shall be full compensation for the cast iron ring and cover, the brick adjustment or precast grade rings when required, the manhole floor, and all labor, tools, equipment and incidentals necessary to install these items. Standard manholes and standard drop manholes shall also be measured from the flow line to the top of rim and paid for at the contract unit price bid per vertical foot for STANDARD MANHOLE, TYPE __ V.F. and STANDARD DROP MANHOLE, TYPE __ V.F. This payment shall be full compensation for all steps, eccentric manhole sections, manhole barrel sections, drop pipes, fittings, joints, labor, materials, tools, equipment and incidentals necessary to complete each type of manhole in a manner acceptable to the City's Project Manager.

22.08 SEWER SERVICES - CONSTRUCTION AND RECONSTRUCTION

A. GENERAL

Where shown on the plans or as directed by the City's Project Manager, sewer services shall be constructed or reconstructed as necessary. All Work by the Contractor on sewer service shall be performed as provided in Title 24 of the Lincoln Municipal Code (L.M.C.) and by the Lincoln Plumbing Code. These codes shall be strictly adhered to under all conditions.

All construction or reconstruction shall be made using materials approved by the Lincoln Municipal Code.

B. CONSTRUCTION OF SEWER SERVICES

Where called for on the plans, new sanitary sewer services shall be constructed under cul-de-sacs or other future paving. Generally the location will be from the location of the wye fitting, as shown on the plans, to a specified location on the right-of-way for adjacent properties. Wye fittings shall be of a type compatible with the sewer main pipe being laid.

C. RECONSTRUCTION OF SEWER SERVICES

Where called for on the plans or as directed by the City's Project Manager, sewer services shall be reconstructed to the location of the newly constructed sewer main or to raise, lower, or realign the service to avoid conflict with the utility being constructed.

Where the reconstructed line will lie within 18 inches vertically of the utility being constructed, the line shall be cast iron soil pipe, bell end spigot, service weight or heavier; ductile iron pipe, Class 52 with polyethylene encasement; Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) ASTM D-2241 PVC pipe, Class 160, with push-on gasketed joints. All other reconstructions shall be any of the approved materials. Replacement services shall be extended to the distance from the main required to provide positive slopes. Fittings of the same material as pipe being used may be required when extreme changes in elevations or alignments are necessary.

Where new taps are deemed necessary by the City's Project Manager, they shall be scheduled with, and made by, the Wastewater Collection Section of the Lincoln Wastewater System.

The Contractor shall obtain all necessary tapping permits required through City Building & Safety Department. Tapping saddles, taps, and plugs for abandonment will be supplied at no additional cost to the Contractor. The Contractor will be responsible for all excavation and backfilling and supply of all other materials and labor required.

Where possible, the City's Project Manager may direct that the sewer service pipe be bored under existing paving or other utilities or structures.

22.08 SEWER SERVICES - CONSTRUCTION AND RECONSTRUCTION (Continued)

D. BASIS OF PAYMENT

WYE, ___" x ___", shall be measured and paid for at the contract unit price bid per each for each size. This price shall be full compensation for all excavations, backfill, testing, labor, materials, tools, equipment and incidentals necessary to complete the Work in a manner acceptable to the City's Project Manager.

Measurement and payment will be made at the contract unit price bid per each for CONSTRUCT or RECONSTRUCT SEWER SERVICE. Such payment shall be full compensation for all labor, tapping permits, plumbing permit, fittings, and materials, except as otherwise provided, excavation for taps and abandonments, backfill for taps and abandonments, sod, equipment, tools and incidentals necessary to complete the reconstruction in a workmanlike manner, all as accepted by the City's Project Manager.

Measurement and payment will be made at the contract unit price bid per linear foot for SEWER SERVICE PIPE, ___". Such payment shall be full compensation for furnishing and installing all pipe materials, all labor, excavation, backfill, equipment, tools, collars or connecting devices, and incidentals necessary to place the pipe in service as accepted by the City's Project Manager.

Boring for sewer service pipe shall be measured and paid for at the contract unit price bid per linear foot for BORING FOR SEWER SERVICE PIPE. Such payment shall be full compensation for all labor, equipment, tools, and incidentals necessary to produce the bore hole ready to receive the sewer service pipe, as accepted by the City's Project Manager. The pipe to be placed in the bore hole shall be paid for as provided above.

22.09 TESTING

A. GENERAL

Line acceptance tests shall be required for each section of sanitary sewer constructed between manholes or junction structures. Line acceptance tests shall consist of hydrostatic or low pressure air testing for leakage; deflection testing for all plastic pipe; and internal television inspection. In addition, all PVC pipe furnished under the Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings ASTM F-679 reference shall be checked to ascertain that the pipe being furnished meets the acceptable T-1 minimum wall thickness requirements. Manholes and junction structures shall also be tested for acceptable performance as hereinafter provided. Except for said T-1 wall thickness checking, the tests specified below shall not be initiated until the related backfill is compacted in place; the line, manholes, and structures have been cleaned of all interfering debris; and suitable access for necessary testing equipment is provided.

The Contractor shall furnish all labor, tools, and equipment to perform all the tests specified hereinafter and only in the presence of the City's Project Manager or observer, except where such tests are specifically designated as being the responsibility of the City. The methods and the equipment used for the tests shall be approved by the City's Project Manager. No direct payment will be made for the testing required herein. The costs associated with the testing are to be considered subsidiary to the costs of the sewer lines and manholes.

Except for pipe replacement projects where existing services must be reconnected as the new replacement pipe is being laid, or as otherwise directed by the City's Project Manager, live wastewater flow shall not be permitted in the sanitary sewer line until all of the following tests are completed and found acceptable. With the City's Project Manager's approval, dry taps to the new line may be permitted prior to testing, provided that the service line stub outs are temporarily capped off in an air-tight manner.

B. LINE ACCEPTANCE TESTS

1. Hydrostatic Tests

The following hydrostatic test may be used to meet line leakage testing requirements, or, alternately, the Contractor may at his option substitute the low pressure air testing procedure specified below. For hydrostatic testing, the maximum acceptable leakage rate shall be 0.0016 gallons per hour per lineal foot per inch) diameter. The minimum head at the upper manhole or structure shall be 5 feet more than the groundwater level surrounding the pipe. The groundwater level shall be ascertained prior to testing by connecting a clear plastic tube to the pipe nipple installed as previously described in this chapter. The pipe nipple shall then be capped. The Contractor shall use a stand pipe not greater than 4 inches in diameter that is connected to a plug in the segment to be tested. The stand pipe shall be of sufficient length to maintain the proper test head. The test period shall be for a minimum of one (1) hour. If the leakage rate is in excess of the amount specified above, the Contractor shall make such repairs as are necessary and retest the line until these requirements are met.

The Contractor, at his option, may combine the above hydrostatic test with the exfiltration tests for the connecting manholes or structures specified hereinafter, provided that the highest test head and longest test time for the line segment and manholes in combination are met. If the combined leakage rate allowance is exceeded, the Contractor shall isolate the problem(s), make the necessary repairs, and retest the line segment and manholes separately or in combination until found acceptable.

22.09 TESTING (Continued)

B. LINE ACCEPTANCE TESTS (Continued)

2. Air Tests

Low pressure air testing may be used in lieu of hydrostatic testing specified above. The equipment shall be supplied with positive on/off valves and regulator relief valves set at no more than 8 psig for pressurizing the sewer line. The pressure gauge shall have a range of zero to ten psig, with 0.1 psig divisions and an accuracy of 0.05 psig. The pressure gauge shall have been calibrated and certified as to accuracy within the past year. The Contractor may be directed to obtain a suitable pressure gauge if for any reason the gauge on hand has questionable accuracy.

The test procedures required shall be as follows:

- a. Prior to testing, the backfill shall have been placed and compaction requirements fully met, and the line shall have been cleaned of all foreign matter.
- b. All equipment shall be checked for proper functioning prior to actual line testing. Use one (1) length of spare pipe laid on the ground; pressurize pneumatic plugs on each end to 25 psig; and internally pressurize the pipe to 5 psig. The plugs shall hold without bracing, and the line pressure gauge shall show no loss of air. Exercise proper safety precautions around the pressurized line in being prepared for possible blow out of the plugs.
- c. After all equipment has been inspected, proceed with actual line testing. Insert the pneumatic plugs at each end of the test segment; extend air lines to the top of the manhole; make sure no personnel remain in manholes; then carefully pressurize the plugs. Low pressure air shall be introduced into the sealed line until the internal pressure reaches 4 psig. Allow at least two (2) minutes for the air pressure to stabilize. Once the stabilization period has ended, reduce the internal pressure within the line segment to 3.5 psig. Disconnect the air supply to the control panel and begin testing. The portion of the line being tested shall be termed acceptable if the time required in minutes for the pressure to decrease 1 psig shall not be less than the time shown in the following table:

<u>Pipe Diameter (inches)</u>	<u>Minimum Time (minutes)</u>
6	2.8
8	3.8
10	4.7
12	5.7
15	7.1
18	8.5
21	9.9
24	11.3
27	12.7
30	14.2
36	17.0
42	19.8

22.09 TESTING (Continued)

B. LINE ACCEPTANCE TESTS (Continued)

2. Air Tests (Continued)

- d. When the presence of ground water is evident above the invert of the sewer line being tested, a pressure correction will be added to the 3.5 psig normal start test pressure. Under this condition, the air test pressure shall be increased 0.433 psig for each foot the groundwater level is above the invert of the pipe. All gauge pressures shall be increased by this amount. If the current prevailing groundwater is more than twenty seven (27) inches above the invert of the pipe, an infiltration or exfiltration test may be required by the City's Project Manager. Thus, internal air pressures should never exceed 5.0 psig.
- e. On sewers large enough to permit entry by personnel, the Contractor may air test individual joints using the same acceptance criteria as specified above, provided the equipment and procedures are first approved by the City's Project Manager.

3. Television Inspection

Internal television inspection of new sanitary sewers will be performed by the City on a cost per foot basis at no cost to the Contractor. The prevailing TV inspection cost can be obtained from the department of Public Works/Utilities Business Office. In most cases, television inspection will be scheduled no earlier than thirty (30) days after the installation of the pipe and shall be done at the same time and in conjunction with final deflection testing, as specified below, and after all line leakage and manhole exfiltration testing has been completed and found acceptable. Televised lines shall be termed 'acceptable' if no defects are found, such as open joints, breaks, cracks, excessive pipe deformation, intrusions, depositions and debris left in the line, or excessive vertical or horizontal misalignment. Follow-up TV inspection activities that may be required as a result of repairs to defective new sanitary sewers will be billed as an additional cost to the Contractor at the prevailing TV inspection rate.

4. Deflection Testing

Deflection tests shall be made on all pipe installed on the project. The Contractor is encouraged to perform his own preliminary deflection testing to screen out obvious defects prior to completing other Work that may later be disturbed by re-excavation to repair defects.

Final deflection testing shall not be done sooner than thirty (30) days after backfill has been compacted in place by the Contractor, unless the time limitation is expressly waived by the City's Project Manager. The maximum allowable deflection for any pipe shall be five percent (5%) of the base inside diameter of the pipe.

The mandrel shall be pulled through the test segment using a pulling force equivalent to hand power. The line shall be termed "acceptable" if, during final deflection testing, the mandrel passes completely through the line without restriction. In no case shall excessive force be applied in pulling the mandrel that may damage the pipe or that may erroneously indicate that deflection was within acceptable limits by temporarily expanding the pipe.

22.09 TESTING (Continued)

B. LINE ACCEPTANCE TESTS (Continued)

4. Deflection Testing (Continued)

If excessive deflection is indicated, the Contractor shall make necessary repairs at his own expense and the line retested until found acceptable. No additional time waiting period shall apply for retesting following repair of the line and proper recompaction of the backfill, unless otherwise directed by the City's Project Manager.

On any pipe size 8" to 15" the City will perform the mandrel test, at no cost to the Contractor.

On any pipe size greater than 15", it will be the responsibility of the Contractor to perform the mandrel test with City staff in observance.

C. MANHOLE PERFORMANCE TESTS

1. General

All manholes shall be constructed so as to be free from infiltration. The interior of the manhole shall be observed during the flushing operation for location of any deficiencies. The manhole shall also remain free from visible infiltration during the two-year period of guarantee. If any infiltration is observed during that period, the Contractor shall be required to make any necessary repairs.

2. Exfiltration Tests

Exfiltration tests shall be performed on all manholes and pipe junction structures, except where groundwater conditions do not permit proper test head levels to be achieved, as specified below. Test procedures shall be as follows:

- a. Insert pneumatic plugs in all lines entering and leaving the manhole. Extend air lines to the top of the manhole, and make sure all personnel are out of the manhole. Carefully pressurize each plug to 25 psig to seal each line.
- b. Fill the manhole to a level at least 5 feet above the groundwater level surrounding the manhole, or to an 8 foot depth, whichever is higher. Allow the water to stand until maximum absorption has been reached, then refill the manhole if necessary to its original depth. If the required test head would be higher than the bottom of the frame for the manhole cover, either the exfiltration test head shall be decreased or the test waived, at the discretion of the City's Project Manager.
- c. After the manhole has been refilled, the manhole exfiltration test shall begin and shall last for a period of at least four (4) hours. The manhole shall be considered "acceptable" if the equivalent rate of exfiltration (leakage) does not exceed 0.0016 gallons per hour per vertical foot of test head per inch diameter of the manhole. For convenience, the following table may be used to evaluate allowable leakage rate (for the cylindrical portion of the manhole only; for other structural shapes, adjust the maximum leakage rate and head drop on the basis of equivalent diameter for the same perimeter):

22.09 TESTING (Continued)

C. MANHOLE PERFORMANCE TESTS (Continued)

**TABLE 22.09 A - ALLOWABLE MANHOLE LEAKAGE
RATES FOR MANHOLE EXFILTRATION TEST**

Nominal Manhole Diameter inches	Manhole Volume gal. per VF	Maximum Leakage Rate gal./ VF / hr.*	Maximum 4-Hr. Head Drop* inches
4	94	0.08	0.30
5	147	0.10	0.25
6	211	0.12	0.20

*At 8 foot test head.

3. Vacuum Testing

Vacuum testing of manholes, when used, shall be performed on all manholes and pipe junction structures to conform to the requirements of Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test” ASTM Designation C 1244. Test procedures shall be as follows:

- a. All lift holes shall be plugged with an approved non-shrink grout.
- b. All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manhole.
- c. The test head shall be placed at the top of the manhole in accordance with the manufacturer’s recommendation. Top of the manhole is considered to be the top of the casting forming the manhole lid.
- d. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop 1 inch of mercury. The manhole shall pass if the time is greater than the time listed in the table on the preceding page for the depth and diameter of the manhole being tested.
- e. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

22.09 TESTING (Continued)

C. MANHOLE PERFORMANCE TESTS (Continued)

3. Vacuum Testing (Continued)

TABLE 22.09 B - MINIMUM TEST TIMES FOR VARIOUS MANHOLE DIAMETERS

Manhole Depth (feet)	Manhole Diameter (inches)								
	30	33	36	42	48	54	60	66	72
	Time (seconds)								
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	29	34	40	46	52	56	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	64	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

22.10 SUBSTANTIAL COMPLETION

Sanitary sewer Work shall be considered substantially complete when all pipe is laid and backfilled; all manholes are complete and backfilled; leakage testing for all pipe and manholes is complete and accepted; paving, sidewalks, and driveways are replaced; and final clean up and park space are finished.

22.11 FINAL ACCEPTANCE

The project shall be considered eligible for final acceptance by the City when all required Work is complete and accepted by the City's Project Manager, including internal television inspection, mandrel testing of all plastic pipe, all items on plan completed, and correction of all deficiencies found as a result of testing and/or final inspection by the City's Project Manager. Eligibility for final acceptance shall not be delayed for more than sixty (60) calendar days past the date of substantial completion on account of the City's failure to complete internal television inspection and mandrel testing of plastic pipe because of equipment problems, scheduling conflicts, or other unforeseen circumstances attributable to the City's own responsibilities and actions.

22.12 GUARANTEE

At any time during the two year guarantee period, and within the time period allowed, the Contractor shall correct any defect in material or workmanship which has been brought to his attention. Such items shall include but not be limited to trench settlement including subsequent pavement damage, pipe leaks, and failures.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 23

WATER MAINS

ARTICLE	TITLE	
23.00	GENERAL	2302
23.01	MATERIALS PURCHASED FROM THE CITY	2302
23.02	CONSTRUCTION SERVICES PURCHASED FROM THE CITY	2302
23.03	CONTRACTOR SUPPLIED MATERIALS	2302
	A. REFERENCED STANDARDS	2302
	B. JOINT TYPES	2303
	C. GASKET MATERIAL	2305
	D. JOINT LUBRICANTS	2305
	E. DUCTILE IRON PIPE	2305
	F. PRESTRESSED CONCRETE CYLINDER PIPE	2305
	G. POLYVINYL CHLORIDE (PVC) PIPE	2306
	H. CAST IRON AND DUCTILE IRON FITTINGS	2306
	I. ANCHORING COUPLINGS AND FITTINGS	2306
	J. RESTRAINT COLLARS FOR VALVES AND REDUCERS	2306
	K. POLYETHYLENE ENCASEMENT	2306
	L. COPPER SERVICE PIPE	2307
	M. SERVICE PIPE CONNECTORS	2307
	N. HYDRANT DRAIN MATERIAL	2307
	O. AIR RELIEF VALVES	2308
	P. TRACER WIRE	2308
23.04	REMOVED MATERIALS	2308
	A. GENERAL	2308
	B. BASIS OF PAYMENT	2308
23.05	HANDLING AND STORAGE	2309
23.06	EXCAVATION AND BACKFILL	2309
23.07	INSTALLATION OF PIPE AND FITTINGS	2310
	A. GENERAL	2310
	B. CUTTING PIPE	2310
	C. PREVENTING CONTAMINATION	2310
	D. UTILITY CONFLICTS	2311
	E. CAST IN-PLACE THRUST RESTRAINTS	2311
	F. TRACER WIRE	2312
	G. JOINTING PIPES	2312
	H. POLYETHYLENE ENCASEMENT	2314
	I. WATER MAIN SHUTDOWNS	2315
	J. BASIS OF PAYMENT	2315
23.08	INSTALLATION OF VALVES AND HYDRANTS	2316
	A. GENERAL	2316
	B. BASIS OF PAYMENT	2317

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 23

WATER MAINS

ARTICLE	TITLE	
23.09	TEMPORARY HYDRANTS AND BLOW-OFF FOR FLUSHING AND DISINFECTION	2318
	A. GENERAL	2318
	B. BASIS OF PAYMENT	2318
23.10	WATER SERVICE CONSTRUCTION OR RECONSTRUCTION	2318
	A. GENERAL	2318
	B. BASIS OF PAYMENT	2319
23.11	ABANDONMENT OF WATER MAIN	2320
	A. GENERAL	2320
	B. BASIS OF PAYMENT	2320
23.12	HIGHWAY, STREET AND RAILROAD CROSSING	2320
23.13	TESTING	2321
23.14	DISINFECTION OF THE COMPLETED WORK	2322
23.15	COLD WEATHER CONSTRUCTION	2322
23.16	SUBSTANTIAL COMPLETION	2322
23.17	FINAL COMPLETION AND ACCEPTANCE	2322
23.18	GUARANTEE	2322
TABLE	TITLE	
23.03 A	WEDGE REQUIREMENTS FOR RETAINER GLANDS	2304
23.03 B	POLYETHYLENE ENCASEMENTS	2307
23.03 C	HYDRANT DRAIN MATERIAL GRADATIONS	2307
23.05 A	DUCTILE IRON PIPE STORAGE	2309
23.07 A	MAXIMUM JOINT DEFLECTIONS	2313
23.07 B	MAXIMUM JOINT OPENINGS	2313
23.13 A	WATER MAIN PRESSURE TESTING	2321

CHAPTER 23

WATER MAINS

23.00 GENERAL

The Work covered in this chapter includes the materials, appurtenant devices, water services, installation and testing of water main construction and reconstruction.

23.01 MATERIALS PURCHASED FROM THE CITY

The Contractor shall purchase the following materials from the Lincoln Water System:

- Valves
- Valve boxes, rings and lids
- Fire hydrants

The above materials are available for inspection at the Lincoln Water System Service Center. The Contractor shall provide all labor and transportation for loading and hauling of said materials.

Water will be supplied to the Contractor in accordance with the General Conditions and Title 17 of the Lincoln Municipal Code.

All materials shall be billed to the Contractor at prices and rates established by the Public Works and Utilities Business Office. Contractors may obtain the current material prices from the Public Works and Utilities Business Office.

23.02 CONSTRUCTION SERVICES PURCHASED FROM THE CITY

The Contractor shall purchase the following services from the Lincoln Water System:

- Flushing and disinfection services and materials
- Water main tapping and abandonments
- Water main shutdowns
- Installation of hydrant extensions

All services shall be billed to the Contractor at prices and rates established by the Public Works and Utilities Business Office.

23.03 CONTRACTOR SUPPLIED MATERIALS

A. REFERENCED STANDARDS

1. American National Standards Institute (ANSI). American Water Works Association (AWWA). All referenced standards shall be the latest revision thereof
 - a. ANSI/AWWA C104/A21.4 - Cement-Mortar Lining for Ductile Iron Pipe and Fittings
 - b. ANSI/AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems
 - c. ANSI/AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings
 - d. ANSI/AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

23.03 CONTRACTOR SUPPLIED MATERIALS (Continued)

A. REFERENCED STANDARDS (Continued)

- e. ANSI/AWWA C115/A21.15 - Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
 - f. ANSI/AWWA C151/A21.51 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast for Water
 - g. ANSI/AWWA C153/A21.53 - Ductile-Iron Compact Fittings for Water Service
 - h. ANSI/AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type
 - i. ANSI/AWWA C651 - Disinfecting Water Mains
 - j. ANSI/AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch thru 12 inch for Water Transmission and Distribution
 - k. ANSI/AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inch thru 48 inch for Water Transmission and Distribution
 - l. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
- 2. American Society for Testing and Materials (ASTM)
 - a. A615 - Specifications for Deformed and Plain Billet-Steel.
 - b. A617 - Specifications for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.
 - c. B88 - Specification for Seamless Copper Water Tube
 - 3. Material and Construction Trade Standards
 - a. Ductile Iron Pipe Research Association, Polyethylene Encasement Installation Guide
 - b. Uni-Bell PVC Pipe Association, Installation Guide for PVC Pressure Pipe

B. JOINT TYPES

- 1. Push-on joints shall conform to the requirements of ANSI/AWWA C111/A21.11 for ductile iron pipe and “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe ASTM F477 for Polyvinyl Chloride Pipe.”
- 2. Mechanical joints shall conform to the requirements of ANSI/AWWA C111/A21.11. Bolts and nuts for mechanical joints shall be high-strength, low alloy steel as described in Paragraph 11-6.5 of ANSI A21.11.
- 3. Restrained push-on joints shall conform to the performance requirements as described in Section 11.9 of ANSI A21.11.

23.03 CONTRACTOR SUPPLIED MATERIALS (Continued)

B. JOINT TYPES (Continued)

4. Special mechanical joints shall conform to the following:

- a. Swivel couplings (anchoring couplings) shall mean a standard plain end connection with an integrally cast compression gland and freely rotating bolt ring bearing on the compression gland, designed to mate with a standard mechanical joint connection and to prevent the joint from separating under pressure when all bolts are in place. Swivel couplings shall be similar to Tyler Pipe swivel adapter or U.S. Pipe rotatable mechanical joint gland. The rotatable bolt ring portion of swivel couplings shall be fabricated from ductile iron and shall have the letters "D.I." or the words "Ductile Iron" cast in the bolt ring.
- b. Solid couplings shall mean a standard plain end connection with an integrally cast compression gland and bolt ring, designed to mate with a standard MJ bell and gasket. Solid couplings shall be similar to Tyler Pipe solid gland or U.S. Pipe integral mechanical joint gland.
- c. All retainer glands shall utilize a wedge action principle to fully restrain the fitting and pipe together. Wedge action retainer glands shall be EBAA Iron Sales "Megalug", Tyle Pipe MJR Gland, Romac Industries GripRing, or approved equal. Retainer glands shall be fabricated from ductile iron and shall have the letters "DI" or the words "Ductile Iron" cast into the gland.

Retainer glands shall be supplied clearly tagged or otherwise marked for use with either PVC or Ductile Iron pipe depending on the pipe material being used.

Retainer glands shall use the following minimum number of wedges for each pipe size and pipe material shown below:

TABLE 23.03 A – WEDGE REQUIREMENTS FOR RETAINER GLANDS

Nominal Pipe Size (inches)	Minimum wedges per gland PVC Pipe	Minimum wedges per gland Ductile Iron Pipe
6	6	3
8	6	4
12	8	8
16	12	12
24	16	16

5. Flange connections shall conform to the requirements of ANSI B16.1 for 125-pound class and shall also conform to ANSI/AWWA C115/A21.15. The flange gaskets shall be 1/8 inch thick red rubber. The gasket shall be of the full face or inside bolt ring coverage styles. Bolts shall be sufficient length to expose 1/4 to 1/2 inch of the bolt beyond the outer face of the nut when the joint is fully assembled.

23.03 CONTRACTOR SUPPLIED MATERIALS (Continued)

B. JOINT TYPES (Continued)

6. Precast concrete cylinder pipe joints shall conform to AWWA C301. The joint rings shall be galvanized steel. The external joint filler material shall be cement impregnated polyurethane foam in a closed loop form equal to Mar Mac Flex-Protex or shall be a cement mortar grout composed of one (1) part Portland or mortar cement to two (2) parts sand and sufficient water to flow easily. Joint diapers shall be heavy-duty cotton with wire or steel straps in the hem. Diapers shall be a minimum of 6 inches wide for all pipes 36 inches in diameter or smaller. All diapers for pipes larger than 36 inches shall be a minimum of 7 inches wide.

C. GASKET MATERIAL

All gaskets, with the exception of gaskets for flanged joints, shall be neoprene or other synthetic rubber. Natural rubber gaskets are not acceptable.

D. JOINT LUBRICANTS

All joint lubricants shall be a vegetable soap base or equal and shall be supplied by the pipe manufacturer. Lubricants shall be supplied in sterile, tightly sealed, small quantity containers. Any lubricant which has been contaminated with dirt or other foreign material shall be rejected.

E. DUCTILE IRON PIPE

Ductile iron pipe shall conform to the requirements of ANSI/AWWA C151/A21.51. All pipe shall be Class 52 unless otherwise specified. The cement mortar lining shall be standard weight and shall conform to the requirements of ANSI/AWWA C104/A21.4. Unless otherwise specified, all pipe shall be supplied in 18 or 20 foot lengths and shall have push-on type joints.

F. PRESTRESSED CONCRETE CYLINDER PIPE

Prestressed concrete cylinder pipe shall be manufactured in accordance with AWWA C301 and shall be designed in accordance with Appendix A or Appendix B of that Specification. Pressures and external loads used in design shall be as specified elsewhere in the Contract Documents.

The Contractor shall supply the following information for approval prior to delivery of the pipe and appurtenances:

1. Design Calculations
2. Proof of Design Test Results
3. Tabulated Layout Schedule
4. Affidavit of Compliance

Fine aggregate shall be clean natural sand. Artificial or manufactured sand shall not be used.

All branch outlets and other connections shall be of the joint type shown on the plans. Where projects are terminated without connecting to existing pipe, a mechanical joint bell adapter and mechanical joint plug shall be provided.

Adapter section shall be provided to connect to valves, fittings and existing pipe. All adapters, fittings and other specials shall be cement mortar lined.

23.03 CONTRACTOR SUPPLIED MATERIALS (Continued)

G. POLYVINYL CHLORIDE (PVC) PIPE

Polyvinyl Chloride (PVC) pipe shall conform to AWWA C900 or C905. All pipe 12 inches in diameter or smaller shall be PVC 1120 DR 14 with O.D. conforming to that of cast iron pipe unless otherwise specified. PVC pipe larger than 12 inches in diameter shall be PVC 1120 DR 18 conforming to that of cast iron pipe unless otherwise specified. Joints shall be push-on type with rubber compression ring joints conforming to "Standard Specification for Elastomeric Seals (Gaskets) for Joint Plastic Pipe" ASTM F477.

H. CAST IRON AND DUCTILE IRON FITTINGS

Cast iron and ductile iron fittings shall conform to the requirements of ANSI/AWWA C110/A21.10 and shall be supplied with a standard weight cement mortar lining conforming to ANSI/AWWA C104/A21.4 and all necessary glands, bolts, nuts and gaskets to complete a non-restrained mechanical joint fitting connection. Ductile iron compact fittings shall be in accordance with ANSI/AWWA C153/A.21.53. All joints shall be mechanical joint bells unless otherwise provided in the Contract Documents.

Pressure ratings for fittings shall be a minimum of 250 p.s.i. water working pressure for 12 inch nominal diameter and smaller, based on the diameter of the largest bell. For fittings larger than 12 inch nominal diameter, a pressure rating of 150 p.s.i. shall be used unless otherwise specified.

I. ANCHORING COUPLINGS AND FITTINGS

Anchor couplings shall consist of a length of pipe with a solid coupling end connection and a swivel coupling end connection. Anchor couplings shall be similar to Tyler Pipe adapter swivel fittings or U.S. Pipe hydrant connection pieces.

Anchor elbows shall consist of nine (90) degree elbow with two (2) swivel couplings, Anchor elbows shall be similar to the Tyler Pipe Swivel x Swivel 90 degree ELL swivel fittings.

Anchor pipe shall consist of a length of pipe with two (2) swivel coupling end connections.

Swivel tees shall be cast to the requirements of ANSI A21.10 with mechanical joint run end connection and a swivel coupling on the branch connection. Swivel tees shall be similar to Tyler Pipe MJ x MJ x swivel tees or U.S. Pipe valve and hydrant tees.

J. RESTRAINT COLLARS FOR VALVES AND REDUCERS

Restraint collars for valves and reducers when using PVC for water main construction shall be supplied and constructed in accordance to the applicable Lincoln Standard Plans or contract Special Provisions. Restraint collars for valves and reducers shall be considered subsidiary to PVC Water Main construction and are not measured or paid for as a separate fitting for purposes of this chapter.

K. POLYETHYLENE ENCASEMENT

Polyethylene encasement shall be Class C, black pigmented, 8 mils. thick, linear low density, polyethylene conforming to the requirements of ANSI/AWWA C105/A21.5. The encasement may be supplied in flat sheets or tubes at the Contractor's option. Tape used to repair or patch the encasement shall be manufactured from synthetic materials. Duct tape shall not be used for repairs. The tubes, measured when laid flat, and the flat sheets shall conform to TABLE 23.03 B – POLYETHYLENE ENCASEMENTS.

23.03 CONTRACTOR SUPPLIED MATERIALS (Continued)**K. POLYETHYLENE ENCASEMENT (Continued)****TABLE 23.03 B – POLYETHYLENE ENCASEMENTS**

Nominal Pipe Diameter (inches)	Polyethylene Encasement Tube and Sheet Widths (inches)	
	Tube	Sheet
6	20	40
8	24	48
2	30	60
16	37	74
24	54	108
30	67	134
36	81	162
48	108	216
54	121	242

L. COPPER SERVICE PIPE

Copper water service pipe shall be Type "K" seamless soft-drawn copper tubing which conforms to the "Specifications for Seamless Copper Water Tube", ASTM Designation B 88.

M. SERVICE PIPE CONNECTORS

All copper service pipe connectors shall be fabricated from red brass. All copper supply and service pipe shall be joined by either flared-end connectors or brazed, non-lead, eutectic joints.

N. HYDRANT DRAIN MATERIAL

Hydrant drain material shall be clean, washed, hard, durable, uncoated and uniformly graded Class "A" gravel as specified by the Nebraska Department of Roads. Gradation shall be as follows:

TABLE 23.03 C – HYDRANT DRAIN MATERIAL GRADATIONS

Sieve Size	% Passing
5/8"	100
1/2"	96.5
3/8"	92.8
#4	71
#10	16
#30	1.9
#200	0

23.03 CONTRACTOR SUPPLIED MATERIALS (Continued)

O. AIR RELIEF VALVES

Air relief valves shall be provided by the Contractor to conform to the size, type and configuration shown on the plans.

P. TRACER WIRE

All PVC water mains owned by the City of Lincoln shall be installed with a locator wire attached. The wire shall be direct bury 12 AWG solid steel core, copper clad wire with 30 mil, blue, HDPE insulator. Wire shall have a 30 volt rating with a minimum tensile break force of 380 pounds. Approved manufacturer shall be Copperhead Industries, or equal. The wire shall be installed with as few splices as possible. Splices shall utilize end to end **3M DBR** connectors, sealed with silicone sealant, aqua seal, or equal and covered with Scotch #33 electrical tape.

23.04 REMOVED MATERIALS

A. GENERAL

When called for on the plans and Contract Documents, the Contractor shall remove water main pipe and dispose of it.

When called for on the plans, the Contractor shall remove and reset water main valves, hydrants, and plugs at the location and grade as indicated on the plans. The Contractor shall exercise care in the removal and resetting of these items. The Contractor shall thoroughly examine each appurtenance to ascertain whether it is in proper working condition; and if there is a question regarding the condition of the appurtenance, the Contractor shall contact the Lincoln Water System to exchange the item for one that is working.

When called for on the plans and Contract Documents, water main valves, hydrants, and plugs shall be removed and salvaged. The Contractor shall deliver the salvaged appurtenances to the Lincoln Water System Shop. Receipts for salvaged materials shall be delivered to the City's Project Manager.

B. BASIS OF PAYMENT

Water main pipe removed in accordance with these Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per linear foot for REMOVE WATER MAIN. Such payment shall be full compensation for all excavation, removal, backfill, disposal of excess materials, equipment, tools, labor and incidentals necessary to perform the Work called for.

Water main valves, hydrants and plugs removed and relayed, removed and salvaged, or removed in accordance with these Specifications and accepted by the City's Project Manager shall be measured and paid for at the contract unit price bid per each for REMOVE AND SALVAGE _____, REMOVE AND RESET _____, or REMOVE _____. Such payment shall be full compensation for all excavation, removal of appurtenances and thrust blocking, bedding or foundation rock if required, resetting, loading of salvaged items, resetting valve box, backfill, materials, equipment, tools, labor and incidentals necessary to perform the Work.

23.05 HANDLING AND STORAGE

The Contractor shall protect all material from damage and handle material carefully in accordance with the manufacturer's recommendations. Equipment used to handle material such as slings, lifting lugs, hooks and other devices shall be designed to protect pipe, coatings, linings, joint elements, castings, valves, hydrants, and all other material.

Gaskets shall be protected from deterioration and stored out of direct sunlight for prolonged periods and in such a manner that they will not contact oils, fumes, solvents, and other materials and substances that attack rubber or synthetic rubber materials.

All hydrants and valves shall be protected so that latent water within the valves or hydrants will not freeze. The hydrants and valves shall be stored in such a manner that water will not enter drains and other openings. All butterfly valves shall be stored indoors. All resilient seated wedge valves shall be stored indoors or with the wedge in a raised position. All pipe, fittings, valves and hydrants shall be kept clean and protected from contamination by mud and dirt.

Prestressed concrete cylinder pipe shall not be stacked higher than allowed by the manufacturer's recommendations. PVC pipe shall not be stacked higher than 8 feet or in accordance with manufacturer's recommendations whichever is less. Ductile iron pipe shall not be stacked higher than allowed in TABLE 23.05 A – DUCTILE IRON PIPE STORAGE.

TABLE 23.05 A – DUCTILE IRON PIPE STORAGE

Pipe Size (inches)	Maximum Number of Tiers
6	13
8	11
12	9
16	7
24	5
30	4
36	4

No direct measurement or payment for storage and handling of materials used in the construction of water mains will be made. The costs associated with the materials to be incorporated into the Work shall be considered subsidiary to the items for which direct payment is made.

23.06 EXCAVATION AND BACKFILL

Excavation and backfill for water mains and appurtenances shall conform to the requirements of Chapter 20 of these Specifications except as hereinafter modified for water main construction. Unless otherwise shown on the plans, modified by Special Provisions, or directed by the City's Project Manager, all PVC pipe shall be embedded with approved materials to at least 6 inches above the top of the pipe.

23.07 INSTALLATION OF PIPE AND FITTINGS

A. GENERAL

The Contractor shall use the proper tools and equipment necessary to safely install all pipe, fittings and appurtenances to the lines and grades as shown on the plans. Installation of pipe and fittings shall be in accordance to manufacturer's requirements and instructions except where otherwise provided in the specifications. Prior to beginning Work, the Contractor shall submit to the City's Project Manager a copy of the manufacturer's installation instructions for review and approval. The Contractor shall retain a copy of the installation instruction at the project site for reference during construction.

B. CUTTING PIPE

1. Ductile Iron Pipe

When nonstandard lengths of pipe are required to install valve and fittings, terminate lines, or make connections, the Contractor shall cut the pipe using an abrasive wheel, milling type cutter, or other approved mechanical cutter. Torch cutting shall be used only with specific permission of the City's Project Manager and then only in strict conformance with the manufacturer's recommendations. After cutting, the Contractor shall bevel the ends of the pipe to approximate the manufactured bevel of a full length of pipe. Pipe which is not cut square or which has rough and jagged edges that might nick or cut gaskets shall be reworked to the approval of the City's Project Manager.

2. Prestressed Concrete Cylinder Pipe

No cutting of prestressed cylinder pipe will be allowed. All pipe which does not fit or close shall be rejected and the rejected pipe removed from the job site.

3. PVC Pipe

PVC pipe shall be cut using carpenter, hack saws or abrasive wheel. Care shall be taken to make all cuts square and perpendicular to the longitudinal axis of the pipe. After cutting, the Contractor shall bevel the ends of the pipe to approximate the manufactured bevel of a full length of pipe. Pipe which is not cut square or which has rough and jagged edges that might nick or cut gaskets shall be reworked to the approval of the City's Project Manager. When twelve (12) inch butterfly valves are called for on the plans for PVC pipe, the pipe ends shall be chamfered on the inside radius as detailed in the Lincoln Standard Plans so that the valve operates to a fully closed position.

C. PREVENTING CONTAMINATION

Existing valves and valves connecting the existing system to the new construction shall be operated only by the Lincoln Water System; except that the Contractor may operate those valves to fill the new mains for testing, only after notification of Lincoln Water System personnel.

The Contractor shall keep the pipe and appurtenances clean and free from tools, rags, dirt, mud, non-potable water, and other foreign materials and objects at all times during installation. If pipe laying is stopped or delayed for any reason, the Contractor shall seal the open ends of all pipes. Seals shall be capable of preventing the entry of water and other foreign material with the excavation completely full of water.

23.07 INSTALLATION OF PIPE AND FITTINGS (Continued)

C. PREVENTING CONTAMINATION (Continued)

All pipes shall be jointed immediately after placement in the excavation. Bell-ends of pipe shall face in the direction of laying. The Contractor shall ensure that the pipe is not displaced after it is laid to the proper line and grade; and should the pipe become displaced the Contractor shall relay the pipe to the proper line and grade at no additional cost or expense to the City.

D. UTILITY CONFLICTS

Where unforeseen conflicts between the water construction and existing utilities are discovered, the Contractor shall immediately notify the City's Project Manager. Where the water main is to be constructed below or within 18 inches of a storm sewer pipe, the Contractor shall lay a full length of water main pipe centered on the sewer or such length as will provide the maximum possible separation of the joints in the water main from the sewer line. The Contractor shall also reconstruct any sanitary sewer with one (1) 20 foot length of C900 pressure pipe or equivalent, such that the maximum possible separation between the water main and the sewer pipe joints will result. The backfill material shall be select, low-permeability soil.

Where the water main is located below a sanitary sewer pipe, to prevent the possibility of contaminated wastewater reaching the potable water main, the entire space between the top of the water main up to the spring line (half way) of the sanitary sewer shall be back-filled with flowable fill. No granular fill shall be used. The extent along the water main shall be the entire length of pipe and fittings at the bottom of the excavation, and the extent along the sewer shall be to undisturbed earth. This flowable backfill shall be subsidiary to other items of work for which direct payment is made.

Where existing water mains are to be looped around another utility, the Contractor shall plan his Work so that disruptions to water service are minimized. The Contractor shall provide adequate personnel, equipment and materials necessary to complete the Work as quickly as possible. All necessary materials shall be on site, and where ever possible, the Contractor shall preassemble the entire looping configuration, including bends or offsets and restraint devices, before the water main will be scheduled for shutdown by Lincoln Water System. Service fees charged by the Lincoln Water System shall be considered subsidiary to the cost of looping the water main in the event of a utility conflict. Additional fees for extended shutdowns shall not be cause for additional compensation to the Contractor.

E. CAST IN-PLACE THRUST RESTRAINTS

The Contractor shall construct concrete thrust blocks conforming to the requirements of the Lincoln Standard Plans at all locations shown on the plans or indicated by the City's Project Manager. All thrust blocks shall be placed so that pipe and fitting joints will be accessible for repairs. The bearing face of all thrust blocks shall rest against undisturbed soil. When the existing water mains must be reconstructed or looped, the Contractor shall restrain all fittings with ductile iron retainer glands installed in accordance with the manufacturer's recommendations in addition to concrete thrust blocks, anchorages and/or gravity blocks.

Gravity block straps of the size and type specified in the Lincoln Standard Plans shall be State Steel type M1020, or equivalent, low carbon, low manganese, general purpose, merchant quality stainless steel that is suitable for forming and welding. All strap material not embedded in concrete shall be covered with polywrap or tape prior to backfilling.

23.07 INSTALLATION OF PIPE AND FITTINGS (Continued)

F. TRACER WIRE

The Contractor shall install tracer wire (as per 23.03 P) directly to the top of the pipe between the 10 o'clock and 2 o'clock positions, with PVC pipe only. Tracer wire shall be secured to the main every five (5) feet with tape patches and shall be secured so that some slack can be taken out of the wire for valve and tap installations. Tracer wire shall be extended to the ground surface and terminated in accordance with the Standard Plans using a coil of excess wire at least eighteen (18) inches in length inside the termination box. For line valves and hydrant branch valves (branch less than ten feet) the tracer wire shall be attached to the exterior of the valve box and inserted into the valve box eight (8) inches from the top of the box through a field drilled ½" hole. For hydrant branch valves (branch greater than ten feet) the tracer wire shall be placed in a VALVCO termination box placed at grade next to the street side of the hydrant and attached to the termination screws. VALVCO termination box shall be complete with factory lid stamped as "WATER". Tracer wire shall be installed with as few splices as possible. No bare wire shall be exposed, with the exception of one (1) inch of wire to be stripped at the access loop for contact with tracing equipment. The two ends of the wire shall be knotted to prevent strain on the splice. Branch connections shall be made without cutting the main wire utilizing a connection clip and sealing the joint the same as splices. Tracer wires shall be tested by the Contractor for continuity after backfilling with a wire continuity tracing device. All wires failing to provide positive continuity for signal transmission shall be repaired or replaced at the Contractor's expense. After testing the ends, all tracer wires shall be sealed with heat shrink tape. Installation and testing of tracer wire shall be considered subsidiary to the installation of PVC pipe.

G. JOINTING PIPES

1. General

All bells, gaskets, lubricants and appurtenances shall be kept clean. Gaskets shall be of the proper style for the pipe being laid. Joints shall be deflected after assembly.

2. Ductile Iron Pipe

Bell ends shall be protected during joining by approved methods.

Maximum pipe joint deflections for push-on and mechanical jointed pipe shall conform to TABLE 23.07 A – MAXIMUM JOINT DEFLECTIONS.

3. PVC Pipe

PVC pipe shall be joined by inserting the spigot end of the pipe into the bell no further than marked by the manufacturer. Insertion on the PVC pipe further than the manufacturer's mark shall require reassembly. PVC pipe shall be installed in strict conformance to the manufacturer's requirements and instruction except that in no case shall PVC pipe be installed by bending the pipe. Bell ends shall be protected during joining by approved methods.

23.07 INSTALLATION OF PIPE AND FITTINGS (Continued)

G. JOINTING PIPES (Continued)

4. Mechanical Joints

Mechanical joints shall be assembled in strict conformance with the manufacturer's instructions and recommendations. Bolts on opposite sides of the joint shall be drawn up evenly to ensure even pressure around the gland and gasket. The Contractor shall tighten all retainer gland screw wedges according to manufacturer's recommendations for each type of retainer gland and pipe material. Prior to final tightening, the Contractor shall make any necessary deflections. Deflections for ductile iron pipe shall not exceed those shown in TABLE 23.07 A – MAXIMUM JOINT DEFLECTIONS.

TABLE 23.07 A – MAXIMUM JOINT DEFLECTIONS

Pipe Diameter (Inches)	Push-on Joints			Mechanical Joints		
	Deflection Angle (Degrees)	Maximum Offset (inches)	Minimum Curve Radius (feet)	Deflection Angle (Degrees)	Maximum Offset (inches)	Minimum Curve Radius (feet)
6	4° 00'	17.0	285	4° 00'	17.0	285
8	4° 00'	17.0	285	4° 00'	17.0	285
12	4° 00'	9.5	285	4° 00'	9.5	285
16	2° 24'	9.5	475	2° 24'	9.5	475
24	2° 24'	9.5	475	2° 24'	9.5	475
30	2° 24'	9.5	475	2° 24'	9.5	475
36	2° 24'	9.5	475	2° 24'	9.5	475
48	1° 36'	6.5	715	1° 36'	6.5	715
54	1° 12'	5.0	955	1° 12'	5.0	955

5. Prestressed Concrete Cylinder Pipe Joints

The Contractor shall make all joints in prestressed concrete cylinder pipe in strict conformance with the manufacturer's instructions and recommendations. After placing the gasket on the spigot end of the pipe, the Contractor shall run a smooth round steel rod between the gasket and the spigot for one complete turn around the pipe and repeat in the opposite direction to ensure uniform stretching of the gasket.

After seating but prior to homing the pipe, the Contractor shall check the gasket for proper location using feeler gauges. Gaskets for pipes larger than 24 inches in diameter shall be checked from both the inside and outside of the pipe. Pipes shall be deflected where required after homing, according to the following:

TABLE 23.07 B – MAXIMUM JOINT OPENINGS

Pipe Diameter (Inches)	Maximum Joint Opening (Inches)
6-36	3/4
48	1
54	1-1/8

The exterior joint recesses shall be filled with cement mortar. Cement mortar shall be rodded into diaper with a wire curved to conform to the radius of the pipe.

23.07 INSTALLATION OF PIPE AND FITTINGS (Continued)

H. POLYETHYLENE ENCASEMENT

Polyethylene (PE) encasement shall be installed on all ductile and cast iron water mains, water valves, fittings and water services using Method A or B as detailed in AWWA/ANSI C105/A21.5 except that the encasement shall consist of double wrapping. All pipe and fittings encased with PE shall be handled, repaired and installed in accordance to guidelines published by DIPRA. The Contractor shall double wrap and seal with tape all bolted connections, anchoring couplings, anchoring elbows, valves, and fire hydrants. Encasement for fittings and valves on PVC pipe shall extend a minimum of eighteen (18) inches past the joint. The Contractor shall ensure that hydrant drain holes are not blocked or covered. All water main and service valves shall be doubled wrapped, fully encased and sealed with tape around the valve stem operator underneath the operating nut.

The Contractor shall wrap all copper supply pipes from the tap extending 5 feet away from any ductile or cast iron main, and shall repair all PE encasement at the tap location. Copper services connected to PVC water mains are not required to be encased, unless otherwise noted. All ductile iron fittings used on PVC water services shall be doubled wrapped.

I. WATER MAIN SHUTDOWNS

All water main shutdowns shall be performed by Lincoln Water System personnel upon request from the Contractor.

At least forty eight (48) hours prior to the time that tapping, valve operation, flushing or disinfection services are required, the Contractor shall notify the Assistant Superintendent of Water Construction or his representatives to provide for scheduling such services. These services shall be scheduled only during normal City working hours.

Additional notice shall be required when critical water customers such as industries, schools, day cares, medical facilities, etc are impacted by the shutdown. Interruptions of water service to critical customers may require Work to be performed outside normal Work hours or on weekends. The Lincoln Water System shall coordinate with the City's Project Manager and notify the Contractor when critical customers are connected to the water main planned for shutdown.

Prior to Lincoln Water System making the shutdown, the Contractor shall be fully prepared to perform the work in the most expedient manner possible. The Contractor shall have all necessary fittings, pipe, tools, and accessories available onsite to perform the work. If in the opinion of the City's Project Manager that the Contractor is not prepared to perform the work, a shutdown shall not be provided. This condition shall not be cause for claim of damages or additional compensation by the Contractor.

If the proposed work involves eight (8) inch or larger water mains or affects service to commercial and industrial customers, a plan must be submitted to Lincoln Water System for approval. The plan shall indicate all fittings and dimensions of any pieces to be installed to complete the work causing the shut down. The plan shall indicate the estimated time out of service, requested time for the shutdown, general description of how the work will be performed, required pumping equipment and the number of employees expected to perform the work

23.07 INSTALLATION OF PIPE AND FITTINGS (Continued)

I. WATER MAIN SHUTDOWNS (Continued)

The water main shall be excavated prior to the shutdown and the excavation prepared to make work conditions safe and clean. Where directed by the City's Project Manager, the Contractor shall use crushed rock or crushed concrete in the bottom of the excavation to provide a suitable work surface for ease of construction and to provide for sanitary conditions. These materials shall be compensated in accordance to applicable bid items.

Contractors shall be adequately equipped to pump drain water and anticipate some leakage of water past valves. Adequate pumping equipment shall be a condition for approval of the shut down plan.

All parts, fittings and materials necessary to complete the work must be preassembled to the extent possible prior to the actual valve closure or the water will not be shut off.

There shall be no cost for a shut down which interrupts water service for less than two (2) hours. For interruptions of water service lasting two (2) or more hours the Contractor shall be billed the applicable fee for each hour or portion of an hour past the initial two (2) hour period of time. The shut down time shall be considered the time from when the water main has been isolated by the Lincoln Water System to the extent possible up to the time that Lincoln Water System is notified that work has been completed sufficiently to allow service to be restored.

Service fees charged for water main shutdowns shall be considered subsidiary to the cost of installation of the water main or the cost of the reconstructing or looping the water main or water services in the event of a utility conflict and shall not be cause for additional compensation to the Contractor

J. BASIS OF PAYMENT

WATER MAIN of the various sizes called for on the plans shall be measured and paid for at the contract unit price bid per linear foot for each different diameter required. Pipe shall be measured through fittings and valves. Such payment shall be full compensation for all excavation, backfill, pipe, bedding material, other materials, testing, equipment, tools, labor, and incidentals necessary to complete the Work in accordance with these Specifications and as accepted by the City's Project Manager.

DUCTILE IRON PIPE WATER MAIN of the various types and sizes called for on the plans shall be measured and paid for at the contract unit price bid per linear foot for each different diameter required. Pipe shall be measured through fittings and valves. Such payment shall be full compensation for all excavation, backfill, pipe, other materials, testing, equipment, tools, labor and incidentals necessary to complete the Work in accordance with these Specifications and as accepted by the City's Project Manager.

POLYVINYL CHLORIDE (PVC) WATER MAIN of the various types and sizes called for on the plans shall be measured and paid for at the contract unit price bid per linear foot for each different diameter required. Pipe shall be measured through fittings and valves. Such payment shall be full compensation for all excavation, backfill, pipe, bedding material, other materials, testing, equipment, tools, labor, and incidentals necessary to complete the Work in accordance with these Specifications and as accepted by the City's Project Manager.

23.07 INSTALLATION OF PIPE AND FITTINGS (Continued)

J. BASIS OF PAYMENT (Continued)

All CAST IRON AND DUCTILE WATER MAIN FITTINGS, including ductile iron compact fittings, shall be measured separately and shall be paid for at the contract unit price bid per each for the various fittings called for in the proposal.

Glands, bolts, nuts and gaskets necessary to complete a non-restrained mechanical joint connection for water main fittings are considered accessory items to the connection. No direct payment shall be made for these items, but are considered subsidiary to CAST IRON AND DUCTILE IRON WATER MAIN FITTINGS for which payment is made.

RETAINER GLANDS of the various sizes called for to complete a restrained mechanical joint connection for water main fittings shall be counted and paid for at the contract unit price bid per each. All Work shall be in conformance with these Specifications and accepted by the City's Project Manager.

23.08 INSTALLATION OF VALVES AND HYDRANTS

A. GENERAL

Immediately prior to installation, the Contractor shall inspect all valves and hydrants to ensure they are in good operating condition and free from defects. All valves shall be installed in such a manner that the operating nut and key will be in a vertical position. When the operator is located on the side of the valve, the Contractor shall install the valve with the operator located on the curb side of the valve.

All valve sizes should rest on support block with treated wood wedge(s) driven between the bottom of the valve and the support blocking. Valves 12 inches in diameter and larger shall be installed resting on one or more precast concrete support blocks 18 inches square and 4 inches thick which bear against undisturbed earth.

The Contractor shall check the installation of all butterfly valves to be certain that the valve can be operated throughout its entire range of operation, and that it does not have contact with the inside edges of the pipe when operating.

Where tapping sleeves and valves are to be installed, the Contractor shall make all excavations to the dimensions required and provide all necessary trench protection. The Contractor shall provide precast concrete pads and other stabilizing materials under the tapping valves necessary to prevent rotation of the tapping sleeve on the main.

The Contractor shall provide and install a valve box over every valve operator. The valve box shall be installed plumb and centered over the operating nut and with the bottom of the box sufficiently lower than the operating nut to prevent the entry of soil. The top of the box shall be set flush with the final grade or paved surface. Valve box adjusting rings shall not be used to adjust valve boxes to grade. Valve boxes shall be stabilized to prevent out of alignment during compaction. Misaligned valve boxes shall be replaced during the warranty period.

Hydrants shall be set plumb, resting on precast concrete pads, four (4) inches thick and sixteen (16) inches square. The support pads shall rest against undisturbed earth. The top of the flange on the hydrant shall be set to the grade shown on the plans. A hydrant of the length shown on the plans shall be used to attain this elevation. The Contractor shall make appropriate deflections or rotations in the tee and anchoring elbow, or use an anchoring offset, to meet this grade.

23.08 INSTALLATION OF VALVES AND HYDRANTS

A. GENERAL (Continued)

Where a hydrant extension is necessary to meet the required grade, the hydrant extension shall be installed only by Lincoln Water System. Only one extension will be permitted on a hydrant. The Contractor shall remove and reset all hydrants which cannot be adjusted to grade with one extension. The Contractor shall notify the City's Project Manager or that person's representative when hydrant extensions are required.

The Contractor shall place a minimum of 0.75 cubic yards of hydrant drain material (as per 23.03 N) around the base of the hydrant to allow free ready drainage of the barrel. Polyethylene wrap shall be placed on top of the drainage gravel prior to the commencement of backfilling. Hydrant drain holes shall be kept open and clean at all times. Care should be exercised as to not block the drain holes with polyethylene wrap or concrete from backing blocks.

When obtaining hydrants from the Lincoln Water System, the Contractor shall determine and select the hydrant shoe configuration that best suits proper orientation of the steamer (large) nozzle perpendicular to the curb line. When required, adjustments to the final hydrant nozzle orientation shall be made by the Lincoln Water System with all applicable costs and fees assessed to the Contractor. These fees shall be considered subsidiary to the cost of installing the water main and shall not be cause for additional compensation by the Contractor.

Backfill shall be accomplished in accordance with the provisions of Chapter 20 of these Specifications, except that all backfill within 3 feet of all hydrants and valve boxes shall be compacted using a mechanical hand tamper to 95% of maximum dry density as measured by AASHTO Method T-99.

B. BASIS OF PAYMENT

All VALVES of the various types and sizes indicated on the plans and actually installed shall be counted and paid for at the contract unit price bid per each. Such price shall include the valve, valve box, support blocks, other materials and labor necessary to install the valves, all equipment, tools, and incidentals necessary to complete the Work in accordance with these Specifications and as accepted by the City's Project Manager.

All HYDRANTS installed, as shown on the plans or as directed, except temporary hydrants used for flushing or disinfection of the mains, shall be counted and paid for at the contract unit price bid per each for HYDRANT, COMPLETE, L=5.5 feet or L=6.5 feet. Such price shall be full compensation for all loading, hauling, installation, thrust blocking, hydrant drain material, backfilling, labor, tools, materials, equipment and incidentals necessary to complete the Work in accordance with these Specifications and as accepted by the City's Project Manager.

All HYDRANT EXTENSIONS necessary to adjust the hydrants to grade shall be counted and paid for at the contract unit price bid per each for HYDRANT EXTENSION, COMPLETE. Such price shall be full compensation for all installation costs charged by Lincoln Water System, hydrant extension kits, labor, tools, materials, equipment and incidentals necessary to complete the Work in accordance with these Specifications and as accepted by the City's Project Manager.

The unit price for HYDRANT EXTENSION, COMPLETE shall be an established unit price per each in the bid proposal.

23.09 TEMPORARY HYDRANTS AND BLOW-OFF FOR FLUSHING AND DISINFECTION

A. GENERAL

Temporary hydrants and blow-offs shall be provided as shown on the plans or as determined by the Lincoln Water System to provide adequate discharge of water for preliminary and final flushing of the water main(s) in accordance to AWWA C651. The installation of temporary hydrants and blowoffs shall include any necessary protection of surrounding areas from damage caused by water erosion and any other provisions necessary for the conveyance of discharge water to protect downstream facilities or property.

B. BASIS OF PAYMENT

When called for in the proposal, payment for temporary hydrants and blow offs used in conformance with these Specifications and accepted by the City's Project Manager shall be made at the contract unit price bid per each for TEMPORARY HYDRANT AND BLOW-OFF. The Such payment shall be full compensation for installation of temporary hydrant and blow-off, necessary erosion protection, discharge water conveyance and downstream protection, removal of temporary hydrant and blow-off and any materials, equipment, tools, labor, or incidentals necessary to complete the work in accordance with the plans.

23.10 WATER SERVICE CONSTRUCTION OR RECONSTRUCTION

A. GENERAL

For the purpose of constructing or reconstructing all water supply and service lines, the Contractor shall comply with the provisions of Title 17 of the Lincoln Municipal Code. The Contractor shall cause all Work to be performed by a licensed plumber. All water services that are uncovered in the course of construction shall be inspected by the Lincoln Water System to assess their integrity and recommend replacement to customers when found to be in unsatisfactory condition. All water services that are reconstructed shall be inspected by the Lincoln Water System.

All water supply or service lines which are to be looped or reconstructed shall be constructed of Type "K" seamless soft-drawn copper tubing or ductile iron pipe.

The Contractor shall place all reconstructed water services or looped water services so as to provide a minimum cover of 4 feet. Minimum lateral clearance from structures open to the weather, such as storm sewer inlets, shall be 3 feet. All other clearance shall be a minimum of 6 inches.

Looping a water service shall consist of the reconstruction of a water service across the width of the excavation for the facility being built or within 5 feet of said excavation. When the break in the service line is within 5 feet of either the tap or the curb stop, the Contractor shall loop the service pipe from the tap or curb stop to the opposite side of the excavation and only one (1) joint will be allowed. When the break in the service line is beyond 5 feet from the tap or curb stop, the Contractor shall loop only that portion of service within the excavation and 2 joints will be allowed. All joints shall be located at or near the edges of the excavation and in no case shall the joints be positioned beneath other pipes or structures.

23.10 WATER SERVICE CONSTRUCTION OR RECONSTRUCTION (Continued)

A. GENERAL (Continued)

When a service constructed of lead, galvanized steel, pitted copper, or other material considered unacceptable according to Title 17 of the Lincoln Municipal Code requires looping or reconstruction, the entire service from tap to curb stop shall be replaced.

When a water service which does not conflict with the Work is damaged by the Contractor, it must be repaired or replaced at the expense of the Contractor to the City's Project Manager's satisfaction. Copper service pipe in good condition may be repaired, all other unacceptable service materials shall be replaced from tap to curb stop.

When a service is replaced to the corporation tap, a new tap may be required. No tap shall be allowed to remain which is smaller than 3/4inch.

New curb stops and boxes may be required when the service is reconstructed to the curb stop. Such curb stop may be ordered to be replaced if inoperable or obsolete. All curb stops and boxes shall be supplied by the Lincoln Water System at no cost to the Contractor.

All corporation taps, labor and equipment required to replace taps will be supplied by the Lincoln Water System to the Contractor at no cost. The Contractor shall be responsible for all excavation, boring, backfilling, installation of curb stops and boxes, sod, pavement, and other incidentals necessary to complete the looping or reconstruction.

All water services crossing or paralleling a new main shall be transferred to the new main if the main is 16" or smaller.

Any tap removed from service shall be immediately abandoned at the main by the Lincoln Water System at no cost to the Contractor, unless the main is to be abandoned as part of the Work of the contract. The Contractor shall be responsible for excavation, backfill, sod, pavement and other incidentals necessary to complete the abandonment.

B. BASIS OF PAYMENT

When the items of Work stated below do not appear as bid items in the proposal form, all Work necessary for the looping or reconstruction of water services shall be paid for as an Extra Work item.

When the items of Work stated below are included in the proposal form, the payment shall be as follows:

COPPER WATER SERVICE PIPE or DUCTILE IRON WATER SERVICE PIPE of the various sizes called for shall be measured and paid for at the contract unit price bid per linear foot. Such payment shall be full compensation for all materials, tools, equipment, and labor including the licensed plumber, excavation, backfill, sod, clean-up and incidentals necessary to install the pipe in a manner acceptable to the City's Project Manager.

Boring for water service pipe shall be measured and paid for at the contract unit price per linear foot for BORING FOR ____" WATER SERVICE PIPE. Such payment shall be full compensation for all labor, materials, equipment, tools and incidentals necessary to produce the bore hole ready to receive the water service pipe, as accepted by the City's Project Manager. Water service pipe to be placed in the bore hole shall be paid for as provided above.

23.10 WATER SERVICE CONSTRUCTION OR RECONSTRUCTION (Continued)

B. BASIS OF PAYMENT (Continued)

LOOP WATER SERVICE shall be measured and paid for at the contract unit price bid per each. This payment shall be full compensation for all labor, equipment, excavation, backfill, tools, incidentals, and materials except pipe, necessary to complete the Work in a manner acceptable to the City's Project Manager.

CONSTRUCT OR RECONSTRUCT WATER SERVICE shall be measured and paid for at the contract unit price bid per each. Such payment shall be full compensation for all labor, tools, and materials, except pipe and materials supplied by the City, equipment, excavation, backfill and incidentals necessary to complete the Work in a manner acceptable to the City's Project Manager.

23.11 ABANDONMENT OF WATER MAIN

A. GENERAL

When existing water mains are shown to be abandoned in place on the plans, the Contractor shall turn all valves to the off position, remove one (1) or more feet of the top section of the valve box, fill with sand and cap or plug with concrete, and plug each end of the abandoned water main segment with concrete.

B. BASIS OF PAYMENT

ABANDONMENT OF WATER MAIN shall be measured and paid for at the contract lump sum amount. Such payment shall be full compensation for all labor, tools, and materials necessary to complete the Work in a manner acceptable to the City's Project Manager.

23.12 HIGHWAY, STREET AND RAILROAD CROSSING

Highway, street and railroad crossings shall be constructed as indicated on the plans and as specified in the respective permits issued, if applicable. The City will obtain all necessary permits. Pipe encasement shall be constructed in conformance with Chapter 20 of these Specifications.

23.13 TESTING

The Contractor shall furnish all gauges, pumps and other equipment necessary to perform all of the acceptance tests and shall provide all assistance necessary or required by the City's Project Manager to verify the test results. No test shall be conducted until all thrust blocking has attained sufficient strength to resist any thrusts imposed by the test pressures applied.

The Contractor shall carefully fill the main or mains to be tested with water from the existing water distribution system. The Contractor shall bleed all air from pipes, valves, fittings and hydrants during filling operations. All corporation stops required to expel air shall be installed by the Lincoln Water System. The Contractor shall provide and backfill all excavations required to install corporation stops. All air taps will be abandoned by the Lincoln Water System personnel after testing is completed.

The Contractor shall pump water into the system to raise the pressure to the level indicated in the table below at the lowest elevation in the section being tested. The Contractor shall maintain the test pressure for a minimum of two (2) hours, carefully measuring all water added to the system during that period. The rate of water added per 1,000 feet of pipeline shall not exceed maximum allowable rate as shown in TABLE 23.13 A – WATER MAIN PRESSURE TESTING.

TABLE 23.13 A – WATER MAIN PRESSURE TESTING

Nominal Pipe Size (inches)	Maximum Allowable Rate (gallons/hour)	Test Pressure (psi)
6	0.64	200
8	0.85	200
12	1.28	200
16	1.47	150
24	2.21	150
30	2.76	150
36	3.31	150
48	4.41	150
54	4.97	150

When the pipeline being tested contains sections of various diameters, the allowable losses shall be the sum of the computed allowable losses for each size. Where sections are isolated for testing, the allowable losses will be computed for the length of sections being isolated.

During the test period, the ground surface along the length of the section being tested shall be examined for leakage. All detected leaks shall be repaired regardless of the test results.

In the event that the test requirements are not met, the Contractor shall locate and repair all defects at his own expense. Following the repairs, the tests shall be repeated until the test result requirements are met.

Pressure testing shall not be measured or paid for directly. Testing shall be considered subsidiary to those items for which direct payment is made.

23.14 DISINFECTION OF THE COMPLETED WORK

The Contractor shall keep the Work clean during construction to facilitate disinfection. All excavation and backfill required to install chlorination taps shall be provided by the Contractor

For water mains 24 inch and smaller, the Contractor shall provide for the scheduling of the flushing and disinfection by the Lincoln Water System at least twenty-four (24) hours in advance of the time that those services are desired. All costs of disinfection, including tests, shall be billed to and paid for by the Contractor.

For water mains 30 inch and larger, the Contractor shall provide a flushing and disinfection plan to the City's Project Manager for review and approval that is in conformance to the Special Provisions or the requirements specified in AWWA C651. This plan shall include the method and disinfectant to be used in disinfection process, the concentration of disinfectant to be used, the method of neutralization of the disinfectant prior to discharge into open channels or storm sewer systems. The documented results of the bacteriological tests shall be provided to the City's Project Manager with a copy to the Lincoln Water System.

Flushing and disinfection will be repeated at the Contractor's expense until bacteriological tests conducted by the Lincoln Water System indicate the system is properly disinfected.

The Work required to disinfect the system shall not be measured for direct payment. Disinfection shall be considered subsidiary to those items for which direct payment is made

23.15 COLD WEATHER CONSTRUCTION

All construction performed in cold weather or during periods where frost penetration of the soil exceeds 6 inches shall be in accordance with Chapter 20 of these Specifications.

23.16 SUBSTANTIAL COMPLETION

Water main Work shall be considered substantially complete when all pipe is laid, all hydrants, valves, fittings and appurtenances installed and operable, backfill complete, testing complete and accepted, disinfection complete, tap holes backfilled, water services connected, paving, sidewalks and driveways replaced, final clean-up and park space finished.

23.17 FINAL COMPLETION AND ACCEPTANCE

The project shall be considered eligible for final acceptance by the City when all required Work is complete and accepted by the City's Project Manager, including all Work associated with existing water main abandonment, valve box grade adjustments, required grade adjustments to hydrants including installation of hydrant extensions in accordance to these specifications, required adjustments to hydrant nozzle orientation, seeding and/or sodding, and correction of all deficiencies found as a result of testing and/or final inspection by the City's Project Manager.

23.18 GUARANTEE

At any time during the two year guarantee period, and within the time period allowed, the Contractor shall correct any defect in material or workmanship which has been brought to his attention. Such items shall include but not be limited to trench settlement including subsequent pavement damage, pipe leaks, damage to polyethylene encasement, hydrants out of plumb, hydrants which drain improperly, valve boxes out of plumb or offset from center of operating nut, or service line leaks.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 24

TRAFFIC SIGNALS, ITS AND LIGHTING

ARTICLE	TITLE	
24.00	GENERAL	2403
	A. STANDARDS	2403
	B. QUALIFIED PERSONNEL	2403
	C. MATERIAL TESTS	2403
	D. ELECTRICAL SERVICE APPLICATIONS	2404
	E. CITY FURNISHED MATERIALS	2404
	F. EXCAVATION AND BACKFILL	2405
	G. CONTRACTOR RESPONSIBILITY	2405
	H. GRADES	2405
	I. FOUNDATIONS AND BASES	2406
	J. BLANK ON PURPOSE	2407
	K. DOWNTIME FOR TRAFFIC SIGNALS OR STREET LIGHTING	2407
	L. ENERGIZING OR DE-ENERGIZING TRAFFIC SIGNALS	2408
	M. ANTI-SEIZE COMPOUND	2408
	N. SUBSTANTIAL COMPLETION	2408
	O. INSPECTION COMPLETION	2409
	P. SIGNAL SUPPORT SPAN	2409
24.01	REMOVE OR RELOCATE OR ADJUST	2410
	A. GENERAL	2410
	B. BASIS OF PAYMENT	2410
24.02	TEMPORARY TRAFFIC SIGNAL	2411
	A. GENERAL	2411
	B. BASIS OF PAYMENT	2411
24.03	CONDUIT	2412
	A. GENERAL	2412
	B. INSTALLATION	2412
	C. CONDUIT BORED	2414
	D. CONDUIT IN TRENCH	2415
	E. BASIS OF PAYMENT	2415
24.04	BLANK ON PURPOSE	2416
24.05	PULL BOXES	2416
	A. GENERAL	2416
	B. INSTALLATION	2416
	C. BASIS OF PAYMENT	2417

CHAPTER 24

TRAFFIC SIGNALS, ITS AND LIGHTING

ARTICLE	TITLE	
24.06	RISERS	2417
	A. GENERAL	2417
	B. INSTALLATION	2417
	C. BASIS OF PAYMENT	2417
24.07	ELECTRICAL METER PEDESTAL	2418
	A. GENERAL	2418
	B. INSTALLATION	2418
	C. BASIS OF PAYMENT	2418
24.08	STEEL POLES	2419
	A. GENERAL	2419
	B. STREET LIGHT POLES	2419
	C. INSTALLATION	2420
	D. ROTATE MAST ARMS	2421
	E. EMBEDDED STEEL POLE INSTALLATION	2421
	F. BASIS OF PAYMENT	2422
24.09	GROUND RODS	2423
	A. GENERAL	2423
	B. INSTALLATION	2423
	C. BASIS OF PAYMENT	2423
24.10	DETECTORS	2424
	A. GENERAL	2424
	B. LOOP DETECTORS	2424
	C. PEDESTRIAN PUSH BUTTONS	2425
	D. CAMERA DETECTOR	2426
	E. NON-INTRUSIVE DETECTOR	2426
	F. EMERGENCY DETECTOR	2426
	G. BASIS OF PAYMENT	2426
24.11	CABINETS	2427
	A. GENERAL	2427
	B. INSTALLATION	2427
	C. BASIS OF PAYMENT	2427

CHAPTER 24

TRAFFIC SIGNALS, ITS AND LIGHTING

ARTICLE	TITLE	
24.12	CABLE	2428
	A. TYPES AND CLASSES OF CABLE	2428
	B. INSTALLATION	2429
	C. SPLICES AND CONNECTIONS	2430
	D. LABELING	2432
	E. BASIS OF PAYMENT	2432
24.13	SIGNAL HEADS, METRO STREET NAME SIGNS AND LED SIGNS	2433
	A. GENERAL	2433
	B. INSTALLATION	2433
	C. BASIS OF PAYMENT	2434
24.14	ROADWAY LIGHTING, LUMINAIRES AND LAMPS	2435
	A. GENERAL	2435
	B. MATERIAL AND DESIGN (HID, high intensity discharge)	2435
	C. MATERIAL AND DESIGN (LED)	2440
	D. INSTALLATION	2443
	E. BASIS OF PAYMENT	2444
24.15	BLANK ON PURPOSE	2444
24.16	BLANK ON PURPOSE	2444
24.17	BLANK ON PURPOSE	2444
24.18	WOOD POLES	2445
	A. GENERAL	2445
	B. INSTALLATION	2445
	C. BASIS OF PAYMENT	2445

CHAPTER 24

TRAFFIC SIGNALS, ITS AND LIGHTING

24.00 GENERAL

A. STANDARDS

Where NEMA Specifications are established, all electrical equipment shall conform to the standards of National Electrical Manufacturers Association (NEMA). In addition to the requirements of these Standard Specifications and the plans, all material and Work shall conform to the Standard Specifications of the following organizations: National Electric Safety Code (NESC); American Society for Testing and Materials (ASTM); American Standards Association (ASA); International Municipal Signal Association, Inc. (IMSA); Insulated Cable Engineers Association (ICEA); American Institute of Steel Construction (AISC); American Association of State Highway and Transportation Officials (AASHTO); Manual on Uniform Traffic Control Devices (MUTCD); and the ordinances of the City of Lincoln (City), insofar as they apply. Wherever reference is made in the Standard Specifications to the standard mentioned above, the reference shall be construed to mean the code or standard that is in effect on the date of advertising of the contract document.

Traffic Signal Poles shall reflect the 1994 AASHTO guidelines for pole design.

B. QUALIFIED PERSONNEL

A certified and qualified journeyman lineman shall be on the job site to supervise the pulling of the fiber, splicing of wire where permitted, and to perform the task of final connections in all signal indications, push buttons, loop detectors, cameras, and dynamic message signs. A licensed and qualified journeyman electrician shall wire the cabinet. All workers on the job site shall have IMSA, Traffic Signal Level 1 certification or approved equivalent within 1 year of employment. Proof of certification or license of individuals on job site shall be required at the pre-construction meeting.

C. MATERIAL TESTS

When any reference is made in the Standard Specifications to a standard, such as ASTM, ICEA, IMSA, etc., or a related Specification referred to by reference therein, which states that a certain test is to be made only at the request of the purchaser, it shall be considered that the City does request that such test be made. The tests shall be made at the Contractor's expense and a certified copy of each test shall be submitted to the City's Project Manager prior to the installation of such material.

Traffic Signal and/or Street Lighting poles require shop drawings and Manufacturer's certification of compliance. In the case of wood poles, the type, size, treatment, or certain unspecified situations shall require that in addition to the above, the Contractor furnish mill test data or design calculations.

The Contractor shall submit to the City's Project Manager 1 hard copy and 1 electronic (pdf) copy of a complete list of all equipment and materials they intend to install. Catalog cuts and/or Manufacturers model number shall be required for the materials furnished by the Contractor and incorporated into the project. There shall be no substitutes for any of the items on the list without prior written approval of the City's Project Manager.

24.00 GENERAL (Continued)

D. ELECTRICAL SERVICE APPLICATIONS

The Contractor shall make arrangements with Lincoln Electric System (LES) for power service. Any delay resulting from a Contractor's untimely request to the local utility for power service shall not be justification for the suspension or extension of the working days or calendar days on a project. Electrical services at the locations shown on the plans have been previously agreed to by the City and the Utility. The locations of all such services are subject to minor revisions in the field in order to adapt field requirements as may be determined by the Utility and the City's Project Manager.

E. CITY FURNISHED MATERIALS

The Work covered in this chapter shall include the furnishing of certain materials and equipment and the installation of all necessary materials and equipment to provide a traffic signal and/or a street light installation complete, in place and ready for operation; and/or the modification, removal or salvage of existing traffic signal and/or street light components or systems; in accordance with the plans and these Standard Specifications. When the item is furnished by the City the item of payment is prefaced by the word, "Install".

Furnished Traffic Signal Materials shall be picked up at Traffic Operations storage locations between 7:30 a.m. to 8:30 a.m. weekdays with 24 hour notice, with the exception of city holidays. Furnished Street Lighting materials shall be picked up at LES Storeroom at the Walter Canney Service Center at 27th and Fairfield Streets, between 7:30 a.m. to 4:00 p.m. weekdays, with the exception of holidays. Further direction may be required either by Special Provision or by the City's Project Manager. Refer to Section V; "Control of Materials", Subsection F. "Materials Supplied By The City" of the General Provisions and Requirements for procedures to be followed in handling City-furnished materials and/or equipment.

The Contractor shall be responsible for all material or equipment furnished by the City from the time that it is picked up to the completion of work. The costs of damaged materials shall be deducted from the final payment.

The contractor shall take all precautions to protect the cabinet from damage including any concrete splatters, dents, scratches or any other damage as noted by the City's Project Manager. In the event of damage to the cabinet, the contractor shall remove the damaged cabinet and re-wire a new cabinet supplied by the City. The cost of the damaged cabinet shall be deducted from the final payment.

City traffic signal personnel shall be responsible for bench testing traffic signal cabinets to be installed by the Contractor, and shall field test each installed traffic signal cabinet prior to turn on. All other activities associated with the installation, including but not limited to, labor, materials, tools, and transportation are the responsibility of the Contractor.

The Contractor shall furnish all other materials, including, but not limited to, concrete reinforcing steel, conduit, pull boxes, cable, splice kits, messenger cable and hardware, pole clamps and hardware, risers, down guys, ground rods and clamps, traffic signal poles, street light poles, luminaires, and all other miscellaneous materials and/or hardware necessary to complete the Work in accordance with the Plans, Standard Specifications, or the Special Provisions.

24.00 GENERAL (Continued)

F. EXCAVATION AND BACKFILL

Excavation for trenches, pull boxes or foundation removal shall be backfilled and compacted daily unless properly protected. All trenches for burial of electrical cable and conduit shall not exceed 6" in width.

All excavations shall be backfilled within 48 hours of excavation.

The first 4" of backfill for trenches shall consist of finely pulverized earth and shall contain no broken glass, rocks, or other sharp material that might damage the cable.

The remainder of the backfill material will normally be earth excavated from the trench unless such earth is water saturated or frozen. Backfill material shall be substantially dry, loose, clean earth free from rocks and debris. Excessively dry or excessively sandy material is not permitted.

Before backfilling, all standing water shall be removed from the trench. Tamping shall be done at no more than 12" backfill level intervals to ensure proper compaction throughout the depth of the void. The foot of the compressed air or hydraulic tamper to be used to compact the backfill shall be sized in accordance with the width of the trench. Hand tamping is not permitted. All excess backfill material shall be removed promptly from the site.

G. CONTRACTOR RESPONSIBILITY

The Contractor is responsible to inform the City's Project Manager of any defect found in the existing electrical or communications systems. Such defects may include, but not be limited to existing improper splices or existing damaged cable or existing damaged conduit. The City's Project Manager and Contractor shall determine a plan and cost to correct said defect.

The Contractor is responsible to locate the signal system within the project area, until the final inspection is complete.

H. GRADES

All work shall conform to line, elevation and grade as shown on the plans. If no grades are shown on the plans, the longitudinal grade for the improvement shall be the same as the grade of the top of the existing curb. If there is no curb, the longitudinal grade shall be considered as a straight line between points where elevations are shown on the plans.

The elevation of top of pull box and top of pole foundation shall be established according to conditions below. The elevation of the top of Cabinet Base shall be 3" above the grade listed unless the Cabinet Base is in the sidewalk, in which case it shall be at grade.

1. Existing curb with no sidewalk: The grade shall slope upward from the top of the back edge of the curb at the rate of 2%.
2. Existing curb with sidewalk: The grade shall be a straight line from the top of the back edge of the curb to the top of the curbside of the sidewalk.
3. Existing curb with adjoining sidewalk: The grade shall be the same as the grade of the top of the sidewalk.
4. If the lateral grade of the existing roadway exceeds 2.5%, the grade will be set by the City's Project Manager.

24.00 GENERAL (Continued)

I. FOUNDATIONS AND BASES

Foundations and bases shall be constructed and/or installed in accordance with Lincoln Standard Plans (LSPs) LSP 82 and 92, to the elevation as shown on the plans or directed by the City's Project Manager.

All foundations shall be poured within 48 hours of excavation.

Positioning of anchor bolts shall ensure that all access and relative position of the structure and its components are in the position shown on the project plans. Anchor bolts shall be set so that 2 bolts are placed in tension and 2 in compression.

Foundations and Bases will not be measured for payment separately, but are considered subsidiary to the installation or relocation of poles or traffic signal cabinets.

1. Reinforced Concrete

Forms shall be firmly braced and secured in place. Forms shall not be removed until the concrete has set, and at no time shall they be removed within 12 hours after the concrete has been placed.

Prior to pole and cabinet installation, anchor bolts and foundation holes shall be barricaded or suitably enclosed to protect the public from possible injury.

All reinforcement bars for concrete reinforcement shall be Grade 40 or Grade 60 steel and shall conform to the requirements of "Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement", ASTM Designation A 615, or "Standard Specifications for Raw Steel and Axle-Steel Deformed Bars for Concrete Reinforcement", ASTM Designation A 996. Bars shall be free from excess rust, scale or other substances which prevent the bonding of concrete to the reinforcement.

There shall, in all cases, be at least 3" of concrete between anchor bolts and steel reinforcing members at any edge of foundation or base.

No foundation or base shall be poured until they are free of water or debris including trash. The bottom of the foundations and bases shall rest securely on firm undisturbed ground. Both forms and excavations shall be thoroughly wet before placing concrete. An Observer shall be present for the pouring of all traffic signal foundations and bases. The Project Manager shall be contacted 24 hours in advance of the pour. Any foundations poured without the Observer present shall be subject to removal and replacement at the Contractor's expense.

The foundations and bases shall be L3500 concrete, poured monolithically and consolidated with a mechanical vibrator as it is placed, from the bottom to the top, in the form. No floating of steel allowed. The top and any exposed portion of the foundation or base shall be troweled smooth, true and level.

Anchor bolts shall protrude within the range shown on LSP 82 with the nuts and threads covered to protect them during pouring.

Grinding concrete to form a chamfer shall not be permitted.

24.00 GENERAL (Continued)

I. FOUNDATIONS AND BASES (Continued)

1. Reinforced Concrete (Continued)

After the foundation or base has been poured, no modification shall be made. If the anchor bolts, conduit, or any part of the foundation or base are installed in an incorrect manner, as determined by the City's Project Manager, the entire foundation or base shall be removed and a new foundation or base installed. The Contractor shall bear all costs of replacing work, including cost of anchor bolts, deemed unsatisfactory by the City's Project Manager.

Pole shafts shall not be set on the foundations until the concrete has achieved a compressive strength of 2500 psi or an age of 72 hours. Mast arms shall not be installed until the concrete has achieved a compressive strength of 3000 psi or an age of 7 days.

2. Power Installed Foundation

The Power Installed Foundation shall be of the size required by the luminaire mounting height as shown on LSP 92.

The Power Installed Foundation is not to be used in fill areas or where the soil bearing strength is less than 1,500 pounds per square foot or on slopes in excess of 5%.

Power Installed Foundations shall be installed in accordance with the manufacturer's instructions. The foundation shall be installed with its axis plumb. Cable entrance shall be parallel to the roadway unless indicated otherwise in the plans or directed by the City's Project Manager. Trenches for conduit or cable shall be as narrow as practical, but in no case shall the trench width exceed the diameter of the foundation shaft.

J. BLANK ON PURPOSE

K. DOWNTIME FOR TRAFFIC SIGNALS OR STREET LIGHTING

When the described Work includes any task that renders the existing traffic signal system inoperable the downtime necessary shall occur only between the hours of 8:00 a.m. and 3:00 p.m., provided the intersection is controlled by law enforcement personnel. The Contractor shall notify the Lincoln Police Department (LPD) a minimum of 48 hours prior to the actual requested time to arrange for officer control. This service shall be paid for by the Contractor. The intersection shall remain in service at all other times, day or night.

There shall be No night time disruption to existing street lighting at any time during the project. Any street light disruption shall be restored to full operation prior to other project work commencing.

24.00 GENERAL (Continued)

L. ENERGIZING OR DE-ENERGIZING TRAFFIC SIGNALS

It is the intent of this Standard Specification to minimize interruption to both vehicular and pedestrian traffic and activities in the area adjacent to the described Work.

A Traffic Signal or Pedestrian Signal shall only be turned off by City personnel.

The Contractor is responsible for contacting LES, to have LES energize or de-energize any Street Light Cable or energize Service Cable for Traffic Signal Equipment. Under no circumstance shall the contractor open any LES locked facilities, such as a Transformer or Pedestal.

Prior to a new or rebuilt signal being turned on, in flashing or permanent operation, the Contractor shall have completed all non-LES splices; including signal display, detection, power, pre-emption, and flash testing of the completed installation.

The Work shall be planned such that the City Traffic Operations personnel are notified 24 hours prior to placing the signal in flash. In cases where multiple signals are involved, 24 hours per signal shall be provided.

Requests shall go through the Project Manager. Signal turn-ons shall occur between 8:00 a.m. and 3:00 p.m., Monday through Thursday.

New signalized locations shall be placed in pre-determined flashing operation for a minimum of 4 days, with the exception of new roadways.

M. ANTI-SEIZE COMPOUND

The Contractor shall use an approved anti-seize compound everywhere metal screws into, onto or against metal.

N. SUBSTANTIAL COMPLETION

The traffic signal and/or street lighting portion of projects shall not be considered substantially complete until all items shown on the proposal or called for in any contract document are completed to the satisfaction of the City's Project Manager, excluding seed/sod if outside planting season. The system shall be fully operational in accordance with the Plans and Standard Specifications.

Liquidated damages shall continue to accrue until such time as the Work is deemed to be substantially completed by the City's Project Manager. However, the Contractor may submit a written request to the City's Project Manager for approval to suspend Work to allow additional time for completion of minor items of the Work. Granting the request for additional time by the City's Project Manager shall not relieve the Contractor of responsibilities for the completion of those items for which the suspension is requested.

24.00 GENERAL (Continued)

O. INSPECTION COMPLETION

Upon completion of a fully operational traffic signal, ITS, lighting, and communications system, an Inspection shall be completed by the City. The Contractor is allowed a defined number of calendar days to complete the following: correct any items as listed on the Inspection Forms, return Inspection Forms back to City, and correct any subsequent deficiencies identified by inspections until City accepts all work. The Contractor is responsible for identifying any changes in the construction from the original plans so that updated information can be documented in AS BUILT plans.

Prior to the start of inspection, 1 hard copy and 1 electronic (pdf) copy of as-built plans shall be provided to the City. These as-built drawings shall be labeled "AS BUILT", with the Contractors initials and date.

The number of days for the inspection process is as follows: 45 calendar days are allowed for the entire system Inspection and Correction process. The City is allowed 14 calendar days for the initial inspection and 7 calendar days for each additional inspection needed thereafter.

Initial and subsequent City inspections shall be included as part of the calendar days allowed. If the Contractor has not corrected all items on the conduit Inspection form to the satisfaction of the City and has not received final acceptance from the City within the allotted time, the Contractor shall be assessed liquidated damages of \$500 per calendar day until all work is completed and deemed acceptable.

P. SIGNAL SUPPORT SPAN

Span wire shall be 3/8", galvanized, 7 strand, high-strength grade steel wire strand. Signal support span wire shall, in all cases, have a minimum strength capable of supporting the maximum load to which they may be subjected. Tie wire shall be 1/4" diameter high-strength grade steel wire strand. Tie wire installed for any one span wire mounted location shall be the same diameter for all tie wire spans. Span wire and tie wire shall conform to the requirements of "Standard Specifications for Zinc-Coated Steel Wire Strand", ASTM Designation A-475.

All ferrous metal line hardware items shall be galvanized and shall conform to the requirements of "Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware", ASTM Designation A153. All hardware items shall have a minimum strength capable of supporting the maximum load to which they may be subjected.

Pole clamps used for signal support spans and messenger cable shall be installed in such a manner to prevent any rubbing or strain of the cable clamp against the pole clamp or its connecting bolt. 4 piece (90° separation) clamps shall be used.

Span wire shall be installed with 5% sag, +/- 1%, with traffic signals installed, and shall be adjusted on the poles so as to provide the proper mounting height indicated on the plans.

Tie wires shall be pulled snug to stabilize the traffic signal heads, but shall not support any of their weight. A tie wire safety link as described on the plans furnished by the City and installed by the Contractor shall be placed between the pole band and tie wire. Under no circumstances shall the tie wire be utilized to plumb poles.

24.01 REMOVE OR RELOCATE OR ADJUST

A. GENERAL

Existing traffic signal and/or street light components or systems shall be removed or relocated in accordance with the plans and these Standard Specifications. All bases and foundations shall be removed completely. All poles or components indicated to be removed shall become the property of the Contractor except as noted on the plans or by the Special Provisions. Equipment designated for return shall be returned to the location shown on the plans. Retained equipment and material shall be protected to prevent damage. The cost of damaged equipment or materials shall be deducted from the final payment. The excavation remaining after the removal of an item from below grade shall be backfilled in conformance with Chapter 20 of these Standard Specifications.

B. BASIS OF PAYMENT

1. Remove

REMOVE _____, completely removed and accepted by the City's Project Manager, shall be measured for payment as single units, except cable as linear feet and shall be paid for at the contract unit price bid per each for the item. This price and payment shall be full compensation for removing and disposal of all materials; removal of existing foundation or existing base, for all excavation and backfill; for the return of equipment designated for return and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work in accordance with the plans and these Standard Specifications.

2. Relocate

RELOCATE _____, complete, in place and accepted by the City's Project Manager, shall be measured for payment as single units, except cable as linear feet and shall be paid for at the contract unit price bid per each for the item. Relocate Poles includes removal of existing foundation, excavation and backfill; new foundation and contractor supplied concrete, conduit stub-out, reinforcing steel, power installed foundations, pole setting foam, ground rods and anchor bolts. This price and payment shall be full compensation for all removal from original position and installation to proposed position, and for all labor, equipment, tools, materials, storage, and incidentals necessary to complete the Work in accordance with the plans and these Standard Specifications.

3. Adjust

ADJUST _____, complete, in place and accepted by the City's Project Manager, shall be measured for payment as single units and shall be paid for at the contract unit price bid per each for the item. This price and payment shall be full compensation for all adjustments from the original position and installation to the proposed position, excavation and backfill; and for all labor, equipment, tools, materials, storage, and incidentals necessary to complete the Work in accordance with the plans and these Standard Specifications.

24.02 TEMPORARY TRAFFIC SIGNAL

A. GENERAL

Temporary traffic signal systems shall be installed as called for on the plans. The City shall furnish the Contractor with traffic signal and pedestrian signal heads, traffic signal cabinet, emergency devices, detector connections, luminaires, street name signs, video detection, magnetic probe, and pedestrian push button assemblies, complete with the correct hardware for the application, such as, hanger assembly and tether for span wire installation. All other materials shall be furnished and installed by the Contractor, unless otherwise noted.

The Contractor shall make arrangements with LES for power service for the temporary signals. Any delay resulting from a Contractor's untimely request to the Utility for temporary power service shall not be justification for the suspension or adjustment of the working days or calendar days on a project. The Contractor shall be responsible for the utility costs to install or relocate the power service.

When the Work is complete, the Contractor shall remove the traffic signal and return furnished materials to the City. The cost of the damaged material shall be deducted from the final payment.

B. BASIS OF PAYMENT

INSTALL AND REMOVE TEMPORARY _____, complete, in place, removed and accepted by the City's Project Manager, shall be measured as a single unit and shall be paid for at the contract unit price per each system. This price and payment shall be full compensation for furnishing all materials not furnished by the City, installing all materials, connecting, maintaining, and removing the temporary signal system, salvaging requested items from the temporary signal, and for all labor, equipment, tools, materials, excavation, and incidentals required to complete the Work.

24.03 CONDUIT

A. GENERAL

Conduit used for cable runs shall be rigid polyvinyl chloride (PVC) conforming to Underwriters Laboratories (UL) "Standard for Safety" UL-651, or in the case of HDPE, ribbed or smooth wall. Conduits for Fiber Optic Cable installation shall be orange and Electrical shall be black/gray.

1. Rigid Polyvinyl Chloride (PVC) Conduit, Schedule 40

Standard plastic couplings must be used to join conduit ends. The conduit may be formed or bent by warming until it is flexible and pliable enough to work easily. Wrinkles or buckling will not be permitted. Conduit must not be heated to the point of deterioration or damaging the material.

2. High Density Polyethylene (HDPE) Conduit, Schedule 40

All HDPE conduit shall have a tensile strength of 4000 psi. Either smooth wall or ribbed types are acceptable for traffic signal applications. All street light applications shall use smooth wall.

3. Main Line Conduit Group (MLCG), ASTM D 1248 Type III Class C, Grade P33, Category 5, SDR 11 unless otherwise specified in the Plans.

All Main Line Conduit Group shall consist of (6) 1-1/4" High-density polyethylene (HDPE) conduits in accordance with the requirements of NEMA TC7. Conduit shall be smooth wall coiled duct meeting the requirements of ASTM D 1248 Type III Class C, Grade P33, Category 5, SDR 11 (direct bury), SDR 13.5 (installed within other conduits), SDR 15 (if allowed on specific project plans), unless otherwise specified in the Plans. Conduit markings shall follow the color code below:

- orange no stripe (City use)
- orange with blue stripe
- orange with black stripe
- orange with white stripe
- orange with green stripe
- orange with red stripe

B. INSTALLATION

Electrical conduit shall be placed at a depth of 30". Fiber Optic Conduit shall be placed at a depth of 48".

The routing of conduit as shown in the plans indicates, in most cases, the general location and direction of the conduit runs. If, due to obstructions or certain other field conditions encountered during construction, it is necessary to depart substantially from the routing shown, the City's Project Manager will determine the new location in the field. Conduits terminating in cabinets, poles, or pull boxes shall not be transposed.

Conduits shall be secured in their permanent positions during the pouring and curing of the foundation or base or placement of rock in pull boxes. The installation of transformer base-type poles requires that the conduits shall be placed as near the door opening as possible.

24.03 CONDUIT (Continued)

B. INSTALLATION (Continued)

Conduits terminating in pull boxes shall be routed under the pull box and cut parallel to the pull box lid. Conduit stub outs shall extend not less than 6" from the outer face of the foundation or pull box, and at the proper depth as stated above, in the directions shown on the plans; and shall be capped with a standard pipe cap in the pull box with the cardinal (compass) direction of the stub marked on the cap and taped in place. The other end of the stub in the dirt shall be covered a properly sized conduit end cap.

The individual conduits in the MLCG shall be bound together as one with a hose clamp at the bottom of the pull box line.

A continuous length of polypropylene, 200 pound pull string shall be placed in City designated fiber conduit with 10' extra neatly secured at each end.

A continuous Fiber Locate Cable shall be placed in City designated fiber conduit.

The Contractor shall use 90 degree factory sweeps, with a 48" radius, in controller bases, the home run pull box (first electrical pull box to the cabinet) and in fiber pull boxes; in all other cases, the Contractor shall use 90 degree factory bends with a 16" minimum radius.

All joints and terminations shall be made in accordance with the manufacturer's instructions and good practice. Joints shall be watertight and mechanically sound. The conduit shall not contain debris or other foreign matter and shall have a constant circular cross-sectional area.

For communication system conduits, any fiber conduit entering the bottom of fiber pull boxes shall be located in the near right side corner of the box, as you approach, at least 4" from the side and end walls. The conduit shall be sloped towards the top far edge of the box to facilitate pulling of the cables. In applications where MLCG is utilized, the conduits shall be hose clamped together, 6" from the end of the conduits. The hose clamps shall be installed prior to rock backfill in the pull box. When long radius sweeps are needed to bring the MLCG into a pull box, a compression coupling capable of providing a watertight connection in buried or restrained applications shall be used. When the long radius sweeps are required the MLCG color coding shall be preserved by the coupling. In the unusual event that the MLCG is shallow MLCG penetrations into the side wall of pull boxes shall be made using single conduit knockouts or cored entrances.

In special cases, only approved by the City's Project Manager, conduits entering through the side wall of pull box shall be located a minimum of 4" above and maximum 8" above the floor, 4" away from the pull box corner and shall extend 4" inside the box wall. The void between the knockout and the conduit shall be filled with mastic to form a watertight seal.

Excavation for trenches shall be backfilled and compacted daily unless properly protected. All excavations shall be backfilled within 48 hours of excavation. Any excavation required to be open longer than 48 hours will need approval by the City's Project Manager. The first 4" of backfill for trenches shall consist of finely pulverized earth and shall contain no broken glass, rocks, or other sharp material that might damage the conduit. The remainder of the backfill material will normally be earth excavated from the trench unless such earth is water saturated or frozen. Backfill material shall be substantially dry, loose, clean earth free from rocks and debris. Excessively dry or excessively sandy material is not permitted. Before backfilling, all standing water shall be removed from the trench. Tamping shall be done at no more than 12" backfill level intervals to ensure proper compaction throughout the depth of the void. Hand tamping is not permitted. All excess backfill material shall be removed promptly from the site.

24.03 CONDUIT (Continued)

C. CONDUIT BORED

When shown on the plans the jacking or directional boring of conduit is to be done with equipment designed and designated for that purpose or other approved methods where a constant pressure can be applied and controlled, and in accordance with approved procedures.

Pavement shall not be disturbed without the approval of the City's Project Manager. Jacking or directional boring shall be kept 24" from the edge of any type of pavement wherever possible. Excessive use of water which might undermine pavement or soften sub grade will not be permitted.

Determine all utility locations near the path of the proposed pushed (bore) conduit, including depth. Use this information to avoid damage to utilities and/or facilities within the work area. Provide this information, including the sources, to the City's Project Manager a minimum of five working days prior to boring. Do not bore until the City's Project Manager approves that submittal.

Prior to boring, expose all utilities for which it is customary and safe to do so.

The diameter of the drilled hole shall conform to the outside diameter of the conduit as closely as practical. Pressure grout as directed by the City's Project Manager, to fill any voids, which develop during the installation operation. Remove and replace any conduit damaged in directional drilling operations at no expense to the project.

Conduit depths shall be a minimum as follows:

- 48" in soil
- 48" below a projected slope from the flow line of a ditch.
- 48" under a roadway measured from the surface of said roadway to the top of the installation
- 48" under a storm water or creek channels design flow line

All empty ducts shall be sealed using expandable style duct plugs sized to match conduit.

Conduit logs detailing bore depth shall be presented to the City after all boring operations. Conduit logs shall include as built drawings of conduit and GPS location measurements of all pull box lids accurate to 10 digits. All conduit logs shall be electronic and of a format approved by the City of Lincoln.

Repairs to conduit shall use a coupling capable of providing a watertight/airtight connection in buried or restrained applications.

The use of water and other fluids in connection with the drilling operation will be permitted only to the extent necessary to lubricate cuttings. Jetting will not be permitted, and the use of water alone as a drilling fluid will not be permitted. Use a drilling fluid/slurry consisting of at least 10% high grade, processed Bentonite to consolidate excavated material, seal the walls of the hole, and furnish lubrication for subsequent removal of material and immediate installation of the pipe.

24.03 CONDUIT (Continued)

C. CONDUIT BORED (Continued)

Provide a means of collecting and containing drilling fluid/slurry that returns to the surface, such as slurry pit, or a method approved by the City's Project Manager. Provide measures to prevent drilling fluids from entering storm sewer systems. Prevent drilling fluid/slurry from accumulating on or flowing onto sidewalks, other pedestrian walkways, driveways, or streets. Immediately remove any slurry that is inadvertently deposited on pedestrian walkways. Transport waste drilling slurry from the site and dispose of it. Do not allow slurry to enter wetlands. Protect wetlands using appropriate soil erosion control measures approved by the City's Project Manager. Boring fluid shall be appropriate for soil conditions. Waste oil and/or environmentally non-compatible polymers shall not be part of the drill fluid composition. Used boring fluid shall be properly, and legally, disposed of.

The contractor shall continuously monitor boring operations for possible frac-out of drill fluid. Any frac-out or surface uplifting shall be contained, cleaned up, and repaired.

Use a digital walkover locating system to track the drill head during the bore. At minimum, the locating system shall be capable of determining the pitch, roll, heading, depth, and horizontal position of the drill head at any point along the bore. During each drilling operation, locate the drill head every 10' along the bore and prior to crossing any underground utility or structure. Upon completion of the drilling operation and conduit installation, furnish the City's Project Manager with an as-built profile drawing and plan drawing for the drilled conduit showing the horizontal and vertical locations of the installed conduit.

Wall penetrations of existing concrete retaining walls shall be performed by the drilling, or other approved construction means, of an opening with a minimum diameter of 1" greater than the outside diameter of the conduit(s) to be inserted through the wall. Reinforcing bars shall be located on the fill face of the wall using non-destructive scanning techniques. Openings shall be located to avoid cutting or otherwise damaging reinforcing bars on the fill face side of the wall. Sufficiently remove any rough edges from the wall opening to prevent damage to the conduit(s). The wall penetrations shall be filled with a Type III epoxy grout. The cost of wall penetrations will be considered incidental to the unit price of conduit.

D. CONDUIT IN TRENCH

Conduit in trench shall mean conduit which is directly buried in earth and shall be installed in suitable trenches in conformance with 24.00.F.

E. BASIS OF PAYMENT

CONDUIT, ____", BORED; CONDUIT, MAIN LINE GROUP BORED; CONDUIT, ____", TRENCHED; CONDUIT and MAIN LINE GROUP TRENCHED, complete, in place and accepted by the City's Project Manager, shall be measured as lineal feet from center to center of pull boxes to center of foundations to center of cabinet, to center of pole if there is no foundation of such material of the size and type required and shall be paid for at the contract unit price bid per linear feet for the conduit. This price and payment shall be full compensation for all excavation required; pulling string (in City fiber conduit), fiber locate cable (in City fiber conduit), conduit caps, hose clamps, backfilling and compacting; and for all labor, equipment, tools, materials, and incidentals required to complete the Work.

Pulling String and Fiber Locate Cable are subsidiary to City communication conduits. The installation of conduit stub outs as called for on the plans, including necessary couplings, elbows, sweeps and bends shall be considered part of those items for which payment is made and shall not be measured separately.

24.04 BLANK ON PURPOSE

24.05 PULL BOXES

A. GENERAL

Pull boxes, T6, T9, TR27, T48 and their lid are required to conform to all test provisions of ANSI/SCTE 77 “Specifications for Underground Enclosure Integrity” Tier 15 and labeled as such inside the pull box and on the top of the lid. All lids are required to have a minimum coefficient of friction of 0.5 in accordance with ASTM C1028. Independent third party verification or test reports stamped by a registered Professional Engineer certifying that all test provisions of this Standard Specification have been met are required with each submittal. Pull Box, T48 shall have a split lid (2-piece).

Pull box shapes and nominal dimensions shall conform to LSP 81.

Pull box lids shall also be labeled “ELECTRIC”, “TRAFFIC”, or “FIBER” on top as indicated on the Plans.

B. INSTALLATION

Pull boxes shall be installed at the locations shown on the plans.

The excavation for the pull box, T6 and T9 shall extend at least 12” below the bottom and 6” beyond the sides of the pull box and shall be lined with geotextile filter fabric meeting the requirements of Chapter 21 of the City of Lincoln Specifications. The pull box shall rest firmly on an aggregate base, meeting all of the requirements of coarse aggregate for concrete as described in Chapter 3 of the City of Lincoln Specifications.

Pull Boxes T6 and T9 shall have aggregate base that extends 12" below the bottom and at least 6" beyond the outside edges of the pull box. In addition, the aggregate base shall extend 6" up on the outer sides of the pull box, measured from the bottom of the box. The aggregate base shall be placed in 6" lifts and compacted with mechanical or hand methods to the satisfaction of the City’s Project Manager. See LSP 81 for aggregate placement detail.

The geotextile filter fabric shall be folded over the top of the aggregate base and shall extend to the sides and ends of the pull box. The remaining excavation shall be backfilled with soil and shall meet the requirements for backfill in Chapter 20 of the City of Lincoln Specifications.

The excavation for the pull box, TR27 and T48 shall extend at least 12” below the bottom and 12” beyond the sides of the pull box and shall be lined with geotextile filter fabric meeting the requirements of Chapter 21 of the City of Lincoln Specifications. The pull box shall rest firmly on an aggregate base, meeting all of the requirements of coarse aggregate for concrete as described in Chapter 3 of the City of Lincoln Specifications.

Pull Boxes TR27 and T48 shall have aggregate base that extends 12" below the bottom and at least 12" beyond the outside edges of the pull box. In addition, the aggregate base shall extend 12" up on the outer sides of the pull box, measured from the bottom of the box. The aggregate base shall be placed in 6" lifts and compacted with mechanical or hand methods to the satisfaction of the City’s Project Manager. See LSP 81 for aggregate placement detail.

The geotextile filter fabric shall be folded over the top of the aggregate base and shall extend to the sides and ends of the pull box. The remaining excavation shall be backfilled with soil and shall meet the requirements for backfill in Chapter 20 of the City of Lincoln Specifications.

24.05 PULL BOXES (Continued)

B. INSTALLATION (Continued)

Pull boxes shall not be placed in concrete unless specifically indicated on the plans or otherwise directed by the City's Project Manager.

Do not install pull box lid bolts.

Pull box edges, lid and lifting eye shall be kept clear of concrete and foreign material.

C. BASIS OF PAYMENT

PULL BOX, _____, complete, in place and accepted by the City's Project Manager, shall be measured for payment as single units for each type and shall be paid for at the contract unit price bid per each. This price and payment shall be full compensation for all excavation required; for furnishing and installing the pull box and lid; for conduit, conduit bends or long radius sweeps, conduit stub out, geotextile filter fabric and aggregate base; and for all labor, equipment, tools, materials, and incidentals required to complete the work.

24.06 RISERS

A. GENERAL

A riser is a conduit vertically attached to a pole or a building used to hold cable. The riser shall be Galvanized Rigid Steel (GRS) conforming to the UL "Standard for Safety" UL-6 and PVC, Schedule 40, conforming to UL "Standard for Safety: UL-651.

B. INSTALLATION

All risers shall be schedule 40 PVC and shall be of the size specified in the plans, at the location shown on the plans. The riser shall be GRS a full 10' from grade up without joints, installed on standoffs and grounded. Risers mounted on the side of building shall be located as close to any existing underground network riser as is practical in a manner acceptable to the City's Project Manager. The steel portion of the conduit riser shall be grounded at the top.

All pole risers shall be on standoff brackets provided by LES. These can be picked up at the LES store room. See 24.00.E for location and hours. See LSP 83 for spacing detail.

LES is to build the Riser above the 10' of GRS and provide the cable to the meter when a meter is required. If there is no meter, then the contractor is to build the riser to its needed height and provide the cables, including enough cable for LES to energize.

The bottom 3' of service risers installed on buildings shall be encased in concrete not less than 3" in thickness. Concrete shall be L3500 conforming to the requirements of Chapter 3 of these Standard Specifications.

C. BASIS OF PAYMENT

RISER, _____", complete, in place and accepted by the City's Project Manager, shall be measured for payment as single units for the various sizes and shall be paid for at the contract unit price bid per each for. This price and payment shall be full compensation for all excavation required; for furnishing and installing the riser; for picking up and installing standoff, provided by LES installation, for conduit pipe clamps, ground wire, ground rod, concrete encasement, steel riser guards, meter socket, and incidentals are considered part of the riser assembly.

24.07 ELECTRICAL METER PEDESTAL

A. GENERAL

When placing an Electrical Meter Pedestal the Contractor shall supply the pedestal. LES shall furnish and install KWH meter, cable from source to the meter and the upper part of the riser, when applicable. Metallic pedestals shall be bonded to the service neutral. A ground rod shall be installed at the pedestal and bonded to the service neutral. Meter socket shall be ring style. Meter socket is to have lugs to receive a 120/240 volts single phase 3 wire service.

B. INSTALLATION

Meter Pedestals shall be installed at the locations shown on the plans. See LSP 83 for installation detail.

C. BASIS OF PAYMENT

ELECTRICAL METER PEDESTAL, complete, in place and accepted by the City's Project Manager, shall be measured as single units and shall be paid for at the contract unit price bid per each for the item. This price and payment shall be full compensation for the excavation and backfilling required, for furnishing and installing the pedestal, ground rod; for all labor, equipment, tools, materials, and incidentals necessary to complete the Work.

24.08 STEEL POLES

A. GENERAL

Traffic Signal Pole and Combination Traffic Signal / Street Light Pole Standard Specifications are found on LSP 85. Street Light Pole Standard Specifications are found on LSP 92. Pedestal Pole Standard Specifications are found on LSP 90.

B. STREET LIGHT POLES

1. General

Poles shall conform in detail to the requirements set forth in this Standard Specification and as shown on the plans. Each pole shall consist of a steel shaft, grounding terminal, wire inlet, hand hole and hand hole cover.

The following criteria shall be evaluated when designing these poles:

- a. Total weight of each luminaire - 40 pounds.
Effective projected area for each luminaire shall be 3 square feet.
- b. Wind loads (gust factor of 104 MPH) shall be 23.5 pounds per square foot on all supported surfaces including projected area of luminaires, sign surface area of 8 square feet, and pole sections.
- c. Ice loads (unit weight of ice equal to 56 pounds per cubic foot) shall be assumed to be 1" of ice on the horizontal projection of all exposed surfaces including sign surface area of 8 square feet. A ½" radial ice coating shall be assumed on the vertical projection of all exposed surfaces.

2. Shaft

The shaft shall be of steel and shall be a continuously tapered tube fabricated from not less than No. 11 manufacturer's gauge thickness, best grade steel. The shaft shall have only 1 longitudinal welded joint and shall be free of intermediate horizontal joints or welds. Only 1 length of sheet steel shall be used which shall be formed into a continuously tapered shaft having a taper of approximately 0.14" per foot. The shaft shall then be cold rolled under enough pressure to flatten the weld and increase the physical characteristics of the shaft so that the metal will have a minimum guaranteed yield strength of 48,000 psi.

The cold rolling process shall form a round shaft approximately 23' in length with a top outside diameter of approximately 3" and a bottom diameter of approximately 6". A 3" x 5" handhole with removable cover plate shall be centered approximately 18" above the ground line of the pole.

A grounding nut for accommodating a ½" 13 UNC threaded bolt shall be provided on the inside of the shaft so as to be easily accessible from the handhole opening.

The overall length of the shaft shall be such that the luminaire specified has its light center located per plan mounting height above the ground when mounted on the pole with the base of the pole to be a minimum of 4' below grade.

A wire opening with a minimum diameter of 1 ½" shall be provided in the shaft. It shall be a grommeted, smooth surface opening to prevent damage to wire being drawn through the hole. The opening shall be approximately 24" below the ground line.

24.08 STEEL POLES (Continued)

B. STREET LIGHT POLES (Continued)

3. Painting

After all welds have been completed on the pole shaft, it shall be thoroughly cleaned of all loose scale and other foreign material, hot dip galvanized and finish painted at the factory. Care is to be taken during shipping and installation to protect the finish from any cuts or scrapes.

4. Modifications

The Contractor shall submit to the City's Project Manager for approval the name of the manufacturer and the type of pole he proposes to furnish. The Contractor or his representatives shall make no field modifications on any pole, or part thereof, without the written permission of the City's Project Manager.

Modifications shall be construed to mean any drilling, filing, tapping, cutting, bending, or any other operation that will change the physical, mechanical, or architectural qualities of the pole.

C. INSTALLATION

Poles, pole arms and/or pedestals are to be installed at the locations shown on the plans, unless permission to change the locations is given by the Project Manager. Poles shall be placed so that modifications and/or attachments are carefully oriented, as indicated on the plans.

The Traffic Signal Pole hand hole and festoon outlet shall be located on the side opposite the street.

A ground rod shall be set in undisturbed earth as shown on LSP 82 and 92. A continuous bare copper ground wire shall be connected from the ground rod to the grounding lug on the pole. When transformer bases are used, the pole shaft section and the transformer base section shall also be bonded to the ground rod.

Pole shafts must be erected so that they are plumb with their entire load in place. The mast arms shall be correctly oriented, as shown on the plans. Plumbing of pole shafts shall be accomplished by adjusting the leveling nuts on the foundation anchor bolts. Shims or similar devices for plumbing or racking will not be permitted except for leveling of the transformer base as per the manufacturer. The Contractor is responsible for additional nuts and washers for the Pedestal Pole if needed.

The Contractor shall notify the City of any damaged poles or surfaces before they pick up poles from pole storage site. The Contractor shall handle all poles in a manner to prevent damage to pole surface. All poles shall be clean after erection, and damaged surfaces shall be repaired to the City's Project Manager's approval.

After the mast arms orientation and height are verified by the City's Project Manager, the Contractor shall pin the mast arms as soon as possible.

24.08 STEEL POLES (Continued)

D. ROTATE MAST ARMS

At the City's Project Manager's discretion, the mast arms shall be oriented parallel to the traveled roadway and later swung into their final orientation. The Contractor shall only rotate the mast arms to the correct orientation upon the direction of the City's Project Manager. When the Contractor is rotating the mast arms to the final plan orientation, they must loosen bolts so that the mast arm clamp does not bind on the shaft or cause damage to the finish.

If the City's Project Manager calls for the final plan mast arm orientation only, then the Contractor shall not be paid for rotating the mast arms.

Payment for arms rotated into place due to construction constraints is subsidiary to Install Mast Arm Pole.

E. EMBEDDED STEEL POLE INSTALLATION

Embedded steel poles shall be backfilled with pole setting foam. The Contractor shall coat the entire vertical pole butt surface with foam from base 6" below ground line. The poles shall be masked to 1" above the ground line to prevent splattering and provide a uniform edge.

All holes for poles shall be drilled, augured or vacuumed. The soil shall be removed from the holes mechanically or vacuumed. The diameter of the finished hole shall not exceed the pole diameter at ground line more than 4" nor less than 2". Depths of holes shall be determined by embedment length requirements of the pole.

In case of over-drilling, the holes shall be backfilled to proper depth with compacted soil. The Contractor shall take every precaution to prevent surface drainage from entering the holes.

A 6" layer of crushed rock shall be placed in the base of each hole. The crushed rock shall have been sieved after crushing to remove excessive fines and shall be so graded to meet the following requirements:

Total retained on 1-1/2" sieve	0-5%
Total retained on 1/2" sieve	90-100%

A small section of PVC conduit shall be used during backfilling application to assure access to the underground wire inlet after the backfilling process has been completed to allow installation of the underground wire thru the pole setting foam.

Poles shall be plumbed and held in stationary position for no less than 20 minutes (or as recommended by the foam manufacturer) after the foam has been applied. The masking shall be removed as soon as the foam expansion reaction has ceased. The remainder of the hole shall be backfilled with clean earth and tamped.

Application and use of the foam shall be in strict adherence to the manufacturer's instructions. A copy of the manufacturer's instructions shall be present on the job site and available to the Project Manager. The age of the pole setting foam components shall not have exceeded the manufacturer's recommended shelf life under the conditions by which the manufacturer defines shelf life.

After the recommended curing period, the foam shall have a core density of not less than 4.2 pounds per cubic foot and shall have a shear strength not less than 38 psi. and shall have a compressive strength not less than 75 psi.

24.08 STEEL POLES (Continued)

E. EMBEDDED STEEL POLE INSTALLATION (Continued)

The foam shall be tested, when required by the City's Project Manager, in accordance with ASTM D 2856/ANSI K 65.152; ASTM D 1623/ANSI K65.32; and ASTM D 1621/ANSI K65.31.

F.BASIS OF PAYMENT

POLE, INSTALL _____ complete, in place, and accepted by the City's Project Manager, shall be measured for payment as single units and shall be paid for at the contract unit price bid per each. This price and payment shall be full compensation for all excavation, for picking up and installing the pole, mast arm, luminaire arms, cable, conductors, span wire, tie wire, concrete, conduit stub-out, reinforcing steel, anchor bolts, concrete foundation, anchor bolt covers, power installed foundations, transformer base, breakaway base, pole setting foam, ground rods and clamps, and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work.

INSTALL MAST ARM, complete, in place, and accepted by the City's Project Manager, shall be measured for payment as single units and shall be paid for at the contract unit price bid per each for the item only when called for. This price and payment shall be full compensation for picking up and installing the arm, all labor, equipment, tools, and incidentals necessary to complete the Work.

ROTATE MAST ARM, complete, in place, and accepted by the City's Project Manager, shall be measured for payment as single units and shall be paid for at the contract unit price bid per each for the item only when called for. This price and payment shall be full compensation for all labor, equipment, tools, and incidentals necessary to complete the Work.

POLE, _____ complete, in place, and accepted by the City's Project Manager, shall be measured for payment as single units and shall be paid for at the contract unit price bid per each. This price and payment shall be full compensation for all excavation, for furnishing and/or installing the pole, luminaire arms, cable, conductors, span wire, tie wire, concrete, conduit stub-out, reinforcing steel, anchor bolts, concrete foundation, anchor bolt covers, power installed foundations, transformer base, breakaway base, pole setting foam, ground rods and clamps, and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work.

24.09 GROUND RODS

A. GENERAL

Ground rods shall be high strength steel rods with chemically-bonded copper coverings to provide high-conductivity and to prevent electrolytic action. The copperweld ground rods shall be placed as shown on the plans, 2' from the pole base, and oriented on the same side as the hand hole or in a pull box, if called for on the plans or LSPs; they shall have a nominal diameter of 5/8" and 15' long, except to a Street Light Pole shall be 10' long. For worker safety 5' lengths of ground rod screwed together are allowed. Ground wires shall be connected to ground rods with one-piece non-ferrous clamps which employ set screws as tightening devices. Connections to ground rods shall not be taped.

All ground wires shall be No. 6 AWG, bare solid annealed copper wire unless otherwise specified on the plans.

B. INSTALLATION

Each pole or pedestal or traffic signal cabinet shall be firmly connected to the ground rod provided for each using the grounding terminal or terminal lugs. Placing the ground wire under an anchor bolt nut, anchor bolt cover, or similar device will not be permitted. The Contractor shall attach ground wire to base using terminal lugs. To attach the ground to the pedestal pole base, drill a hole in the pedestal base to accept the terminal lug.

Each pole or pedestal shall be connected to the traffic signal cabinet and the ground rod using a circuit grounding conductor of the size required on the LSP.

Each steel pole shall be connected to both the pole ground and a separately installed circuit grounding conductor of the size called for on the plans.

Ground Rods shall be installed in Pull Boxes where specified on the plans. Ground rods shall be centered on the side opposite the curb and installed 3" away from pull box side walls. The top of the ground rod shall be 10" below the bottom of the pull box lid. Ground Rods in Fiber pull Boxes shall include a Fiber Locate Cable attached to the Ground Bar and attached to the 15' ground rod in the pull box.

C. BASIS OF PAYMENT

GROUND ROD, complete, in place and accepted by the City's Project Manager, shall be measured as single units and shall be paid for at the contract unit price bid per each. This price and payment shall be full compensation for furnishing and installing the Ground Rods; and for all labor, equipment, Fiber Locate Cable, tools, materials, and incidentals required to complete the work.

No measurement or direct payment will be made for ground rods, ground wire, attachments to existing ground, or grounding clamps installed in conjunction with wood or steel poles, pedestal poles, or the pull box nearest the traffic signal cabinet. Ground rods and ground wire shall be considered subsidiary to and included in the bid price for the items for which direct payment is made.

24.10 DETECTORS

A. GENERAL

Detectors shall be inductance loops, detector cameras, non-intrusive detectors, emergency detectors or pedestrian push buttons as called for on the plans. All loop locations shall be marked on the pavement by the Contractor prior to installation and approved by the City's Project Manager. All camera detector, non-intrusive detector, and emergency detector locations shall be located as indicated on the plans. The locations for these detectors shall be coordinated with Traffic Operations and approved by the City's Project Manager. The pedestrian push button locations shall be marked on the pole shaft by the Contractor prior to installation and approved by the City's Project Manager. The Contractor shall review the installation drawing prior to scheduling operations, so as to expedite the installation process and cause a minimum of traffic interference and to ensure correct placement of loops.

The Contractor shall adhere to the specified detector locations including the leads and conduit as shown on the plans. Loops shall always be centered in their respective lanes as identified by final pavement markings shown on the plans. Care should be taken to ensure loops are centered properly within through lanes and left-turn lanes should variable lane widths exist. If some unforeseen condition necessitates repositioning a loop, the change must be approved by the City's Project Manager.

B. LOOP DETECTORS

Loop Detectors are described as either saw cut or under cover loops. Saw cut loops are placed in existing roadways in a 3/8" wide slot. Under cover loops may be placed in or on the subgrade prior to placing the surface, or placed beneath surfacing material, as shown on the plans. All loops shall be 6' x 6'.

1. Saw Cut Loop

After identification of the loop locations, the Contractor shall perform the actual layout by means of either a template or chalk line. All Work related to the installation of a particular loop, with the exception of the layout task, shall be complete in the same Work day.

a. Saw Cutting

Saw cutting will be allowed only when the temperature is 32 degrees F and rising. The concrete cutting equipment shall make use of a tank supplied water source which has sufficient pressure to act as a blade coolant, lubricant, and slot cleaner. Diamond cutting blades utilized for the saw cut shall, without damaging the adjacent areas, provide a clean, well-defined slot having a 3/8" width. The depth of the saw cut shall be 3". On milled surfaces to be overlaid, depth of the saw cut shall be 2" from the lowest groove. The perpendicular saw cuts shall not meet at the corners. Diagonal cuts shall be required at all corners and where the loop wire exits from the actual loop. The saw cut waist shall be collected in a manner to keep from storm drainage.

b. Cleaning the Saw Cut

After the cutting operation, the slots shall be free and clear of moisture and debris, and the presence of any jagged edges or other protrusions which might damage the loop wire.

24.10 DETECTORS (Continued)

B. LOOP DETECTORS (Continued)

c. Wire Installation

Loop wire shall go directly from the loop to a pull box. IMSA 51-5 No. 14 AWG wire shall be used. The loop wire shall be a continuous length, no splicing allowed. The wire brought to the pull box shall be clearly tagged, identifying the loop number using the labeling method as shown in 24.12.D. During installation, the loop wire shall be held in place by lengths of compressible polyethylene or polyurethane foam sealant backer rod, not to exceed 6". The backer rod shall be of sufficient number and size to hold the wire in place while the sealant cures and is resilient over the temperature range of -40 degrees to +160 degrees F. The top of the backer rod shall be at least 1 ½" beneath the surface of the pavement. On milled surfaces, the backer rod shall be at least ½" from the lowest groove.

d. Sealing the Saw Cut

The sealant used to cover the wires in the slots shall be an elastic epoxy resin compound. The epoxy shall have a tack-free curing time of not more than 1 ½ hours at 75 degrees F. The sealant shall be applied into the slot to half depth.

When both the loop and lead-in slots are half filled, a check shall be made for air bubbles and material pile-up and then the slots shall be filled to roadway level. Excess sealant shall be removed by means of squeegee. There shall be neither a trough nor a mound formed. The sealant, when applied into the saw cut, shall displace all the air, and completely fill the area of the slot. Sufficient time for sealant curing shall be allowed before traffic is permitted to move over the area.

2. UC (Under Cover) Loop

The Contractor shall furnish and install under cover loop detectors at a depth of 0" to 6" under new pavement. Care should be taken to prevent damage to the loop and lead in before and during the paving operation.

The under cover loop may be formed to be rigid or flexible, with the number of turns specified. The wire shall be a continuous length, no splicing allowed. The end of the wire brought to the pull box shall be clearly tagged identifying the loop number using the labeling method as shown in 24.12.D.

3. Loop Acceptance

Each loop shall be tested at the cabinet prior to termination and acceptance. All tests shall have the following result prior to acceptance.

New Loop = infinity

New Loop and New Feeder Cable = infinity

C. PEDESTRIAN PUSH BUTTONS

The pedestrian push button assembly will be furnished to the Contractor by the City. Each pedestrian push button shall consist of push button assembly, instruction sign, frame, instruction sign screws and shims that shall only be used on the smaller poles to stabilize the Pedestrian Push Buttons. The shims shall not be used if they cause any separation from the pole to the Pedestrian Push Button. Pedestrian push buttons shall be mounted on the correct pole face as

24.10 DETECTORS (Continued)

C. PEDESTRIAN PUSH BUTTONS (Continued)

shown on the plans, 3'-6" above the adjacent walk surface, taking care to place so that the flat side of pole is flush with the Pedestrian Push Button. The Contractor shall supply brass mounting screws for mounting the assembly to the pole. The pole shaft wire entrance shall be a 7/8" diameter deburred hole. When 2 push buttons are on the same pole shaft, the common (white) cables are spliced in the hand hole or base, not jumpered together at the push buttons.

D. CAMERA DETECTOR

Camera Detector shall be installed on the mast arm at the location shown on the plans. The attachment to the arm shall be by use of the clamp kit, as specified in these Standard Specifications, and a City provided, 5' rigid aluminum conduit extension, placed above the arm. The Contractor shall aim and adjust the camera under the supervision of City personnel. The pole mast arm wire entrance shall be a 1" diameter deburred hole with a 1" inside diameter rubber grommet.

E. NON-INTRUSIVE DETECTOR

Non-Intrusive Detector shall be installed at locations shown on the plans. The mounting bracket for the detector shall be furnished by the City of Lincoln. The Contractor shall aim and adjust the detector in coordination with Traffic Operations personnel. The pole wire entrance shall be a 1" diameter deburred hole with a 1" inside diameter rubber grommet. Changes in mounting or adjustment to locations shall be approved by the City's Project Manager.

F. EMERGENCY DETECTOR

The Emergency Detector shall be installed on the mast arm at the location as shown on the plans. The attachment to the arm shall be by use of the clamp kit furnished by the City. The pole mast arm wire entrance shall be a 1" diameter deburred hole with a 1" inside diameter rubber grommet.

G. BASIS OF PAYMENT

DETECTOR, LOOP, UNDER COVER; DETECTOR, LOOP, SAW CUT; DETECTOR, INSTALL NON-INTRUSIVE; DETECTOR, INSTALL PEDESTRIAN PUSH BUTTON; DETECTOR, INSTALL CAMERA; and DETECTOR, INSTALL EMERGENCY, complete, in place, tested, and accepted by the City's Project Manager, shall be measured for payment as single units and shall be paid for at the contract unit price bid per each for the item.

This price and payment shall be full compensation for the furnishing and installing the under cover loops and for furnishing and installing saw cut loops, including epoxy, and sawing, and for installing furnished Pedestrian Push Buttons with Contractor supplied mounting screws, Camera Detectors, Non-Intrusive Detectors, and Emergency Detectors with Emergency Detector Clamp Kit, clamp kits not included, rigid aluminum conduit, pull-box, conduit as specified, loop wire, and for all labor, equipment, tools, testing, materials, and incidentals required to complete the Work.

In the event an UC Loop does not meet requirements or was not placed as per plan, the Contractor shall remove the roadway to the nearest joint, place a new UC Loop as per plan and replace roadway, all at Contractors expense.

Any surface to be overlaid shall have loops sawed into the base prior to placement of asphalt. Loops not placed prior to surfacing, shall be sawed into the surface without payment to the Contractor.

24.11 CABINETS

A. GENERAL

This section refers to Cabinets, ITS Pole Mount, ITS Pad Mount, and Signal Pad Mount.

Upon completion of the Work, each cabinet shall be properly placed, mounted, wired, and connected to operate as shown on the cabinet prints provided by the City.

Unless otherwise noted, the cabinet, auxiliary equipment, and mounting hardware will be furnished to the Contractor by the City, ready for installation by the Contractor.

B. INSTALLATION

The Contractor shall mount or place each cabinet, base, and concrete pad as shown on the plans in accordance with the LSPs. Cabinet ITS Pad Mount and Signal Pad Mount shall have a 4'-2" x 6' x 4" concrete pad in front of the main door. The Cabinet pad shall be level in both directions.

The Contractor shall connect all conductors for signal heads, detectors, grounds, Fiber Locate Cables, service cables, and fiber optics into the traffic signal cabinet. The Contractor shall connect the service cables and have the power panel energized.

All cables shall be routed to the cabinet and neatly trained to their destination in the cabinet utilizing industry standard Velcro ties, and shall be clearly identified using the labeling method as shown in 24.12.D.

The Contractor shall work closely with the City's Project Manager in scheduling cabinet installations so as to minimize intersection down time.

All wiring for the cabinet shall be completed by the Contractor using a wiring diagram furnished by the City.

The Contractor shall mount Cabinet, ITS Pole Mount on the designated pole with the top at 6' above the ground.

C. BASIS OF PAYMENT

CABINET, INSTALL, ____, installed, connected, cables labeled, tested and accepted by the City's Project Manager, shall be measured as a single unit and shall be paid for at the contract unit price bid per each for. This price and payment shall be full compensation for picking up and installing the cabinet, concrete pad, base, all connections, reinforcing steel, concrete, ground rod and for all labor, equipment, tools, materials, excavation, and incidentals required to complete the Work.

24.12 CABLE

A. TYPES AND CLASSES OF CABLE

All classes of cable shall be on substantially constructed reels, plainly marked as to size, type, and insulation identification. Only 1 length of cable shall be shipped on each reel. All cable must be new. Damaged cable or repairs on damaged cable will not be permitted. All cables shall be stranded copper, unless otherwise noted.

1. Traffic Signal Cable

Traffic signal cable shall be IMSA Specification No. 19-1, No. 14 AWG.

2. Lead-In Cable

Lead-In Cable shall be IMSA Specification No. 50-2, No. 14 AWG.

3. Loop Detector Wire

Loop Detector wire shall be IMSA Specification No. 51-5, No. 14 AWG.

4. Service, Street Lighting, Circuit Grounding Cable and Pole Grounding Wire

The cable for underground circuits and pole grounding shall be single conductor, the size specified on the plans, type XLP USE-2, RHH/RHW-2 600 Volt, Copper Cable. UL 44 and UL 854, ICEA S-95-658/NEMA WC-70, C (UL) US Federal spec. A-A-59544. Pole ground wire shall be bare No. 6 AWG solid copper.

5. Camera Detector Cable

Camera Detector Cable shall be 3 conductor and PV Coax combination in a single jacket ("Siamese cable").

The first element consists of 3 conductors each of No. 18 AWG 7/26 copper strand encased in .016" thickness of polyethylene, the color code shall be white, red and blue. The second element shall be a PV Coax single conductor, No. 20 AWG solid copper, surrounded by .056" foam polyethylene with a 95% bare copper braid encased in a 0.035" black polyethylene. This element shall have an outside diameter of 0.242".

The overall assembly is housed in a UV stabilized black polyethylene jacket of 0.030 in thickness.

6. Emergency Detector Cable

Emergency Detector Cable shall be a shielded 3/c. The conductors shall be 20 AWG 7/25 BC 600Vac insulated. The colors shall be blue, orange, and yellow. The outside jacket shall be UV stabilized black polyethylene jacket, and have a total nominal outside diameter of 0.51".

24.12 CABLE (Continued)

A. TYPES AND CLASSES OF CABLE (Continued)

7. Ethernet Communications Cable

Ethernet Communications Cable shall be Cat 6, outdoor rated, with AL Foil shielding to eliminate interference. Cable shall also have HDPE insulation, and include connectors on each end of the cable.

8. RRFB Cable

RRFB Cable shall be IMSA Specification No. 19-1, 4 Conductor No. 18 AWG.

B. INSTALLATION

The installation of power cables shall, in general, conform to the NESC insofar as it applies, subject to the conditions and instruction of the City's Project Manager.

1. In Conduit

Prior to installation of underground cable, the Contractor shall insure that the conduit is open, continuous, free of water, and clear of debris.

The cable shall be installed in such a manner and by such methods ensuring against harmful stretching of the conductor, injury to the insulation, or damage to the outer protective covering of the cable. An approved cable lubricant may be used to aid in pulling through conduit, when necessary.

Where more than 1 cable is to be installed in the conduit, all shall be pulled at the same time. 2' of extra cable shall be left on each lead extending beyond the hand hole in the base of all poles, above the top of all pull boxes, power pedestals, and each side of any splice. 6' of extra cable shall be left in the cabinet.

Under no circumstance will any cable be taped to another cable.

2. Pole Cable

The jacket of all pole shaft cables shall extend through the pole.

3. Direct Buried

Direct buried cable shall be installed in place with an approved cable plow at a depth of 30". In areas where trenching or plowing may damage utilities or the health of mature plants, the boring procedure shall be required.

24.12 CABLE (Continued)

C. SPLICES AND CONNECTIONS

No splices or joints will be permitted to be drawn inside the conduit, nor shall any splices or joints be made in any cable outside of pull boxes, pole bases or traffic signal heads.

Splices are not allowed in Lead In Cable, Service Cable, Camera Detector Cable, Emergency Detector Cable, RRFB Cable and Ethernet Communications Cable. The only splice allowed in Traffic Signal Cable to heads or push buttons is at the pole hand hole. Street Lighting Cable and Circuit Grounding Cable shall be spliced only when a change in size or split of cables is shown on the plans.

Any cable end unused in a pull box shall be weather proofed with shrink tube or approved sealant, not tape.

All Traffic Signal splices and Street light splices below grade shall be made for continuous immersion in water.

Cable connections in signal heads or controller cabinets shall be made at the terminal boards provided for this purpose. All stranded wires inserted under a binder head screw shall be equipped with a solderless pressure-type spade connector with a pre-insulated shank. A crimping tool for insulated connectors shall be used. No bare wire or bare stud shall be exposed.

Service connections to the Cabinet shall be continuous from the power source.

All direct buried street lighting cable splices shall be inspected by LES before backfilling.

1. Heat Shrink Splices

This splice shall be used to connect Traffic Signal Conductors in poles and Loop Detector splices in pull boxes. This splice shall be mechanically and electrically sound with bronze compression sleeve connection encapsulated in a permanent seal, waterproofing and insulating the electrical connection.

Wire ends must be thoroughly cleaned after the insulation is stripped off to ensure complete contact with another wire or the connector. If strands are damaged when the insulation is removed, the section of cable must be discarded. Nicked or damaged conductor strands will not be permitted inside of connectors. Loose wire ends shall not be used as "shims" to make a connection.

All connectors shall be designed for copper to copper connections. Only new connectors may be used. Connectors for compression sleeve splicing shall be of a type that when installed, the heat shrink products with proper mechanical and electrical properties may be utilized for all in-line splices of traffic signal control cable, loop feeder cable, traffic signal power supply cable, and other such applications.

The black heat shrink tubing shall be made of "thermally stabilized modified polyolefins" capable of minimum continuous use of 10,000 hours over an operating temperature range of -65 degrees to +130 degrees F.

24.12 CABLE (Continued)

C. SPLICES AND CONNECTIONS (Continued)

1. Heat Shrink Splices (Continued)

The tubing shall be industry standard "thick wall type", and shall have the ability to conform to severe configuration changes without splitting. It shall have a 3:1 shrink ratio.

The tubing shall be supplied with a factory applied sealant. When heat is applied, the sealant inside the product softens and flows around and over any irregularly-shaped configurations, filling voids and completely water sealing. The sealant shall remain in a semi-flexible state, assuring a complete moisture seal.

Heat sources for the shrinking process can be an electric heat gun or propane/butane gas torch capable of delivering at least 250 degrees F. Scorched or burned splice components and/or sheathing will not be accepted.

2. Block Connectors

Street Light connectors to be used in poles shall be an approved 3 or 4 hole encapsulated connector.

3. Waterproof Block Connectors

This splice shall consist of a mechanically and electrically sound block connector encapsulated in a permanent gel capsule, waterproofing and insulating the electrical connection.

Splice connectors shall be an approved connector for use in a pull box. This connector shall be used only to connect tap wires to service cable, circuit ground and "in run" street light cables. Connectors shall be sized for the appropriate wire size and number of branch circuits.

4. Direct Buried Splice

This splice shall consist of a mechanically and electrically sound compression sleeve encapsulated in an inline splice kit, waterproofing and insulating the electrical connection.

Splice the cable with a compression sleeve and wrap with an approved gel wrap for use in direct buried and secure with tie. This connector shall be used only to connect tap wires to service cable, circuit ground and "in run" street light cables.

5. Secondary Fuses and Fuse Holders

Secondary fuses for single luminaire circuits or in street light poles shall be an approved type KTK, 10 ampere. Secondary fuses for multiple luminaire circuits shall be an approved type KTK, 30 ampere. Fuse holders shall be an approved type HEB.

24.12 CABLE (Continued)

D. LABELING

Cables shall be identified by several wraps of colored tape at all access points. An approved colored tape shall be non fading. Color code as follows:

Circuit Ground Cable:	Green
Traffic Service Cable:	
Neutral AC-	Yellow White
AC+	Yellow Blue
Street Light Cable:	
Neutral AC-	Red White
AC+ Phase 1	Red Blue
AC+ Phase 2	Red Blue Blue
AC+ Phase 3	Red Blue Blue Blue
Festoon Cable:	
Neutral AC-	Violet White
AC+ Phase 1	Violet Blue
AC+ Phase 2	Violet Blue Blue
AC+ Phase 3	Violet Blue Blue Blue
Metered Cable:	
Neutral AC-	Orange White
AC+ Phase 1	Orange Blue
AC+ Phase 2	Orange Blue Blue
AC+ Phase 3	Orange Blue Blue Blue

All other cables shall be identified with easy to read, good quality outdoor cable labeler.

Lead-In Cables shall be identified with phase and amplifier designation, both in the cabinet and the pull box where the loop detector is spliced. Traffic signal cables, push button cables, coaxial cables, camera control cables, camera detector cables, camera power cables, emergency detector cables shall be identified in the cabinet with the corresponding pole number using just the last digit (i.e. "POLE 1"). Communication cable and Fiber Locate Cable shall be identified in the cabinet with the direction of cable from the cabinet (i.e. "FIBER EAST").

Since Fiber Locate Cable is so thin, labeling tape shall be placed on wire perpendicular to the wire like a flag.

E. BASIS OF PAYMENT

CABLE, _____ complete, in place and accepted by the City's Project Manager shall be measured as lineal feet from center to center of pull boxes, foundations, cabinet or pole, of such material of the size and type required and number of fibers or conductors. Cable shall be paid for at the contract unit price bid per linear feet.

This price and payment shall be full compensation for furnishing and installing cable, all necessary slack, testing, documentation, splices, connections, cable labeling, fuses and fuse holders, and all other materials, hardware, labor, equipment, tools, and incidentals necessary to complete the work.

Cable inside loops, foundations, poles, pull boxes, cabinets, and other such devices or structures shall be subsidiary to those items and shall not be measured for payment.

24.13 SIGNAL HEADS, METRO STREET NAME SIGNS AND LED SIGNS

A. GENERAL

Traffic Signal Heads, Pedestrian Signal Heads, LED Signs and Metro Street Name Signs are furnished to the Contractor by the City, ready for installation by the Contractor. The Contractor shall furnish the mast arm clamp kit, shaft clamp kit, and down nipple extensions. The Traffic Signal Head or LED Sign adjustments shall be accomplished by adjusting the clamp kit and the connection from the Signal Head Arm to the Head or Sign. The set screws in the aluminum pipe shall never be adjusted.

The clamp kit shall be high tensile aluminum alloy with a high strength galvanized aircraft cable and stainless steel swaged fittings. The Contractor shall take care in selecting the length of cable required. If there is cable remaining, the Contractor shall tie wrap the excess in a tight coil.

The clamp kit shall have 2 sides with 1 ½" IPS (iron pipe size) signal hardware on one side, and shall be adjustable on the other side to fit the traffic signal pole shaft or mast arm. The clamp kit shall attach to the pole shaft or mast arm by use of an adjustable stainless steel cable and be able to rotate from horizontal to vertical in order to make the signal heads plumb or level. Installation shall be as per manufacturer's instructions.

B. INSTALLATION

Traffic Signal Heads, Pedestrian Signal Heads, Rectangular Rapid Flashing Beacon, LED Signs, Metro Street Name Signs, Speed Zones, Prepare To Stops and Speed Indicators shall be installed as shown in the plans to the approval of the City's Project Manager. All above mentioned locations, except shaft mounted Indicators shall be marked on the pavement by the Contractor prior to installation and approved by the City's Project Manager. Each signal assembly shall be erected so that it is plumb, securely attached with all fittings tight, and present a neat appearance. Traffic signal heads shall be installed in line and all the same relative heights above the crown of the street. Pedestrian Signal Heads shall be aimed at the center of the appropriate ramp for which a person would wait for walk indication.

The pole shaft wire entrances for the Pedestrian Push Buttons and Pedestrian Signal Heads shall be a 7/8" diameter deburred hole with none of the hole exposed outside of the Pedestrian Signal Head. The pole shaft wire entrances for the Traffic Signal Heads or LED Sign shall be a 1" diameter deburred hole with a 1" inside diameter rubber grommet. The pole mast arm wire entrances for the Traffic Signal Heads or LED Sign shall be a 1" diameter deburred hole with a 1" inside diameter rubber grommet.

The pole shaft wire entrance for the cable to the arm shall be a 1 1/2" diameter deburred hole with a 1 1/2" inside diameter rubber grommet.

Down nipple extension 1 ½" in diameter, and of appropriate length, shall be furnished and installed by the Contractor so that all signals on the span will hang at the same elevation as illustrated on the LSPs.

If, after the signal assemblies are erected and the road is open to public travel, the signal is not put immediately into operation, the signal faces shall be covered securely with signal covers specifically designed for all signal heads. Burlap, cardboard, or plastic 'trash style' bags shall not be accepted. All signal covers shall be approved by the City's Project Manager prior to use. No inoperative signals on a road which is open to the public shall be left uncovered under any circumstances. Traffic Signal Heads shall stay covered until the signal is ready to be placed in flash operation. Pedestrian Signal Heads shall stay covered until the signal is ready to be placed in full operation.

C. BASIS OF PAYMENT

HEAD, INSTALL _____, complete, in place and accepted by the City's Project Manager, shall be measured for payment as single units and shall be paid for at the contract unit price bid per each for. This price and payment shall be full compensation for picking up and installing the signal head, clamp kits, nipples, banding, pipe fittings, for all pole and mast arm modifications; and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work.

SIGN, INSTALL METRO STREET NAME, complete, in place and accepted by the City's Project Manager, shall be measured for payment as single units and shall be paid for at the contract unit price bid per each for. This price and payment shall be full compensation for picking up and installing the Metro Street Name Sign, clamp kits, nipples, banding, pipe fittings, for all pole and mast arm modifications; and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work.

SIGN, INSTALL LED; INSTALL SPEED ZONE ON MAST ARM; INSTALL SPEED ZONE ON SHAFT; INSTALL PREPARE TO STOP ON MAST ARM; INSTALL PREPARE TO STOP ON SHAFT; INSTALL SPEED INDICATOR ON SHAFT and RECTANGULAR RAPID FLASHING BEACON, INSTALL complete, in place and accepted by the City's Project Manager, shall be measured for payment as single units and shall be paid for at the contract unit price bid per each. This price and payment shall be full compensation for picking up and installing the LED Sign, picking up and installing Speed Zone on Mast Arm, picking up and installing Speed Zone on Shaft, picking up and installing Prepare to Stop on Mast Arm, picking up and installing Prepare to Stop on Shaft, picking up and installing Speed Indicator on Shaft, clamp kits, nipples, banding, pipe fittings, for all pole and mast arm modifications; and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work.

The furnishing, installing, maintaining and removal of any temporary covering for the signals during construction is considered subsidiary to the installation of the head. Such coverings remain the property of the Contractor after removal. All mounting hardware shall be considered subsidiary to the installation of the signal heads.

24.14 ROADWAY LIGHTING, LUMINAIRES AND LAMPS

A. GENERAL

The luminaire and components shall have been designed for roadway lighting and shall conform to all the applicable requirements of the National Electrical Safety Code.

B. MATERIAL AND DESIGN (HID, high intensity discharge)

1. General

The roadway luminaires shall be similar in appearance to the 'cobra head' type luminaire. The following Standard Specification detail the mechanical, electrical, and optical properties required for each style of luminaire.

All parts, exterior and interior, when in contact with one another shall have a potential difference no greater than 0.25 volts in order to prevent corrosion due to electrochemical reaction.

Non-aluminum metal parts shall also be treated with corrosion resistant finish.

The external finish of the luminaire shall be gray and shall be of such quality that it will not, under normal environmental conditions, blister, crack, fade, or peel for the functional life of the luminaire.

The finish shall not have runs, streaks or foreign materials on the surface and have been evenly and thoroughly applied.

2. Luminaire Housing Assembly

The luminaire housing shell shall be constructed from pressure die cast aluminum. There shall be no rough or jagged edges protruding in either the interior or on the exterior body or edges of the shell.

The luminaire shall be provided with a field identification marker on the lower external surface of the unit. The marker shall conform to the NEMA Standards for Field Identification of High-Intensity Discharge Lamps in Luminaires, Publication No. OD 150-1977.

The luminaire shall consist of 2 sections readily separable from one another. In general, this shall be an upper body and a lower body. All sections shall be well matched to one another and when fully assembled, the luminaire shall be solidly and tightly composed.

The lower body shall be hinge mounted to the upper body and when in the open positions shall allow access to the electrical and/or the optical compartments. The hinge shall be capable of retaining the lower body to the upper body unsupported under full ice load (1" on all horizontal properties) and wind loads with maximum gust velocity of 110 miles per hour.

The upper and lower bodies shall be locked in the closed position with a vibration proof latch which is readily accessible, designed to prevent accidental opening, and may be opened without the aid of tools.

24.14 ROADWAY LIGHTING, LUMINAIRES AND LAMPS (Continued)

B. MATERIAL AND DESIGN (HID) (Continued)

2. Luminaire Housing Assembly (Continued)

The luminaire shall include a EEI-NEMA Standard 3 terminal, twist lock type photo electrical control receptacle. The receptacle shall be an integral part of the luminaire and shall be gasketed.

The lens glass shall be held securely in the lower body with a combination of permanent and removable lugs. The positioning of the lugs shall allow for expansion of the lens but will seat the lens securely enough to prevent the lens from accidentally coming out of the lower body in either the open or closed position.

A one-piece reflector shall be mounted in the upper housing with spring fasteners and shall securely seat on the lens rim, with gasket in place with the luminaire closed. A gasket shall be fixed to either the reflector or the lens to insure sealing of the optical chamber. The gasket shall be designed to be used for the lifetime of the luminaire but shall be attached in such manner that it may be replaced in the field should necessity occur. The gasket shall be constructed of either an ethyl propylene terpolymer or a polyester material. When the gasketing material is ethyl propylene terpolymer, a supplemental filtering system shall be incorporated into the optical chamber to insure the proper breathing of the optical system.

The 150 watt and larger luminaire shall have a large size housing. The 100 watt and smaller shall have a small size housing.

3. Optical System

The socket shall be porcelain enclosed mogul screw base socket with a spring loaded center contact and lamp grips.

The socket housing shall be securely seated into the optical chamber using a heat resistant gasket between the reflector and the socket as well as positive mechanical means to insure the sealing.

The reflector shall be constructed from lighting sheet type aluminum. The finish shall be "Alzak" or equal. The oxide coating of the finish shall be no less than 0.13 ounces per square foot and shall be 99.9% pure aluminum. The reflecting surface shall not char, burn, nor give off fumes when heated to 300 to 390 degrees F. The heat transfer coefficient shall be equal to that of "Alzak" finished reflector sheet.

The finish shall be impervious to dust and dirt in a normal environment. Periodic cleaning with a soap and water solution shall neither damage nor reduce the reflectivity of the finish.

The finish shall be highly specular and shall have minimum reflectivity of 82% throughout the visible portion of the electromagnetic spectrum. The reflector shall have transmittance of at least 80%; and a refractive index of 1.474-1.488 at 2'.

The lens glass shall be flat and shall be constructed of heat resistant, thermal, shock treated, clear borosilicate glass.

24.14 ROADWAY LIGHTING, LUMINAIRES AND LAMPS (Continued)

B. MATERIAL AND DESIGN (HID) (Continued)

3. Optical System (Continued)

The following characteristics of borosilicate glass (tempered) apply:

- 1) coefficient of thermal expansion per degree C $34-52 \times 10^{-7}$.
- 2) from 0-300 degrees, cm/cm degree Celsius
- 3) upper working temperatures degree Celsius (mechanical considerations only)
- 4) tempered-normal service type glass 250° - 260° Celsius.
- 5) thermal shock resistance (Plates 6 x 6 x 1/4") based on plunging samples into cold water after oven heating.
- 6) resistance of 100° C means no breakage if heated to 110° C and plunged into water at 10° C.
- 7) allowable range 100°-150° C.
- 8) impact abrasion resistance (relative resistance to sand blasting) 3.1-3.2.

All ballast components shall be mounted on a metal plate easily accessible for in-place maintenance or removal when the luminaire is open. The ballast shall, when in position, be an integral part of the luminaire and shall be electrically connected to the luminaire with quick disconnect plugs.

All electrical components and connections shall have been pre-wired at the factory so the luminaire is ready for immediate installation.

4. Photometric Requirements

The luminaire shall have a 'cut-off' type light distribution characteristic as follows:

- 1) Vertical distribution: IES - Medium
- 2) Lateral distribution: IES - M.C. III as required on the plans
- 3) Control of the candlepower distribution: Maximum candlepower shall fall between 66°-75° (degrees projected angles above nadir).

5. Electronic Photoelectric Controls

a. General

All controls must meet or exceed ANSI C136.10 - 1988.

b. Electrical Rating

- | | |
|-----------------------------------|--|
| 1) Line Voltage Operating Range | 105-305 VAC 60 HZ (240 Volt) |
| 2) Load Rating | 1000 Watt |
| | 1800 VA Ballast |
| 3) Contact Rated Life | 5000 Operations Minimum |
| 4) Contact Chatter on Opening | Less than 5 milliseconds |
| 5) Dielectric Strength | 5000V Between Current Carrying
Parts & Metal Mounted Surfaces |
| 6) Photocontrol Power Consumption | 1.5 Watts Maximum |

24.14 ROADWAY LIGHTING, LUMINAIRES AND LAMPS (Continued)

B. MATERIAL AND DESIGN (HID) (Continued)

5. Electronic Photoelectric Controls (Continued)

c. Time Delay & Failure Mode

- | | |
|-----------------|-------------|
| 1) On Delay | None |
| 2) Off Delay | 2-4 Seconds |
| 3) Failure Mode | Fail On |

d. Photosensor & Level Setting

- | | |
|-----------------------------|------------------------------------|
| 1) Type | Sealed Cadmium Sulphide or Silicon |
| 2) Turn On | 1.5 +/- 0.3 Footcandles |
| 3) Turn Off - Turn on Ratio | 1.5:1 |

e. Surge Protection

- | | |
|------------------|----------------------|
| 1) Type | Metal Oxide Varistor |
| 2) Joules Rating | 640 Minimum |

f. Housing and Markings

- | | |
|---------------------------------|---|
| 1) Color | Black |
| 2) Cover Material | High Impact & UV Stabilized |
| 3) Base Material | High Impact |
| 4) Housing Skirt Size | 3" + 1/8" Diameter |
| 5) Base Markings and Provisions | Year & Month of Manufacture, Provisions |
| 6) Cover Markings | Manufacturer's Logo & Year of Manufacture |
| 7) Cover/Base/Receptacle Seal | Cross-Linked Polyethylene Gasket |
| 8) Plug Blades | Brass, 3 Blade NEMA Twist Lock |
| 9) Cover Window | Clear, UV Stabilized & Sealed |

g. Quality Control & Calibration

- | | |
|--------------------------------------|------|
| 1) Production Calibration - | 100% |
| 2) Inspection After Final Assembly - | 100% |

h. Other Type Tests

- | | |
|--------------------------------|---|
| 1) Ambient Temperature Range - | 40° C to 65° C |
| 2) Moisture Resistance - | 98% |
| 3) Drop Test | Drop of 3 ft. to Concrete Floor Without Damage to Housing or Electrical Operation |

i. Warranty

- | | |
|----------------|-------------|
| 1) Length | 4 Years |
| 2) Replacement | One for One |

Approved manufacturers and catalog numbers are:

Dark to Light (DTL)	DLL127 1.5 BK
Sun-Tech	TRS-2
Ripley	6390L-BK

j. Circuit Board

Silicone Coated

24.14 ROADWAY LIGHTING, LUMINAIRES AND LAMPS (Continued)

B. MATERIAL AND DESIGN (HID) (Continued)

6. Electrical Requirements

Lamp	<u>150 watt HPSV</u>	Ballast Type	<u>Constant Wattage</u>
Line Voltage			240 Volts
% Allowable Voltage Variation			+10%
Wattage Regulation			Per ANSI%
Lumen Regulation			Per ANSI%
Line Watts (Max.)			195 Watts
Lamp Current Crest Factor (Max.)			1.8
Power Factor			90+%
% Allowable line voltage DIP			10-35%
Open-Circuit Volt (min)			110 Volts
Line Operating current			1.0 Amps
Line Starting current			0.6 Amps
BIL Rating			5 KV

Plug-in Starting Aid requirement for HPSV Lamps

Pulse Peak Voltage (min.)	2500 RMS
Pulse Peak Voltage (max.)	4000 RMS
Pulse Width	1 Micro sec. (min.) at 2250 Volts
Pulse Repetition	50 per sec. (min.)
Pulse Peak Current	0.2 Amp (min.)

7. Electrical Requirements

Lamp	<u>250 watt HPSV</u>	Ballast Type	<u>Constant Wattage</u>
Line Voltage			240 Volts
% Allowable Voltage Variation			+10%
Wattage Regulation			Per ANSI%
Lumen Regulation			Per ANSI%
Line Watts (Max.)			310 Watts
Lamp Current Crest Factor (Max.)			1.8
Power Factor			90+%
% Allowable line voltage DIP			10-35%
Open-Circuit Volt (min)			195 Volts
Line Operating current			219 Volts
Line Starting current			0.9 Amps
BIL Rating			5 KV

Plug-in Starting Aid requirement for HPSV Lamps

Pulse Peak Voltage (min.)	2500 RMS
Pulse Peak Voltage (max.)	4000 RMS
Pulse Width	1 Micro sec. (min.) at 2250 Volts
Pulse Repetition	50 per sec. (min.)
Pulse Peak Current	0.2 Amp (min.)

24.14 ROADWAY LIGHTING, LUMINAIRES AND LAMPS (Continued)

B. MATERIAL AND DESIGN (HID) (Continued)

8. Electrical Requirements

Lamp	<u>400 watt HPSV</u>	Ballast Type	<u>Constant Wattage</u>
Line Voltage			240 Volts
% Allowable Voltage Variation			+10%
Wattage Regulation			Per ANSI%
Lumen Regulation			Per ANSI%
Line Watts (Max.)			482 Watts
Lamp Current Crest Factor (Max.)			1.8
Power Factor			90+%
% Allowable line voltage DIP			10-35%
Open-Circuit Volt (min)			195 Volts
Line Operating current			2.0 Amps
Line Starting current			1.3 Amps
BIL Rating			5 KV

Plug-in Starting Aid requirement for HPSV Lamps

Pulse Peak Voltage (min.)	2500 RMS
Pulse Peak Voltage (max.)	4000 RMS
Pulse Width	1 Micro sec. (min.) at 2250 Volts
Pulse Repetition	50 per sec. (min.)
Pulse Peak Current	0.2 Amp (min.)

C. MATERIAL AND DESIGN (LED)

References for this section include ANSI/NFPA 70, National Electrical Code (NEC) or latest issue, IEEE C63.41, Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits, FCC 47 CFR Part 15, Federal Code of Regulation (CFR) testing standard for electronic equipment, IESNA LM-79, Electrical and Photometric Measurements of Solid State Lighting Products, IESNA LM-80, Approved Method for Measuring Lumen Maintenance of LED Light Sources, IESNA TM-15, Luminaire Classification System for Outdoor Luminaires, UL1598, Standard for Safety of Luminaires and IEEE C2-2012, National Electric Safety Code or latest issue.

Luminaires shall be of uniform quality and appearance. Manufacturers of LED luminaires shall provide a report or certification from a testing laboratory detailing a suitable testing program incorporating high heat, water, and thermal shock test regimens to ensure system reliability and to substantiate lifetime claims. The use of IESNA LM-80 data to predict luminaire lifetime is not accepted. At time of manufacture, electrical and light technical properties shall be recorded for each luminaire. At a minimum, this should include lumen output, CCT, and CRI. Each luminaire shall utilize a unique serial numbering scheme. Luminaires shall be provided with a minimum of 5 year warranty covering LEDs, drivers, surge protectors, photo control receptacles, and mechanical components. Warranty period shall begin at date of delivery.

24.14 ROADWAY LIGHTING, LUMINAIRES AND LAMPS (Continued)

C. MATERIAL AND DESIGN (LED) (Continued)

If a manufacturer other than the approved vendors is to be considered, they must conform to LES Specifications. Submittals shall include luminaire cut sheets, cut sheets for LED light sources; cut sheets for LED driver(s); diagrams illustrating light output and input power as a function of control for dimmable LED driver; cut sheets for surge protection device; instructions for installation and maintenance; summary of luminaire recyclability per the FTC Green Guides, expressed by percentage of luminaire weight; description of luminaire, LED light source(s) and LED driver(s) and manufacturer shall supply part number for light bars, drivers, and surge protectors of the luminaires supplied. Calculations and supporting test data indicating a lumen maintenance life of not less than 80,000 operating hours. Lumen depreciation curve for each driver. A completed Appendix B for each Appendix A. If proposed luminaires are on the LES Standards Approved List, only the catalog cut of the luminaire with catalog number must be submitted.

Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of housing, LED array, photo receptacle, terminal block, surge protector, and electronic driver (power supply).

Each luminaire shall be rated for a minimum operational life of 80,000 hours at an average operating time of 11.5 hours per night. This life rating must be conducted at 25 degrees C ambient temperature. The rated operating temperature range shall be -30 degrees C to +40 degrees C. Each luminaire must be capable of operating above 100F (37C), but not expected to comply with photometric requirements at elevated temperatures.

Photometry must be compliant with IESNA LM-79 and shall be conducted at 25 degrees C ambient temperature.

The individual LEDs shall be constructed such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.

Each luminaire shall be listed with Underwriters Laboratory, Inc. under UL1598 for luminaires.

Luminaires must have an external label per ANSI C136.15 and an internal label per ANSI C136.22.

Electrically test fully assembled luminaires before shipment from factory.

Luminaires shall be designed for ease of component replacement and end-of-life disassembly. Manufacturer shall submit information regarding recycling and proper disposal of luminaire and all individual components as well as name and address of nearest recycling location for materials.

Painted or finished luminaire components exposed to the environment shall exceed a rating of six per ASTM D1654 after 1000 hours of testing per ASTM B117 and the coating shall exhibit no greater than 30% reduction of gloss per ASTM D523, after 500 hours of QUV testing at ASTM G154 Cycle 6.

Mechanical design of protruding external surfaces (heat sink fins) shall facilitate hose-down cleaning and discourage debris accumulation.

24.14 ROADWAY LIGHTING, LUMINAIRES AND LAMPS (Continued)

C. MATERIAL AND DESIGN (LED) (Continued)

Minimum color rendering index (CRI): 70. Correlated Color Temperature (CCT) shall conform to table below.

Manufacturer-Rated Nominal CCT (K)	Allowable LM-79 Chromaticity Values	
	Measured CCT (K)	Measured Duv
4000	3710 to 4260	-0.005 to 0.007
4500	4260 to 4746	-0.005 to 0.007

All internal components shall be assembled and pre-wired using modular electrical components.

Luminaire shall have three-hole terminal blocks for incoming AC lines and a photo control receptacle.

Access to internal components shall be latched and hinged in a manner to prevent accidental opening. Luminaire shall have ingress protection.

Maximum power consumption allowed for the luminaire shall be determined by application. The luminaire shall not consume power in the off state.

The luminaire shall operate from a 60 HZ AC line over a voltage ranging from 108 VAC to 305VAC. The fluctuations of line voltage shall have no visible effect on the luminous output. The luminaire shall have a power factor of 0.90 or greater. Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent. The luminaire circuitry shall include fused surge protection devices (SPD) to withstand high repetition noise transients as a result of utility line switching, nearby lightning strikes, and other interference. The SPD shall protect the luminaire from damage and failure for common mode transient peak voltages up to 10kv (minimum) and transient peak currents up to 5ka (minimum). SPD shall conform to UL 1449. SPD performance shall be tested per the procedures in ANSI/IEEE C62.41-1992 (or current edition) for category C (standard). The SPD shall fail in such a way that the luminaire will no longer operate. The SPD shall be field replaceable.

Each luminaire shall have integral UL listed Class I power supplies.

The LED circuitry shall prevent visible flicker to the unaided eye over the voltage range specified above.

LED drivers must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.

Drivers shall have a Class A sound rating.

LEDs shall be provided with optical elements to provide IESNA Type II, III, IV or V distributions. Optical assemblies shall have a minimum efficiency of 85% regardless of distribution type. For Type II and Type III distributions, street side efficiencies shall be a minimum of 70%. All LEDs and optical assemblies shall be mounted parallel to the roadway surface. All LEDs shall provide the same optical pattern such that catastrophic failures of individual LEDs will not constitute a loss in the distribution pattern.

24.14 ROADWAY LIGHTING, LUMINAIRES AND LAMPS (Continued)

C. MATERIAL AND DESIGN (LED) (Continued)

The luminaire shall not allow more than 10% of the rated lumens to project above 80 degrees nor 2.5% above 90 degrees from vertical.

Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed. The luminaire shall have a minimum heat sink surface such that LED manufacturer's maximum junction temperature is not exceeded at maximum rated ambient temperature. The heat sink shall be aluminum.

Luminaires shall be capable of withstanding cyclical loading in (G = Acceleration of Gravity) a minimum level of 3.0 G peak sinusoidal loading with the internal driver installed, for a minimum of 100,000 cycles without failure of any luminaire parts. Testing is to be performed in three planes: a horizontal plane parallel to the direction of mounting, a horizontal plane perpendicular to the direction of mounting, and the vertical plane.

The housing shall be designed to prevent the buildup of water on the top of the housing. Exposed heat sink fins shall be oriented so that water can run off the luminaire freely, and carry dust and other accumulated debris away from the unit.

The optical assembly of the luminaire shall be protected against dust and moisture intrusion per the requirements of IP-66 (minimum) to protect all optical components.

The electronics/power supply enclosure shall meet the requirements for NEMA/UL wet locations.

Housing shall be fabricated from materials that are designed to withstand a 3,000 hour salt spray test as specified in ASTM Designation B117.

Each refractor or lens shall be made from UV inhibited high impact plastic such as acrylic and be resistant to scratching.

Polymeric material of enclosures containing either the power supply or electronic components of the luminaire shall be made of UL94VI flame retardant materials. The lens of the luminaire is excluded from this requirement.

All electronics and materials shall be lead free.

Luminaire shall have toolless entry.

Manufacturer or local sales representative shall provide installation and troubleshooting support via telephone and/or email and supply on site support when requested.

Manufacturers must be a roadway luminaire manufacturer and have a minimum of 5 years documented experience in LED luminaire manufacture.

D. INSTALLATION

The position of the lamp socket in each luminaire must be adjusted in accordance with the manufacturer's Specifications to provide the I.E.S. type distribution pattern required by the plans.

24.14 ROADWAY LIGHTING, LUMINAIRES AND LAMPS (Continued)

D. INSTALLATION (Continued)

Unless otherwise indicated in the plans or directed by the City's Project Manager, luminaires shall be installed level in both horizontal axes.

Each completed street light circuit shall have a 72 hour burn test prior to acceptance.

E. BASIS OF PAYMENT

LUMINAIRE, _____, complete, in place and accepted by the City's Project Manager, shall be measured as single units and shall be paid for as at the contract unit price bid per each for the item. This price and payment shall be full compensation for furnishing and installing the Luminaires and for furnishing bulbs, labor, equipment, tools, materials, and incidentals necessary to complete the Work.

24.15 BLANK ON PURPOSE

24.16 BLANK ON PURPOSE

24.17 BLANK ON PURPOSE

24.18 WOOD POLES

A. GENERAL

Wood poles shall be dense Southern Yellow Pine, and shall meet all ASA requirements for the length and class shown on the plans. Preparation of the timber for treatment, the method and result, shall conform to the requirements of "Standard Specifications for Pressure Treatment of Timber Products", ASTM Designation D-1760. The finished poles shall be sufficiently dry on the surface so that no preservative will bleed out and drip off the poles.

Poles shall be approved by an independent commercial laboratory.

B. INSTALLATION

Poles shall be set to a depth of 10% of the pole length plus 24". When earth fill is specified, earth around the hole shall be tamped solid, and to the satisfaction of the City's Project Manager. No frozen earth shall be used in tamping holes. Holes shall be of sufficient size to permit tamping completely around the pole.

Fill, other than earth fill, shall be as specified in the Special Provisions.

Guy wires shall be of the same diameter and tensile strength as the messenger cable supporting attachment to which they are linked, and shall conform to the requirements of "Standard Specifications for Zinc-Coated Steel Wire Strand", ASTM Designation A-475.

Ground anchors shall be power screw-type, having an 8" minimum diameter and using a 7' x 5/8" diameter rod to minimize soil disturbance, unless otherwise shown on the plans.

All ferrous metal line hardware items shall be galvanized and shall conform to the requirements of "Standard Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware", ASTM Designation A153.

Guy guard shall be high visibility plastic 8' in length.

Down guys shall not enter the ground less than 24" from the edge of the sidewalk unless otherwise shown on the plans.

C. BASIS OF PAYMENT

WOOD POLE, ____ complete, in place and accepted by the City's Project Manager, shall be measured as a single unit and shall be paid for at the contract unit price per each for the item. This price shall be full compensation for the excavation required; for furnishing and/or installing the wood pole; for concrete as required, pole hardware, cable, conductors, span wire, tie wire, down guy, overhead guy; for ground rod and ground wire connections; and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 25

ORNAMENTAL STREET LIGHTING

ARTICLE	TITLE	
25.00	GENERAL	2502
25.01	ELECTRICAL CONDUIT	2503
25.02	ELECTRICAL CONNECTORS	2503
25.03	SECONDARY FUSES AND FUSE HOLDERS	2503
25.04	GROUND RODS	2503
25.05	POLES	2504
	A. EMBEDDED STEEL POLES	2504
	B. FIBERGLASS POLES	2504
25.06	LUMINAIRES	2504
25.07	LAMPS	2505
25.08	ELECTRICAL CABLE	2505
25.09	PHOTOELECTRIC CONTROLS	2505
25.10	FERROUS HARDWARE	2505
25.11	PULL BOXES	2506
25.12	GRADES	2506
25.13	TRENCHING AND BACKFILLING	2506
25.14	RESTORING STREET SURFACES AND CONCRETE WORK	2506
25.15	INSTALLATION OF POLES	2507
	A. EMBEDDED STEEL POLES	2507
	B. FIBERGLASS POLES	2507

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 25

ORNAMENTAL STREET LIGHTING

25.16	INSTALLATION OF LUMINAIRES	2507
25.17	INSTALLATION OF CABLE AND CONDUIT	2508
25.18	INSTALLATION OF PHOTOELECTRIC CONTROLS AND LAMPS	2508
25.19	POWER SUPPLY AND RISER	2508
25.20	TREE TRIMMING	2509
25.21	SECONDARY CONNECTIONS	2509
25.22	REMOVING AND RESETTING MAILBOXES	2509
25.23	BASIS OF PAYMENT	2509

CHAPTER 25

ORNAMENTAL STREET LIGHTING

25.00 GENERAL

The Work covered in this chapter shall include the furnishing of certain materials and equipment and the installation of all necessary materials and equipment to provide an ornamental street lighting installation complete, in place, and ready for operation in accordance with the plans and these Standard Specifications. No Work shall be done on any electrical circuits without making sure the connection to the source of supply has been broken. Arrangements for clearance shall be made with System Operations of the Lincoln Electric System (LES).

The City will furnish the material and/or equipment listed in the Special Provisions. All other material, equipment, and labor required to provide an ornamental street lighting installation in accordance with the plans and these Standard Specifications shall be furnished by the Contractor. Refer to the General Provisions and Requirements of the City of Lincoln Standards for procedures to be followed in handling City furnished materials and/or equipment.

All materials and equipment furnished by the Contractor shall be new and shall conform to the applicable standards of the National Electrical Manufacturers Association (NEMA), the Insulated Cable Engineers Association (ICEA), the International Municipal Signal Association (IMSA), the American Society for Testing Materials (ASTM), and the American National Standards Institute (ANSI). Installation of equipment shall conform to the requirements of the National Electrical Safety Code, and the ordinances of the City of Lincoln. Wherever reference is made in these Standard Specifications to the codes or standards mentioned above, the reference shall be construed to mean the code or standard currently in effect.

Material shall be as specified on the plans and in these Standard Specifications. Wherever manufacturer's catalogue numbers are used, that specific item is to be used unless approved equal material or other manufacturer's material is specifically authorized by the City's Project Manager.

Before ordering any material, the Contractor shall submit to the City's Project Manager for approval 2 copies of the manufacturer's Specifications and drawings for all of the equipment and materials indicated below. Materials shall be on the Lincoln Electric System's Standard Material List. The City shall not be liable for any equipment or materials ordered or purchased by the Contractor prior to approval.

- Paint
- Poles
- Luminaires and Lamps
- Cables, Splicing and Termination Devices
- Conduits
- Fuseholders and Fuses
- Control Equipment, Breakers, Switches, Contractors, Relays
- Lightning Arrestors, Enclosures, etc.
- Brackets, Hardware, etc.
- Pull Boxes
- Wiring and Connection Diagrams of All Cabinets, Circuits
- Connectors

The manufacturer's Specifications and drawings shall include the brand name, any identifying numbers, required technical data, and any other information necessary for the City's Project Manager's review and for procuring exact replacements of any and all equipment and material used on this project.

25.01 ELECTRICAL CONDUIT

Electrical conduit shall be of the size and type shown on the plans. Quality and installation of electrical conduit shall be in accordance with Chapter 24 of these Standard Specifications.

25.02 ELECTRICAL CONNECTORS

See Chapter 24 of these Standard Specifications.

25.03 SECONDARY FUSES AND FUSE HOLDERS

See Chapter 24 of these Standard Specifications.

25.04 GROUND RODS

Ground rods shall be of high strength steel rod with a chemically bonded copper covering to provide high conductivity and prevent electrolytic action. Ground rods shall be at least 5/8" in diameter and 10' in length. Ground rods shall be in compliance with the IMSA Specification No. 62-1956. Ground wires shall be connected to ground rods with one-piece nonferrous clamps which employ set screws as tightening devices. Connections to ground rods need not be taped.

25.05 POLES

A. EMBEDDED STEEL POLES

See Chapter 24 of these Standard Specifications.

B. FIBERGLASS POLES

1. General

The pole shall be hollow and nonporous, constructed of nonconductive fibrous glass and polyester resin. The pole shall be inert to soil chemicals, smog by-products, insecticides, herbicides, animal urine, mild acids and alkalis, deicing salts and saltwater. The surface finish shall be smooth.

The pole shall not be affected by ultraviolet radiation or weathering to the extent that no visible checking, chalking, deterioration or change of strength will occur during the normal life of the pole. The pole shall also be free from degradation by freeze-thaw cycles. The pole shall not support combustion.

2. Dimensions

- | | |
|---------------------------------|--|
| a. Overall Length | 23' Nominal |
| b. Burial Depth | 4' Minimum |
| c. Mounting Height | Per plan to light center of luminaire |
| d. Handhole and Cover | 2.5" diameter round, 18" above grade |
| e. Alternate Handhole and Cover | 2.5" to 3" by 5" oval |
| f. Tenon Top | 3" outside diameter by 3.5" long steel or molded |
| g. Wire Entrance Hole | 1" to 1.5" minimum grommets, 24" below grade |
| h. Pole Butt | Approximately 7" diameter, square or non-symmetrical |
| i. Taper | 0.120 to 0.150" per foot of length |

3. Weight: Not greater than 65 pounds

4. Color: Black or grey, as specified on the plans

25.06 LUMINAIRES

Luminaires shall be supplied as directed on the plans.

25.07 LAMPS

Lamps shall meet ANSI Standards in all respects. Lamps shall be Clear High Pressure Sodium Vapor, Universal Burn type and the wattage as shown on the plans. All lamps shall be non-cycling and must pass Toxic Characteristic Leaching Process (TCLP) limits.

Performance Data:

Rated Average Life at 10 hr/start	24,000 hours
% Mean Lumens at 10 hr/start	90%
Warm-up Time	3-4 minutes
Restart Time	1 minute

Physical Description:

Base Designation	Mogul
Bulb Designation	E-23-1/2
Bulb Finish	Clear
Light Center Length	5"
Bulb Temperature Limitations (maximum)	400° C
Base Temperature Limitations (maximum)	210° C

Electrical Description:

Nominal Lamp Watts	70
Nominal Lamp Volts	52
Nominal Lamp Current	1.6 Amperes
Maximum Crest Factor	1.8

Starting Pulse Requirements:

Pulse Peak Voltage (minimum)	2500
Pulse Peak Voltage (maximum)	4000
Pulse Width	1 Microsecond (minimum) at 2250
Pulse Repetition	50 per second
Pulse Peak Current	0.2 Amperes (minimum)

25.08 ELECTRICAL CABLE

See Chapter 24 of these Standard Specifications

25.09 PHOTOELECTRIC CONTROLS

See Chapter 24 of these Standard Specifications

25.10 FERROUS HARDWARE

All ferrous metal used in line hardware items shall be hot dip galvanized in conformity with "Standard Specifications for Zinc Coating (Hot Dip) on Iron and Steel Hardware", ASTM Designation A153-53. The grade of steel and part design shall conform to Edison Electric Institute (EEI) Specifications where applicable. All hardware items shall have a minimum strength capable of supporting the maximum load to which they may be subjected.

25.11 PULL BOXES

All Work shall conform to Chapter 24 of these Standard Specifications.

25.12 GRADES

All Work shall conform to Chapter 24 of these Standard Specifications.

25.13 TRENCHING AND BACKFILLING

All cables, trenched or plowed, shall be 24" in depth on rear lot lines and 30" in depth on front and side lot lines. Cable route along the curb shall be centered approximately 5.5' from the sidewalk side of the curb unless otherwise specified on the plans.

All trenches shall be backfilled and compacted daily unless properly protected. All trenches for burial of electrical cable and conduit shall not exceed 6" in width.

The first 4" of backfill shall consist of finely pulverized earth and shall contain no broken glass, rocks, or other sharp material that might damage the cable. Where the cable enters conduit, care shall be taken to protect the cable as outlined elsewhere in these Standard Specifications.

The remainder of the backfill material will normally be earth excavated from the trench unless such earth is water saturated or frozen. Backfill material shall be substantially dry, loose, clean earth free from rocks and debris. Excessively dry or excessively sandy material is not permitted.

Before backfilling, all standing water shall be removed from the trench. Tamping shall be done at no more than 12" backfill level intervals to ensure proper compaction throughout the depth of the void. The foot of the compressed air or hydraulic tamper to be used to compact the backfill shall be sized in accordance with the width of the trench. Hand tamping is not permitted. All excess backfill material shall be removed promptly from the site.

Directional boring may be used by the Contractor with the City's Project Manager's approval.

25.14 RESTORING STREET SURFACES AND CONCRETE WORK

Improvements such as sidewalks, curbs, gutters, Portland cement concrete and asphaltic concrete pavement, bituminous surfacing, base material, and any other improvements removed, broken, or damaged by the Contractor shall be replaced or reconstructed in accordance with the applicable chapters of these Standard Specifications.

25.15 INSTALLATION OF POLES

A. EMBEDDED STEEL POLES

See Chapter 24 of these Standard Specifications.

B. FIBERGLASS POLES

Fiberglass poles shall be installed in the same manner as set forth in 25.16.A, except that grounding shall be as specified in this Article and the use of polyurethane foam is optional.

An alternative to polyurethane foam backfill for fiberglass poles is earth backfill. Where earth backfill is used the diameter of the hole shall be sized in accordance with the diameter of the foot of the compressed air or hydraulic tamper to be used to compact the backfill. Hand tamping is not permitted. The distance between any point on the ground line of the pole to the perimeter of the hole shall be a minimum of 2" plus the diameter of the tamper foot, but not greater than the tamper foot diameter plus 6".

Backfill material will normally be earth excavated from the hole unless such earth is water saturated or frozen. Backfill material shall be substantially dry, loose, clean earth free from rocks and debris. Excessively dry or excessively sandy material is not permitted.

Before backfilling, all standing water shall be removed from the hole. Crushed rock in accordance with 25.16.A shall be installed in the bottom of the hole. After the pole is plumbed and held fast in a true position, approved backfill material shall be installed in the voids between the pole and the hole perimeter. Tamping shall be done at not more than 12" backfill level intervals to ensure proper compaction throughout the depth of the void. After backfilling and tamping are completed, additional earth shall be banked around the ground line perimeter of the pole to a height of 3". All excess backfill material shall be removed promptly from the site.

A ground rod shall be installed a minimum of 24" from the nearest edge of the augered hole and a minimum of 12" below final grade. A continuous ground wire shall connect the ground rod to the grounding lead in the luminaire by means of the wire opening of the pole shaft.

25.16 INSTALLATION OF LUMINAIRES

All luminaires shall be leveled by means of bubble level after installation and the refractor shall be properly oriented with respect to the street.

25.17 INSTALLATION OF CABLE AND CONDUIT

Conduit shall be installed in accordance with Chapter 24 of these Standard Specifications.

Cable installed in conduits shall be installed in accordance with Chapter 24 of these Standard Specifications.

Aerial cable shall be installed in accordance with Chapter 24 of these Standard Specifications.

Direct burial cable shall be installed in a dug trench at a depth of 24" on rear lot lines and 30" on front and side lot lines unless obstructions interfere. Along the street the cable shall be installed approximately 5.5' from the sidewalk side of the curb unless otherwise specified. Use of an approved cable plow will also be permitted. In areas where trenching may permanently damage the health of mature plants, the boring procedure shall be required.

The cable shall be laid in a single piece from the source to the pole top or from one pole top to the next. No splices shall be permitted in the underground section of the cable. All splices, when required or necessary, are to be made in the base of the pole or in the pull box.

The cable shall be handled with care to avoid nicks or abrasions to the sheath. Any section of the cable which the City's Project Manager considers to be damaged shall be discarded.

Where necessary to clear permanent obstructions such as manholes, inlets, etc., the cable may be rerouted, but the City's Project Manager shall approve of such rerouting.

Electrical Connections shall be installed in accordance with Chapter 24 of these Standard Specifications. Care is to be given to ensure that all cable is installed within the designated easements.

The Contractor is responsible for notifying the property adjacent to any construction approximately 1 week prior to doing Work.

25.18 INSTALLATION OF PHOTOELECTRIC CONTROLS AND LAMPS

All photoelectric controls shall be seated securely in the twist-lock receptacle and oriented so the "eye" window faces north. Orientation shall be made by means of adjustments provided by the manufacturer.

Lamps shall not come in contact with any foreign materials or liquids.

The Contractor shall plainly record the installation dates on lamps and photocells in the spaces provided by the manufacturer.

25.19 POWER SUPPLY AND RISER

Power supplies shall be installed at the locations shown on the plans. The power supply riser shall be 1 1/2". The riser shall be steel conduit a full 10' from the in ground 90 up without joints and shall be grounded. All pole risers shall be on stand off brackets provided by LES and can be picked up at LES Storeroom at the Walter Canney Service Center at 27th and Fairfield Streets, between 7:30 a.m. to 4:00 p.m. weekdays, with the exception of holidays. See LSP 83 for spacing detail. Power supplies from transformers or service pedestals shall be installed by the Contractor. The Contractor is responsible for contacting LES, to have LES energize or de-energize any Street Light Cable. Under no circumstance shall the contractor open any LES locked facilities, such as a Transformer or Pedestal.

25.20 TREE TRIMMING

Authorized tree trimming shall be done according to the direction of the City Forester. After trimming, all brush shall be hauled away and the area cleared of leaves and small twigs. Where required by City regulations, the services of a licensed Arborist shall be employed for tree trimming.

25.21 SECONDARY CONNECTIONS

When all Work has been completed and the luminaires are ready to be energized, the Contractor is responsible for contacting LES, to have LES energize or de-energize any Street Light Cable. Under no circumstance shall the contractor open any LES locked facilities, such as a Transformer or Pedestal.

25.22 REMOVING AND RESETTING MAILBOXES

Where rural type mailboxes interfere with cable installation adjacent to the curb, these shall be removed and reset to their original location not more than 2 days after removal. They must be available on the premises at all times in a position to receive mail. The Contractor shall make arrangements with the Post Office Station serving this area for details.

25.23 BASIS OF PAYMENT

Ornamental street lighting shall be measured and paid for on a per unit basis, complete, in place and accepted by the City's Project Manager. This price and payment shall be full compensation for all labor, equipment, tools, materials, and incidentals necessary to complete the Work.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 26

COMMUNICATIONS

ARTICLE	TITLE	
26.00	GENERAL	2601
	A. MATERIAL TESTS	2601
	B. CONTRACTOR RESPONSIBILITY	2601
	C. SUBSTANTIAL COMPLETION	2601
	D. INSPECTION COMPLETION	2602
	E. LOCATE SYSTEM	2602
	F. TESTING	2602
26.01	BLANK ON PURPOSE	2604
26.02	FIBER MARKER	2604
	A. GENERAL	2604
	B. INSTALLATION	2604
	C. BASIS OF PAYMENT	2604
26.03	BLANK ON PURPOSE	2604
26.04	GROUND BAR	2605
	A. GENERAL	2605
	B. INSTALLATION	2605
	C. BASIS OF PAYMENT	2605
26.05	FIBER CABLES	2606
	A. TYPES AND CLASSES OF CABLE	2606
	B. INSTALLATION	2606
	C. BASIS OF PAYMENT	2608
26.06	FIBER CONNECTORS, ENCLOSURES AND ACCESSORIES	2609
	A. COMPONENTS	2609
	B. INSTALLATION	2613
	C. BASIS OF PAYMENT	2615
26.07	INSTALL ITS FIELD SWITCH	2616
	A. GENERAL	2616
	B. INSTALLATION	2616
	C. BASIS OF PAYMENT	2616

CHAPTER 26

COMMUNICATIONS

26.00 GENERAL

A. MATERIAL TESTS

When any reference is made in these Special Provisions, or in the City of Lincoln Standard Specifications to a standard, such as ASTM, ICEA, IMSA, etc., or a related Specification referred to by reference therein, which states that a certain test is to be made only at the request of the purchaser, it shall be considered that the City does request that such test be made. The tests shall be made at the Contractor's expense and a certified copy of each test shall be submitted to the City's Project Manager prior to the installation of such material.

The Contractor shall submit to the City's Project Manager 1 hard copy and 1 electronic (pdf) copy of a complete list of all equipment and materials they intend to install. Catalog cuts and/or Manufacturers model number shall be required for the materials furnished by the Contractor and incorporated into the project. There shall be no substitutes for any of the items on the list without prior written approval of the City's Project Manager.

B. CONTRACTOR RESPONSIBILITY

The Contractor is responsible to inform the City's Project Manager of any defect found in the existing communications system encountered as part of this contract. Such defects may include, but not be limited to existing improper splices or existing damaged conduit. The City's Project Manager and Contractor shall determine a plan and cost to correct said defect.

The Contractor is responsible for locates within the project area, until the final inspection is complete.

C. SUBSTANTIAL COMPLETION

The communications system shall not be considered substantially complete until all items shown on the proposal or called for in any contract document are completed to the satisfaction of the City's Project Manager excluding seed/sod if outside planting season. The system shall be fully operational in accordance with the Plans and Standard Specifications and these or any other Special Provisions included as part of the project.

Liquidated damages shall continue to accrue until such time as the Work is deemed to be substantially completed by the City's Project Manager. However, the Contractor may submit a written request to the City's Project Manager for approval to suspend Work to allow additional time for completion of minor items of the Work. Granting the request for additional time by the City's Project Manager shall not relieve the Contractor of responsibilities for the completion of those items for which the suspension is requested.

26.00 GENERAL (Continued)

D. INSPECTION COMPLETION

Upon completion of a fully operational fiber optic communications system (including: locate system, fiber cable, and all communications equipment, where applicable), an inspection shall be completed by the City. The Contractor is allowed a defined number of calendar days to complete the following: correct any items as listed on the Inspection Form, return Inspection Form back to City, and correct any subsequent deficiencies identified by inspections until City accepts all work. The Contractor is responsible for providing an electronic format set of plans (as-built drawings) compatible with GIS and/or CAD format, detailing any changes made during construction from the original design. In addition, electronic format of any fiber optic communications system schematics, fiber splice diagrams, and cabinet equipment and connections shall also be provided in above-stated format as acceptable to the City of Lincoln.

Prior to the start of inspection, 1 hard copy and 1 electronic (pdf) copy of as-built plans shall be provided to the City. These as-built drawings shall be labeled "AS BUILT", with the Contractors initials and date.

The number of days for the inspection process is as follows: For the conduit system: 45 calendar days are allowed for the entire conduit system Inspection and Correction process. The City is allowed 14 calendar days for the initial inspection and 7 calendar days for each additional inspection needed thereafter.

Initial and subsequent City inspections shall be included as part of the calendar days allowed. If the Contractor has not corrected all items on the conduit Inspection form to the satisfaction of the City and has not received final acceptance from the City within the allotted time, the Contractor shall be assessed liquidated damages of \$500 per calendar day until all work is completed and deemed acceptable.

E. LOCATE SYSTEM

The locate system is comprised of ground rods, ground bars, fiber locate cable and fiber markers. This system is used by the locate technician to locate communication cables in conduits and indicate where fiber pull boxes are.

All locate system components shall be installed where indicated on the plans.

Ground Bars provide a field wiring terminal for the connection of Fiber Locate Cable.

F. TESTING

1. General

The overall communication system testing shall include a bare end fiber test after installation of the fiber optic cable, and a follow-on test after all final splicing and termination work is completed. On a per project basis, this test procedure may include measuring the loss of fiber installed by others before splicing to it. For each fiber optic link, including spare fibers, determine whether the optical loss is within the limits permitted by these specifications. A link is a continuous segment of fiber between one connector (or unterminated end) and another connector (or unterminated end). When testing links that do not have connectors on both ends, use a mechanical splice to attach a pigtail to the unterminated fiber for the duration of the test.

26.00 GENERAL (Continued)

F. TESTING (Continued)

1. General (Continued)

Acceptance Testing is incidental to the Fiber Optic Cable and will not be paid for separately.

2. Procedures

For each fiber link, follow this procedure:

If the link includes fiber installed by others, use an optical loss test set to measure and record the optical loss over that portion of the link before it is spliced to new fiber.

Calculate the maximum allowable loss for the completed link, both at 1310 nm and at 1550 nm. Use the following formula:

Maximum link loss = Measured loss over portion installed by others
+ (Fiber length in km) x (0.35 for 1310 nm and 0.25 for 1550 nm)
+ (Number of fusion splices) x (0.05)
+ (Number of mechanical splices [for temp. connection]) x (0.3)
+ (Number of connections) x (0.5)

Provide this calculation to the engineer along with the test results.

If the measured loss exceeds the calculated maximum, use an optical time domain reflectometer and other test equipment to troubleshoot the link. Take whatever corrective action is required, including cable replacement, to achieve a loss less than the calculated maximum.

Test Result Documentation. Prepare a diagram showing all of the links tested in this project. For the portions installed in this project, show the equipment cabinets, splices, and pigtails. On each line representing a link, show the maximum allowable loss and the actual loss. The actual loss shall be the one measured after all corrective actions have been taken. Submit an electronic copy of this diagram to the engineer, along with the calculations for the maximum allowable loss. Submit the diagrams and calculations in an electronic format acceptable to the engineer.

Documentation. Provide the engineer mark-ups of the plans, neat and legible, illustrating as-built versions of the splice and connection diagrams that are contained in the plans.

Certifications. The fiber optic cable shall be factory certified to meet the requirements in this specification. In addition, the manufacturer shall certify that the fiber optic cable has a life expectancy of 20 years.

Guarantee. All items covered by this specification shall carry a two-year guarantee from the date of acceptance against any defects in workmanship or materials.

26.01 BLANK ON PURPOSE

26.02 FIBER MARKER

A. GENERAL

Fiber Marker shall be a Fiber Marker shall be a 66" long x 3.9"+, flexible fiberglass post with tapered triangular end for ground installation. Fiber Marker shall have 14" long x 2.8"+ label, that is non-reflective, outdoor-durable, vinyl, with "Warning, Fiber Optic Cable, City of Lincoln, Before digging in this area call 402-441-6855. Fiber Marker shall be standard APWA orange color, and have a post durability rating for 20+ years outdoor.

B. INSTALLATION

Fiber Marker shall be installed at locations as indicated on the plans by inserting the base end into the soil at a depth of 24", as per the manufacturer's recommendation. Fiber Marker shall be installed over the top of the fiber conduit as to depict the alignment of fiber conduit directly below the marker.

C. BASIS OF PAYMENT

FIBER MARKER, complete, in place and accepted by the City's Project Manager, shall be measured as a single unit and shall be paid for at the contract unit price per each for the item. This price shall be full compensation for furnishing and/or installing the fiber marker; and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work.

26.03 BLANK ON PURPOSE

26.04 GROUND BAR

A. GENERAL

Ground Bar shall be 1-UL listed, ANSI Certified, CSA Listed. Ground Bar shall be 14 position. Ground Bar shall be insulated/isolated from the pull box utilizing plastic or nylon standoffs.

Ground Bars shall be all copper or aluminum construction, 6"L x 1/2"H x 1/4" W, with no less than 5 x 3/16" mounting holes. Grounding bar shall be mounted to the side of the pull box using standoffs and shall be placed no less than 6" from the ground rod and 10" from the bottom of the pull box lid.

B. INSTALLATION

Ground Bars shall be installed at locations as indicated on the plans and shall be mounted at the center point of the sidewall of the Pull Box T48 opposite the curb, 6" below the top rim. Ground Bar insulators will need to be mounted with 2 stainless steel machine screws through the sidewalls of the pull box, with 2 stainless steel washers on the outside of the pull box. Ground Bars shall then be mounted to the insulators such that they are insulated from the pull box.

C. BASIS OF PAYMENT

GROUND BAR, complete, in place and accepted by the City's Project Manager, shall be measured as a single unit and shall be paid for at the contract unit price per each for the item. This price shall be full compensation for furnishing and/or installing the ground bar; for standoffs; and for all labor, equipment, tools, materials, and incidentals necessary to complete the Work.

26.05 FIBER CABLES

A. TYPES AND CLASSES OF CABLE

All classes of cable shall be on substantially constructed reels, plainly marked as to size, type, and insulation identification. Only 1 length of cable shall be shipped on each reel. All cable must be new. Damaged cable or repairs on damaged cable will not be permitted. All cables shall be stranded copper, unless otherwise noted.

1. Fiber Locate Cable

Fiber Locate Cable shall be a new single conductor #14 AWG type THHN 600 volt, stranded copper. Insulation jacket color shall be orange. UL 44 and UL 854, ICEA S-95-658/NEMA WC-70, C (UL) US Federal spec. A-A-59544. Fiber Locate Cable is incidental to the communications conduits installed and will not be paid for separately, unless otherwise specified and quantified on the plans.

2. Single Mode Fiber Cable

All Single-Mode Fiber Cable fiber shall be single-mode conforming to ITU-T G652.D. Single-Mode Fiber Cable shall conform to ANSI/ICEA S-87-640 Standard for Optical Fiber Outside Plant Communications Cable. Cable type shall be non-armored, all Dielectric suitable for lashed aerial and duct installation. Single-Mode Fiber Cable shall contain water swellable tape to prevent water intrusion. Strength member of the Single-mode Fiber Cable shall be of a non-conductive type and shall provide strength sufficient for installation and residual loads. The cable sheath shall have length markings in feet, and shall indicate that the unit of measure is feet. The cable shall have an operating temperature range of -40 degrees C to 70 degrees C. Number of single-mode fibers within the Single-mode Fiber Cable shall be specified on the project plans. The cables shall be constructed with twelve fibers per tube.

All fibers shall be suitable for transmission using both 1310 nm and 1550 nm wavelengths. Attenuation shall not exceed 0.35 dB/km and 0.25 dB/km for 1310 nm and 1550 nm signals, respectively.

B. INSTALLATION

1. Fiber Locate Cable

Fiber Locate Cable shall be installed in the orange no stripe conduit within the Main Line Conduit Group (MLCG), or within any designated fiber conduit as indicated on the plans. Each locate cable shall be terminated at the conductor terminals on the insulated, isolated Ground Bar affixed to the inside of the pull box and to the ground buss in the cabinet.

2. Single Mode Fiber Cable

Single-Mode Fiber Cables shall be installed in such a manner and by such methods ensuring against harmful stretching of the optical fiber, injury to the jacket, damage to the outer protective covering of the cable, or cable crushing. An approved cable lubricant may be used to aid in pulling through conduit.

26.05 FIBER CABLES (Continued)

B. INSTALLATION (Continued)

2. Single Mode Fiber Cable (Continued)

To provide proper slack in cable, 50' of extra fiber cable shall be neatly coiled and secured in each pull box with Velcro fasteners. For pull box locations with Splice Enclosures, this means 25' of additional cable on each side of the Splice Enclosure for a total 50' of slack. Under no circumstance shall any cable be taped or otherwise bound to another cable. Fiber cable shall be installed in conduit with a suitable cable feeding method to protect the cable and guide it into the duct. Break away pulling swivels rated at 600 lbs. shall be used to ensure that the maximum tensile force for the cable is not exceeded and to prevent cable twisting. Ensure that no residual tension remains on the cable after installation, except the weight of the cable.

Do not install conductors carrying AC power in the same wiring harness as cables carrying control or communications signals.

No splices or joints will be permitted to be drawn inside the conduit, nor shall any splices or joints be made in any cable outside of pull boxes or cabinets.

Single-Mode Fiber Cable shall be installed within the ambient temperature limits specified by the manufacturer.

Arrange all fiber cabling, including fiber optic pigtails, so that any removable assembly can be removed without disturbing cabling that is not associated with the assembly being removed.

Prior to installation, perform such tests as indicated in this provision to confirm that the cable is in good condition and complies with the specifications. Any defects found after installation will be deemed the fault of the contractor.

Install the cable such that the optical and mechanical characteristics of the fiber are not degraded. Do not violate the minimum bend radius or the maximum tension, both during and after installation. During cable installation, keep the bend radius at a minimum of twenty times the outside diameter of the cable.

Cables shall be neatly coiled in fiber optic pull boxes and hung on cable racks as available for organized storage and ease of future access.

Before any cable installation is performed, provide the engineer with a copy of the cable manufacturer's recommended maximum pulling tensions for each cable size. These pulling tensions shall be specified for pulling from the cable's outer jacket. Also, provide a list of the minimum allowable cable bending radius and the cable manufacturer's approved pulling lubricants. Only those lubricants approved by the cable manufacturer will be permitted.

If the cable is pulled by mechanical means, use a clutch device to ensure the allowable pulling tension is not exceeded. Also, attach a strain gauge to the pulling line at the cable exit location, and at a sufficient distance from the take-up device, such that the strain gauge can be read throughout the entire cable pulling operation.

26.05 FIBER CABLES (Continued)

B. INSTALLATION (Continued)

2. Single Mode Fiber Cable (Continued)

Do not leave the let-off reel unattended during a pull, in order to minimize the chance of applying excess force, center pull, or back feeding.

Use an approved lubricant, in the amount recommended by the cable manufacturer, to facilitate pulling the cable. After the cable has been installed, wipe the exposed cable in a pull box, junction box, or cabinet clean of cable lubricant with a cloth before leaving the pull box, junction box, or cabinet. After installation, cut off and discard the first 10 feet of the cable. These 10 feet are not included in the quantities and are considered incidental to the fiber work. Seal the fiber optic cable ends to prevent the escape of the filling compound and the entry of water.

All fiber optic cables installed in pull boxes or cabinet locations shall be neatly and definitively labeled using fiber cable tags provided by the City of Lincoln. These fiber optic cable tag labels shall be labeled by the contractor with the number and direction of fiber cables (to/from) and which fibers are spliced, if any.

All fiber optic cable new or relocated shall be tested by the Contractor with an Optical Time Domain Reflectometer (OTDR). Testing shall be performed after all connectors are complete if the Contractor is expected to perform the connectorization. If the contractor is not expected to perform the connectorization then a bare end test of the fiber shall be performed to test cable integrity after contractor installation. In the case of separate contractors for Fiber Optic Cable install and Fiber connectorization an additional OTDR test will be required of the connectors by the connector contractor after all specified connectors are complete. Testing of fiber optic cable shall be conducted in accordance with the Acceptance Testing section of these provisions.

C. BASIS OF PAYMENT

CABLE, FIBER OPTIC, ___ STRAND, SINGLE MODE complete, in place and accepted by the City's Project Manager shall be measured as lineal feet from center to center of pull boxes, cabinets, or enclosures plus slack coil amounts furnished and installed as specified on the plans of such material of the size and type required and number of fibers. Cable shall be paid for at the contract unit price bid per linear feet.

This price and payment shall be full compensation for furnishing and installing cable, all necessary slack, testing, documentation, connections and all other materials, hardware, labor, equipment, tools, and incidentals necessary to complete the work.

Additional slack cable required inside pull boxes, cabinets, and other such devices or structures, not quantified or indicated on the plans shall be subsidiary to those items and shall not be measured for payment.

26.06 FIBER CONNECTORS, ENCLOSURES AND ACCESSORIES

A. COMPONENTS

1. Fiber SC Connector

All Fiber SC Connectors shall be temperature rated for -40 C to 70 C or better, and shall be compliant with ANSI/TIA-568-B.3 and TIA/EIA-604-3. Fiber SC Connectors shall be SC type compatible with single-mode fiber and shall be terminated using an appropriate Fiber Fan Out Kit. Fan Out Kits are incidental to fiber termination work.

All Fiber SC Connectors shall be installed using the method recommended by the connector manufacturer, and shall be installed compatible with both Fiber Distribution Rack Mount Enclosures, and Fiber Distribution Wall Mount Enclosures.

2. Fiber SC Panel Pigtail

Fiber SC Panel Pigtail shall be temperature rated for -40 °C to 70 °C and shall conform to Design and Test Criteria GR-3152, GR-771. Fiber SC Panel Pigtail shall have 12 SC UPC single mode ports in a housing with an outdoor single mode pigtail of appropriate length for the application. Fiber SC Panel Pigtail shall be wall, or din rail mountable.

3. Fiber Optic Cable Fusion Splice

When a buffer tube is required to be opened in order to perform fusion splicing, cut only the fibers to be terminated/spliced at a location according to the Plans. Unused fibers or fibers that are continuous through a splice location (expressed fibers) are to be coiled, and neatly routed around the inside edges of the splice tray. Fusion splicing will ensure alignment is via fiber cores and splicing equipment shall be fully automated X, Y, and Z axis (3-axis) alignment using a light injection/detection system. Use splicing equipment that has an auto fusion time control to monitor the power level through the splice to complete the fusing process when splice loss is a minimum. Provide splice losses that average less than or equal to 0.05dB/splice between any two optical ports, and do not exceed the same level for any splice. Protect all splices with a thermal shrink sleeve, 60 mm long. Place the completed splices in a splice tray.

4. Fiber Optic Cable Splice Enclosures

Fiber Optic Splice Enclosures shall be listed in the latest edition of the Rural Utilities Service (RUS), List of Materials Acceptable for Use on Telecommunications Systems of RUS Borrowers, category pl, closure design e, suffix B; or be of brand Coyote Fiber Optic Closures, or approved equal. They shall include all materials necessary to make, organize, and protect the splices.

Fiber Optic Splice Enclosure housing shall be non-metallic resistant to solvents, stress cracking, and creep.

Fiber Optic Splice Enclosure shall be re-enterable not requiring encapsulation or potting to resist water penetration.

26.06 FIBER CONNECTORS, ENCLOSURES AND ACCESSORIES (Continued)

A. COMPONENTS (Continued)

4. Fiber Optic Cable Splice Enclosures (Continued)

The Fiber Optic Splice Enclosure shall be of a size sufficient to accommodate the number of Single-Mode Fiber Cables and splices specified on the project plans. Fiber Optic Splice Enclosures shall be furnished and installed as either “small” or “large” as defined on the project plans and specs. Fiber Optic Splice Enclosure, Small; shall be able to accommodate a minimum of 48 splices. Fiber Optic Splice Enclosure, Large; shall be able to accommodate a minimum of 144 splices. The Fiber Optic Splice Enclosure shall provide a clamping mechanism to prevent pistoning of the central strength member and to prevent cable sheath pullout.

The Fiber Optic Splice Enclosure shall have appropriate hardware and installation procedures to facilitate the bonding and grounding of metal components in the enclosure and the armored cable sheath. The cable bonding hardware shall be able to accommodate a copper conductor equal to or larger than a No. 6 AWG.

The Fiber Optic Splice Enclosure shall accommodate and include splice trays suitable for single fiber, single fiber heat shrink, mechanical, or ribbon heat shrink splices, and shall accommodate the number of splices specified in the project plans.

A bond clamp shall remain firmly attached to the cable armor sheath while under a tensile load of 9-kg (20 lbf). Following removal of the load, there shall be no evidence of clamp loosening or damage to the cable sheath, armor, or clamp that would reduce its current carrying capacity as required by the AC fault test.

The electrically conductive path used for continuity and grounding of the splice enclosure metallic components shall be capable of withstanding an AC current of 1000 Amperes for 20 seconds.

The cable clamping and sealing hardware used to terminate optical fiber cable shall not cause an attenuation change greater than ± 0.05 dB per fiber, when tested with a source operating at $1550\text{nm} \pm 20\text{nm}$.

An axial load of 100 lbf, individually applied to each cable, shall not cause mechanical damage to the cable or clamping hardware. The load to the optical fiber cable shall not cause an attenuation change greater than ± 0.05 dB per fiber, when tested with a source operating at $1550\text{nm} \pm 20\text{nm}$.

Subjecting the closure/cable interface to 90° flexing for 8 cycles at ambient temperatures of $-18^\circ\text{C} \pm 2^\circ\text{C}$ ($0^\circ\text{F} \pm 3.6^\circ\text{F}$) and $40^\circ\text{C} \pm 2^\circ\text{C}$ ($104^\circ\text{F} \pm 3.6^\circ\text{F}$) shall not cause any mechanical damage to the cable or clamping hardware. In addition, flexing of the optical fiber cable shall not cause an attenuation change greater than ± 0.05 dB per fiber, when tested with a source operating at 1550 ± 20 nm.

Subjecting the closure/cable interface to 10 cycles of torsional loading at ambient temperatures of $-18^\circ\text{C} \pm 2^\circ\text{C}$ ($0^\circ\text{F} \pm 3.6^\circ\text{F}$) and $40^\circ\text{C} \pm 2^\circ\text{C}$ ($104^\circ\text{F} \pm 3.6^\circ\text{F}$) shall not cause any mechanical damage to the cable or clamping hardware. In addition, torsional loading of the optical fiber cable shall not exceed allowable attenuation changes.

26.06 FIBER CONNECTORS, ENCLOSURES AND ACCESSORIES (Continued)

A. COMPONENTS (Continued)

4. Fiber Optic Cable Splice Enclosures (Continued)

The enclosure shall not exhibit any mechanical damage after being subjected to a vertical drop from a height of 0.75 m (30") at temperatures of $-18^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($0^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$) and $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($104^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$).

The diameter of the optical fiber splice enclosure shall not permanently deform more than 10%, nor temporarily deform more than 20%, when it is compressed by a uniformly distributed load of 300 lbf. Additionally, the compressive load shall cause no mechanical damage to the enclosure or its contents.

The enclosure shall not exhibit any mechanical damage after being subjected to mechanical impact of 100 lbf (136 Nm) at temperatures of $-18^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($0^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$) and $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($104^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$).

The enclosure central member clamp shall prevent movement (e.g. bowing, pistoning, or breaking) of the cable central member (CM) when the CM exerts a force of 100 lbf on the clamp.

Sealing components (gaskets, grommets, O-rings) used in an enclosure, shall not permit the entry of water into the enclosure after thermal aging at $90^{\circ}\text{C} \pm 1^{\circ}\text{C}$ ($194^{\circ}\text{F} \pm 1.8^{\circ}\text{F}$) for 720 hours (30 days).

The enclosure shall be capable of safe and proper assembly at temperatures of $0^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($32^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$) and $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($104^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$) using materials and procedures specified by the manufacturer.

The enclosure shall not exhibit any mechanical damage or corrosion following 30 days of severe temperature and humidity cycling from $65^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($150^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$) and 95% relative humidity to $-40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($-40^{\circ}\text{F} \pm 3.6^{\circ}\text{F}$) and uncontrolled humidity. Additionally, at the midpoint of the temperature cycle, re-entry and re-assembly of the enclosure shall be done. If the enclosure has a hinged cover, it shall be flexed 25 times.

The enclosure shall show no evidence of water intrusion into the compartment containing fiber splices after it is immersed in water and subjected to 10 freeze/thaw cycles.

The splice enclosure shall show no evidence of water penetration following exposure to a 20' waterhead for a period of 7 days.

An enclosure shall show no evidence of corrosion following exposure to acidified saltwater for a period of 90 days.

The enclosure shall show no change in sealing ability after submersion in a specified chemical test fluid for 7 days. The mechanical integrity of the enclosure shall be confirmed by performing the compression and impact tests. The enclosure seal shall also be checked by performing the water immersion test. Additionally, samples of external, nonmetallic enclosure materials shall neither experience a change in weight greater than 10%, nor experience a reduction in tensile strength or elongation properties greater than 20%, after immersion in the chemical test fluid.

26.06 FIBER CONNECTORS, ENCLOSURES AND ACCESSORIES (Continued)

A. COMPONENTS (Continued)

4. Fiber Optic Cable Splice Enclosures (Continued)

Samples of external, nonmetallic enclosure materials shall not have a reduction in tensile strength or elongation properties greater than 20% of their original value, after being exposed to a UV-B type ultraviolet light source with a peak emission at 313 nm for 2,160 hours (90 days).

Samples of polymeric enclosure materials shall not support fungus growth when tested per ASTM G 21. A rating of 0 is required.

5. Fiber Distribution Wall Mount Enclosure

Fiber Closet Connector Housing shall be a wall mountable housing capable of housing 4 Fiber SC Closet Pigtails. Closet Connector Housing shall be compatible with SC Closet Pigtails. Closet Connector Housing shall have storage for appropriate splice trays. Closet Connector Housing shall have a hinged door to provide convenient access to installed SC Closet Pigtails and splice trays.

6. Fiber Distribution Rack Mount Enclosure

Fiber Rack Mount Connector Housing shall be a 19" rack mountable housing capable of housing 4 SC Closet Pigtails. Fiber Rack Mount Connector Housing shall be compatible with SC Closet Pigtails. Closet Connector Housing shall have storage for appropriate splice trays. Rack Mount Connector Housing shall have a hinged door to provide convenient access to installed SC Closet Pigtails and splice trays.

7. Factory Terminated Patch Panel w/ Pigtail

Factory terminated patch panels with pigtails will provide for connectivity between field cabinets and fiber optic cable in pull boxes. The factory terminated end will be mounted in the traffic signal or ITS cabinet, and the opposite end of the pigtail shall be spliced in the Fiber Splice Enclosure located in the T48. A fiber splice schematic indicating the fusion splice plan will be provided by the City. These factory terminated patch panels with pigtails shall be provided in either 4-step, skinny (8 fiber port) or 6-step, skinny (12 fiber port) configurations and have type SC connectors. They shall have the following characteristics:

Test	Single mode
Test wavelength	1550nm
Insertion loss	0.2dB typical, 0.5dB max.
Reflectance	<-55dB (apc connector)
Durability	500 matings, <0.2dB change
Tensile strength - straight pull (cable tail)	50lbs (220N), <0.2dB change
Temperature range	-40 to +70C
Ferrule polish	UPC
Connector Type	SC

The Factory Terminated Patch Panel w/ Pigtail, whether 4-step or 6-step, shall be provided with a minimum pigtail length of 75' unless otherwise noted in special cases.

26.06 FIBER CONNECTORS, ENCLOSURES AND ACCESSORIES (Continued)

A. COMPONENTS (Continued)

8. Junction Box

Junction Box shall be 2' x 2' x 6" Powder coated steel. Junction Box shall be NEMA 3R rated and shall be lockable.

9. 3", 3 Cell Fabric Innerduct

3", 3 Cell Fabric Innerduct shall be 3", 3 cell polyester/nylon textile innerduct. Fabric Innerduct shall be capable of accommodating up to a 1" diameter cable per cell. Fabric Innerduct shall contain 1250 lb. polyester flat woven pull tape.

B. INSTALLATION

1. Fiber SC Connector

For Single-Mode Fiber Optic Cable the below table specifies minimum acceptable SC Connector performance:

Loss Mode	Maximum Acceptable Loss (dB)
Single-Mode SC connector (dB loss/connector)	.50 dB max

All OTDR test shall be performed using appropriate launch and receive cables. OTDR submitted test results shall use the full scale of the OTDR display, shall include 2 point loss from launch cable to launch cable, and shall include Optical Return Loss. When testing connectors a 2 point loss measurement across the connector shall be performed. All testing shall be performed at 1310nm and 1550nm wavelengths.

2. Fiber SC Panel Pigtail

SC Panel Pigtail shall be securely installed where indicated on plans. SC Panel Pigtail shall be mounted in such a way so as to allow easy access. SC Panel Pigtail shall be spliced into existing fiber using a fusion splice. Finished splice shall be housed in a Fiber Splice Enclosure. After installation the SC Panel Pigtail shall be tested with an Optical Time Domain Reflectometer using appropriate launch and receive cables. SC Panel Pigtail shall meet or exceed the below parameters:

Loss Mode	Maximum Acceptable Loss (dB)
SC Connector Insertion Loss (Per Connector)	.50 dB Max
SC Panel Pigtail Fusion Splice (Per Splice)	≤ 0.30 Db

26.06 FIBER CONNECTORS, ENCLOSURES AND ACCESSORIES (Continued)

B. INSTALLATION (Continued)

3. Fiber Optic Cable Fusion Splice

Fiber Optic Cable Fusion Splice shall be cleaved, cleaned, aligned and spliced according to the fiber splice machine specifications.

Splice shall be protected with either Butterfly or heat shrink splice protection and shall be secured in a splice tray designed for fusion splices

4. Fiber Optic Cable Splice Enclosure

Installation of Fiber Optic Cable Splice Enclosure shall follow manufacturer's directions. Installation of Fiber Optic Cable Splice Enclosures in underground Fiber Pull Boxes shall be done in accordance to manufactures directions. Fiber Optic Cable Splice Enclosure shall be neatly hung within the T48 pull box along with excess fiber coils. No Fiber Optic Cable Splice Enclosures shall be permitted for direct burial or in conduit splicing.

5. Fiber Distribution Wall Mount Enclosure

Fiber Distribution Wall Mount Enclosure shall be securely installed where indicated on plans and shall use appropriate mounting hardware. Closet connector housing shall be mounted in such a way as to provide easy access to connector housing access door and the connection points.

6. Fiber Distribution Rack Mount Enclosure

Fiber Distribution Rack Mount Enclosure shall be securely installed where indicated on plans and shall use appropriate mounting hardware. Rack Mount Enclosure shall be mounted in such a way as to provide easy access to components, doors and connection points as mounted within ITS cabinets.

7. Factory Terminated Patch Panel w/ Pigtail

Installation of the Pigtails shall follow manufacturer's instructions.

8. Junction Box

Junction Box shall be installed where indicated on plans and shall be securely fastened to building using 4 fastening points. Building entrances shall be PVC conduit of a size specified on the plans and shall use weather tight bulkheads on all entrances to the Junction Box. All entrances to building shall be sealed with mastic to prevent water intrusion.

9. 3", 3 Cell Fabric Innerduct

Fabric Innerduct shall be installed from Pull Box to Pull Box or where specified on plans using continuous unspliced lengths. Fabric Innerduct shall be installed using the manufacturers specified installation procedure. After installation, Fabric Innerduct and pull tape shall be secured following the manufacturer's recommended method.

26.06 FIBER CONNECTORS, ENCLOSURES AND ACCESSORIES (Continued)

C. BASIS OF PAYMENT

FIBER SC CONNECTOR; FIBER SC PANEL PIGTAIL; FIBER OPTIC CABLE FUSION SPLICE; FIBER OPTIC CABLE SPLICE ENCLOSURE, ____; FIBER DISTRIBUTION WALL MOUNT ENCLOSURE; FIBER DISTRIBUTION RACK MOUNT ENCLOSURE; FACTORY TERMINATED PATCH PANEL W/PIGTAIL, ____-STEP and JUNCTION BOX, 2' X 2' complete, in place and accepted by the City's Project Manager, shall be measured as a single unit and shall be paid for at the contract unit price bid per each. This price and payment shall be full compensation for furnishing and installing the items; and for all labor, equipment, tools, materials, and incidentals required to complete the Work.

For City of Lincoln furnished items: FIBER SC CONNECTOR, INSTALL; FIBER SC PANEL PIGTAIL, INSTALL; FIBER OPTIC CABLE SPLICE ENCLOSURE, ____, INSTALL; FIBER DISTRIBUTION WALL MOUNT ENCLOSURE, INSTALL; FIBER DISTRIBUTION RACK MOUNT ENCLOSURE, INSTALL and FACTORY TERMINATED PATCH PANEL W/PIGTAIL, ____-STEP; complete, in place and accepted by the City's Project Manager, shall be measured as a single unit and shall be paid for at the contract unit price bid per each. This price and payment shall be full compensation for installing the items as provided by City of Lincoln; and for all labor, equipment, tools, materials, and incidentals required to complete the Work.

3", 3 CELL FABRIC INNERDUCT, complete, in place and accepted by the City's Project Manager, shall be measured as lineal feet from center to center of pull boxes, or where specified on plans, of such material of the size and type require and shall be paid for at the contract unit price bid per linear feet. This price and payment shall be full compensation for furnishing and installing 3", 3 Cell Fabric Innerduct, pulling tape, all necessary slack, documentation; and for all labor, equipment, tools, materials, and incidentals required to complete the Work.

26.07 INSTALL ITS FIELD SWITCH

A. GENERAL

ITS Field Switch shall be a field-hardened, Ethernet switch provided by the City of Lincoln for installation in cabinet locations as part of Traffic Signal and ITS projects as indicated on the plans.

B. INSTALLATION

ITS Field Switch shall be installed at locations shown on the plans. Unless otherwise specified, the units shall be shelf-mounted in cabinets as indicated, for applicable connections to communications cable and equipment. Switches will be pre-programmed by City of Lincoln, Traffic Operations, with relevant SFP modules for installation. Proper power supplies shall also be installed on din rails, and will be provided by City of Lincoln for contractor installation.

C. BASIS OF PAYMENT

INSTALL ITS FIELD SWITCH, complete, in place, and accepted by the City's Project Manager, shall be measured for payment as single units and shall be paid for at the contract unit price bid per each for the item only when called for. This price and payment shall be full compensation for picking up and installing ITS Field Switch, all labor, equipment, tools, and incidentals necessary to complete the Work.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 30

SEEDING AND SODDING

ARTICLE	TITLE	
30.00	DESCRIPTION	3002
30.01	QUALITY ASSURANCE	3002
30.02	SOURCE QUALITY CONTROL	3003
30.03	PLANTING SEASON	3003
30.04	MATERIALS (GENERAL INFORMATION)	3003
	A. GENERAL PLANT MATERIALS REQUIREMENT	3003
	B. SEED (GENERAL)	3004
	C. SOD (GENERAL)	3007
	D. GRASS PLUGS (GENERAL)	3008
	E. FERTILIZER	3008
	F. TOPSOIL	3009
	G. COMPOST	3009
	H. MULCH	3009
	I. WATER	3010
30.05	GENERAL CONSTRUCTION METHOD	3010
	A. GENERAL	3010
	B. PREPARATION OF SOIL	3010
	C. FERTILIZING	3011
	D. SITE CLEAN-UP	3011
30.06	COVER CROP	3012
	A. GENERAL	3012
	B. EARLY SEASON (SPRING COVER CROP)	3012
	C. MID-SEASON (LATE SUMMER/FALL COVER CROP)	3012
	D. LATE SEASON (WINTER COVER CROP)	3013
30.07	SEEDING	3013
	A. GENERAL	3013
	B. TOPSOIL	3013
	C. BOOSTER FERTILIZER	3013
	D. SEED	3013
	E. MULCHING	3014
	F. SEEDING METHOD	3014
	G. ADDITIONAL FERTILIZING	3015
	H. WATERING	3015
	I. INSPECTIONS	3015
	J. GERMINATION INSPECTIONS	3015
	K. BASIS OF PAYMENT	3016

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 30

SEEDING AND SODDING

ARTICLE	TITLE	
30.08	SODDING	3016
	A. GENERAL	3016
	B. TOPSOIL	3016
	C. BOOSTER FERTILIZER	3016
	D. CARE AND HANDLING	3016
	E. TRANSPORTING SOD ON SITE	3017
	F. INSTALLATION	3017
	G. MAINTENANCE	3017
	H. MOWING	3017
	I. ADDITIONAL FERTILIZING	3017
	J. WATERING	3018
	K. INSPECTIONS	3018
	L. BASIS OF PAYMENT	3018
30.09	PLUGGING	3018
	A. GENERAL	3018
	B. TOPSOIL	3018
	C. SOD PLUGS	3018
	D. OVERSEEDING WITH COVER CROP (ALTERNATIVE)	3019
	E. BOOSTER FERTILIZER	3019
	F. PRE-EMERGENT CONTROL	3019
	G. POST-EMERGENT CONTROL	3019
	H. CARE AND HANDLING	3019
	I. INSTALLATION	3020
	J. MAINTENANCE	3021
	K. INSPECTIONS	3021
	L. BASIS OF PAYMENT	3021
30.10	ACCEPTANCE AND ESTABLISHMENT PERIOD	3022
30.11	REPLACEMENT OF MATERIAL AND GUARANTEE PERIOD	3022
30.12	VANDALISM	3023
30.13	QUALIFICATIONS FOR SUBMITTING BIDS	3023

CHAPTER 30

SEEDING AND SODDING

30.00 DESCRIPTION

The Work described in this section shall pertain to any seeding, sodding or turf plugging work.

Work shall include all labor, material and equipment as herein specified. The Work shall comply with the requirements of all legally constituted authorities having jurisdiction.

This Work shall consist of furnishing, delivering and planting of plant material and all operations incidental thereto, in accordance with City of Lincoln Standard Plans, the Special Provisions, and these Standard Specifications

30.01 QUALITY ASSURANCE

Contract sodding work to a single firm specializing in sodding and growing of turf grass. Firm shall have satisfactory record of performance on completed projects of comparable size and quality.

Contract seeding work to a single firm specializing in seeding turf and/or wildflower mixes. Firm shall have satisfactory record of performance on completed projects of comparable size and quality.

Contract plugging work to a single firm specializing in plugging grass. Firm shall have satisfactory record of performance on completed projects of comparable size and quality.

Contractor must comply with American Sod Producers Association Classes of sod materials.

The City's Project Manager may inspect sod, seed or plugs at site before planting, for compliance with requirements for genus, species, variety, size and quality. The City's Project Manager may reject unsatisfactory or defective material at any time during progress of Work. Rejected materials shall be immediately removed from project site.

Submittals

Certificate of Inspection: Submit certificates of inspection as required by governmental authorities.

Certified Analysis: Submit manufacturer's certified analysis, or, where applicable, Analysis of recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists. Include soil amendments and fertilizer materials.

List of Sources: Submit a written list of the supplies where the material was produced. Materials from unapproved sources will be rejected.

30.02 SOURCE QUALITY CONTROL

Ship materials with certificates of inspection required by governing authorities. Comply with regulations applicable to sod, seed and materials.

Do not make substitutions. If specified sod, seed and other materials are not obtainable, submit proof of non-availability to City's Project Manager.

Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable. The actual planting shall be performed during those times in this season which are normal for such Work as determined by weather conditions, and accepted practice in the locality.

30.03 PLANTING SEASON

Within thirty (30) days after receiving the signed contract, the Contractor shall submit a written list of the nurseries from whom the Contractor will purchase the materials, and the source where the material was produced. The list shall be submitted to the City's Project Manager. The Contractor will be notified if there are any unapproved sources of materials on the list. Materials from unapproved sources will be considered for rejection.

The planting season for all material shall be:

SEED	April 15 - May 30. September 1 - October 15.
SOD	March 1 to June 15, and September 1 to October 15.
PLUGS	May 1 to August 1. Soil temperatures must consistently be above 60 degrees F (16 degrees C).

Sodding/Seeding/Plugging operations shall be performed during this season only, except when prior written permission is obtained from the City's Project Manager. The actual sodding/seeding/plugging shall be performed during those times in this season which are normal for such Work as determined by weather conditions, and accepted practice in the locality.

30.04 MATERIALS (GENERAL INFORMATION)

A. GENERAL PLANT MATERIALS REQUIREMENT

1. All material shall comply with all applicable State and Federal laws, including inspection certifications which shall include the project number and the plant material that the certification covers. All material is subject to inspection by representatives of the City, State and Federal Governments.
2. All material furnished shall be true to name and type and legible labels shall be furnished to insure that all species, varieties, boxes, bundles, bales or other containers are identified. The information on the label shall cover the botanical genus, species, and common name or variety.
3. All material shall be sound, healthy specimens and first-class representatives of their species or variety, and shall have well formed tops and healthy root systems.

30.04 MATERIALS (GENERAL INFORMATION) (Continued)

A. GENERAL PLANT MATERIALS REQUIREMENT (Continued)

4. Materials which are planted and later discovered to be not true to name may be allowed to remain in place as approved by the City's Project Manager without payment being made therefore.
5. A representative sample of all material shall be submitted to the City's Project Manager for approval prior to planting if requested.
6. Any material that is planted which does not meet the specified minimum size shall be rejected or allowed to remain in place without payment being made therefore.
7. If a Contractor is unable to locate sufficient material in specified sizes, negotiation for unit price reduction shall be concluded prior to installation.
8. All material shall be true to species and variety specified and grown/produced in accordance with good horticultural practices.
9. Substitution of specified materials shall not be permitted unless authorized by the City's Project Manager.

B. SEED (GENERAL)

1. All seed shall be certified blue tag seed unless otherwise specified.
2. All seeds shall comply with the applicable State and Federal seed laws.
3. Seed used shall be free of crop, weed and inert matter.
4. The Contractor shall obtain from the seed dealer and furnish to the City's Project Manager an analysis of each type and lot of seed the Contractor proposed to use.
5. The analysis shall provide complete information on the seed as required by the State and Federal laws, as well as the specific crop and noxious weed seed present.
6. The City's Project Manager may approve use of the seed if the information on the analysis is satisfactory. A minimum of eighty-five percent (85%) pure live seed (purity x germination x 100) is required for approval. Grass seed mixtures shall comply with the formulas provided in the seeding tables.

Listed below are Standard Specifications for each type of grass seed mixture. Included in each Standard Specifications are the grasses which are approved for use in that mixture. Other cultivars may be approved by the City's Project Manager provided they are recommended by the most current NEBGUIDE, titled "Recommend Turfgrass Cultivars", published by the Cooperative Extension Service of the University of Nebraska at Lincoln, or by the Extension Turfgrass Specialist.

30.04 MATERIALS (GENERAL INFORMATION) (Continued)

APPROVED VARIETIES INCLUDE:

TYPE “A” - Lawn Mix (High maintenance turf, sunny locations)

For use in sunny locations receiving higher maintenance, water on a regular basis and requiring adequate appearance and rapid establishment.

Kentucky Bluegrass Blend

Description:	Dark green color, good shade tolerance, disease resistant
Location:	Sites with irrigation, Office Parks, Residential
Seeding Period:	April 15 - May 30; September 1 - October 15
Composition:	60% Bluechip, Blue Moon and NuBlue Ky. Bluegrass, 40% Accent or Caddieshack and SR4220 Perennial Ryegrass
General Application:	Seed 2 to 3 lbs. /M Sq. Ft.
Overseed Application:	Overseed 1 to 1 ½ lbs. /M Sq. Ft.

TYPE “B” - Fescue Mix (Medium maintenance turf, sunny locations)

For use in sunny locations receiving medium maintenance and requiring adequate appearance and rapid establishment.

Turf Type Tall Fescue, Kentucky Bluegrass and Perennial Ryegrass Mix

Description:	Lower growing dwarf fescue, high wear tolerance, lo
Location:	Parks and lower maintenance areas with or without irrigation. Mowing required.
Seeding Period:	April 15 - May 30; September 1 - October 15
Composition:	88% Arid 3, Jaguar 3, Masterpiece and Rembrandt (E), Turf TypeTall Fescue 7%, Blue Chip and NuBlue Kentucky Bluegrass - 5% Turf Type Perennial Ryegrass.
General Application:	Seed 8 to 10 lbs. /M Sq. Ft.
Overseed Application:	Overseed 4 to 5 lbs. /M Sq. Ft.

TYPE “C” - Buffalo grass (Low maintenance turf in sunny locations)

For use in sunny locations receiving little or no supplement water beyond establishment and requiring minimal mowing.

Buffalo grass cultivars including: Legacy, Cody, Bowie, Bison, Texoka, Tatanka, Prestige, Top Gun

Description:	Low growing, 4" - 8" little or no mowing
Location:	Medians, Boulevards, Open Space areas
Seeding Period:	May 1 – September 10
Composition:	Varies between species
General Application:	Apply 2 to 3 pounds of seed per 1000 sq. ft.
Overseed Application:	Apply 1 to 2 pounds of seed per 1000 sq. ft.

30.04 MATERIALS (GENERAL INFORMATION) (Continued)

TYPE “D” - Shade Mix (For use in shady locations)

For use in areas receiving little or no sun.

Description:	Versatile mix of fescues, fairly low maintenance
Location:	Residential, older areas of town (i.e. Capitol Environs District)
Seeding Period:	April 15 - May 30; September 1 - October 15
Composition:	MX 86 Sheeps Fine Fescue, Rescue 911 hard Fine Fescue, SR3200 Blue Fine Fescue, Jamestown Chewings Fine Fescue and Rose creeping Red Fine Fescue or equivalent(s).
General Application:	Apply 4 to 6 Lbs. /M Sq. Ft.
Overseed Application:	Overseed 2 to 4 Lbs. /M Sq. Ft.

TYPE “E” - Low Growing Grass Mix (Outlying City and Acreages)

For use in areas requiring low maintenance, low growing, natural native prairie look

Description:	Mixture of cool and warm season grasses
Location:	Outlying areas of town, acreages:
Seeding Period:	April 15 - May 30; September 1 - October 15
Composition:	Blue Fine Fescue, hard Fine Fescue, Sheeps Fine Fescue, Blue Grama, Little Bluestem and Sideoats Grama
General Application:	Seed 16 to 32 Lbs. /Ac (½ to 1 Lb. /1,350 Sq. Ft.).
Overseed Application:	N/A

TYPE “F” - Rural Mix (County Road and Rural NRD Projects)

For use in sunny rural locations and along roadsides for quick growth and erosion control.

Description:	Strong sod forming abilities of bromegrass with deep rooting fescue	
Location:	County Roads, Rural NRD Projects	
Seeding Period:	April 15 - May 30; September 1 - October 15	
Composition:	See Below	
General Application:	Smooth Bromegrass, VNS	10 lbs pls/acre
	Oats, Jerry	20 lbs pls/acre
	Hairy Vetch	2.25 lbs pls/acre
	Clover, Mammoth Red, VNS	2.25 lbs pls/acre
	Switchgrass, NE 28	2.25 lbs pls/acre
	18-46-0 Fertilizer	200 lbs/acre
Overseed Application:	Zinc Sulfate Monohydrate	20 lbs/acre
	N/A	

TYPE “G” - Native Prairie Mix

For use in sunny locations, low maintenance and taller grasses are acceptable.

Description:	Mixture of (5) native warm season grasses
Location:	Native Prairie, Natural Areas
Seeding Period:	May 1 - May 30; September 1 - October 15
Composition:	2.0 PLS Lbs. Big Bluestem, 1.5 PLS Lbs. Each of Little Bluestem and Indiangrass, 1.0 PLS each of Canada and Virginia Wild Rye and 0.6 PLS Lbs. Each of Switchgrass and Sideoats Grama.
General Application:	Apply 20 pounds per acre.
Overseed Application:	N/A

30.04 MATERIALS (GENERAL INFORMATION) (Continued)

TYPE "H" - Flood Plain Mix (For use in drainage channels and on channel side slopes)

For use in sunny locations with tolerance to standing water from 14 to 60 days.

Description:	Mixture of deep rooted grasses for wetlands
Location:	This mixture may be used along shorelines, dams and lowland pastures
Seeding Period:	April 15 - May 30; September 1 - October 15
Composition:	Big Bluestem, Canada Wildrye, Red Top, Reed Canarygrass, Virginia Wildrye, Switchgrass and Western Wheatgrass
General Application:	Seed 15 - 20 Lbs. /Acre
Overseed Application:	N/A

TYPE "I" - Waterway Mix

For use in areas required to conform to the county ASCS Specifications for waterways.

Description:	Mixture blended for waterways
Location:	Waterways
Seeding Period:	April 15 - May 30; September 1 - October 15
Composition:	57% Smooth Brome grass, 11.50% Orchardgrass, 11.50% Tall Fescue and 20% Switchgrass.
General Application:	Apply 24 Lbs. /Acre
Overseed Application:	N/A

C. SOD (GENERAL)

1. Sod shall be taken from sources approved by the City's Project Manager.
2. The sod shall be a first class representation of normal cultivars of bluegrass, fescue, buffalo grass or zoysia.
3. The Contractor shall furnish to the City's Project Manager, upon request, a list of the cultivars used to produce the sod.
4. Sod shall be uniform in color and quality and shall be free of weeds, diseases or other visible imperfections at the time of acceptance.
5. The sod shall be mowed and raked to remove stems, sticks and grass clippings prior to cutting.
6. The sod shall be cut to a depth of approximately 3/4 inch. Extreme care shall be taken in cutting, handling, transporting and laying the sod to avoid unnecessary damage to and loss of earth from roots of the sod.
7. Sod shall not have dry or dead edges.
8. Certified sod, if requested, shall have been inspected and approved by the State Certifying Agency.

30.04 MATERIALS (GENERAL INFORMATION) (Continued)

C. SOD (GENERAL) (Continued)

APPROVED VARIETIES INCLUDE:

Rhizomatous Tall Fescue
Turf Type Tall Fescue
Bluegrass/Fescue Blend
Buffalo grass (Legacy, Cody, Bowie, Bison, Texoka, Tatanka, *Prestige, Top Gun*)
Zoysia Grass

D. GRASS PLUGS (GENERAL)

1. Grass plugs shall be taken from sources approved by the City's Project Manager.
2. The plugs shall be a first class representation of normal cultivars of specified grass.
3. The Contractor shall furnish to the City's Project Manager a list of cultivars used to produce the plugs.
4. Grass plugs shall be uniform in color and quality and shall be free of weeds, disease or visible imperfections at the time of acceptance.
5. Extreme care shall be taken in cutting, handling, transporting and placing the plugs to avoid unnecessary damage to and loss of earth from the roots of the plugs.

APPROVED VARIETIES INCLUDE:

Buffalo Grass (Legacy, Cody, Bowie, Bison, Texoka, Tatanka, *Prestige, Top Gun*)
Zoysia Grass

E. FERTILIZER

All fertilizer shall be checked and approved for acceptance prior to use. Fertilizer shall be a commercial turf product containing nitrogen, available phosphoric acid and soluble potash as required, in a recognized plant food form. All fertilizer shall comply with the provisions of the State of Nebraska Fertilizer Act of 1955, with subsequent revisions.
This act requires:

1. Each brand and grade of commercial fertilizers must be registered by the Nebraska Department of Agriculture and Inspection.
2. Each container of commercial fertilizer shall have either placed on or affixed to the container in written or printed form, the net weight and the following information:
 - a. The name and address of the person guaranteeing the fertilizer.
 - b. The guaranteed analysis showing the minimum percent of plant food claimed in the following form:

Total nitrogen (N)____%
% Cold Water Insoluble Nitrogen (CWIN)(if applicable) ____%
Available Phosphoric Acid (P₂O₅) ____%
Soluble Potash (K₂O)____%

30.04 MATERIALS (GENERAL INFORMATION) (Continued)

E. FERTILIZER (Continued)

If distributed in bulk, a written or printed statement of the weight and preceding information shall accompany delivery and be supplied to the City's Project Manager. Any grade or mixture of grades of phosphoric acid and potash fertilizer may be used providing the proportions of the minimum rate of application per acre are in accordance with these Standard Specifications or as directed by the City's Project Manager. Components of bulk blends must be close in particle size to prevent segregation. The City's Project Manager may approve immediate use of any commercial turf or fertilizer which is registered for sale in Nebraska.

F. TOPSOIL

Shall be fertile, friable, natural loam, dark in color (often black), free of subsoil, clay lumps, brush, weeds, roots, stumps, stones larger than 1-1/2" in any dimensions, debris and other extraneous or toxic matter and harmful to plant growth. Topsoil shall be obtained from local sources and exhibit an acidity range (pH) of 6.0 to 8.5. Identify location of source.

G. COMPOST

Shall be humus-like material made from the decomposition of organic materials which may have included leaves, branches, yard prunings and grass clippings such as LINGRO compost. The compost materials shall be decomposed to form a highly stabilized product and screened with 1/2 inch or less screen opening. The compost shall be free of all inorganic debris. LINGRO compost is available from the City of Lincoln's Solid Waste Operation. Ratio of topsoil to compost should be a minimum of 2 to 1.

H. MULCH

Mulching shall be applied in such a manner as to remain in place. An alternative may be approved by the City's Project Manager. Mulch alternatives shall include the following:

1. Hydro-mulch: If hydro-mulch is used, it shall be evenly applied to all seeded areas at the minimum rate of two thousand (2,000) pounds per acre with a three percent (3%) tackifier and shall be applied immediately after seed application.
2. Peat moss: If peat moss is used, it shall be evenly applied to all seeded areas at the minimum rate of one (1) cubic yard per one thousand (1,000) square feet. The peat moss will be pulverized, will not be less than sixty percent (60%) decomposed organic matter by weight, and will have a pH from four (4) to six (6).
3. Prairie Hay: If hay shall be used, it shall be applied evenly over the seeded surface at the minimum rate of two (2) tons per acre. Hay shall be obtained from local source.
4. Wheat Straw: If wheat straw shall be used, it shall be applied at the rate of three (3) tons per acre.
5. All materials used as mulch will be free from all noxious weed, seed-bearing stalks, or roots and shall be inspected and approved the City's Project Manager.

30.04 MATERIALS (GENERAL INFORMATION) (Continued)

I. WATER

1. Water shall be potable.
2. The Contractor shall provide water, equipment, methods of transportation, water tanker, hoses, sprinklers, and labor necessary for the application of water.

30.05 GENERAL CONSTRUCTION METHOD

A. GENERAL

Examine finish surfaces, grades, topsoil quality and depth. Do not start seeding, sodding or plugging Work until unsatisfactory conditions are corrected.

B. PREPARATION OF SOIL

1. Apply Roundup or approved equal non-selective post-emergent herbicide to all areas to be seeded, sodded or plugged prior to preparation. Apply per manufacturer's instructions.
2. Existing weed stubble and small weeds shall be cut and partially incorporated into the soil during seed bed preparation Work. All other vegetation that will interfere with the seeding or sodding operations shall be removed by the Contractor. Extreme care shall be exercised to avoid injury to trees and shrubs.
3. Limit preparation to areas which will be immediately seeded, sodded or plugged. Remove stones over 1 inch in any dimension and sticks, roots, rubbish and extraneous matter.
4. The seed bed shall be prepared not more than three (3) days prior to the installation of seed, plugs, or sod by loosening the soil to a depth of not less than 2 inches nor more than 4 inches by disking, harrowing or tilling. Surface crusting caused by water during the interim must be loosened prior to the seeding operation. All soil erosion shall be filled prior to the seeding or plugging operation.
5. Top soil shall be of a quality to support the growth of grass. The area shall be in a smooth even condition, free of all debris, roots and stones larger than 1 inch in their largest dimension. All lumps of soil shall be pulverized, raked out or removed.
6. Grade lawn areas to a smooth, free draining and even surface with a loose, moderately course texture. Roll and rake, remove ridges, and fill depressions as required to drain. Surface crusting caused by water during the interim between preparation and seeding, sodding or plugging must be loosened prior to installation.

30.05 GENERAL CONSTRUCTION METHOD (Continued)

B. PREPARATION OF SOIL (Continued)

7. The seed bed adjacent to curbs, walks or other paved areas shall be finished to a grade of 1" below the paved surface in the case of seeding or plugging and 1" below for sodding.
8. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to seeding, sodding or plugging.

C. FERTILIZING

The fertilizer shall be applied with approved mechanical spreaders or with an approved hydraulic seeder at the rates specified in these provisions and shall cover the entire area uniformly. Any fertilizer blending shall be approved by the City's Project Manager.

On the basis of the guaranteed analysis, the City's Project Manager shall specify the mixing proportions (if necessary) and application rate necessary to provide the correct (N-P-K) nutrients in conformance with the plans or Special Provisions.

Fertilizers containing quick release sources of nitrogen can be used in the spring and fall when temperatures are not to exceed 80 degrees F. Caution must be taken in application to insure that the rate does not exceed one pound of nitrogen (N) per 1,000 square feet. Quick release fertilizers must be applied to dry foliage only to prevent phytotoxicity. The fertilizer source exhibiting the lowest salt index should be chosen to further prevent phytotoxicity.

Starter type fertilizer shall be incorporated into the soil prior to plugging, seeding or sodding. Maintenance fertilizer shall be applied after laying the sod. The application rates for fertilizer shall conform to Chapter 30 of the Standard Specifications.

D. SITE CLEAN-UP

Any remaining peat, soil, sand, rock or similar material which has been brought onto the site by Work operations or otherwise, will be removed, and all other remaining debris will be disposed of. All ground area disturbed as a result of the sodding operations will be renovated to its original condition or to the required new condition.

30.06 COVER CROP

A. GENERAL

A cover crop may serve as an alternative to providing soil cover when seeding, sodding or plugging is not an alternative. Cover crop is intended to prevent soil erosion by wind and water. Cover crops may be used in situations in the following situations:

1. The window for seeding, sodding or plugging has passed.
2. If a quick cover is necessary to prevent erosion prior to the completion of the project.
3. To be planted in conjunction with seed or plugs to provide quicker immediate coverage until the desired specified material is established.

The following cover crops may also be used as mixes requiring adjustments made to the seeding rates.

B. EARLY SEASON (SPRING COVER CROP)

A spring cover crop is planted in early spring to provide soil cover during the spring. Alternatives include:

<u>Type of Seed</u>	<u>Application Rate Lb/acre</u>
Annual Rye	20 - 25
Winter Rye	20 - 25
Alfalfa (Ranger or Vernal)	18
Seeding Period:	March 1 - May 20
General Application:	1 to 1.5 bu/acre

Spring cover crops can be established by aerial seeding in the spring, as well as by drilling or broadcasting seed.

C. MID-SEASON (LATE SUMMER/FALL COVER CROP)

A mid-season cover crop is planted in late spring or early summer to provide soil cover during the late summer and fall. Alternatives include:

<u>Type of Seed</u>	<u>Application Rate Lb/acre</u>
Annual Rye	20 - 25
Alfalfa (Ranger or Vernal)	18
Seeding Period:	May 21 - July 20
General Application:	1 to 1.5 bu/acre

Mid-Season cover crops can be established by aerial seeding in the late spring to summer, as well as by drilling or broadcasting seed.

30.06 COVER CROP (Continued)

D. LATE SEASON (WINTER COVER CROP)

A winter cover crop is planted in late summer or fall to provide soil cover during the winter. Plants selected need to possess enough cold tolerance to survive hard winters. Alternatives include:

<u>Type of Seed</u>	<u>Application Rate Lb/acre</u>
Winter Rye	20 - 25
Alfalfa (Ranger or Vernal)	18
Seeding Period:	August 1 - September 30
General Application:	1 to 1.5 bu/acre

NOTE: After August 31, Hairy Vetch may be used at the rate of 25 pounds per acre.

Winter cover crops can be established by aerial seeding in the late summer or fall, as well as by drilling or broadcasting seed.

30.07 SEEDING

The seeding operation shall be restricted to the periods listed under the seeding mixtures (31.05) unless otherwise authorized by the City's Project Manager. No Work shall be accomplished when the ground is frozen, or otherwise untillable.

Appropriate mechanical spreaders approved the City's Project Manager. Hydraulic seeding equipment also may be used when approved by the City's Project Manager. All equipment used for the seeding operation shall be as per the manufacturer's recommendations.

A. GENERAL

The Contractor will provide all labor, equipment and materials necessary to furnish and install seed as required by the accepted plans and these Standard Specifications.

B. TOPSOIL

Topsoil preparation will be as described in this Section, Topsoil Preparation, of these Standard Specifications.

C. BOOSTER FERTILIZER

All fertilizer requirements will meet the requirements of this Section, Topsoil Preparation, of these Standard Specifications. A booster fertilizer with the chemical analysis of Nitrogen-18, Phosphorous-46, Potash-0, with four percent (4%) iron and eight percent (8%) sulfur will be applied on the prepared soil at the rate of five (5) pounds per one thousand (1,000) square feet immediately prior to seeding.

D. SEED

Seed will be furnished in sealed, unopened, standard containers and labeled in accordance with the USDA Rules and Regulations and the Federal Seed Act. Seed will be fresh, clean, pure live seed equal in quality to the standards for Certified Blue Tag Seed. The City's Project Manager, at the Contractor's expense, may require tests of seed verification.

30.07 SEEDING (Continued)

E. MULCHING

Mulching shall be applied loose enough to allow sunlight to penetrate and air to circulate slowly, but thick enough to partially shade the ground, reduce water evaporation and reduce wind and water erosion. Mulching also shall be applied in such a manner as to remain in place as per these Standard Specifications.

F. SEEDING METHOD

1. Fescue/Bluegrass Seeding

- a. Whenever possible, the seed will be applied using a Brillion seeder or equal equipment to drill the seed into a properly prepared seedbed. The seeder will be equipped with a satisfactory feeding mechanism, an agitator, double disc furrow openers, depth bands and packer wheels. Seed will be sown to a depth of one-quarter inch (1/4") into a properly prepared seedbed. Seed drilling will be done in 2 separate applications crossing the area at right angles to one another to guarantee proper coverage. On sloping land, the final seeding operation will follow the general contour. All seeded areas will be top-dressed with either hydro-mulch or peat moss after the seeding is completed.
- b. In areas where the drill method of seeding cannot be used, a broadcast method may be substituted. If the broadcast method is used, the seeding rate must be doubled, and the area must be dragged after seeding followed by a suitable top dressing.
- c. Immediately following the completion of the seeding operation, the entire area shall be compacted with an approved roller.

2. Hydraulic Seeding

- a. Hydraulic seeding shall be the process by which, initially grass seed is combined with a water solution and applied to a prepared seed bed by means of a hydraulic sprayer. The material shall be a natural or cooked cellulose fiber processed from whole wood chips which will disperse readily in water, mulch, non-toxic dye and other approved additives are combined with a water solution and applied in the same manner. The mulch fibers will physically form a strong moisture-holding mat to assist in soil erosion control, while providing percolation properties and favorable micro climate conditions.
- b. Hydraulic seeding equipment shall include a pump, rated and operated at 100 gallons per minute (375 L/min) and at 100 psi (690 kPa) pressure, unless otherwise directed by the City's Project Manager. The equipment shall have a suitable pressure gauge, and a nozzle adapted to the type of Work. Storage tanks shall have a means of estimating the volume used or remaining in the tank. When using hydraulic seeding, the seed bed preparation, fertilize, and watering instructions shall be in accordance with the requirements of this chapter as stated for "Seeding".

All equipment and materials shall be approved by the City's Project Manager prior to the seeding operation.

30.07 SEEDING (Continued)

F. SEEDING METHOD (Continued)

3. NATIVE SEEDING

- a. Whenever possible, the seed will be applied using a drill-type seeder. Seed will be sown to a depth of one-half inch (½") into a properly prepared seedbed. On sloping land, the seed shall be applied following the general contour. All seeded areas will be top dressed with either hydro-mulch, peat moss, or straw after the seeding is completed.
- b. In areas where the drill method of seeding cannot be used, a broadcast method may be substituted. When using the broadcast method, the seeding rate must be doubled, and the area must be scarified and dragged after seeding, followed by a suitable top dressing.

G. ADDITIONAL FERTILIZING

At the time of the first mowing, the Contractor will apply a commercial fertilizer with the chemical analysis of Nitrogen-20, Phosphorous-10, Potash-5, plus two percent (2%) iron at the rate of five (5) pounds per one thousand (1,000) square feet. Care should be taken to prevent burning. Any areas disturbed or damaged by the Contractor during fertilizing operations will be repaired in accordance with these Standard Specifications at the Contractor's expense.

H. WATERING

The Contractor will be responsible for watering the seeded area(s) a minimum of two (2) times per day (mid-morning and late afternoon) and for keeping the areas moist until the lawn is established. The Contractor will be responsible for water usage until the vegetation is accepted.

I. INSPECTIONS

Inspections shall be completed in accordance with this Section, Inspections, of these Standard Specifications. The Contractor must notify the City's Project Manager for inspections of seed certification and germination.

J. GERMINATION INSPECTIONS

When germination is complete and plants are visible, the Contractor will notify the City's Project Manager and request a germination inspection for approval in order to begin the guarantee period. Any areas deemed by the City's Project Manager to be thin, weak or dead will be replaced at this time. All washouts will be reseeded immediately after the germination inspection. No partial acceptance will be made. The Contractor shall be responsible for the growth of the seeded area. Any portion of the seeded area that is not in good growing condition at the end of thirty (30) days shall be re-seeded as specified for "Seeding" above.

30.07 SEEDING (Continued)

K. BASIS OF PAYMENT

The Contractor shall seed all areas disturbed by construction operations. Limits of the seeding areas to be used in determining payment quantities are indicated in the plans. Areas outside those limits shall be seeded at the Contractor's expense. No separate measurement or payment shall be made for soil preparation. This Work shall be considered subsidiary to seeding for which direct payment is made.

Seeding of the various types called for on the plans, completed in conformance with the plans and Standard Specifications and acceptable to the City's Project Manager shall be measured to the nearest 0.1 or the nearest square foot and paid for at the contract unit price bid per acre or per square foot for SEEDING, TYPE _____. Such payment shall be full compensation for all labor, equipment, tools, materials, fertilizer, water establishment period and incidentals necessary to complete the Work.

30.08 SODDING

A. GENERAL

Sod shall not be placed on frozen ground or during drought periods. The sod shall be moist when it is placed. Dry and/or frozen sod will not be accepted. Transverse joints between sod strips shall be staggered. The sod shall be placed carefully to produce tight joints. The sod shall be watered immediately after it is placed. Firming shall be accomplished by rolling the newly placed sod with an approved sod roller within seven (7) days after it is replaced.

The Contractor will provide all labor, equipment and materials necessary to furnish and The Contractor will provide all labor, equipment and materials necessary to furnish and install all sod as required by the accepted plans and these Standard Specifications.

B. TOPSOIL

Topsoil preparation will be as described in this Section, Topsoil Preparation, of these Standard Specifications.

C. BOOSTER FERTILIZER

All fertilizer will meet the requirements of Chapter 30 of these Standard Specifications. A booster fertilizer with a chemical analysis of Nitrogen-12, Phosphorous-12, Potash-4, with four percent (4%) iron and eight percent (8%) sulfur will be applied at a rate of five (5) pounds per one thousand (1,000) square feet immediately prior to sodding.

D. CARE AND HANDLING

Care will be exercised at all times to retain the native soil on the sod roots during transportation, handling and planting. Dumping sod from vehicles will not be permitted. The sod will be transported to the site within twenty-four (24) hours from the time it is cut, unless it can be stored to the satisfaction of the City's Project Manager. During delivery and while in stacks, all sod will be kept moist and protected from exposure to the wind, sun and freezing. All damaged or dry sod will be rejected.

30.08 SODDING (Continued)

E. TRANSPORTING SOD ON SITE

Sod can be transported on or across the site on pallets by forklift. Damage to the sod bed by the vehicles will be kept to a minimum and will be regraded before sodding of the area. Damage caused to paving, curbs, fence, plants or other objects during sodding, will be repaired or replaced by the Contractor at his expense as directed by the City's Project Manager.

F. INSTALLATION

The sod bed will be lightly sprinkled just prior to laying the sod. All sod strips will be placed tightly against each other so no open joints are apparent. Joints between ends of strips will be staggered at least one foot (1') between adjacent rows. At the end of walks and drives, the sod will have the same finish grade as the abutting surfaces. At curbs the sod will have the same finish grade as the top of the curb. Sod placed on slopes equal to four horizontal to one vertical (4:1) will be staked with wood or wire pins not less than six inches (6") long and spaced not more than thirty inches (30") apart. The pins shall be driven into the ground at an angle against the flow of the water until the top of the stake is three inches (3") above the sod. Sod laying will begin at the bottom of the slope and progress upward with strips laid transverse to the slopes. Immediately after the sod has been laid, it should be tamped or rolled with approved equipment to eliminate all air pockets and to provide a smooth, even surface. Immediately after rolling or tamping the sod, sufficient water will be applied to completely saturate the sod. The sod will be watered as often as required to prevent it from drying out. Settled sod areas will be pulled up, regraded, relayed, and retamped.

G. MAINTENANCE

The proper care and maintenance of the sodded areas will be the responsibility of the Contractor until the Work has been completed and accepted by City's Project Manager. The maintenance operations will begin as soon as each portion of the area is sodded. Maintenance will consist of repair and replacement of eroded areas, watering, mowing (when the sod is established), weeding, fertilizing, and resodding as necessary to provide an even, consistent stand of grass. All replacement sodding deemed necessary will be done by the Contractor at his own expense.

H. MOWING

During the maintenance period, after the sod is established, the Contractor will begin mowing all lawn areas on a routine basis using a mowing height of three inches (3"). Frequency of mowing will be determined by the growth rate of the grass but at no time should the clippings exceed two inches (2") in length. Only turf-type mowers will be used for this operation.

I. ADDITIONAL FERTILIZING

Thirty (30) days after sod is laid, an application of fertilizer with the chemical analysis of Nitrogen-12, Phosphorous-12, Potash-4, with four percent (4%) iron and eight percent (8%) sulfur will be applied at the rate of six (6) pounds per one thousand (1,000) square feet. When applied, the fertilizer must be dry and free flowing. All damage caused to the sod during fertilizer application will be repaired by the Contractor at his expense.

30.08 SODDING (Continued)

J. WATERING

The Contractor will be responsible for watering the sodded area(s) a minimum of two (2) times per day (mid-morning and late afternoon) and for keeping the areas moist for a period of fourteen (14) days following the initial sodding operation and until the sod is established.

K. INSPECTIONS

Inspections shall be completed in accordance with this Section, Inspections, of these Standard Specifications. The Contractor must notify the City's Project Manager for inspection of sodding. When sodding operations are complete, the Contractor will notify the City's Project Manager and request a sodding inspection for approval in order to begin the guarantee period. Any areas deemed by the City's Project Manager to be thin, weak or dead will be replaced at this time. No partial acceptance will be made. Any portion of the sodded area that is not in good growing condition will be moved and replaced with fresh live sod. If the sod has been replaced the water period will begin again for fourteen (14) days following the replacement.

L. BASIS OF PAYMENT

The Contractor shall sod all areas disturbed by construction operations. Limits of the sodding areas to be used in determining payment quantities are indicated in the plans. Areas outside those limits shall be sodded at the Contractor's expense. No separate measurement or payment shall be made for soil preparation. This Work shall be considered subsidiary to sodding for which direct payment is made.

Sodding completed in conformance with the plans and Standard Specifications and accepted will be paid at the contract unit price bid per square foot for SODDING. Such payment shall be full compensation for all labor, equipment, tools, materials, incidentals necessary to complete the Work.

30.09 PLUGGING

A. GENERAL

The Contractor will provide all labor, equipment and materials necessary to furnish and install all sod plugs as required by the accepted plans and these Standard Specifications.

B. TOPSOIL

Topsoil preparation will be as described in this Section, Topsoil Preparation, of these Standard Specifications.

C. SOD PLUGS

The Contractor shall obtain sod plugs from strongly rooted, nursery grown sod composed of grass species referred to in Chapter 30 of these Standard Specifications. Provide healthy living stems with attached roots. Provide 1" x 1" plugs. Plugs shall be uniform in color and quality and shall be free of weeds, disease or visible imperfections at the time of acceptance.

30.09 PLUGGING (Continued)

D. OVERSEEDING WITH COVER CROP (ALTERNATIVE)

To expedite coverage of an area, annual rye may be used as a cover crop in conjunction with the sod plugs. The overseeding of annual rye shall be between 1 and 2 pounds per 1000 sq. ft. This will provide quick coverage and still allow for the establishment of the plugs. Overseeding may result in clean-up of spent crop by mowing.

E. BOOSTER FERTILIZER

1. Fertilizer shall be a commercial turf product containing nitrogen, available phosphoric acid (P205) and soluble potash (K20) as required, in recognized plant food form. All fertilizers shall comply with the provisions of the State of Nebraska Fertilizer Act of 1955, with subsequent revisions.
2. Granular, non-burning product of neutral character composed of not less than 50% organic slow acting, guaranteed analysis professional fertilizer. Starter fertilizer containing 10% nitrogen, 20% phosphoric acid, and 10% potash by weight, or similar approved composition. Fertilizer shall not contain any herbicide or weed killers.

F. PRE-EMERGENT CONTROL

Plateau Herbicide manufactured by American Cyanamid Company, or approved equal.

G. POST-EMERGENT CONTROL

Round-up Herbicide, manufactured by Monsanto, or approved equal. Do not apply product containing 2, 4-D if temperatures are expected to exceed 80 degrees F on the day of application.

Dormant buffalo grass can be sprayed with Roundup or equivalent to control winter weeds. Fall applications can be applied after the first frost or when the buffalo grass turns straw-brown.

Spring Application of Roundup or equivalent can be done in early April. A period of two weeks should be allowed for the herbicide to work. Roundup or equivalent should not be applied to buffalo grass if the dormant turf is showing any green color. Roundup or equivalent applied to semi-dormant buffalo grass will significantly delay green up and could severely damage the grass.

H. CARE AND HANDLING

1. Care will be exercised at all times to retain the native soil on the sod roots during transportation, handling and planting. Dumping sod plugs from vehicles will not be permitted. The sod plugs will be transported to the site within twenty-four (24) hours from the time harvested, unless it can be stored to the satisfaction of the City's Project Manager. All sod plugs will be kept moist and protected from the exposure to the wind, sun and freezing. All damaged or dry sod plugs will be rejected.
2. Do not harvest or transport sod plugs when moisture contact may adversely affect the sod's survival.
3. Protect sod plugs from sun, wind, and dehydration prior to installation.

30.09 PLUGGING (Continued)

I. INSTALLATION

1. Plugs shall not be placed during periods of drought.
2. Plant individual plugs with root cluster and portions of stem buried in soil. Firm the soil around plugs after planting. Do not cover tips.
3. Space plugs 12 inches on center each direction or as otherwise specified by the City's Project Manager.
4. Drill a hole 1 1/4" diameter and 1 1/4" deep. Place the plug into the hole, being sure the plug is to the bottom of the hole. Failure to place plug firmly to the bottom of hole will create an air pocket under the plug, reducing the chance for survival. Measure the next plug, using the specified spacing. Repeat installation procedure. Continue in a straight line to the end of the planting area. Move the specified spacing for the second row and continue planting. Stagger plugs as in Figure 1.

```

X  X  X  X  X  X  X  X  X  X
  X  X  X  X  X  X  X  X  X
X  X  X  X  X  X  X  X  X  X

```

Figure 1

5. Plant plugs and lightly roll with lawn roller
6. Water plugs with a fine spray immediately after planting.
7. If plugs are installed in an area with a 4:1 slope or greater, an erosion control blanket shall be laid over the entire plugged area. Secure erosion control blanket to ground with 6" wire staples, 6" wood or 6" plastic pins.
8. Plugged areas shall be watered twice daily for 10 minutes per setting during the first fourteen (14) days after planting. After fourteen (14) days, the plugged areas shall be watered once per day for fifteen (15) minutes per setting. After the fourth week, soak the area once or twice per week until plugs have covered the area. These guidelines are subject to variance with the City's Project Manager.
9. Apply Plateau herbicide, or approved equal pre-emergent control within 5 days after initial watering at a rate of 1 ounce per acre or recommended label rate.
10. Apply starter fertilizer to plugged areas at a rate equal of 1.0 pound of actual nitrogen per 1,000 square foot. Apply first application of fertilizer three (3) weeks after initial plugging. Apply fertilizer by mechanical rotary or dry type distributor, thoroughly and evenly incorporated across the plugged areas. Apply second application of fertilizer eight (8) weeks after initial plugging.
11. A lightweight, biodegradable, erosion control blanket such as XCEL SR Straw blanket, XCEL S-2 Superior excelsior blanket, North American Green DS150 or equivalent may be used over the top of the plugs to preserve moisture or control erosion at the discretion of the City's Project Manager.

30.09 PLUGGING (Continued)

J. MAINTENANCE

1. Maintain plugged areas until completion and acceptance of the entire project. Maintain plugged areas including watering, weed control, mowing, application of herbicides, fungicides, insecticides, resodding until an established planting is achieved and accepted by the City's Project Manager.
2. A nitrogen fertilizer should be used every thirty (30) days until fully established.
3. Keep all plugged areas thoroughly watered for sixty (60) days after final acceptance of the entire project per the Standard Specifications. Any portion of the plugged area that is not in good growing condition at the end of the sixty (60) days shall be re-plugged as specified above.
4. Begin mowing the plugged area as soon as the plugs attain a height of 3 inches and cannot be easily pulled out of the soil. Maintain all plugged areas at a height of 3 inches for sixty (60) days after the final acceptance.
5. Repair, rework and replug all areas that have been washed out, eroded, or do not catch at the end of the sixty (60) days.
6. The proper care and maintenance of the plugged areas will be the responsibility of the Contractor until the Work has been completed and accepted by the City's Project Manager.

K. INSPECTIONS

Inspections shall be completed in accordance to these Standard Specifications. The Contractor must notify the City's Project Manager for inspection of plugged areas. When operations are completed, the Contractor will notify the City's Project Manager and request an inspection for approval in order to begin the guarantee period. Any areas deemed by the City's Project Manager to be thin, weak or dead will be replaced at this time.

L. BASIS OF PAYMENT

The Contractor shall plug all areas disturbed by construction operations. Limits of the plugging areas to be used in determining payment quantities are indicated in the plans. Areas outside those limits shall be plugged at the Contractor's expense. No separate measurement or payment shall be made for soil preparation. This Work shall be considered subsidiary to plugging for which direct payment is made.

Plugging completed in conformance with the plans and Standard Specifications and acceptable to the City's Project Manager shall be measured and paid for at the contract unit price bid per square foot for PLUGGING. Such payment shall be full compensation for all labor, equipment, tools, materials, fertilizer, water establishment period and incidentals necessary to complete the Work.

30.10 ACCEPTANCE AND ESTABLISHMENT PERIOD

Upon completion of planting the City's Project Manager will inspect the seeded/sodded/plugged area(s) for acceptability. The Contractor will be notified of the dates of this inspection. All items of Work as required in the Standard Specifications, the Special Provisions, and the plans shall have been performed prior to this inspection. Any item not completed may make a planting unacceptable. Unacceptable materials may be allowed to remain in place without payment. An inspection may be made subsequent to the final inspection to determine the acceptability of material and therefore, allowing payment for such materials.

During the establishment period, the Contractor shall properly maintain all materials planted under the contract. The establishment procedures shall include, protective measures against pests and diseases, watering as often as required by necessity, seeding with a pre-emergent weed control or other approved means, and other establishment procedures as deemed necessary by the City's Project Manager including the removal of any dead plant material for the project. The Contractor shall be responsible for watering all plant material as necessary during the establishment period.

The establishment period will follow the completion of all planting and shall extend for a period of:

SEED	Thirty (30) days
SOD	Fourteen (14) days
PLUGS	Sixty (60) days

The establishment period will not begin until all of the following items of Work as required in the Standard Specifications, the Special Provisions, and the plans have been performed including proper installation of material, watering, fertilizing and mulching. All plant material shall be in viable growing condition when the project enters the establishment period.

Upon completion of the establishment period, the City's Project Manager will make an inspection of the seeded/sodded/plugged material to identify any material to be replaced under warranty. The inspection will normally be made during the month that the establishment period terminates. The Contractor will be notified of the dates of this inspection. A list of quantities and locations will be provided to the Contractor for replacement. Replacement of materials shall occur within receipt of this list. Plant replacement shall be at the Contractor's expense. Establishment procedures that have not been performed shall be brought to the Contractor's attention and may cause the establishment period to be extended. All replacement plant material shall receive the establishment procedures referred to in this Section. The Contractor will be notified in writing when his/her establishment responsibilities on the acceptable material have been terminated.

30.11 REPLACEMENT OF MATERIAL AND GUARANTEE PERIOD

The guarantee period for seeded/sodded/plugged areas shall begin at the date of acceptance.

The Contractor shall guarantee all material to be in healthy and flourishing condition for a period of:

SEED	Sixty (60) days
SOD	Thirty (30) days
PLUGS	Ninety (90) days

from date of acceptance.

30.11 REPLACEMENT OF MATERIAL AND GUARANTEE PERIOD (Continued)

The Contractor shall replace, without cost, and as soon as weather conditions permit and within a specific planting period, all materials determined by the City's Project Manager to be dead during or at the end of the guarantee period.

Replacement material shall closely match adjacent specimens of the same species that have been planted. Replacements shall be subject to all requirements, standards, special provisions and Standard Specifications stated herein.

The guarantee of all replacement plants shall extend for an additional period of:

SEED	Sixty (60) days
SOD	Thirty (30) days
PLUGS	Ninety (90) days

from date of their acceptance and installation. In the event that replacement materials are not acceptable during or at the end of the said extended guarantee period, the City's Project Manager may elect subsequent replacement or credit (refund) for them.

30.12 VANDALISM

Seeded/Sodded/Plugged areas damaged to be replaced as a result of vandalism as a part of this contract shall be paid for by the City.

30.13 QUALIFICATIONS FOR SUBMITTING BIDS

- A. Contractor must be able to demonstrate a minimum work experience record.
- B. Contractor must be able to demonstrate successfully completed projects similar to scope and scale.

CITY OF LINCOLN NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 31

LANDSCAPE WORK

ARTICLE	TITLE	
31.00	DESCRIPTION	3102
31.01	QUALITY ASSURANCE	3102
31.02	PLANTING SEASON	3103
31.03	MATERIALS	3103
	A. GENERAL PLANT MATERIALS REQUIREMENT	3103
	B. NURSERY GROWN PLANT MATERIALS	3106
	C. SELECT TOPSOIL	3106
	D. COMPOST	3107
	E. MULCH	3107
	F. ANTI-DESICCANT	3107
	G. PLANT STARTER	3107
	H. STAKES	3107
	I. SUPPORT TIES	3107
	J. TREE WRAP	3107
	K. TREE GUARD	3107
31.04	RECEIVING AND STORING OF PLANT MATERIALS	3112
31.05	TRANSPORTING PLANTS TO THE PLANTING SITE	3112
31.06	LOCATION OF PLANT MATERIAL	3113
	A. STREET TREES	3113
	B. PARK TREES AND OTHER LANDSCAPED AREAS	3113
31.07	SITE PREPARATION	3113
31.08	PLANTING OF TREES AND SHRUBS	3113
31.09	PLANTING PERENNIALS AND ORNAMENTAL GRASSES	3115
31.10	PRUNING OF PLANT MATERIAL	3115
31.11	STAKING AND SUPPORT OF PLANT MATERIAL	3116
31.12	MARKING PARK TREES	3116
31.13	CARE INSTRUCTIONS FOR STREET TREES	3116
31.14	ACCEPTANCE AND ESTABLISHMENT PERIOD	3116
31.15	REPLACEMENT OF PLANT MATERIAL AND GUARANTEE PERIOD	3117

CITY OF LINCOLN NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 31

LANDSCAPE WORK

ARTICLE	TITLE	
31.16	VANDALISM	3118
31.17	QUALIFICATIONS FOR SUBMITTING BIDS	3118

CHAPTER 31

LANDSCAPE WORK

31.00 DESCRIPTION

The Work described in this section shall pertain to any landscape work. Work shall include all labor, material and equipment as herein specified. The Work shall comply with the requirements of all legally constituted authorities having jurisdiction.

Nomenclature used in these Standard Specifications and the Special Provisions, and the plans shall conform to the standard nomenclature established in "Hortus Third"; American Standard for Nursery Stock (ANSI Z60.1-2004) or the Tree and Shrub Transplanting Manual, 1991 or current revision.

Plant material shall mean trees, shrubs, vines, ground covers and plants of all descriptions, required to be furnished for the project, in accordance with these Standard Specifications, the Special Provisions, and the details shown in the plans.

This Work shall consist of furnishing, delivering and planting of plant material and all operations incidental thereto, in accordance with City of Lincoln Standard Plans, any Special Provisions, and these Standard Specifications.

31.01 QUALITY ASSURANCE

All plant material shall conform to the American Standard for Nursery Stock (ANSI Z60.1-2004 or most current).

Trees, Shrubs and Plants: Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.

If specified landscape material is unobtainable, submit proof to City's Project Manager together with proposal for use of equivalent material.

The City's Project Manager may inspect trees and shrubs either at place of growth or at site before planting, for compliance with requirements for genus, species, variety, size and quality, size and condition of balls and root systems, insects, injuries and latent defects. The City's Project Manager may reject unsatisfactory or defective material at any time during progress of Work. Rejected trees or shrubs shall be immediately removed from project site.

Submittals shall include:

- Certificate of Inspection - certificates of inspection as required by governmental authorities.
- Certified Analysis - manufacturer's certified analysis, or, where applicable, analysis of recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, including soil amendments and fertilizer materials.
- Container-Grown Material - samples of all container-grown material prior to planting.
- List of Sources - a written list of the nurseries where the plant material was grown. Plant materials from unapproved sources will be rejected.

31.02 PLANTING SEASON

Within thirty days after receiving the signed contract, the Contractor shall submit a written list of the nurseries from whom the Contractor will purchase the plant material, and the source where the plant material was grown. The list shall be submitted to the City's Project Manager. The Contractor will be notified if there are any unapproved sources of plant materials on the list. Plant materials from unapproved sources will be considered for rejection.

The planting season for all plant material shall be: Fall Planting season shall be from September 15 to December 1 for all coniferous materials, from September 15 to December 1 for all deciduous materials and August 15 to September 15 for all perennials and ornamental grasses; Spring Planting season shall be from March 1 to June 1 for all coniferous materials, from March 1 to June 1 for all deciduous materials and May 1 to June 1 for all perennials and ornamental grasses. Planting operations shall be performed during this season only, except when prior written permission is obtained from the City's Project Manager. The actual planting shall be performed during those times in this season which are normal for such Work as determined by weather conditions, and accepted practice in the locality.

31.03 MATERIALS

A. GENERAL PLANT MATERIALS REQUIREMENT

1. All plant material shall conform to the American Standard for Nursery Stock (ANSI Z60.1-2004 or most current)
2. All plant material shall comply with all applicable State and Federal laws, including inspection certifications which shall include the project number and the plant material that the certification covers. All plant material is subject to inspection by representatives of the City, State and Federal Governments.
3. All plant material furnished shall be true to name and type and legible labels shall be furnished to insure that all species, varieties, boxes, bundles, bales or other containers are identified. The information on the label shall cover the botanical genus, species, and common name, size or age of each species or variety.
4. All plant material shall be sound, healthy specimens and first-class representatives of their species or variety, and shall have well formed tops and healthy root systems.
5. Plant materials which lack proper proportions, or have serious injuries to the bark or roots, broken branches, objectionable disfigurements, shriveled dry roots, broken balls, insect pests, diseases, or which are not found to comply with these Standard Specifications in any way shall be rejected. Rejected plant material shall be removed from the project as soon as practical.
6. Plant materials which are planted and later discovered to be not true to name, may be allowed to remain in place without payment being made therefore.
7. A representative sample of all container grown and/or pot grown material shall be submitted to the City's Project Manager for approval prior to planting if requested.

31.03 MATERIALS (Continued)

A. GENERAL PLANT MATERIALS REQUIREMENT (Continued)

8. All balled and burlapped (B & B) and container grown plant material is subject to internal examination of the ball at any time to ascertain the condition of the roots and surrounding soil ball and the location of the root collar/trunk flare(s) in relation to the top of the soil ball. (See American Standard for Nursery Stock - ANZI Z 60.1 - 2004 or most current; Standard 1.6.3. Root ball depth)
9. Any plant material that is planted which does not meet the specified minimum size prior to pruning shall be rejected or allowed to remain in place without payment being made therefor.
10. If a Contractor is unable to locate sufficient plant material in specified sizes, negotiation for unit price reduction shall be concluded prior to planting.
11. All plant materials shall be of normal growth and uniform height, according to species, with straight established trunks and developed leaders, roots, and crowns. Heeled in stock will not be acceptable. Plants cut from larger sizes to meet bid Specifications shall not be accepted.
12. All plant material shall be true to species and variety specified and nursery grown in accordance with good horticultural practices. Plant material collected from wild or native stands will not be accepted, nor that which is sheared.
13. Coniferous trees (i.e., pines, firs, spruce) which have been sheared will not be accepted. All coniferous trees shall have a single leader with a viable bud. Trees with multiple leaders may be pruned leaving a single leader, providing that the resulting form is characteristic of the species.
14. All plant material shall be sound, healthy, vigorous, well branched and densely foliated if in leaf, free of disease, insects, eggs or larvae and shall have healthy, well developed root systems. They shall be free from physical or mechanical damage or conditions that would prevent thriving growth.
15. The bark of woody plant material shall be healthy and firm with no indications of fungus, cankers or galls, insect bores, die back, frost cracks, sun scald or mechanical injury. Any of these defects shall be reason for rejection.
16. All plant material shall exhibit adequate and healthy twig growth and have well formed live buds. Branches shall diverge from the trunk at a wide angle, except in those varieties that normally grow in narrow upright forms. Plants shall have normal, well developed branches, be uniformly and fully branched as seen from all sides, have good crotch angles and a vigorous root system. All plants shall be first class representatives of their species or variety.
17. Trees with multiple leaders, unless specified, shall be rejected.
18. Plants that meet specified sizes, but do not possess a normal balance between height and spread shall be rejected.
19. Plant material with a damaged or crooked leader or having pruning cuts over 3/4 inch in diameter that are not completely callused, shall be rejected.

31.03 MATERIALS (Continued)

A. GENERAL PLANT MATERIALS REQUIREMENT (Continued)

20. All plant material is subject to visual inspection by the City's Project Manager prior to installation. All plant material shall be assembled in one location to permit inspection if requested. The supplier of plant materials shall notify the City's Project Manager at least five (5) working days prior to delivery so that a mutually agreeable time can be arranged for inspection, if requested by the City.
21. Substitution of specified plant material shall not be permitted unless authorized by the City's Project Manager.
22. Plants shall conform to the measurements specified, except that plants larger than those specified may be used if approved by the City's Project Manager. Use of larger plants shall not be cause for claims for additional payment. If larger plants are approved, the root system, container and/or root ball shall be increased in proportion to the size of plant.
23. Caliper measurements shall be taken on the trunk six (6) inches above the natural ground line for trees up to four (4) inches in caliper and twelve (12) inches above the natural ground line for trees over four (4) inches in caliper. Height and spread dimensions specified refer to the main body of the plant and not from branch tip to branch tip. Plants shall be measured when branches are in their normal position.
24. If a range of size is given, no plants shall be less than the minimum size and no less than fifty percent (50%) of the plants shall be as large as the maximum specified. Measurements specified are minimum size acceptable after pruning, where pruning is required. Plants that meet height and spread but do not possess a normal balance between height and spread shall be rejected.
25. Plant material Specifications for street trees will establish the height to which trees should be free of branching. Height of branching should bear a relationship to the size and kind of tree so that the crown of the tree will be in good balance with the trunk (i.e. $\frac{1}{2}$ to $\frac{1}{2}$ the total height of the tree is a trunk free of branching and the other $\frac{1}{2}$ to $\frac{1}{2}$ is a well branched tree crown). Refer to Section 1, ANSI Z60-2004 or most current. Branching height for specified plant materials will be noted on the bid proposal and all bidders should be aware of this Standard Specification. Plant material not meeting this Standard Specification may be rejected by the City's Project Manager.
26. The minimum height growth for pine trees shall be as follows: a) trees 3 - 5 feet in height shall have at least 2 feet of new height growth during the last 2 growing seasons, and b) trees 5 foot and over in height must have at least 3 feet of new height growth during the last 3 growing seasons.

31.03 MATERIALS (Continued)

B. NURSERY GROWN PLANT MATERIALS

1. All plant materials shall be “nursery grown” by established commercial nurseries and sold to and installed by licensed and certified nurseries and/or landscape Contractors.
2. Fresh dug material is given preference over plant material held in storage. Plant material held in storage may be rejected if excessive growth has occurred in storage.
3. Unnecessary injury to or removal of fibrous roots from the plant material is cause for rejection of the plant materials. The soil for balled material shall be in such condition so as to insure no crumbling or cracking. Balls shall be wrapped with burlap prior to removal from the ground. The burlap shall be held in place with cord and pinning nails. Handling of balled and burlapped material shall be in such a manner as to keep the soil intact. Plant material on which earthen balls do not hold together or which crack in handling shall be rejected.
4. Balled plant material shall have a solid ball of soil of adequate size held in place securely and wrapped with burlap and tightly bound with twine or rope. Soil balls may also be secured with wire baskets.
5. Bare root plant material shall have abundant root growth and fibrous feeder roots with good color and moisture. Kinked, circling and/or girdling roots are not acceptable and plant material having such root systems shall be rejected.
6. Container grown plant material shall be well established in their containers. Container plant material which shows evidence of being root bound, overgrown, recently canned or which has girdling roots shall be rejected.
7. A processed balled shade or flowering tree (i.e., a tree dug bare root, while dormant, to which a growing medium is added around the roots to form a ball) shall not be acceptable.

C. SELECT TOPSOIL

Select topsoil shall be fertile, friable, natural loam, dark in color (often black), free of subsoil, clay lumps, brush, weeds, roots, stumps, stones larger than 1-1/2" in any dimensions, debris and other extraneous or toxic matter and harmful to plant growth. Topsoil shall be obtained from local sources and exhibit an acidity range (pH) of 6.0 to 8.5. Source locations shall be identified.

Select topsoil called for on the plans, completed in conformance with the plans and Standard Specifications, and acceptable to the City’s Project Manager shall be measured and paid for at the contract unit price bid per cubic yard for SELECT TOPSOIL. Such payment shall be full compensation for all labor, equipment, tools, materials, and incidentals necessary to complete the Work.

31.03 MATERIALS (Continued)

D. COMPOST

Shall be humus-like material made from the decomposition of organic materials which may have included leaves, branches, yard prunings and grass clippings such as LINGRO compost. The compost materials shall be decomposed to form a highly stabilized product and screened with ½ inch or less screen opening. The compost shall be free of all inorganic debris. LINGRO compost is available from the City of Lincoln's Solid Waste Operation. Ratio of topsoil to compost should be a minimum of 2 to 1.

E. MULCH

Mulch for Trees, Shrubs and Perennials: Organic mulch, free from wood chips, sawdust and deleterious materials, suitable for top dressing of trees. Mulch shall consist of shredded native hardwood bark mulch not larger than 4" in length and ½" in width.

F. ANTI-DESICCANT

Anti-Desiccant: Emulsion type, film-forming agents designed to permit transpiration but retard excessive loss of moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions.

G. PLANT STARTER

Plant Starter: Liquid solution with an analysis of 3-10-3 (low analysis fertilizer), such as Upstart manufactured by Ortho.

H. STAKES

Stakes shall be 2 inch x 2 inch wooden stake of suitable length to adequately support the plant material. Typically, stakes will be a minimum of six (6) feet in length. Stakes shall be driven at least 12" into the soil for secure support outside of planting ball. (Refer to details in Chapter 31.)

I. SUPPORT TIES

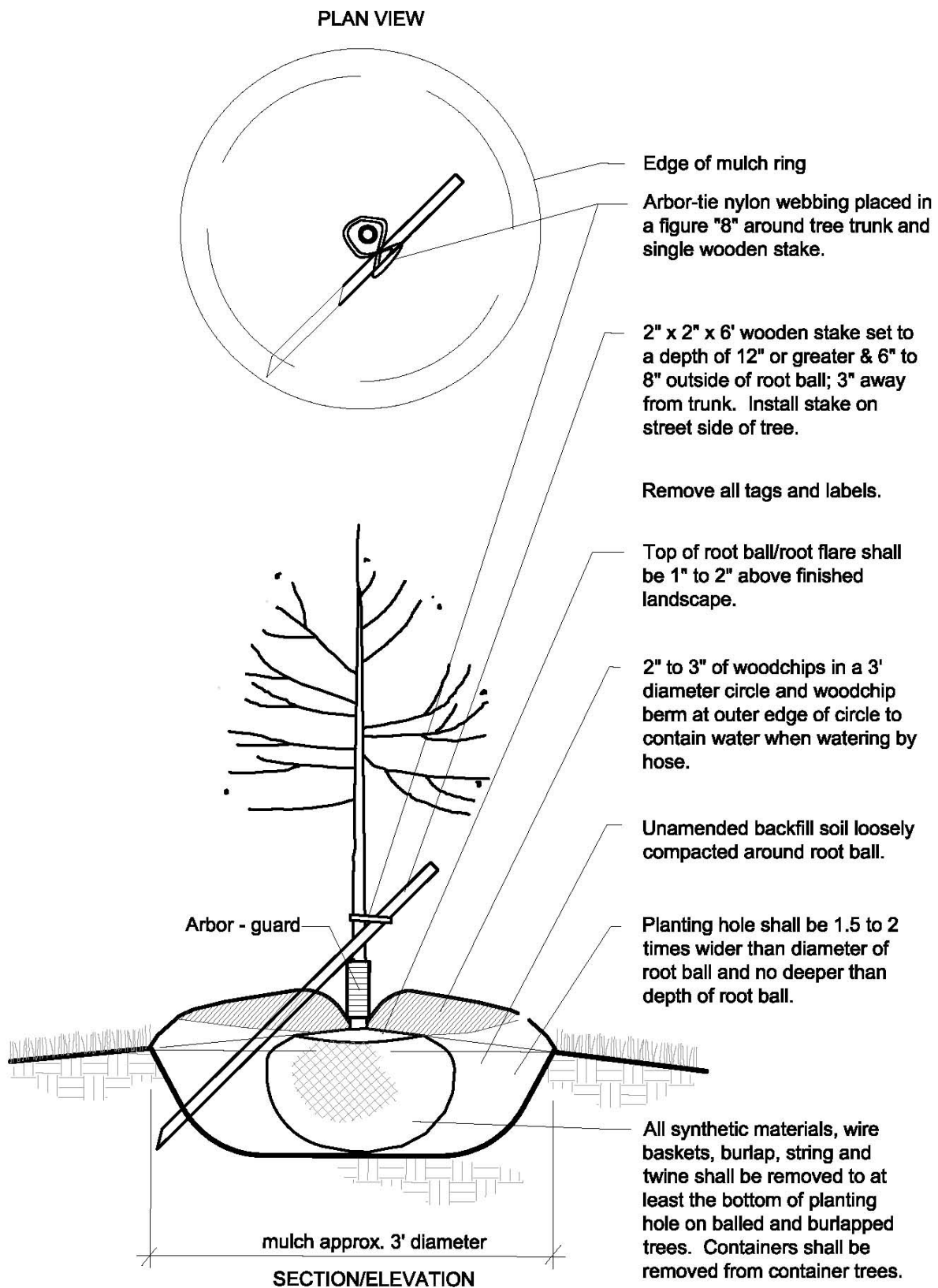
No metal wire or rubber hose shall be used in supporting trees. Trees should be secured to stakes using a fabric type of tree tie (i.e. Arbor Tie) or rubber cinch tie. The support shall be tied in a figure eight (8) loop between the tree and the stake(s) to allow for flexibility. Do not tie trees too rigidly to stakes. (Refer to details in Chapter 31.)

J. TREE WRAP

Tree wrap shall not be used on any trees planted in association with this contract. All existing tree wrap, cardboard or Styrofoam, if any, shall be removed from trunks immediately after planting.

K. TREE GUARD

Tree guard (i.e. arbor-guard) shall be installed at the base of the trunk when the tree has been planted and will be provided by the City.

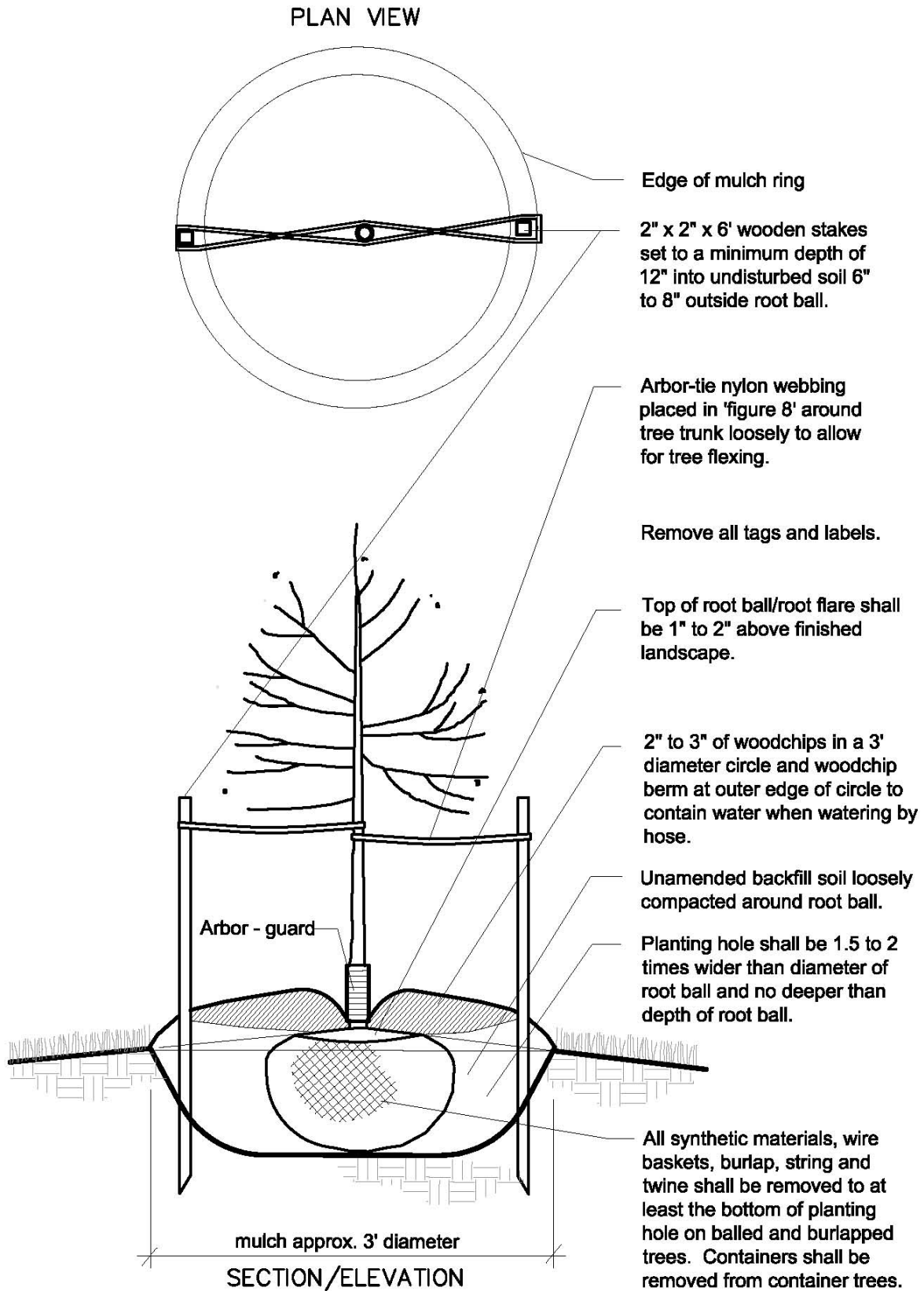


1

DECIDUOUS TREE PLANTING DETAIL FOR STREET TREES

Not to scale

Approved by the City of Lincoln Parks & Recreation Dept. 01.30.2009

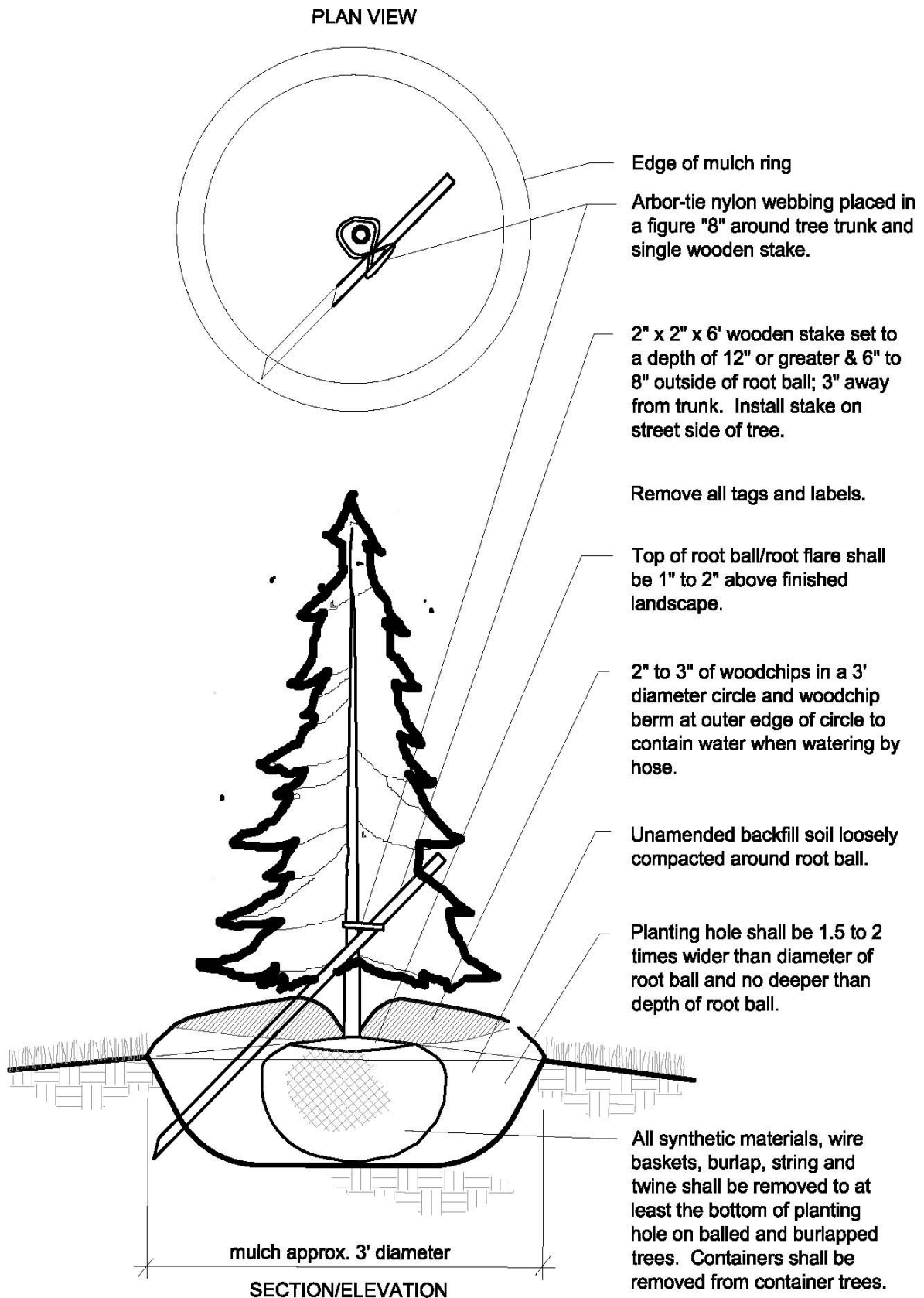


2

DECIDUOUS TREE PLANTING DETAIL FOR PARK TREES

Not to scale

Approved by the City of Lincoln Parks & Recreation Dept. 01.30.2009

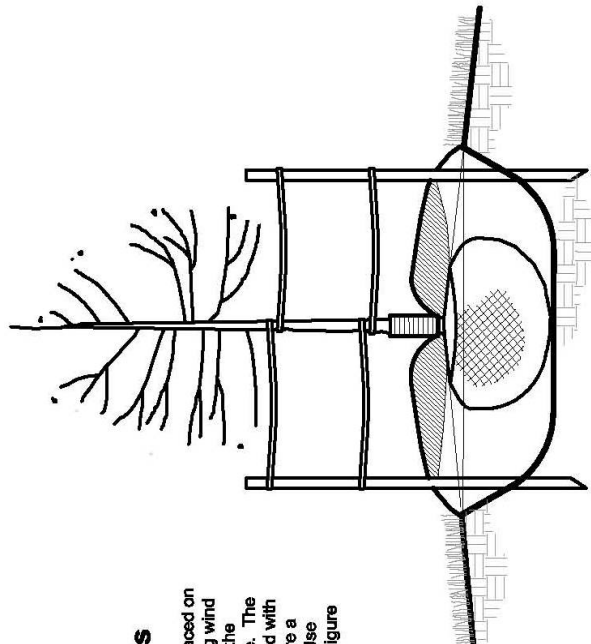


3

EVERGREEN TREE PLANTING DETAIL

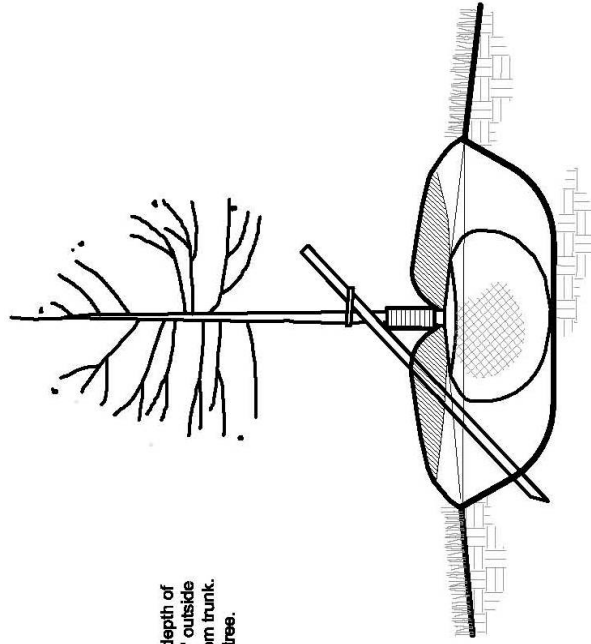
Not to scale

Approved by the City of Lincoln Parks & Recreation Dept. 01.30.2009



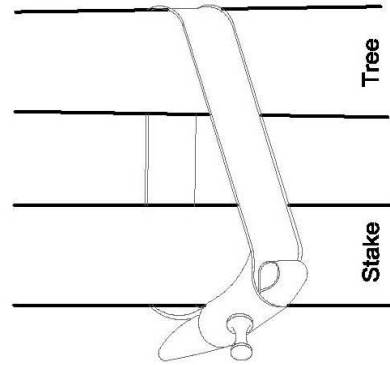
Double Stakes

(Park Trees only)
One stake should be placed on the side of the prevailing wind with the other stake on the opposite side of the tree. The tree should be supported with four Cinch-Ties to assure a straight, firm position. Use either the Standard or Figure Eight tying method.



Single Stake

A single stake set to a depth of 12" or greater & 6" to 8" outside of root ball; 3" away from trunk. Install on street side of tree.



Standard Tie

Wrap Cinch-Tie around the tree trunk and the stake to form a loop. Tie with the double-back locking configuration. Secure with a galvanized nail driven through the Cinch-Tie and into the stake to prevent slippage.

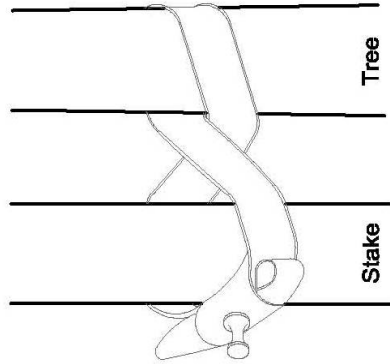


Figure Eight Tie

Wrap Cinch-Tie around the tree trunk and the stake twisting to form a figure eight. Tie with the double-back locking configuration. Secure with a galvanized nail driven through the Cinch-Tie and into the stake to prevent slippage.

CINCH - TIE DETAILS

Not to scale

Approved by the City of Lincoln Parks & Recreation Dept. 01.30.2009

31.04 RECEIVING AND STORING OF PLANT MATERIALS

Storage facilities for plant material must receive approval of the City's Project Manager prior to delivery of the plant material. The storage facility shall have an adequate water supply, shade, good ventilation, and protection from drying winds.

Plant material that cannot be planted immediately on delivery shall be kept in storage, and well protected with wet soil, sawdust, wood chips, shingle tow, moss, peat, straw, hay or other acceptable moisture holding media. Plant material stored in the above manner shall be kept well watered.

31.05 TRANSPORTING PLANTS TO THE PLANTING SITE

Delivery and/or the planting of street trees shall be coordinated with the City's Project Manager at (441-7847) at least 24 hours before planting or delivery. The successful bidder(s) shall notify the City's Project Manager as soon as possible when specified plant materials have been received so coordination of deliveries and/or plantings can be made. Plants shall be subject to inspection for conformity to Standard Specification requirements and approval by the City's Project Manager upon delivery and/or at time of planting, unless a request has been made for inspection prior to delivery.

1. LOADING

Care shall be taken to protect the trunk, branches and roots from abrasions and breakage when loading, transporting, unloading and/or planting. Plants too tall to be transported in an upright position must be tipped to a horizontal position. Branches must be tied prior to tipping to prevent breaking branches and bruising of the bark. The trunk and top must be supported when plants are tilted to a horizontal position. The trunk must be blocked near the ball and tied secure for support. Trunks shall be padded to prevent bruising and tops tied securely to the bed of the truck or trailers.

2. TRANSPORTING

Plants are to be transported by truck or low trailer. Bare-roots shall be covered with moist peat moss, sphagnum, sawdust, straw or wood chips before transporting. Plants shall have their tops tied in and be packed tightly on the truck to prevent shifting, which may cause breaking of the soil ball and branches. Excessive bending of branches must be avoided when tops are tied in or down. All plants with leaves and/or transported long distances shall be transported in an enclosed truck or covered with heavy canvas to prevent wind whipping and drying out while in transit. Plants in leaf shall be covered immediately before being transported and the cover shall be removed immediately after arriving at the planting site to avoid high temperatures which can severely injure the plants.

3. UNLOADING

Hand push carts shall be used to move balled and burlapped plants to the planting hole when unloaded from the truck. Plant material set off at the planting site shall be protected from freezing, drying out, breaking apart, overheating and other injuries. Plants that will not be planted immediately shall be protected from drying by the sun and wind.

Prevention of mechanical damage to plant material (i.e., crown, trunk or roots) and protection of root systems and crowns from drying during transportation, delivering and/or planting shall be the responsibility of the successful bidder(s). Plant materials shall not be removed from storage prior to complete preparation of the planting site for immediate planting.

31.06 LOCATION OF PLANT MATERIAL

A. STREET TREES

A list of designated locations (i.e., addresses) for street trees will be provided by the City's Project Manager when bid(s) has been awarded. Planting locations will be marked by the City with paint or wooden stakes. The Contractor is to inform the City's Project Manager on a daily basis as to what locations have been planted during the prior day and where planting will resume. Access to the planting sites will be restricted to roads for all vehicles. Permission to travel with any equipment anywhere other than the established roads must be obtained from the City's Project Manager.

B. PARK TREES AND OTHER LANDSCAPED AREAS

A list of designated locations for park trees will be provided by the City's Project Manager when bid(s) has been awarded. Planting locations will be marked by the City with paint or wooden stakes. The Contractor is to inform the City's Project Manager on a daily basis as to what locations have been planted during the prior day and where planting will resume. Access to the planting sites will be restricted to roads for all vehicles. Permission to travel with any equipment anywhere other than the established roads must be obtained from the City's Project Manager.

31.07 SITE PREPARATION

The Contractor will be responsible for having all underground utilities properly located prior to digging/planting. Any utility relocates that are necessary will also be the responsibility of the Contractor including any costs associated with them and not the City of Lincoln. Planting sites less than five (5) feet from lateral underground utility lines (i.e. electric, gas, water, etc.) shall require contacting the City's Project Manager so that alternate planting location(s) can be marked.

1. Layout and stake individual tree and shrub locations before start of planting work.
2. Examine proposed planting areas and conditions of installation.
3. Do not start planting until unsatisfactory conditions are corrected.
4. Make minor adjustments as may be necessary or requested.
5. Installation of plant material may not begin until City's Project Manager has approved planting locations.

31.08 PLANTING OF TREES AND SHRUBS

Trees may be moved and planted with an approved mechanical tree spade. The tree spade shall have a manufacturer's size rating equal to or exceeding the tree sizes to be moved. The machine shall be approved by the City's Project Manager prior to use. Trees shall be planted at the designated locations in the manner as shown in the plans and in accordance with sections of the Standard Specifications that are applicable. Tree pits may either be dug manually or mechanically using an auger or tree spade.

Excavate pits, beds and trenches with vertical sides and with bottom slightly raised at center to provide proper drainage. Loosen hard subsoil in bottom of excavation and scarify sides.

For balled and burlapped trees and shrubs, scarify bottom of the excavations to a depth of 4". Make excavations equal to the depth of ball, and diameter at least twice as wide as the root ball or root systems to allow enough space to permit loose backfill to be worked down and around the root ball or root system. (Refer to details in Chapter 31, showing root ball in reference to soil line and back-fill)

31.08 PLANTING OF TREES AND SHRUBS (Continued)

Glazing of the sides of the planting pits dug with shovels, mechanical augers, or tree spades shall be minimized by scarifying or roughening before backfilling to provide for easier lateral outward growth of the developing roots. All tree pits shall be backfilled manually.

Planting pits shall be backfilled the same day they are dug. If any planting pits are to be left open when Work is not in process or create a safety hazard to the public, they shall be covered over or properly barricaded.

Plants shall be lifted and handled with suitable support of the soil ball to avoid damage. Container and balled and burlapped plant material shall be lifted, carried and/ or lowered by the root ball, never by the trunk.

Plants shall be set so that the root flare is 1" to 2" above the existing grade. Plants should not be planted deeper than they were in their former growing location. To eliminate settling, the bottom of the planting hole shall be undisturbed soil so that it will give solid support to the bottom of the root ball or root system.

Plants must be plumb (straight) and centered in the planting hole before backfilling and after planting is complete.

Fertilizer shall be an approved root biostimulant (i.e. Roots by City). Apply according to the directions on the label.

If the plant is in a container or pot, the plant shall be carefully removed from the container or pot and the exterior of the root ball manually loosened to encourage roots to grow out into the surrounding soil prior to setting the plant in the planting hole.

If the plant is balled and burlapped all rope, strings, twine, wire, and wrapping from the top one-half (½) of the ball shall be removed after the plant has been set in the planting hole.

The balance of the wrapping is to be left intact around the root ball. All waterproof or water repellant wrappings shall be removed entirely from the ball.

If large or numerous rocks, construction debris, fill, tree roots or other obstructions are encountered in digging planting pits, suitable alternate locations shall be selected by the City's Project Manager. Where such obstructions are encountered, the Contractor shall proceed with doing other planting Work at different designated locations and not stop Work. Under no circumstances shall pits that have such obstructions be left open and shall be backfilled by the Contractor before leaving the site.

Planting pits are to be backfilled with the same soil that is excavated from them. Topsoil and subgrade soil shall be loosened and mixed to a depth twelve (12) inches before backfilling. Topsoil shall be gently firmed around the plant to hold it in place and to eliminate air pockets. When pits are approximately two-thirds (2/3) full, they are to be thoroughly watered to also eliminate air pockets. After this initial watering, topsoil is to be installed to the top of pit and watered. Puddled soil conditions resulting from over watering are to be avoided.

After the planting pit has been completely backfilled, make a ridge of soil two (2) to four (4) inches in height is to be formed around the outside margin of the pit to create a reservoir for watering.

31.08 PLANTING OF TREES AND SHRUBS (Continued)

Top of planting pits are to be mulched with a two (2) to four (4) inch layer of wood chips five (5) feet in diameter, immediately after planting. All shrub beds to be mulched as a continuous bed with a natural 6" trench separating the planting area from the turf area.

Plants are to be thoroughly watered immediately after planting. Over watering is to be avoided. Contractor must supply water and equipment needed (e.g., water truck, hose, buckets, etc.) to water trees. Under no circumstances shall water from homes be used by the Contractor to water trees. Watering from fire hydrants may be used only after securing a permit and meter from the City Water Department.

When conditions detrimental to plant growth are encountered, such as rubble fill or adverse drainage conditions, notify City's Project Manager. Hand excavate near underground utilities. Maintain grade stakes set by other until removal is agreed upon by all parties considered.

31.09 PLANTING PERENNIALS AND ORNAMENTAL GRASSES

Prepare soil at perennial areas by spading deeply to a depth of at least 8 inches below the finished grade. Add yard waste compost to planting area so that the final planting medium composition is 60% topsoil and 40% compost to the 8 inch depth. Rake planting bed smooth. Some ornamental grasses may not require compost, so verify with City's Project Manager.

Moisten soil before planting to allow it to dry slightly until workable. Set plants at specified spacing. Do not remove plant from container until it is to be set in planting soil.

Mulch perennial plants. Provide not less than 2" thickness of mulch and work into top of backfill and finish level with adjacent grades. Mulch within 24 hours of planting. Thoroughly water mulched areas. All perennial and ornamental grass beds to be mulched as a continuous bed with a natural 6" trench separating the planting area from the turf area. Mulch shall cover all disturbed earth within the planting area.

Plants shall be thoroughly watered immediately after planting. Over watering is to be avoided. Contractor must supply water and equipment needed (e.g., water truck, hose, buckets, etc.) to water trees. Under no circumstances shall water from homes be used by the Contractor to water trees. Watering from fire hydrants may be used only after securing a permit and meter from the City Water Department.

When conditions detrimental to plant growth are encountered, such as rubble fill or adverse drainage conditions, notify City's Project Manager. Hand excavate near underground utilities. Maintain grade stakes set by other until removal is agreed upon by all parties considered.

31.10 PRUNING OF PLANT MATERIAL

Pruning shall only be done at the time of planting if necessary. All broken, weak and interfering (i.e., crossing or rubbing) branches shall be properly removed by the Contractor after the tree has been planted. Drop crotch pruning shall be done and pruning cuts properly made so that the branch collar and/or branch bark ridge are not cut. All other sound and healthy branches shall be left intact to provide maximum leaf surface to manufacture food for crown and root growth.

31.11 STAKING AND SUPPORT OF PLANT MATERIAL

Wrapping of trunks with tree wrap is not required. All existing tree wrap, if any, shall be removed from trunks immediately after planting.

Staking of all upright deciduous and coniferous trees is required.

Staking shall be required after planting Street Trees and Park Trees. Staking of Street Trees shall be completed immediately after planting unless staking is not specified.

Street Trees are to be secured after planting by a single support stake driven at approximately a 45⁰ (degree) angle to the ground plane avoiding the root ball. Stakes are to be driven to a minimum depth of 12 inches into undisturbed soil and contained within the 5' mulched tree ring. Trees should be secured to stakes using nylon webbing configured in a "Figure 8" allowing for flexibility of the tree trunk, while transferring support from the stake to the tree. (Refer to details in Chapter 31.)

Deciduous Park Trees & Trees in other Landscaped Areas are to be secured after planting by two support stakes driven at approximately 90⁰ (degree) angle to the ground plane avoiding the root ball. Stakes are to be driven to a maximum depth of 12 inches into undisturbed soil and contained within the 5' mulched tree ring. Trees should be secured to stakes using nylon webbing configured in a "Figure 8" allowing for flexibility of the tree trunk, while transferring support from the stake to the tree. (Refer to details in Chapter 31.) Tree guards shall be installed on all deciduous trees. The guards shall be plastic and will be provided by the City.

31.12 MARKING PARK TREES

Park trees shall be marked with materials provided by the City to aid in monitoring plantings from year to year. Deciduous trees shall be marked with a circle of spray paint approximately two (2) inches in diameter at the base of the trunk. Coniferous trees shall be marked with a colored tag placed on a side branch, not on the central leader.

31.13 CARE INSTRUCTIONS FOR STREET TREES

Instructions on the care of street trees will be provided by the City for the Contractor to distribute immediately at each planting location. The Contractor is to leave the instructions in the form of a "door hanger" at the door of the adjoining residence or commercial property. Door hangers are not to be placed in mail boxes.

31.14 ACCEPTANCE AND ESTABLISHMENT PERIOD

Upon completion of planting the City's Project Manager will inspect the plant material for acceptability. The Contractor will be notified of the dates of this inspection. All items of Work as required in the Standard Specifications, the Special Provisions, and the plans shall have been performed prior to this inspection. Any item not been completed may make a plant unacceptable. Unacceptable plant material may be allowed to remain in place without payment. A subsequent inspection may be made thirty (30) days subsequent to the initial inspection to determine the acceptability of plant material and therefore, allowing payment for such plants.

31.14 ACCEPTANCE AND ESTABLISHMENT PERIOD (Continued)

During the establishment period, the Contractor shall properly maintain all plant materials planted under the contract. The establishment procedures shall include additional pruning, protective measures against pests and diseases, watering as often as required by necessity, cultivating, repairing dunes to the watering basins, replacing mulch which becomes displaced, keeping the stakes firm and the guys adjusted, weeding with a pre-emergent weed control or other approved means, and other establishment procedures as deemed necessary by the City's Project Manager, including the removal of any dead plant material for the project. The Contractor is responsible for watering all plant material as necessary during the one year establishment period.

The establishment period will follow the completion of all planting and shall extend for a period of one year. The establishment period will not begin until all of the following items of Work as required in the Standard Specifications, the Special Provisions, and the plans have been performed on each and every plant material; including proper planting, backfilling, watering, pruning, staking, supporting, water basin construction and mulching. All plant material shall be in viable growing condition when the project enters the establishment period.

Upon completion of the establishment period, the City's Project Manager will make an inspection of the plant material to identify plant material to be replaced under warranty. The inspection will normally be made during the month that the establishment period terminates. The Contractor will be notified of the dates of this inspection. A list of plant material quantities and locations will be provided to the Contractor for replacement. Replacement of plant materials shall occur within thirty (30) days of receipt of this list. Plant replacement shall be at the Contractor's expense. Establishment procedures that have not been performed shall be brought to the Contractor's attention and may cause the establishment period to be extended. All replacement plant material shall receive the establishment procedures referred Chapter 31. The Contractor will be notified in writing when his/her establishment responsibilities on the acceptable plant material have been terminated.

31.15 REPLACEMENT OF PLANT MATERIAL AND GUARANTEE PERIOD

The Contractor shall guarantee all plant material to be in healthy and flourishing condition for a period of one (1) year from date of acceptance. The guarantee period for trees shall begin at the date of acceptance.

The Contractor shall replace, without cost, and as soon as weather conditions permit and within a specific planting period, all plants determined by the City's Project Manager to be dead during or at the end of the guarantee period.

During the guarantee period, the City shall properly maintain all plant materials planted under the contract. The establishment procedures shall include additional pruning, protective measures against pests and diseases, watering as often as required by necessity, cultivating, repairing damage to the watering basin, replacing mulch which becomes displaced, keeping the stakes firm and support ties adjusted, weeding with a pre-emergence weed control or other approved means and other establishment procedures as deemed necessary by the City's Project Manager including the removal of any dead plant material from the project.

31.15 REPLACEMENT OF PLANT MATERIAL AND GUARANTEE PERIOD (Continued)

Replacement plants shall be free of dead or dying branches and branch tips shall bear foliage of normal density, size and color if in leaf. Replacements shall closely match adjacent specimens of the same species that have been planted. Replacements shall be subject to all requirements, standards, special provisions and Standard Specifications stated herein.

The guarantee of all replacement plants shall extend for an additional period of one (1) year from date of their acceptance and installation. In the event that replacement plants are not acceptable during or at the end of the said extended guarantee period, the City's Project Manager may elect subsequent replacement or credit (refund) for them.

31.16 VANDALISM

Trees damaged as a result of vandalism are not required to be replaced as apart of this contract.

31.17 QUALIFICATIONS FOR SUBMITTING BIDS

To submit bids, a Contractor must have all of the following qualifications and certification:

- Be licensed according to the Nebraska Administrative Code for Plant Protection and Plant Pest Act.
- Be a Nebraska Certified Nurseryman and a current member of the Nebraska Nursery and Landscape Association.
- Be able to demonstrate a minimum work experience record.
- Be able to demonstrate successfully completed projects similar to scope and scale.

CITY OF LINCOLN NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 32

SOIL EROSION and SEDIMENT CONTROL

ARTICLE	TITLE	
32.00	GENERAL	3202
32.01	NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT	3202
	A. GENERAL	3202
	B. BASIS OF PAYMENT	3203
32.02	SYNTHETIC FABRIC SEDIMENT FENCE	3203
	A. GENERAL	3203
	B. MATERIALS	3203
	C. INSTALLATION	3204
	D. MAINTENANCE AND REMOVAL	3204
	E. BASIS OF PAYMENT	3205
32.03	CONSTRUCTION ENTRANCE	3205
	A. GENERAL	3205
	B. MATERIALS	3205
	C. INSTALLATION	3206
	D. MAINTENANCE AND REMOVAL	3206
	E. BASIS OF PAYMENT	3206
32.04	INLET PROTECTION	3206
	A. GENERAL	3206
	B. MATERIALS	3207
	C. INSTALLATION	3207
	D. MAINTENANCE AND REMOVAL	3208
	E. BASIS OF PAYMENT	3208
32.05	EROSION CONTROL BLANKET (ECB)	3208
	A. GENERAL	3208
	B. MATERIALS	3208
	C. INSTALLATION	3209
	D. MAINTENANCE	3209
	E. BASIS OF PAYMENT	3210
32.06	TURF REINFORCEMENT MAT (TRM)	3210
	A. GENERAL	3210
	B. MATERIALS	3210
	C. INSTALLATION	3210
	D. MAINTENANCE	3211
	E. BASIS OF PAYMENT	3211
32.07	TRIANGULAR SEDIMENT BARRIERS	3211
	A. GENERAL	3211
	B. MATERIALS	3211
	C. INSTALLATION	3212
	D. MAINTENANCE AND REMOVAL	3213
	E. BASIS OF PAYMENT	3213

CITY OF LINCOLN NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 32

SOIL EROSION and SEDIMENT CONTROL

ARTICLE	TITLE	
32.08	ROCK DITCH CHECK	3214
	A. GENERAL	3214
	B. MATERIALS	3214
	C. INSTALLATION	3214
	D. MAINTENANCE AND REMOVAL	3215
	E. BASIS OF PAYMENT	3215
32.09	COMPOST FILTER SOCK	3216
	A. GENERAL	3216
	B. MATERIALS	3216
	C. INSTALLATION	3216
	D. MAINTENANCE AND REMOVAL	3217
	E. BASIS OF PAYMENT	3217
32.10	BIODEGRADABLE LOG (WATTLE) DITCH CHECK	3217
	A. GENERAL	3217
	B. MATERIALS	3218
	C. PREPARATION	3218
	D. INSTALLATION	3218
	E. MAINTENANCE AND REMOVAL	3219
	F. BASIS OF PAYMENT	3219
32.11	TRANSITION MAT	3220
	A. GENERAL	3220
	B. MATERIALS	3220
	C. INSTALLATION	3220
	D. BASIS OF PAYMENT	3220
32.12	COIR FIBER LOG REVETMENTS	3221
	A. GENERAL	3221
	B. MATERIALS	3221
	C. INSTALLATION	3221
	D. MAINTENANCE	3221
	E. BASIS OF PAYMENT	3221
TABLE	TITLE	
32.02 A	SEDIMENT FENCE REQUIREMENTS	3203
32.03 A	FILTER FABRIC PROPERTIES	3205
32.09 A	COMPOST FILTER SOCK SIZES	3216
32.10 A	TEMPORARY EROSION CONTROL AND SEDIMENT RETENTION WATTLE	3218

CHAPTER 32

SOIL EROSION and SEDIMENT CONTROL

32.00 GENERAL

This Work shall consist of constructing, maintaining, and removing erosion control measures that are used to minimize erosion and sedimentation during construction. This Work shall be performed at locations shown on the plans or as directed by the City's Project Manager.

32.01 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT

A. GENERAL

The Contractor shall understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit that authorizes the stormwater discharges associated with the industrial activity from the construction site. For reference the general permit is posted on the City's web site, www.lincoln.ne.gov; keyword: NPDES.

Additionally, the Contractor, as evidenced by their signature on this proposal, agrees and understands that, if awarded the contract on this project, he/she:

- becomes a co-permittee, along with the owner(s), to the Nebraska Department of Environmental Quality NPDES General Permit for Stormwater Discharge from construction sites on this project; and
- is legally bound to comply with the Clean Water Act to ensure compliance with the terms and conditions of the stormwater pollution prevention plan as developed under the NPDES permit and the terms of the NPDES permit; and
- will hold owners harmless for damages and fines arising as a result of noncompliance with the terms of the stormwater permits and authorizations associated with the work on this project; and
- shall be responsible for the maintenance of the sediment control measures until permanent stabilization and cover crop is established; and
- shall complete permanent or temporary stabilization within seven (7) calendar days of soil disturbance to the surface of all perimeter controls, topsoil stockpiles, and any other disturbed or graded areas on the project site which are not being used for material storage, or on which actual earth moving activities are not being performed; and
- shall complete the approved inspection forms and inspect/maintain all sediment or erosion control practices required under this contract at least once every seven (7) calendar days and after any storm event of greater than 0.5 inches of precipitation, on the site, during any 24-hour period; any necessary repairs or cleanup to maintain the effectiveness of the best management practices shall be made by contractor immediately; and
- shall update the approved SWPPP plan immediately following any changes or additions to the plan, keep all inspection forms with the SWPPP plan, preferably on site in a mailbox, and provide copies of all inspection forms and modifications to the SWPPP plan to the City's Construction Project Manager, within 48 hours of inspection.

32.01 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT
(Continued)

B. BASIS OF PAYMENT

Payment for updating the approved SWPPP, performing the required inspections, and maintaining the appropriate documentation shall be paid for at the contract unit price bid per each (EA), per occurrence for SWPPP UPDATING. This price shall be full compensation for any and all labor, tools, equipment and incidentals necessary to complete the inspection, updating and documentation activities listed above.

Payment for maintenance of the sediment and erosion control devices will be as given below in the individual sections.

32.02 SYNTHETIC FABRIC SEDIMENT FENCE

A. GENERAL

Sediment fence is a temporary linear sediment filter barrier constructed of synthetic filter fabric and posts. Sediment fence shall be used for detaining small amounts of sediment and decreasing flow velocities.

B. MATERIALS

1. Sediment fence shall be a pervious sheet of propylene, nylon, polyester or ethylene fabric and shall conform to the Standard Specifications defined in the following table:

TABLE 32.02 A – SEDIMENT FENCE REQUIREMENTS

Fabric Properties	Minimum Requirements	Test Method
Filtering Efficiency	70%	ASTM 5141
Tensile Strength at 20% (max.) elongation:	30 lb./linear inch	ASTM 4632
Standard Strength		
High Strength	50 lb./linear inch	ASTM 4632
Flow Rate	.2 gal./SF/minute	ASTM 5141
Ultraviolet Radiation Stability	90%	ASTM-G-26

2. Posts and stakes shall be standard “T” steel posts and be a minimum of forty (40) inches in length.

32.02 SYNTHETIC FABRIC SEDIMENT FENCE (Continued)

C. INSTALLATION

Sediment fence shall be placed the same day excavating and/or fill is placed and prior to any site disturbing activities upstream of the fence.

Sediment fence can be installed either by trenching or by utilizing a sediment fence installation machine. If trenching is used sediment fence can be entrenched by excavating a four (4) inch wide trench along the line of the fence posts, with the filter fabric being entrenched to a depth of no less than eight (8) inches. The trench must be backfilled and compacted on both sides of the sediment fence.

If a sediment fence installation machine is utilized the sediment fence must be installed at a minimum depth of ten (10) inches into the ground.

Posts shall be driven into the ground to a minimum depth of sixteen (16) inches below the original ground level and at approximately a twenty (20) degree incline toward the upslope side. The posts shall be spaced a maximum of six (6) feet apart for filter fabric not supported by wire mesh and a maximum of ten (10) feet apart for filter fabric supported by wire mesh.

When joints are necessary, sediment fence shall be spliced together only at a support post, with a minimum six (6) inch overlap. The overlap shall be secured as necessary.

These requirements represent minimum installation requirements and do not replace the sediment fence manufacturer installation recommendations that may exceed these requirements.

For details see City of Lincoln Standard Plan LSP-175.

D. MAINTENANCE AND REMOVAL

Sediment deposits shall be removed when the level of deposition reaches one half (½) of the sediment fence height. Removed sediment shall be placed in a suitable location and in a manner that minimizes further erosion.

If, during required inspections, damage to the sediment fence is observed the necessary repairs shall be completed within twenty-four (24) hours of the inspection.

The sediment fence shall not be removed until the up slope area has been permanently stabilized and/or directed by the City's Project Manager. All materials shall be completely removed from the site and stored or disposed of properly.

32.02 SYNTHETIC FABRIC SEDIMENT FENCE (Continued)

E. BASIS OF PAYMENT

Installation shall be paid for at the contract unit price per linear foot (LF) for SYNTHETIC FABRIC SEDIMENT FENCE INST. This price shall be full compensation for furnishing, preparing, transporting, delivering, excavating, and placing the materials, and for all labor, tools, equipment and incidentals necessary to complete the Work.

Maintenance shall be paid for at the contract unit price bid per linear foot (LF), per occurrence for SYNTHETIC FABRIC SEDIMENT FENCE MAINT. This price shall be full compensation for any and all labor, tools, equipment and incidentals necessary to complete the maintenance activities listed in these Standard Specifications.

Removal shall be paid for at the contract unit price bid per linear foot (LF), per occurrence for SYNTHETIC FABRIC SEDIMENT FENCE REM. This price shall be full compensation for any and all labor, tools, equipment and incidentals necessary to complete the removal activities listed in these Standard Specifications.

32.03 CONSTRUCTION ENTRANCE

A. GENERAL

A construction entrance is a stabilized aggregate pad with a filter fabric underline located at any point where vehicular traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk or parking area. Its purpose is to reduce or eliminate the tracking of sediment onto public rights-of-way or streets. It should be used wherever traffic will be leaving a construction site and moving directly onto a public road or other paved area.

B. MATERIALS

1. The aggregate shall be two (2) inch to three and one-half (3 ½) inch diameter, clean crushed rock.
2. Filter fabric shall be resistant to commonly encountered chemicals, hydrocarbons, mildew, rot-resistant, and conform as a minimum to the fabric properties shown in the following table:

TABLE 32.03 A – FILTER FABRIC PROPERTIES

	Fabric Properties	Testing Method
Grab Tensile Strength (lbs)	250	ASTM D4632
Elongation A Failure (%)	60	ASTM D4632
Mullen Burst Strength (psi)	380	ASTM D3786
Puncture Strength (lbs)	125	ASTM D4833
Apparent Opening Size (mm)	.20	ASTM D4751

Fabrics not meeting these Standard Specifications may be used only when design procedure and supporting documentation are supplied to determine aggregate depth and fabric strength.

32.03 CONSTRUCTION ENTRANCE (Continued)

C. INSTALLATION

The minimum width of the entrance shall be twelve (12) feet for sites with multiple access points and twenty-four (24) feet for sites with a single access point. The minimum length of the entrance shall be seventy (70) feet.

The area of the construction entrance shall be excavated a minimum of three (3) inches and shall be cleared of all vegetation, roots, and other objectionable material. The filter fabric shall be placed the full length and width of the construction entrance.

Following the placement of the filter fabric, the aggregate shall be placed over the entire length and width of the construction entrance at a thickness not less than six (6) inches. A three (3) foot wide by six (6) inch high mountable berm of additional aggregate may be placed across the entire width of the construction entrance at the connection to the existing street or paved area.

For application, design, and dimension details refer to Lincoln Standard Plan LSP-176.

D. MAINTENANCE AND REMOVAL

The entrance shall be maintained in a condition which will prevent tracking or flow of sediment onto public right-of-way. This may require periodic top dressing with additional aggregate or the washing and reworking of existing aggregate as conditions demand and repair and/or cleanout of any structures used to trap sediment.

All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains must be removed immediately. The use of water trucks to remove materials dropped, washed, or tracked onto roadways will not be permitted under any circumstances.

The construction entrance shall not be removed from the site and maintenance shall not cease until the site construction is sufficiently complete such that exiting traffic will no longer track material onto the public street or paved area. All filter fabric, aggregate, and any other materials used in the construction of the entrance shall be completely removed from the site and disposed of properly.

E. BASIS OF PAYMENT

Installation of the construction entrance shall be paid for at the contract unit price per ton for CONSTRUCTION ENTRANCE SURFACING. The filter fabric shall be subsidiary to the construction of the entrance. This price shall be full compensation for furnishing, preparing, transporting, delivering, excavating, and placing the materials, and for installation, maintenance, and removal of the Work.

32.04 INLET PROTECTION

A. GENERAL

Inlet protection is a temporary filter installed around inlets, ponding water and thereby reducing the sediment passing through into the storm sewer. Its purpose is to minimize the amount of sediment entering storm drainage systems prior to permanent stabilization of the disturbed area.

32.04 INLET PROTECTION (Continued)

B. MATERIALS

1. Filter Fabric Inlet Protection shall be constructed of a pervious sheet of propylene, nylon, polyester or ethylene fabric as specified above for Synthetic Fabric Sediment Fence. Posts and framing material shall be wooden posts with a minimum height of 30 inches, and framing boards with a cross sectional area of 5 1/4 square inches (standard 2" x 4") or larger. Metal posts shall be standard steel "T" post with a minimum height of 40 inches, or approved equivalent.
2. Curb Inlet Protection shall be made of permeable, durable, high strength geotextile filled with filtering media, of sufficient size to accommodate the inlet, and permeable enough to pass high flow rates of storm water.

C. INSTALLATION

1. Installation of Filter Fabric Inlet Protection around inlet vaults and grate inlets shall consist of stakes spaced evenly with a maximum spacing of three (3) feet around the entire perimeter of the inlet and placed no closer than twelve (12) inches to the nearest face of the inlet. Stakes shall be securely driven into the ground to a minimum depth of twelve (12) inches for wooden stakes and sixteen (16) inches for metal stakes. Stakes shall extend a minimum of eighteen (18) inches above the ground for wooden stakes and twenty-four (24) inches for metal stakes.

Where wooden stakes are used, wooden frames shall be constructed and securely attached to the stakes. One frame shall be flush with the top of the stakes and one frame shall be located approximately four (4) inches above the ground.

The filter fabric shall be cut from a continuous roll to minimize weakness at joints. The bottom of the filter fabric shall be placed in a trench at a minimum depth of six (6) inches and backfilled completely with compacted soil. Filter fabric shall be securely attached to the stakes and frames by staples or wire. The joint shall be overlapped to the next stake.

A temporary dike shall be placed on the down slope side of the structure in locations that are subject to bypass flow.

The storm drain inlet protection shall be constructed and complete as soon as the storm drain inlet might accept runoff.

2. Installation of the Curb Inlet Protection shall be as per plan or manufacturer's recommendation in a manner that ponds water and filters sediment from the water entering the curb inlet, but not in a manner that completely plugs the inlet, causes flooding outside of public right-of-way, or unsafe driving conditions. This may include but not be limited to:
 - a. creating J-Hooks for a series of ponding areas along the gutter upstream from an inlet and,
 - b. installation in front of the curb inlet opening in a manner that blocks sediment laden water from directly entering the storm sewer system while allowing for ponded water to overflow into the storm sewer system during large rain events to prevent localized flooding. A spacer is required in order to keep the Curb Inlet Protection directly away from the drain opening.

32.04 INLET PROTECTION (Continued)

D. MAINTENANCE AND REMOVAL

If during required inspections damage to the structure is observed, the necessary repairs shall be completed within twenty-four (24) hours of the inspection. Sediment deposits shall be removed when the level of deposition reaches one-third (1/3) of the structure height. Removed sediment shall be placed in a suitable location and in a manner that minimizes further erosion. If the curb inlet protection device becomes clogged with debris and sediment, they shall be maintained so as to assure proper drainage and water flow into the storm drain. The structure shall not be removed until the up slope area has been permanently stabilized, or as directed by the City's Project Manager. All materials shall be completely removed from the site and stored or disposed of properly.

E. BASIS OF PAYMENT

Payment for the Installation, Maintenance and Removal of Filter Fabric Inlet Protection shall be subsidiary to the construction of the inlet and shall be full compensation for furnishing, preparing, transporting, delivering, excavating, and placing the materials, and for all labor, tools, equipment and incidentals necessary to complete the installation, maintenance and removal Work.

Payment for the installation of Curb Inlet Protection shall be paid for at the contract unit price per each (EA), per occurrence for CURB INLET PROTECTION INST. This price shall be full compensation for furnishing, preparing, transporting, delivering, excavating, and placing the materials, and for all labor, tools, equipment and incidentals necessary to complete the Work.

Payment for the maintenance of Curb Inlet Protection shall be paid for at the contract unit price bid per each (EA), per occurrence for CURB INLET PROTECTION MAINT. This price shall be full compensation for any and all labor, tools, equipment and incidentals necessary to complete the maintenance activities listed above.

Payment for the removal of the Curb Inlet Protection shall be paid for at the contract unit price bid per each (EA), per occurrence for CURB INLET PROTECTION REM. This price shall be full compensation for any and all labor, tools, equipment and incidentals necessary to complete the removal activities listed above.

32.05 EROSION CONTROL BLANKET (ECB)

A. GENERAL

Erosion Control Blankets are a temporary, degradable rolled erosion control product composed of natural or polymer yarns woven into a matrix, used to provide erosion control and facilitate vegetation establishment.

B. MATERIALS

1. Erosion Control Blanket, Type I shall be constructed of 100% agricultural straw evenly distributed across the entire blanket, covered with a photodegradable polypropylene net having an approximate 0.5 x 0.5 inch net opening, a mass per unit area of 0.40 lbs/sy, and a functional longevity of 12 months.

32.05 EROSION CONTROL BLANKET (ECB) (Continued)

B. MATERIALS (Continued)

2. Erosion Control Blanket, Type II shall be constructed with 70% agricultural straw and 30% coconut fiber evenly distributed across the entire blanket, stitched with degradable thread between a heavy weight UV stabilized polypropylene top net with an approximate 0.63 x 0.63 inch net opening, and a lightweight photodegradable polypropylene bottom net, having an approximate 0.5 x 0.5 inch net opening, a mass per unit area of 0.5 lbs/sy and a functional longevity of 24 months.
3. BD Erosion Control Blanket, Type I shall be constructed with 100% biodegradable materials containing a 100% agricultural straw fiber matrix evenly distributed across the entire blanket, covered with a biodegradable natural organic fiber netting having an approximate 0.5 x 1.0 inch net opening, a mass per unit area of 0.47 lbs/sy, and a functional longevity of 12 months.
4. BD Erosion Control Blanket, Type II shall be constructed with 100% biodegradable materials containing 70% agricultural straw and 30% coconut fiber matrix evenly distributed across the entire blanket, covered on the top and bottom with biodegradable natural organic fiber netting having an approximate 0.5 x 1.0 inch net opening, a mass per unit area of 0.6 lbs/sy and a functional longevity of 18 months.
5. Metal staples for installation shall be No. 11 gauge wire and at least six inches long.
6. 100% natural fasteners shall be at least six inches long.

C. INSTALLATION

Installation shall occur as soon as possible after finish grading operations and/or seeding have been complete, or as directed by the City's Project Manager. On shallow slopes, less than 4H:1V, the blankets may be installed parallel across the slope. On steep slopes, 4H:1V or greater, the blankets shall be installed perpendicular down the slope. In ditches and drainage channels the blankets shall be installed parallel to the direction of flow and in such a manner as to avoid seams along the channel bottom. Entrenchment and overlap shall be as recommended by the manufacturer.

Staples or fasteners will be placed according to the manufacturer. The installation procedures shall ensure that the Erosion Control Blanket will remain in intimate contact with the soil for its period of functional longevity or until such time as full growth of the vegetation occurs. In loose soils, staples or fasteners of greater than 6 inches may be required to properly secure the blanket. 100% natural fasteners will be required when securing biodegradable blankets.

D. MAINTENANCE

If, during required inspections, erosion or undermining beneath the blanket is observed, the blanket shall be pulled back and any lost soil shall be replaced and the area shall be reseeded. After reseeding, the blanket shall be reinstalled as detailed above. Maintenance shall be completed within twenty-four (24) hours of inspection if site conditions are conducive.

32.05 EROSION CONTROL BLANKET (ECB) (Continued)

E. BASIS OF PAYMENT

Erosion Control Blanket shall be paid for at the contract unit price bid per square yard (SY) for ECB, Type I and ECB, Type II and BD ECB, Type I and BD ECB, Type II as measured by the visible surface area after installation is complete. This price shall be full compensation for furnishing, preparing, transporting, delivering and placing the materials, and for all labor, tools, equipment and incidentals necessary to complete the installation and maintenance of the Work.

32.06 TURF REINFORCEMENT MAT (TRM)

A. GENERAL

Turf Reinforcement Mat is a rolled erosion control product composed of non-degradable synthetic fibers, filaments, nets, wire mesh, and/or other elements, processed into a permanent, three dimensional matrix of sufficient thickness. TRMs may be supplemented with degradable components. They provide long-term functionality by permanently reinforcing vegetation during and after maturation.

B. MATERIALS

1. Turf Reinforcement Mat, Type I shall be constructed of 100% coconut fiber matrix with a mass per unit area of 0.5 lbs/sy and a functional longevity of 36 months, incorporated into a permanent three-dimensional matting. The matrix shall be stitch bonded, with a UV stabilized polypropylene thread, between a super heavy duty UV stabilized bottom net with an approximate 0.5 x 0.5 inch net opening, an ultra duty UV stabilized, dramatically crimped intermediate netting with an approximate 0.5 x 0.5 inch net opening, and covered by a super heavy duty UV stabilized top net with an approximate 0.5 x 0.5 inch net opening. The crimped netting shall form prominent closely spaced ridges across the entire width of the mat.
2. Turf Reinforcement Mat, Type II shall be constructed of 100% UV stabilized polypropylene fiber matrix incorporated into a permanent 3-dimensional turf reinforcing matting. The matrix shall be evenly distributed across the entire mat with a mass per unit area of 0.5 lbs/sy. The matrix shall be stitch bonded, with a UV stabilized polypropylene thread, between ultra heavy duty UV stabilized bottom, intermediate and top nettings with approximate 0.5 x 0.5 inch net opening. The intermediate netting shall be dramatically crimped and shall form prominent closely spaced ridges across the entire width of the mat.
3. Staples for installation shall be No. 11 gauge wire and at least six inches long.

C. INSTALLATION

Installation shall occur as soon as possible after finish grading operations and/or seeding have been complete, or as directed by the City's Project Manager. On shallow slopes, less than 4H:1V, the mats may be installed parallel across the slope.

On steep slopes, 4H:1V or greater, the mats shall be installed perpendicular down the slope. In ditches and drainage channels the mats shall be installed parallel to the direction of flow and in such a manner as to avoid seams along the channel bottom. Entrenchment and overlap shall be as recommended by the manufacturer.

32.06 TURF REINFORCEMENT MAT (TRM) (Continued)

C. INSTALLATION (Continued)

Staples will be placed according to the manufacturer. The installation procedures shall ensure that the Turf Reinforcement Mat will remain in intimate contact with the soil for its period of functional longevity or until such time as full growth of the vegetation occurs. In loose soils, staples of greater than 6 inches may be required to properly secure the mat.

D. MAINTENANCE

If, during required inspections, erosion or undermining beneath the mat is observed, the mat shall be pulled back and any lost soil shall be replaced and the area shall be reseeded. After reseeding, the mat shall be reinstalled as detailed above. Maintenance shall be completed within twenty-four (24) hours of inspection if site conditions are conducive.

E. BASIS OF PAYMENT

Turf Reinforcement Mat shall be paid for at the contract unit price per square yard (SY) for TRM, TYPE I and TRM, TYPE II as measured by the visible surface area after installation is complete. This price shall be full compensation for furnishing, preparing, transporting, delivering and placing the materials, and for all labor, tools, equipment and incidentals necessary to complete the installation and maintenance of the Work.

32.07 TRIANGULAR SEDIMENT BARRIERS

A. GENERAL

Triangular sediment barriers operate by intercepting and ponding sediment-laden runoff. Ponding the water reduces the velocity of the incoming flow and allows most of the suspended sediment to settle out. Water exits the check by flow over the top. Triangular sediment barriers can be used as ditch checks, continuous sediment barriers, culvert inlet protection, and drop inlet protection.

B. MATERIALS

1. Flexible Triangular Sediment Barriers shall be triangular in shape, having a height of at least nine (9) inches in the center with equal sides and at least a sixteen (16) inch wide base. The triangular-shaped inner material shall be urethane foam. The outer cover shall be a woven geotextile fabric placed around the inner material and allowed to extend beyond both sides of the triangle at least thirty (30) inches. Standard length of each barrier will be seven (7) feet unless otherwise indicated on the plans.

Staples shall be No. 11 gauge wire and be at least eight (8) inches long or per manufactures Specifications, whichever is greater.

2. Permeable A-Shaped Sediment Barrier is a permeable, high porosity A-Shaped rigid plastic berm with basic dimensions of nine (9) inches in height and three (3) feet in length. The permeable A-shaped barrier shall be installed on top of a turf reinforcement meeting specifications given above for TRM, Type I.

The permeable A-shaped berm shall be installed with galvanized ardox spikes ten (10) inches long using galvanized washers at intervals or per manufactures Specifications, whichever is greater.

32.07 TRIANGULAR SEDIMENT BARRIERS (Continued)

C. INSTALLATION

Triangular sediment barriers shall be installed in locations and configuration as shown on the approved erosion and sediment control plan or as directed by the City's Project Manager.

For installation of flexible triangular sediment barriers, a four (4) inch wide by four (4) inch deep trench shall be excavated perpendicular to the storm water flow. The trench shall extend in a straight line along the entire length of the proposed triangular sediment barrier installation.

Each triangular sediment barrier has two aprons: one upstream and one downstream. The upstream apron is the shorter of the two. Place the triangular sediment barrier on the downstream side of the trench. Conform the flexible triangular sediment barrier to the contour of the ground or the geometry of the ditch so that no space exists between the barrier and the ditch bottom. Place the first four (4) to six (6) inches of the upstream apron in the trench and anchor it with one row of staples on eighteen (18) inch centers at the bottom of the trench angled slightly toward the downstream side. Place an additional row of staples on eighteen (18) inch centers and at changes in grade along the full length of the barrier at the upstream edge of triangular portion of the barrier. The downstream apron, (which folds under the base of the triangular sediment barrier) should terminate freely on the downstream side of the triangular silt barrier. No trench is needed for the downstream apron. The downstream apron shall be anchored with two rows of staples placed on eighteen (18) inch centers.

One row shall be placed where the downstream apron meets the base of the barrier on the downstream side, and the other row should be placed at the downstream edge of the apron.

At joints between sections of the barriers, the ends of the barrier sections shall be placed such that there is no space between the foam materials. The excess fabric at the ends of the barrier sections shall be extended over the adjoining sections and stapled together along the full length of the joint.

When all the sections have been anchored with staples accordingly the trench shall be backfilled with compacted soil.

For installation of permeable A-shaped sediment barriers, grade surface in preparation for seeding, removing all debris and large clumps of dirt and seed in locations where indicated on the plans. Install erosion control blanket at sediment barrier locations. Install erosion control blanket 3 feet wide, perpendicular to the direction of flow, centered under the barrier location. Allow 4 inches slack across the blanket width for folding over upstream foot of the barrier. Trench in and staple the upstream edge of the blanket, recompact soil into the trench. Place sediment barrier units perpendicular to the flow, centered over the erosion control blanket, overlap units by 2 inches. Secure using spikes and washers through the folded erosion control blanket and the foot of the unit. The pins shall be spaced across the entire width of the panel at 10 inches on center for the upstream leg and 20 inches on center for the downstream leg.

32.07 TRIANGULAR SEDIMENT BARRIERS (Continued)

C. INSTALLATION (Continued)

The triangular sediment barrier shall be installed such that the elevation of the ground at both ends of the barrier is higher than the elevation of the top of the barrier at the center of the ditch. This prevents the storm water from flowing around the barrier.

Triangular sediment barriers shall be constructed prior to or the same day that land disturbance activities are performed up slope of the triangular sediment barriers.

For application and design details see the City of Lincoln Standard Plan LSP 180.

D. MAINTENANCE AND REMOVAL

Sediment deposits shall be removed when the level of deposition reaches one half ($\frac{1}{2}$) of the structure height. Removed sediment shall be placed in a suitable location and in a manner that minimizes further erosion.

If, during required inspections, damage to the structure is observed the necessary repairs shall be completed within twenty-four (24) hours of the inspection.

The structure shall not be removed until the up slope area has been permanently stabilized and/or directed by the City's Project Manager. All materials shall be completely removed from the site and stored or disposed of properly.

All ground disturbed by the removal of the structure shall be graded flush with the surrounding ground and stabilized with vegetative cover.

E. BASIS OF PAYMENT

Installation shall be paid for at the contract unit price per linear foot (LF) for TRIANGULAR SEDIMENT BARRIER INST. This price shall be full compensation for furnishing, preparing, transporting, delivering, excavating, and placing the materials, and for all labor, tools, equipment and incidentals necessary to complete the Work.

Maintenance shall be paid for at the contract unit price bid per linear foot (LF) for TRIANGULAR SEDIMENT BARRIER MAINT. This price shall be full compensation for any and all labor, tools, equipment, and incidentals necessary to complete the maintenance activities listed in these Standard Specifications.

Removal shall be paid for at the contract unit price bid per linear foot (LF) for TRIANGULAR SEDIMENT BARRIER REM. This price shall be full compensation for removal, disposal of structures and any trapped sediment, cleaning the site, and any and all labor, tools, equipment, and incidentals necessary to complete the Work.

32.08 ROCK DITCH CHECK

A. GENERAL

Rock ditch checks are small temporary dams constructed across a swale or drainage ditch for the purpose of reducing velocity of concentrated stormwater flows and to pond water, thereby reducing erosion of the swale or ditch and promoting settling of suspended solids behind the ditch check.

B. MATERIALS

Rock ditch checks shall typically be a maximum of 3 feet in height, have a minimum top width of 2 feet measured in the direction of flow with maximum side slopes of 2:1. The upstream half of the rock check dam should be constructed of 2 to 3 inch stone (breaker run) placed against Type A rock rip-rap for the downstream half of the check. Stone ditch checks shall be underlain with geotextile filter fabric. An erosion control blanket shall be placed at the base of the ditch check, extending 6 feet downstream to prevent scour and washing out the toe of the check.

C. INSTALLATION

Rock ditch checks shall be installed in locations and configuration as shown on the approved erosion and sediment control plan or as directed by the City's Project Manager.

For installation of ditch checks, finish grading ditch or channel to final shape and grades, removing all debris and large clumps of dirt. Dig a 6 inch deep trench at the location of the check to key it into the soil. Install geotextile fabric at the location of the check.

Install erosion control blanket so that it overlaps the geotextile fabric by one foot and will be held in place by rock. Staple fabric to soil as per manufacturer's Specifications. Install rock rip-rap for the downstream half of rock check. Install 2 to 3 inch breaker run stone for the upstream half of the rock check.

Ditch checks shall be utilized during rough grading and shall be removed once final grading and channel stabilization is applied, unless intended to be part of a permanent stormwater management plan.

Rock checks shall be installed such that the elevation of the ground at both ends of the check is higher than the elevation of the top of the check at the center of the ditch. This prevents the storm water from flowing around the barrier.

Rock checks shall be constructed prior to or the same day that land disturbance activities are performed up slope of the triangular sediment barriers.

32.08 ROCK DITCH CHECK (Continued)

D. MAINTENANCE AND REMOVAL

Sediment deposits shall be removed when the level of deposition reaches one half (½) of the structure height. Removed sediment shall be placed in a suitable location and in a manner that minimizes further erosion.

If, during required inspections, damage to the structure is observed the necessary repairs shall be completed within twenty-four (24) hours of the inspection.

The structure shall not be removed until the up slope area has been permanently stabilized. All materials shall be completely removed from the site and stored or disposed of properly. All ground disturbed by the removal of the structure shall be graded flush with the surrounding ground and stabilized with vegetative cover.

E. BASIS OF PAYMENT

Installation shall be paid for at the contract unit price per linear foot (LF) for ROCK DITCH CHECK INST. This price shall be full compensation for furnishing, preparing, transporting, delivering, excavating, and placing the materials, and for all labor, tools, equipment and incidentals necessary to complete the Work.

Maintenance shall be paid for at the contract unit price bid per linear foot (LF) for ROCK DITCH CHECK MAINT. This price shall be full compensation for any and all labor, tools, equipment, and incidentals necessary to complete the maintenance activities listed in these Standard Specifications.

Removal shall be paid for at the contract unit price bid per linear foot (LF) for ROCK DITCH CHECK REM. This price shall be full compensation for removal, disposal of structures and any trapped sediment, cleaning the site, and any and all labor, tools, equipment, and incidentals necessary to complete the Work.

32.09 COMPOST FILTER SOCK

A. GENERAL

A compost filter sock is a type of contained compost filter berm. It is a mesh tube filled with composted material that is placed perpendicular to sheet-flow runoff to control erosion and retain sediment in disturbed areas.

Compost filter socks are generally placed along the perimeter of a site, or at intervals along a slope, to capture and treat stormwater that runs off as sheet flow. Additionally, they can be laid adjacent to each other, perpendicular to stormwater flow, to reduce flow velocity and soil erosion. Filter socks can also be used on pavement as inlet protection for storm drains and to slow water flow in small ditches.

B. MATERIALS

1. The compost filter sock is oval to round in cross section and provides a three-dimensional filter that retains sediment and other pollutants. They are assembled by tying a knot in one end of the mesh sock, filling the sock with the composted material (usually using a pneumatic blower), and then knotting the other end once the desired length is reached. Filter socks used for erosion control are typically 12-inches in diameter. Filter socks used for stormwater inlet protection on pavement are typically 8-inches in diameter, but compressed so that the top of the filter sock is lower than the top of the curb. See the following table for minimum sock diameters based on slope and slope length:

TABLE 32.09 A – COMPOST FILTER SOCK SIZES

Slope	Slope Length (feet)	Sock Diameter (inches)
<50:1	250	12
50:1-10:1	125	12
10:1-5:1	100	12
3:1-2:1	50	18
>2:1	25	18

2. Composts used shall be weed free and derived from a well-decomposed source of organic matter. The compost shall be produced using an aerobic composting process meeting CFR 503 regulations, and meet all local, state, and Federal quality requirements. The compost shall be free of any refuse, contaminants or other materials toxic to plant growth, in addition to meeting the following:
 - a. pH of 5.0 – 8.0.
 - b. Particle size with 99% passing a 2-inch sieve and 30% passing the 3/8-inch sieve.
 - c. Moisture content of less than 60%.
 - d. Material shall be relatively free (<1% by dry weight) of inert or foreign man-made materials.
3. Wood Stakes shall be a minimum of 2" x 2" long non-treated hard wood.

C. INSTALLATION

Compost filter socks shall be placed at locations indicated on the plans and as directed by the City's Project Manager. They should be placed parallel to the base of the slope or other affected area, perpendicular to the sheet flow, and as frequently as is necessary to break-up the slope length. No trenching is required, but the composite sock should be uniformly contacting the ground surface. This may require cutting or removing heavy vegetation, and or leveling uneven surfaces. Once the filter sock is filled and put in place, it should be anchored to the slope by driving 2"x2" wooden stakes through the center of the sock at regular intervals or placing stakes on the downstream side of the filter sock.

32.09 COMPOST FILTER SOCK (Continued)

C. INSTALLATION (Continued)

The stakes shall be placed at no greater than 10-feet lineal spacing. The stake should be driven into solid ground a minimum of 12-inches. The top of the stake should be at least 3-inches above the top of the filter sock. The ends of the filter sock should be directed upslope to prevent stormwater from running around the end of the sock.

If used as curb inlet protection, the compost filter sock shall be installed as given in the Curb Inlet Section of these Standard Specifications.

D. MAINTENANCE AND REMOVAL

If during required inspections damage to the structure is observed, the necessary repairs shall be completed within twenty-four (24) hours of the inspection.

Sediment deposits shall be removed when the level of deposition reaches one-half (1/2) of the structure height. Removed sediment shall be placed in a suitable location and in a manner that minimizes further erosion. Alternatively, the City's Project Manager may approve the placement of an additional filter sock placed immediately on top of the existing sediment laden filter sock. If the filter sock becomes clogged with debris and sediment, they shall be maintained so as to assure proper drainage. The structure shall not be removed until the up slope area has been permanently stabilized. All materials shall be completely removed from the site and stored or disposed of properly. The compost may be dispersed of on-site at locations approved by the City's Project Manager.

E. BASIS OF PAYMENT

Payment for the installation of Compost Filter Sock shall be paid for at the contract unit price per linear foot (LF) for COMPOST FILTER SOCK INST. This price shall be full compensation for furnishing, preparing, transporting, delivering, excavating, and placing the materials, and for all labor, tools, equipment and incidentals necessary to complete the Work.

Payment for the maintenance of Compost Filter Sock shall be paid for at the contract unit price bid per liner foot (LF) for COMPOST FILTER SOCK MAINT. This price shall be full compensation for any and all labor, tools, equipment and incidentals necessary to complete the maintenance activities listed above.

Payment for the removal of the Compost Filter Sock shall be paid for at the contract unit price bid per liner foot (LF) for COMPOST FILTER SOCK REM. This price shall be full compensation for any and all labor, tools, equipment and incidentals necessary to complete the removal activities listed above.

32.10 BIODEGRADABLE LOG (WATTLE) DITCH CHECK

A. GENERAL

Erosion control fiber rolls commonly known as Wattles, are elongated tubes of compacted straw and/or other fibers that are installed along contours or at the base of the slopes to help reduce soil erosion and retain sediment. They function by shortening slope length, reducing runoff water velocity, trapping dislodged soil particles and ameliorating the effects of slope steepness.

32.10 BIODEGRADABLE LOG (WATTLE) DITCH CHECK (Continued)

A. GENERAL (Continued)

Wattles are used as water flow dissipaters trapping sediment when located prior to Drain Inlets, etc. Wattles are highly effective when they are used in combination with other surface soil erosion/re-vegetation practices such as surface roughening, straw mulching, erosion control blankets, hydraulic mulching and application of bonded fiber matrix or other hydraulic soil stabilizers.

B. MATERIALS

Wattles shall be a straw-filled tube of flexible netting material exhibiting the following properties. It shall be a machine-produced tube of compacted straw, rice or wheat straw, excelsior, coir, or coconut that is Certified Weed Free Forage, by a manufacturer whose principle business is wattle manufacturing. The netting shall consist of seamless, high-density polyethylene and ethyl vinyl acetate and contain ultra violet inhibitors.

The Wattle shall meet the minimum performance requirements of Table 1. The product must be guaranteed to meet all numeric performance values in Table 1 under the specific conditions as stated.

**TABLE 32.10 A – TEMPORARY EROSION CONTROL
AND SEDIMENT RETENTION WATTLE**

Property	Test Method	Units	Min. Value
Mass per Unit Weight	Field Measured	(lbs/ft)	1.6
Dimension	Field Measured	(Dia/Inches)	8.0 - 9.0
Net Strand Thickness	Field Measured	(Inches)	0.030
Net Knot Thickness	Field Measured	(Inches)	0.055
Netting Unit Weight	Certified	(Ounces/ft)	0.35
Installed Free- Board Ht.	Field Measured	(Height/Inches)	6.0 - 7.0
Straw Fiber	Field Measured	Avg. Length (in)	3.0
Fiber Content	Certified	% Straw	100

C. PREPARATION

Proper site preparation is essential to ensure complete contact of the sediment retention device (Wattle) with the soil. The slope should be prepared to receive the surface mulching/re-vegetation treatment prior to installation of the erosion control and sediment Retention Wattles. Remove all rocks, clods, vegetation or other obstructions so that the installed Wattles will have direct contact with the soil.

A small trench 2-3 inches in depth should be excavated on the slope contour and perpendicular to water flow. Soil from the excavation should be placed down-slope next to the trench.

D. INSTALLATION

Install the Wattles in the trench, insuring that no gaps exist between the soil and the bottom of the Wattle. The ends of adjacent Wattles should be tightly abutted so that no opening exists for water or sediment to pass through. Alternately, Wattles may be lapped, 6-inches minimum to prevent sediment passing through the field joint.

Wooden stakes should be used to fasten the Wattles to the soil. When conditions warrant, a straight metal bar can be used to drive a pilot hole-through the Wattle and into the soil.

32.10 BIODEGRADABLE LOG (WATTLE) DITCH CHECK (Continued)

D. INSTALLATION (Continued)

Wooden stakes should be placed 6" from the Wattle end angled towards the adjacent Wattle and spaced at 2 feet leaving less than 1-2 inches of stake exposed above the Wattle. Alternately, stakes may be placed on each side of the Wattle tying across with a natural fiber twine or staking in a crossing manner ensuring direct soil contact at all times.

Terminal ends of wattles may be dog legged up slope to ensure containment and prevent channeling of sedimentation.

Backfill the upslope length of the Wattle with the excavated soil and compact.

Care shall be taken during installation so as to avoid damage occurring to the Wattle as a result of the installation process. Should the Wattle be damaged during installation, a wooden stake shall be placed either side of the damaged area terminating the log segment.

Field monitoring shall be performed to verify that the placement does not damage the Wattle. Any Wattle damaged during placement shall be replaced as directed by the City's Project Manager, at the Contractor's expense.

E. MAINTENANCE AND REMOVAL

The Wattles shall be inspected after installation to insure that they are trenched-in and that no gaps exist under the wattles or between adjacent ends of the wattles.

Sediment deposits that impair the filtration capability of the wattle shall be removed when the sediment reaches one-third of the wattles functional freeboard height. Removed sediment shall be deposited within the project in such a way that the sediment is not subject to erosion by wind or water, or as directed by the City's Project Manager.

Installed Wattles shall be removed and-or replaced as required to adapt to changing conditions.

When no longer required for the intended purpose, as determined by the City's Project Manager, temporary wattles shall be removed from the site. As an option, the straw wattles may be slit down the length of the netting, and the straw may be used on-site as directed by the City's Project Manager. The netting shall be gathered and disposed of in regular means as it is non-hazardous, inert material.

Trenches, depressions or any other ground disturbances caused by the removal of the temporary straw wattles shall be backfilled and repaired with the excess sediment captured by the wattle, prior to spreading the straw or other final erosion control protection.

F. BASIS OF PAYMENT

Installation shall be paid for at the contract unit price per linear foot (LF) for BIODEGRADABLE LOG DITCH CHECK INST. This price shall be full compensation for furnishing, preparing, transporting, delivering, excavating, and placing the materials, and for all labor, tools, equipment and incidentals necessary to complete the Work.

32.10 BIODEGRADABLE LOG (WATTLE) DITCH CHECK (Continued)

F. BASIS OF PAYMENT (Continued)

Maintenance shall be paid for at the contract unit price bid per linear foot (LF) for BIODEGRADABLE LOG DITCH CHECK MAINT. This price shall be full compensation for any and all labor, tools, equipment, and incidentals necessary to complete the maintenance activities listed in these Standard Specifications.

Removal shall be paid for at the contract unit price bid per linear foot (LF) for BIODEGRADABLE LOG DITCH CHECK REM. This price shall be full compensation for removal, disposal of structures and any trapped sediment, cleaning the site, and any and all labor, tools, equipment, and incidentals necessary to complete the Work.

32.11 TRANSITION MAT

A. GENERAL

Transition Mat is a permanent solution to eliminate scour at the outlets of stormwater pipe systems. The Transition Mat combines vegetation with structural measures to mechanically protect soil from scour and erosion.

B. MATERIALS

1. Transition Mats will be made of high density polyethylene plastic with openings to allow vegetation to grow through the mat.
2. Seeding or sodding under the Transition Mat will be as per plan.
3. Anchor type for the Transition Mats will be as per the manufacturer's recommendation.
4. If Turf Reinforcement Mat is used under the Transition Mat the type of Turf Reinforcement Mat will be as per plan.

C. INSTALLATION

The Transition Mat will be installed on top of sod or Turf Reinforcement Mat. Transition mats will not be installed upon bare ground. Installation methods vary depending upon the amount of stormwater discharge, size of the pipe and site conditions. The installation method will be as per plan.

Anchors will be used to tie the Transition Mat firmly to the ground. Anchors will be embedded a minimum of (24) twenty-four inches into the ground. If loose soil or saturated soil is found under the Transition Mat the anchors will be embedded to a depth required to reach dry compacted material which will hold the anchors firmly in place. Anchors will be spaced per manufacturer's recommendation.

D. BASIS OF PAYMENT

Installation shall be paid for at the contract unit price per square foot (SF) for TRANSITION MAT. Seeding, sodding, or Turf Reinforcement Mat installed under the Transition Mat and anchors used to secure the Transition Mat shall be subsidiary to the installation of the mat. This price shall be full compensation for furnishing, preparing, transporting, delivering, excavating, and placing the materials, and for all labor, tools, equipment and incidentals necessary to complete the Work.

32.12 COIR FIBER LOG REVETMENTS

A. GENERAL

Coir Fiber Logs are installed along the toe of the streambank in order to effectively manage changes in stream flow velocity, providing channel stabilization until vegetation has established. Coir fiber logs are biodegradable and once installed, will remain in place until they decompose.

B. MATERIALS

1. Coir Fiber Logs shall be BioLog, BioD-Roll or approved equal. Coir Fiber Logs shall be made of 100 percent coconut (coir) fiber fill and bound by high strength coir netting with outer net openings of 2" x 2". Logs shall be 12 inches in diameter with an average weight of 5 lbs/ft and density of 7 lbs/cubic foot.
2. Wood Stakes shall be a minimum of 2" x 2" x 36" long non-treated hard wood.

C. INSTALLATION

Coir Fiber Logs shall be installed along the toe of the streambank, trenched in 3 inches and staked at 2' on center or as per the manufactures recommended installation, whichever is more stringent.

When used in conjunction with an erosion control blanket or turf reinforcement mat, the blanket or mat shall be installed under the coir log, within the 3 inch trench and staked into place with the installation of the coir logs. The remaining portion of the blanket or mat shall be installed and stapled per plans or Standard Specifications

D. MAINTENANCE

If, during required inspections, erosion and undermining beneath the log is observed, the log shall be pulled up and any lost soil shall be replaced and the log shall be reinstalled.

E. BASIS OF PAYMENT

Coir Fiber Logs, constructed in accordance with the plans and these Standard Specifications and accepted by the City's Project Manager, shall be measured and paid for at the contract unit price bid per linear foot for COIR FIBER LOG. Measurement shall not include overlapping sections. Such payment shall be full compensation for all coir logs, wood stakes, excavation, slope preparation, fine grading, equipment, materials, tools, labor, and incidentals necessary to complete the Work.

Maintenance shall be paid for at the contract unit price bid per linear foot (LF) for COIR FIBER LOG MAINT. This price shall be full compensation for any and all labor, tools, equipment, and incidentals necessary to complete the maintenance activities listed in these Standard Specifications.

CITY OF LINCOLN NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 33

IRRIGATION WORK

ARTICLE	TITLE	
33.00	DESCRIPTION	3302
33.01	QUALITY ASSURANCE	3303
	A. MANUFACTURER'S QUALIFICATIONS	3303
	B. MATERIALS	3303
	C. GENERAL IRRIGATION REQUIREMENTS	3303
	D. EXPLANATION OF DESIGN AND PLANS	3303
	E. SUBMITTALS	3303
	F. PERMITS AND INSPECTIONS	3304
	G. FIELD RECORD DRAWINGS	3304
	H. SITE CHECK	3304
	I. DELIVERY, STORAGE AND HANDLING	3304
33.02	MATERIALS	3304
	A. ACCEPTABLE MANUFACTURERS	3304
	B. COPPER PIPING	3305
	C. PVC PIPE	3305
	D. POLYETHYLENE PIPE	3305
	E. SPRINKLER RISER	3305
	F. GATE VALVES	3305
	G. DRAIN VALVES	3305
	H. REMOTE CONTROL VALVES	3305
	I. BACKFLOW PREVENTER	3306
	J. WIRING	3306
	K. AUTOMATIC CONTROLLERS	3306
	L. SHRUB AND LAWN SPRINKLER HEADS	3306
	M. REMOTE CONTROL VALVES	3306
	N. WIRELESS VALVE SYSTEM	3307
	O. AUTOMATIC VALVES	3307
	P. VALVE BOXES	3307
	Q. IRRIGATION CONTROL WIRING	3307
	R. COPPER TRACER WIRE	3307
	S. BACKFLOW DEVICE	3307
	T. RAIN SHUT-OFF	3308
	U. QUICK COUPLER VALVES	3308
	V. BACKFLOW ENCLOSURE	3308
33.03	SYSTEM DESIGN	3308
	A. DESIGN PRESSURES	3308
	B. DESIGN VELOCITIES	3308
	C. LOCATION OF SPRINKLER HEADS	3309
	D. SECTIONING OF IRRIGATION SYSTEM	3309
	E. PIPING	3309
	F. EXCAVATING AND BACKFILLING	3309

CITY OF LINCOLN NEBRASKA, STANDARD SPECIFICATIONS

CHAPTER 33

IRRIGATION WORK

ARTICLE	TITLE	
33.04	INSTALLATION	3310
	A. INSTALLATION SCHEDULE AND IMPLEMENTATION	3310
	B. INSPECTION	3310
	C. TRENCHING/HORIZONTAL BORING	3311
	D. BACKFLOW PREVENTER	3311
	E. CIRCUIT VALVES	3311
	F. PLASTIC PIPELINE FITTINGS	3312
	G. CONTROL AND COMMON WIRE INSTALLATION	3313
	H. AUTOMATIC CONTROLLER	3313
	I. CONTROL VALVES	3313
	J. VALVE BOXES	3313
	K. DRAINAGE	3313
	L. SPRINKLER HEADS	3313
	M. FLUSHING AND TESTING	3313
	N. ADJUSTMENTS	3314
33.05	PROTECTION AND REPAIRS	3314
33.06	CLEAN UP	3314
33.07	FINAL INSPECTION	3315
33.08	MAINTENANCE	3315
33.09	OPERATION	3315
33.10	REPLACEMENT AND GUARANTEE	3316
33.11	QUALIFICATIONS FOR SUBMITTING BIDS	3316

CHAPTER 33

IRRIGATION WORK

33.00 DESCRIPTION

The Work described in this section shall pertain to any irrigation system. Work shall include all labor, material and equipment as well as obtaining all tap fees, permits as may be required to complete the irrigation system as herein specified. The Work shall comply with the requirements of all legally constituted authorities having jurisdiction.

Irrigation materials shall mean pipe, irrigation heads, valves, valve boxes, controller, wiring, backflow device, quick coupler valves, protective covers and all description required to be furnished for the project, in accordance with City of Lincoln Standard Plans, Special Provisions, and these Standard Specifications.

This Work shall consist of furnishing, delivering and installation of all irrigation material and all operations incidental thereto, in accordance with these Standard Specifications and the Special Provisions, including the following:

1. The regulation and adjustment of all sprinkler heads, timed sequence control devices, sectional valves, rain sensor, etc.
2. The provision of a qualified, sprinkler system technician to instruct the City's operating personnel in the maintenance and operation of the irrigation system.
3. Arrange for, obtain, and pay for all necessary permits, bonds, and fees.
4. Excavating and backfill and compaction for all Work as specified, and is to include all machinery and labor.
5. To complete underground irrigation system from the point of connection, throughout the site, including piping, fittings, valves, drains, sprinkler fittings, sprinkler heads, automatic controller(s) and any other necessary appurtenances.
6. To furnish and install all piping, fittings, valves, valve boxes, valve covers, electric valve wiring and appurtenances.
7. To furnish and install all automatic control devices and connect controller to electric service.
8. To test the entire piping and wiring systems.
9. To furnish and install sprinkler heads.
10. To regulate and adjust all sprinkler heads, timed sequence control devices, sectional valves, rain sensor, etc.

33.01 QUALITY ASSURANCE

A. MANUFACTURER'S QUALIFICATIONS

Provide underground irrigation system as a complete unit, including heads, valves, controls and accessories.

B. MATERIALS

Equipment and methods of installation shall comply with the following codes and standards:

- National Fire Protection Association (NFPA); National Electrical Code
- American Society for Testing and Materials (ASTM)
- National Sanitation Foundation (NSF)
- The Irrigation Association (IA)

C. GENERAL IRRIGATION REQUIREMENTS

Work shall be performed in accordance with the best standard of practice relating to the various trades and under the continuous supervision of an experienced irrigation capable of designing, electronically drawing, and interpretation of Standard Specifications appropriate for the project.

The Contractor shall coordinate the Work of this section with site earthwork, plumbing, electrical, concrete Work and other trades and schedule in a manner to avoid damage to other Work.

D. EXPLANATION OF DESIGN AND PLANS

It is intended that the Design represented by the Plans and Specifications specify an efficient and complete irrigation system for use in accordance with the Manufacturer's recommendations and meeting the City's Project Manager's approval.

The Irrigation Designer/Contractor shall verify the authenticity of all finish grades within the project area of insurance of proper coverage of the sprinkler system. All finish grades shall be approved in writing prior to installation of the irrigation system. Contractor shall further verify the onsite water pressure. System design is based upon static pressure at the point of connection of each tap with a minimum operating pressure at the irrigation head of 25 psi.

E. SUBMITTALS

Submit manufacturer's product data and installation instructions for each of the system components.

Submit shop drawings for underground irrigation system, including plan layout and details illustrating location and type of heads, valves, piping circuits, controls and accessories. Submit technical data supporting layout design, including individual circuit (section) GPM and pressure loss calculations.

33.01 QUALITY ASSURANCE (Continued)

F. PERMITS AND INSPECTIONS

All Work shall comply in every respect with all city, county and state requirements, laws, ordinances, and rules.

The irrigation Contractor shall obtain and pay for all licenses, permits, and inspections as required by law for the Work specified herein and the accompanying plans.

This will include backflow prevention equipment with shutoff valves and unions for removal.

G. FIELD RECORD DRAWINGS

Upon completion of the irrigation system, a complete 'record drawing' will be submitted to the City's Project Manager. This drawing shall include a hard copy or an electronic file compatible with the City's CAD system and shall indicate thereon all pipe sizes, valve locations, dimensional data from building walls or column center lines, to the piping and valves, sprinkler heads, etc. Accompanying the record drawings shall be instruction sheets and parts lists, covering all operating equipment, bound into a folder.

H. SITE CHECK

Contractor shall carefully examine the Work site, local conditions, Standard Specifications and plot plan for any existing utilities. Any damage to existing utilities or existing structures shall be repaired by the Contractor at no cost to the City.

I. DELIVERY, STORAGE AND HANDLING

Deliver irrigation system components in manufacture's original undamaged and unopened containers with labels intact and legible.

Deliver plastic piping in bundles, packaged to provide adequate protection of pipe ends, both threaded and unthreaded.

Store and handle materials to prevent damage and deterioration.

Provide secure, locked storage for valves, sprinkler heads, and similar components that cannot be immediately replaced to prevent installation delays.

33.02 MATERIALS

A. ACCEPTABLE MANUFACTURERS

Many of the materials chosen for the design of the sprinkler system, have been specifically referred to by the manufacturer's name so as to enable the City to continue to install similar equipment as utilized on previous projects in the project area. Acceptable manufacturers include:

Rain Bird

Or equal, if and specifically listed and approved by special provision or addendum during the bidding period.

33.02 MATERIALS (Continued)

B. COPPER PIPING

Copper piping shall be Type K, hard copper, and will be used on all exposed pipe, i.e. back flow preventer, etc.

Copper pipe fittings shall be wrought solder-type cast solder-joint fittings.

C. PVC PIPE

All PVC pipe shall be virgin, high impact, polyvinyl chloride having a minimum working pressure rating of Class 200 or Schedule 40. All PVC pipe shall be continuously and permanently marked with the manufacturer's name, material size, and schedule of type. Pipe shall conform to U.S. Department of Commerce Commercial Standard CS 207-60, or latest revision. Material shall conform to all requirements of PVC 1120, ASTM D-1785, or latest revision.

Priming and solvent welding shall cause complete leak proof plasticized joint upon evaporation. Solvent shall conform to U.S. Government Specification No. GS-256.63.

D. POLYETHYLENE PIPE

ASTM 2239 flexible polyethylene pipe rated at 100 psi minimum working pressure.

E. SPRINKLER RISER

Flexible swing pipe on heads using 3 gal. /min. or less pvc schedule 40 unitized swing joint on head using more than 3 gal. /min.

F. GATE VALVES

Manufacturer's standard of type and size required brass construction conforming to A.W.W.A. Specifications.

G. DRAIN VALVES

Manufacturer's standard of type and size required.

½" Model AFD-0500 antifreeze drain valve manufactured by Kbi or equal, if and as specifically listed and approved by special provision or addendum during the bidding period.

H. REMOTE CONTROL VALVES

Manufacturer's standard of type and size required.

All valves will be located in valve boxes 12 inch minimum, plastic construction as manufactured by Amtek Corp. Valve box shall be vandal resistant. Lift off lids are not acceptable.

33.02 MATERIALS (Continued)

I. BACKFLOW PREVENTER

The backflow preventer shall be of brass construction conforming to City of Lincoln Standard Requirements for turf irrigation systems. Building and Safety recognize two (2) devices appropriate for irrigation systems:

- Reduced Pressure (RP) principle backflow preventer
- Pressurized Vacuum Breaker (PVB)

The PVB must be installed a minimum of 12" above the highest sprinkler head or outlet on the system.

J. WIRING

Electric control wires from each controller to the automatic valves shall be direct burial UF wire of a different color than the black and white wires used on the 115 volt A.C. power. Ground wire shall be a different color than the control lines. A ground wire shall be required for each controller.

All wire shall be spliced only at valve locations. Minimum size shall be 14 gauge, solid single conductor, copper.

Provide 10" expansion coil at each valve and at 100 ft. intervals.

K. AUTOMATIC CONTROLLERS

Automatic controller shall be a Rainbird ESP LXM or approved equal, pedestal mounted. Controller shall be located in a metal, weather proof and locking housing and shall be installed adjacent to the back flow device. Electrical power (120v, 5a) supply and hook-up to the automatic irrigation controller shall be provided by the owner at the location shown on the irrigation plan.

The controller to be installed and wired in accordance with the manufacturer's published instructions.

Construction: Controller shall be enclosed in a structure having a hinged cover with provision for locking. Controller shall be completely electric in operation and shall not employ hydraulic tubing, or otherwise introduce into the controller water or other fluids subject to freezing or leakage.

Location of controller is indicated on Plans.

L. SHRUB AND LAWN SPRINKLER HEADS

All full and part circle sprinkler bodies and nozzles. These sprinklers shall be of the pop-up type. Spacing of the heads shall not exceed the manufacturer's maximum recommendations.

Matched precipitation will be required on all full and part circle sprinklers on the same zone.

M. REMOTE CONTROL VALVES

Manufacturer's standard of type and size required.

33.02 MATERIALS (Continued)

N. WIRELESS VALVE SYSTEM

Must include a fully submersible battery-powered control unit, waterproof and able to perform system checks, up to 100' away without direct access to the control, solenoid design for minimal power consumption, full submersible and waterproof to 12 feet, ability to set each valve up with own start time, run time and day schedule, double-sealed battery compartment and weather sensor compatible.

O. AUTOMATIC VALVES

Remote control valves shall be solenoid operated, diaphragm, globe-type having IPS threads and suitable for underground burial without protection.

Construction: Valve shall be packless, without sliding seals, and completely serviceable without removing body from pipeline. Design shall be normally closed requiring solenoid to be energized to open valve, thereby causing automatic closure in event of power failure. Solenoid shall be comply with Class 2 National Electric Code and when operating require a maximum of 3.0 watts 24 volts AC. Solenoid shall be coated in epoxy to form a corrosion and moisture proof unit with exposed metal components of non-corrosive material.

P. VALVE BOXES

New control valves shall be installed in 12" standard valve box. All valve boxes shall be as manufactured by Ametek, Caroson or approved equal. Valve boxes shall be installed on a minimum of one (1) cubic foot base of washed gravel for proper foundation of box and easy leveling of box to proper grade and also to provide proper drainage of the valve box. Lift off lids are not acceptable.

Q. IRRIGATION CONTROL WIRING

All new wiring to be used for connecting the automatic controller to the electric remote control valves shall be type UF600V, #14, single wire direct burial PE irrigation control cable. It shall be UL listed and have a 4/64" covering of I.C.C. 100 compound insulation. All pilot or "hot" wires are to be of one color and all "common" wires are to be another color. The Contractor is to install two wires of another color in conjunction with the common wire. These extra wires will be used in the case of wire failure. The additional wires shall be a different color than the control and common wires. All wire connections shall be made with 3M DBY connectors.

R. COPPER TRACER WIRE

Copper tracer wire should be installed with all piping so that the system made is easily found for purposes of adjustments, repairs, and replacements.

S. BACKFLOW DEVICE

The backflow preventer shall be a Febco 765 or approved equal (size as on drawing) pressure type backflow. Size and location shall be per the Irrigation Plan and details or approved equal.

33.02 MATERIALS (Continued)

T. RAIN SHUT-OFF

A rain sensing device shall be installed which will override the automatic setting in the event of rain. This device shall be a 'Rain Check', manufactured by Rainbird or equivalent. The device shall be mounted in a location unobstructed by walls, trees, or other hindrances, and shall be located so as not to be vandalized. Contractor shall verify the location and routing or control wires with the City's Project Manager prior to installation.

U. QUICK COUPLER VALVES

All quick couplers shall be of 5RC body, 55K key and an SH1 swivel 1" shaft x 1" MPT x 3/4" hose thread. Quick coupling valves shall be located within a weather resistant plastic valve box 6 inch minimum, with lockable lid. Do not locate within paved surfaces. Top of quick coupler valves shall be as close to the top of valve box as possible, with a means to anchor coupler valve to prevent it from unthreading from the riser.

A 4" deep layer of coarse gravel shall be placed within the valve box beneath the bottom of the valve.

Backfill shall consist of clean soil free from stones larger than 1" diameter, foreign matter, organic matter and debris. Suitable excavated materials removed to accommodate the irrigation system Work may be used as fill. Imported fill material may be used as required to complete the Work. The Contractor shall obtain rights and pay all costs for imported materials.

Drainage backfill shall be clean gravel or crushed stone, graded from 3/4" minimum to 3" maximum.

Copper Wire installed shall be: #12 awg copper wire with National Electrical Code type THHN/THWN insulation.

V. BACKFLOW ENCLOSURE

The backflow device shall have a steel locking vandalism resistant enclosure approved by the City's Project Manager.

33.03 SYSTEM DESIGN

System Design should not begin until all existing conditions are satisfactorily understood

A. DESIGN PRESSURES

Determine from the City of Lincoln Public Works Department. Actual working pressure in an individual circuit shall fall between manufacturer's recommended minimum and maximum operating pressures for the last sprinkler head in the circuit.

B. DESIGN VELOCITIES

Velocity of water in sprinkler system should not exceed 5 - 6 fps.

33.03 SYSTEM DESIGN (Continued)

C. LOCATION OF SPRINKLER HEADS

Except for roadway medians, begin sprinkler head location at areas to be bordered (sidewalks, etc.) Fill in with sprinklers in the middle areas. Design for 100% radius overlap coverage. Locate sprinkler heads based on triangular spacing wherever possible. Locate sprinkler heads so that trees are approximately halfway between heads wherever possible. Do not overspray sidewalks, roadways, or pavements.

D. SECTIONING OF IRRIGATION SYSTEM

Individual circuits shall be designed so that total gallons per minute (GPM) required per circuit does not exceed available GPM. System shall be designed so that areas irrigated by individual circuits exhibit compatible conditions, including soil type, plant material type and sun exposure. System shall be designed so that sprinkler head types and precipitation rates of sprinklers are compatible on same circuit. Design system so that circuits furthest from supply require lowest total GPM. Design system so that each section includes one quick coupling valve.

E. PIPING

Piping should be laid out as to avoid sides of structures, odd angles, unbalanced friction losses, high friction losses, and excessive trenching.

F. EXCAVATING AND BACKFILLING

An excavation shall be considered unclassified excavation and include all materials encountered.

Excavate trenches of sufficient depth and width to permit proper handling and installation of pipe and fittings.

If the pulling method is used, the pipe "plow" shall be a vibratory type. Starting and finishing holes for pipe pulling shall not exceed 1'-0" by 3'-0" opening.

Excavate to depths required to provide 2" depth of earth fill or sand bedding for piping when rock or other unsuitable bearing material is encountered.

Fill to match adjacent grade elevations with approved earth fill materials. Place and compact fill in layers not greater than 6" DEPTH. Provide approved earth fill or sand to a point 4" above the top of pipe. Fill to within 6" of final grade with approved excavated or borrow fill materials free of lumps or rocks larger than 1" any dimension. Provide clean topsoil free of rocks and debris for top 6" of fill. Install irrigation lines with a minimum cover of 24" for main lines. 12" for laterals based on existing finished grade.

Excavate trenches and install piping and fill during the same working day. Do not leave trenches or partially filled trenches open overnight.

33.04 INSTALLATION

A. INSTALLATION SCHEDULE AND IMPLEMENTATION

The irrigation Work shall be scheduled by the Irrigation Contractor in such a way that existing underground utilities are protected.

The location of each run of pipe, mainline or laterals, and all irrigation head and valves, shall be staked out by the Irrigation Contractor prior to trenching. All pipe, valves, fittings, etc. shall be carefully placed in the locations as shown on the plans and details. The interior of pipes shall be kept free from dirt and debris and when pipe laying is not in progress, open ends of pipes shall be closed by approved means.

B. INSPECTION

When the Irrigation Contractor is prepared for one of the required inspections, the Contractor shall give the City's Project Manager adequate notice to visit the site and perform the inspection. This does not preclude the right of the City's Project Manager to make informal inspection at any time during the Work of this section. The required inspections for which the Irrigation Contractor must notify the City's Project Manager are as follows:

1. UTILITY AND IRRIGATION EQUIPMENT LOCATION STAKING

The City's Project Manager shall inspect the proposed locations of all Irrigation lines and heads for conformance to the Plans and Specifications. The City's Project Manager reserves the right to move, shift or adjust any or all of the proposed locations to better achieve the design intentions as shown on the plans.

2. WIRING INSPECTION

When the wiring has been installed, City's Project Manager shall inspect for conformance to these Plans and Specifications.

3. COVERAGE TEST

After the sprinkler heads have been installed and backfilling operations are complete, the Irrigation Contractor, in the presence of the City's Project Manager, shall perform a coverage test to determine if the irrigation system reaches all parts of the areas to be sodded.

4. STAKING AND LAYOUT

The Irrigation Contractor shall provide all materials necessary for the staking of the irrigation system. All irrigation heads are to be flagged for the City's Project Manager's observation. Contact the City's Project Manager, in advance, and request inspection of the layout. The City's Project Manager will observe layout and indicate any changes as needed.

33.04 INSTALLATION (Continued)

C. TRENCHING/HORIZONTAL BORING

Trenches shall be excavated straight and true with the bottom of the trench uniformly sloped to low points.

Minimum cover over top of installed piping shall be:

- Mainline - 18" minimum
- Lateral Lines - 12" minimum
- Piping under pavement - 24" minimum
- Sleeves - 18" minimum

Trenches shall be backfilled with clean material from excavation. Remove organic material as well as rocks and debris larger than 1" diameter. Place acceptable backfill material in 6" lifts, compacting each lift and flush with water to settle trench except for pavement. The site shall be continuously cleaned up of excess and/or waste materials as the backfilling progresses and shall be left in a neat and workmanlike condition.

Where trenching is required across existing lawns, cut sod uniformly in strips 6" wider than the trench. Remove sod in rolls of suitable size for handling and keep moistened until replanted or replaced.

Backfill trench to within 6" of finished grade and continue fill with acceptable topsoil, compacting the fill to bring sod even with the existing lawn.

Replant sod within (7) days after removal, roll and water generously.

Reseed and restore to original conditions any sod areas not in healthy condition equal to adjoining lawns 30 days after replanting.

D. BACKFLOW PREVENTER

Install backflow prevention valve, pump, booster pump, fittings and accessories required to complete the system. Provide union on downstream and upstream side. Install minimum 12" above highest ground level sprinkler head.

E. CIRCUIT VALVES

Install in accordance to the manufacturer's instructions. Install in valve box, arranged for easy adjustment and removal. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the access box. Provide union on downstream and upstream side. Seal threaded connections on pressure side of control valves with Teflon tape or plastic joint type compound. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.

33.04 INSTALLATION (Continued)

F. PLASTIC PIPELINE FITTINGS

1. INSTALLATION

All workmanship and materials shall be in conjunction with all applicable local codes and ordinances of legally constituted authorities; where the provisions of these Standard Specifications exceed such requirements, these Standard Specifications shall govern. All plastic pipe shall be installed in a manner so as to provide for expansion and contraction as recommended by the Manufacturer.

2. SOLVENT-WELD PIPE AND FITTINGS

Install pipe in dry weather when temperature is above 40 degrees F and in accordance with manufacturer's installation directions. Provide for thermal expansion and contraction. Solvent-weld plastic pipe shall be cut with a pipe cutter or fine-tooth hacksaw with the assistance of a square-in sawing device or in a manner so as to assure a square cut. Burrs and cut ends shall be removed prior to installations so that smooth, unobstructed flow will be obtained. Only the solvent recommended by the manufacturer shall be used. The solvent-weld joints shall be made in the following manner:

Thoroughly clean the mating pipe and fitting with a clean dry cloth. Use primer on connections prior to solvent welding.

Apply a uniform coat of solvent to the outside of the pipe with a nonsynthetic bristle brush. Apply solvent to the fitting in a similar manner. Re-apply a light coat of solvent to the pipe and quickly in-set it into the fitting.

Give the pipe or fitting a quarter (1/4) turn to insure even distribution of solvent and make sure the pipe is inserted to the full depth of the fitting socket. Hold in position for thirty (30) seconds. Wipe off excess solvent that appears at the outer shoulder of the fitting. Care should be taken so as not to use an excessive amount of solvent, thereby causes a weakening or obstruction on the inside of the pipe. The joints in the PVC pipe shall be allowed to set at least twenty-four (24) hours before pressure is applied to the system at a temperature above 40 degrees F.

The pipe shall be installed and maintained at the proper lines and grades with joints centered and with fittings and other appurtenances at the required locations.

All risers to heads shall be constructed of nipples or elbows to permit height adjustment of head. Install heads two inches back of any hard surface.

3. LINES UNDER PAVEMENT

Provide sleeves (as required) using PVCE pipe sized under walks and paving. Location and depths of sleeves shall be noted on the As-Built Irrigation Plan. All sleeving shall be twice the diameter of the irrigation pipe.

33.04 INSTALLATION (Continued)

G. CONTROL AND COMMON WIRE INSTALLATION

Control, common and extra wires shall be installed beside the mainline and in sleeves where required. Wire shall then be placed as loose as possible to allow for expansion and contraction of the wire. Verification of the wire types and installation procedure should be checked to conform to local codes. Connecting and splicing of wire at the valve or in the field will be made by using DBY wire connectors (as designated by the Details). The Irrigation Contractor shall isolate field splices in one (1) central location, in a valve box, if possible. All field splices shall be installed in an Ametek or Carson valve box.

H. AUTOMATIC CONTROLLER

The Automatic Controller and protective enclosures shall be installed adjacent to the backflow device when possible. Alternative locations must be discussed with City's Project Manager. Install box guard shack or equal enclosure per manufacturer's Specifications.

I. CONTROL VALVES

Connect each remote control valve to one station of a controller. Connect remote control valves to a common ground wire system independent of other controllers. Make wire connections to remote control electric valves and splices of wire in the field, using DBY wire connectors in accordance with manufacturer's recommendation.

J. VALVE BOXES

Control valve boxes shall be installed on a minimum of one (1) cubic foot base of clean gravel for proper foundation of box and easy leveling of box to proper grade and also to provide drainage of the valve box.

K. DRAINAGE

Drainage pits shall consist of two (2) cubic foot well, filled to capacity with crushed stone. Drain locations shall be determined on job site by the irrigation Contractor. Provide drains at all low points on the branch piping and in the main at intervals not to exceed 200 feet of pipe.

L. SPRINKLER HEADS

Unless otherwise specifically designated on the Plans, the installation of irrigation heads shall include the excavation and backfill, furnishing, installing and testing of risers, fittings and irrigation heads in accordance with the Plans and Specifications. All irrigation heads shall be installed with pipe or swing joint assemblies as per details.

M. FLUSHING AND TESTING

After all new irrigation piping is in place and connected for a given section, and all necessary division Work has been completed, prior to the installation of the pop-up nozzles, all control valves shall be opened and a full head of water used to flush out the system. Pressure test all lines before join areas are backfilled. Backfill a portion of the trench to maintain pipe stability during test period. All mainline piping shall be tested at hydraulic pressure of 100 PSI. Upon visual inspection of each joint and the ground, any leak detected shall be repaired. The line shall be re-tested until the necessary repairs made to the system are in good working order. After testing, the system shall be flushed with the operation flow passing through each pipe, beginning with the larger mains and continuing through the smaller mains in sequence.

33.04 INSTALLATION (Continued)

N. ADJUSTMENTS

Upon completion of the performance system testing, all necessary repairs and adjustments shall be made.

Adjust sprinklers after installation for proper and adequate distribution of the water over coverage pattern. Adjust for the proper arc of coverage.

The irrigation Contractor and their assignees shall continue to be responsible for properly making any additional adjustments during the maintenance period.

Tighten nozzles on spray type sprinklers after installation. Adjust heads to achieve required coverage and precipitation rates.

Adjust all electric remote control valve pressure regulators and flow control stems for system balance and optimum performance.

Test and demonstrate the controller by operating appropriate day, hour and station selected features as required to automatically start and shut down irrigation cycles to accommodate plant requirements and weather conditions.

33.05 PROTECTION AND REPAIRS

It shall be the responsibility of the Irrigation Contractor to protect and preserve any existing structures, concrete walls, etc. from damage during irrigation construction. If damage does occur, all damage shall be completely repaired or restored by the Irrigation Contractor at no additional cost to the project.

33.06 CLEAN UP

Perform clean up as a continuous operation throughout the duration of the Work. Remove from site all excess materials, soil, debris and equipment. Repair damage resulting from irrigation system installation.

Protect irrigation system and materials from damage due to performance of Work, operation by other Contractors, trades and trespassers. Maintain protection during installation and testing periods.

The entire site shall be left clean, neat and free of debris.

The Contractor shall be responsible for all damage caused by operations to trees, shrubs, curbs, paving, structures, utilities, etc. on the site or adjacent to the site of Work and shall repair, replace or otherwise make good any damage caused by Work.

33.07 FINAL INSPECTION

When the Irrigation Contractor is satisfied that the system is operating properly, that it is balanced and adjusted, and that all Work and clean up is completed, the Contractor shall notify the City's Project Manager that the Work is prepared for Final Inspection. At the given time, the sprinkler system will be inspected for the following:

- Sprinkler heads adjusted to grade
- Sprinkler heads properly aligned
- Nozzles properly adjusted
- Broken heads replaced
- Missing heads replaces (stolen or otherwise)
- Broken risers replaced
- Gate valves and control valves operation properly and not leaking
- Controller operating properly and programmed

Any inconsistencies to the Standard Specification will be noted by the City's Project Manager and a written copy of corrections will be given to the Irrigation Contractor. The City's Project Manager will not accept the system until the corrections from the final inspection have been made by the Irrigation Contractor and an "as built " drawing(s) in both hard copy and electronic format including plan layout and details illustrating location and type of heads, valves, piping circuits, controls and accessories shall be delivered to the City's Project Manager.

33.08 MAINTENANCE

The maintenance of the irrigation system once installed needs to include:

- A description of routine maintenance for (1) year must be developed. Spring start ups and winterization must be included as well as regular monthly check-ups throughout the season of operation.
- A schedule for (1) year of maintenance must be submitted for review by the City's Project Manager, agreed upon and followed by the Contractor.
- Maintenance responsibilities must be assigned to an appointed and qualified employee or outsourced to a private company which specializes in the maintenance and repair of irrigation systems.

33.09 OPERATION

The operation of the system is critical to delivering the correct amount of water required by the plant material.

The watering schedule must be created around the anticipated water requirements of the plant material. A watering schedule must be developed to assure plant material is receiving adequate water. The schedule should be developed in consultation with the City's Project Manager. The water schedule must be assigned to an appointed and qualified employee or outsourced to a private company.

33.10 REPLACEMENT AND GUARANTEE

The new irrigation system workmanship and materials shall be guaranteed for the period of one (1) year from the date of acceptance of Work. The irrigation Contractor shall be responsible for proper winterization of the irrigation system during the one (1) year guaranteed period. This shall include at least one winterization and one spring charge-up of the system.

Should any trouble develop within the time specified above due to faulty materials or material, the defect shall be corrected by the Irrigation Contractor without expense to the owner. The irrigation Contractor is not responsible for repair of sprinkler system due to vandalism, fire, theft acts beyond the Contractor's control.

33.11 QUALIFICATIONS FOR SUBMITTING BIDS

The installation of the irrigation system needs to be performed at a level which will insure the longevity of the system. It is recommended that the Contractor performing the Work must:

- Be a certified irrigation Contractor and fully insured and licensed.
- Be able to demonstrate a minimum work experience record.
- Have successfully completed projects similar in scope and scale.

CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

APPENDIX A

PAY ITEM LIST

Standard Item No.	Standard Item Description	Section	Unit
01.00001	Mobilization	GENERAL	LS
01.01001	Const Staking	GENERAL	LS
01.02001	Survey Monument and Box	GENERAL	EA
01.03001	Property Pin Establishment	GENERAL	EA
01.04001	Pavt & Sidewalk Rem	GENERAL	CY
01.05001	Sawing, Type "A"	GENERAL	LF
01.06001	Sawing, Type "B"	GENERAL	LF
01.07001	Sawing, Type "C"	GENERAL	LF
01.08001	Sawing, Type "D"	GENERAL	LF
01.09001	Wheel Sawing	GENERAL	LF
01.11001	Adj MH to Grade	GENERAL	EA
01.12001	Adj Inlet to Grade	GENERAL	EA
01.12002	Adj Grate Inlet to Grade	GENERAL	EA
01.13001	Adj Water Valve Box To Grade	GENERAL	EA
01.13002	Adj Water Stop Box to Grade	GENERAL	EA
02.01001	Gen Clearing & Grubbing	EARTHWORK	LS
02.02012	Tree Rem (12" to 23")	EARTHWORK	EA
02.02024	Tree Rem (24" to 35")	EARTHWORK	EA
02.02036	Tree Rem (36" & Over)	EARTHWORK	EA
02.02112	Stump Rem (12" to 23")	EARTHWORK	EA
02.02124	Stump Rem (24" to 35")	EARTHWORK	EA
02.02136	Stump Rem (36" & Over)	EARTHWORK	EA
02.03001	Transplant Tree (Saplings to 6")	EARTHWORK	EA
02.04001	Rem & Reset Fence	EARTHWORK	LF
02.05001	Excavation	EARTHWORK	CY
02.05002	Over-Excavation	EARTHWORK	CY
02.05003	Excavation - Borrow	EARTHWORK	CY
02.06001	Excavation - Disposal	EARTHWORK	CY
02.08001	Earthwork Measured in Embankment	EARTHWORK	CY
02.09001	Parking Space Finish	EARTHWORK	SY
03.06001	Flowable Fill	PAVING	CY
04.09006	PCC Pavt, 6"	PAVING	SY
04.09007	PCC Pavt, 7"	PAVING	SY
04.09008	PCC Pavt, 8"	PAVING	SY
04.09009	PCC Pavt, 9"	PAVING	SY
04.09010	PCC Pavt, 10"	PAVING	SY
04.09106	PCC Pavt w/Int Curb, 6"	PAVING	SY
04.09107	PCC Pavt w/Int Curb, 7"	PAVING	SY
04.09108	PCC Pavt w/Int Curb, 8"	PAVING	SY

Standard Item No.	Standard Item Description	Section	Unit
04.09109	PCC Pavt w/ Int Curb, 9"	PAVING	SY
04.09110	PCC Pavt w/Int Curb, 10"	PAVING	SY
04.09206	RPCC Pavt, 6"	PAVING	SY
04.09207	RPCC Pavt, 7"	PAVING	SY
04.09208	RPCC Pavt, 8"	PAVING	SY
04.09209	RPCC Pavt, 9"	PAVING	SY
04.09210	RPCC Pavt, 10"	PAVING	SY
04.09304	Conc Sidewalk, 4"	PAVING	SF
04.09305	Conc Sidewalk, 5"	PAVING	SF
04.09306	Conc Sidewalk, 6"	PAVING	SF
04.09405	Conc Driveway, 5"	PAVING	SF
04.09406	Conc Driveway, 6"	PAVING	SF
04.09505	Conc Bikeway, 5"	PAVING	SF
04.09506	Conc Bikeway, 6"	PAVING	SF
04.09601	Combined Curb & Gutter	PAVING	LF
04.09602	Conc Barrier Curb (9" X 20")	PAVING	LF
04.09604	Conc Median Curb	PAVING	LF
04.09700	Remove Conc Header	PAVING	LF
04.09701	Install Conc Header	PAVING	LF
04.09800	Conc Median Nose	PAVING	EA
04.09804	Conc Median Surfacing, 4"	PAVING	SF
04.09806	Tack-on Conc Median, 6"	PAVING	SF
04.10006	PCC Alley Pavt, 6"	PAVING	SY
04.10007	PCC Alley Pavt, 7"	PAVING	SY
04.10008	PCC Alley Pavt, 8"	PAVING	SY
04.11001	Detectable Warning Panels	PAVING	SF
05.07000	Conc Base, LB-2750, 5",	PAVING	SY
05.07005	Conc Base, LB-3500, 5"	PAVING	SY
05.07006	Conc Base, LB-3500, 6"	PAVING	SY
05.07007	Conc Base, LB-3500, 7"	PAVING	SY
05.07008	Conc Base, LB-3500, 8"	PAVING	SY
06.04000	Surface Milling	PAVING	SY
06.04100	Non-Woven Pavt Overlay Fabric	PAVING	SY
06.04200	Asphaltic Concrete Curb	PAVING	LF
06.06001	Asphaltic Concrete, Type 1	PAVING	TON
06.06002	Asphaltic Concrete, Type 2	PAVING	TON
06.06003	Asphaltic Concrete, Type 3	PAVING	TON
06.06004	Asphaltic Concrete, Type 4	PAVING	TON
07.08010	Conc for Steps & Retaining Walls	PAVING	CY
07.08020	Reinf Stl for Steps & Retaining Walls	PAVING	LBS
07.08030	Modular Block Retaining Wall	PAVING	SF
07.08040	Handrails	PAVING	LF
08.02042	Chain Link Fence, 42"	PAVING	LF
08.02048	Chain Link Fence, 48"	PAVING	LF
08.02054	Chain Link Fence, 54"	PAVING	LF
08.02060	Chain Link Fence, 60"	PAVING	LF

Standard Item No.	Standard Item Description	Section	Unit
08.02066	Chain Link Fence, 66"	PAVING	LF
08.02072	Chain Link Fence, 72"	PAVING	LF
08.03048	Pipe Railing Fence, 48"	PAVING	LF
09.03001	Crushed Rock Roadway Surfacing	PAVING	TON
09.03002	Gravel Surfacing	PAVING	TON
09.04001	Crushed Rock Bikeway Surfacing	PAVING	SF
13.01001	Rem Pavement Mkg, Arrow	PAVEMENT MARKINGS	EA
13.01002	Rem Pavement Mkg, "RR Xing"	PAVEMENT MARKINGS	EA
13.01003	Rem Pavement Mkg, "ONLY"	PAVEMENT MARKINGS	EA
13.01004	Rem Pavement Mkg, 4"	PAVEMENT MARKINGS	LF
13.01006	Rem Pavement Mkg, 6"	PAVEMENT MARKINGS	LF
13.01008	Rem Pavement Mkg, 8"	PAVEMENT MARKINGS	LF
13.01012	Rem Pavement Mkg, 12"	PAVEMENT MARKINGS	LF
13.01016	Rem Pavement Mkg, 16"	PAVEMENT MARKINGS	LF
13.01024	Rem Pavement Mkg, 24"	PAVEMENT MARKINGS	LF
13.02501	Grvd Prfmd Plstc Mkg, Lt Arrow	PAVEMENT MARKINGS	EA
13.02502	Grvd Prfmd Plstc Mkg, Rt Arrow	PAVEMENT MARKINGS	EA
13.02503	Grvd Prfmd Plstc Mkg, Straight Arrow	PAVEMENT MARKINGS	EA
13.02504	Grvd Prfmd Plstc Mkg, Lt/St Arrow	PAVEMENT MARKINGS	EA
13.02505	Grvd Prfmd Plstc Mkg, Rt/St Arrow	PAVEMENT MARKINGS	EA
13.02506	Grvd Prfmd Plstc Mkg, "RR Xing"	PAVEMENT MARKINGS	EA
13.02507	Grvd Prfmd Plstc Mkg, "ONLY"	PAVEMENT MARKINGS	EA
13.02508	Grvd Prfmd Plstc Mkg, Triangles	PAVEMENT MARKINGS	EA
13.02509	Grvd Prfmd Plstc Mkg, Speed Table	PAVEMENT MARKINGS	EA
13.02601	Grvd Prfmd Plstc Mkg, Bike	PAVEMENT MARKINGS	EA
13.02602	Grvd Prfmd Plstc Mkg, Bike Arrow	PAVEMENT MARKINGS	EA
13.02603	Grvd Prfmd Plstc Mkg, Bike End	PAVEMENT MARKINGS	EA
13.02604	Grvd Prfmd Plstc Mkg, Bike Sharrow	PAVEMENT MARKINGS	EA
13.03004	Tplastic Molten Mkg, 4" W	PAVEMENT MARKINGS	LF
13.03005	Tplastic Molten Mkg, 4" Y	PAVEMENT MARKINGS	LF
13.03006	Tplastic Molten Mkg, 6" Y	PAVEMENT MARKINGS	LF
13.03008	Tplastic Molten Mkg, 8" W	PAVEMENT MARKINGS	LF
13.03009	Tplastic Molten Mkg, 8" Y	PAVEMENT MARKINGS	LF
13.03012	Tplastic Molten Mkg, 12" W	PAVEMENT MARKINGS	LF
13.03013	Tplastic Molten Mkg, 12" Y	PAVEMENT MARKINGS	LF
13.03024	Tplastic Molten Mkg, 24" W	PAVEMENT MARKINGS	LF
13.03504	Grvd Tplastic Molten Mkg, 4" W	PAVEMENT MARKINGS	LF
13.03505	Grvd Tplastic Molten Mkg, 4" Y	PAVEMENT MARKINGS	LF
13.03506	Grvd Tplastic Molten Mkg, 6" Y	PAVEMENT MARKINGS	LF
13.03508	Grvd Tplastic Molten Mkg, 8" W	PAVEMENT MARKINGS	LF
13.03509	Grvd Tplastic Molten Mkg, 8" Y	PAVEMENT MARKINGS	LF
13.03512	Grvd Tplastic Molten Mkg, 12" W	PAVEMENT MARKINGS	LF
13.03513	Grvd Tplastic Molten Mkg, 12" Y	PAVEMENT MARKINGS	LF
13.03524	Grvd Tplastic Molten Mkg, 24" W	PAVEMENT MARKINGS	LF
13.04008	Liquid Polyurea Mkg - Type I, 8" W	PAVEMENT MARKINGS	LF
13.04009	Liquid Polyurea Mkg - Type I, 8" Y	PAVEMENT MARKINGS	LF

Standard Item No.	Standard Item Description	Section	Unit
13.04012	Liquid Polyurea Mkg - Type I, 12" W	PAVEMENT MARKINGS	LF
13.04013	Liquid Polyurea Mkg - Type I, 12" Y	PAVEMENT MARKINGS	LF
13.04024	Liquid Polyurea Mkg - Type I, 24" W	PAVEMENT MARKINGS	LF
13.04508	Grvd Liquid Polyurea Mkg - Type I, 8" W	PAVEMENT MARKINGS	LF
13.04509	Grvd Liquid Polyurea Mkg - Type I, 8" Y	PAVEMENT MARKINGS	LF
13.04512	Grvd Liquid Polyurea Mkg - Type I, 12" W	PAVEMENT MARKINGS	LF
13.04513	Grvd Liquid Polyurea Mkg - Type I, 12" Y	PAVEMENT MARKINGS	LF
13.04524	Grvd Liquid Polyurea Mkg - Type I, 24" W	PAVEMENT MARKINGS	LF
13.05004	Liquid Polyurea Mkg - Type II, 4" W	PAVEMENT MARKINGS	LF
13.05005	Liquid Polyurea Mkg - Type II, 4" Y	PAVEMENT MARKINGS	LF
13.05006	Liquid Polyurea Mkg - Type II, 6" Y	PAVEMENT MARKINGS	LF
13.05008	Liquid Polyurea Mkg - Type II, 8" W	PAVEMENT MARKINGS	LF
13.05009	Liquid Polyurea Mkg - Type II, 8" Y	PAVEMENT MARKINGS	LF
13.05504	Grvd Liquid Polyurea Mkg - Type II, 4" W	PAVEMENT MARKINGS	LF
13.05505	Grvd Liquid Polyurea Mkg - Type II, 4" Y	PAVEMENT MARKINGS	LF
13.05506	Grvd Liquid Polyurea Mkg - Type II, 6" Y	PAVEMENT MARKINGS	LF
13.05508	Grvd Liquid Polyurea Mkg - Type II, 8" W	PAVEMENT MARKINGS	LF
13.05509	Grvd Liquid Polyurea Mkg - Type II, 8" Y	PAVEMENT MARKINGS	LF
13.06004	Liquid Polyurea Mkg - Type III, 4" W	PAVEMENT MARKINGS	LF
13.06005	Liquid Polyurea Mkg - Type III, 4" Y	PAVEMENT MARKINGS	LF
13.06006	Liquid Polyurea Mkg - Type III, 6" Y	PAVEMENT MARKINGS	LF
13.06008	Liquid Polyurea Mkg - Type III, 8" W	PAVEMENT MARKINGS	LF
13.06009	Liquid Polyurea Mkg - Type III, 8" Y	PAVEMENT MARKINGS	LF
13.06504	Grvd Liquid Polyurea Mkg - Type III, 4" W	PAVEMENT MARKINGS	LF
13.06505	Grvd Liquid Polyurea Mkg - Type III, 4" Y	PAVEMENT MARKINGS	LF
13.06506	Grvd Liquid Polyurea Mkg - Type III, 6" Y	PAVEMENT MARKINGS	LF
13.06508	Grvd Liquid Polyurea Mkg - Type III, 8" W	PAVEMENT MARKINGS	LF
13.06509	Grvd Liquid Polyurea Mkg - Type III, 8" Y	PAVEMENT MARKINGS	LF
13.07004	Paint Mkg, 4" W	PAVEMENT MARKINGS	LF
13.07005	Paint Mkg, 4" Y	PAVEMENT MARKINGS	LF
13.07006	Paint Mkg, 6" Y	PAVEMENT MARKINGS	LF
13.07008	Paint Mkg, 8" W	PAVEMENT MARKINGS	LF
13.07009	Paint Mkg, 8" Y	PAVEMENT MARKINGS	LF
13.07012	Paint Mkg, 12" W	PAVEMENT MARKINGS	LF
13.07013	Paint Mkg, 12" Y	PAVEMENT MARKINGS	LF
13.07024	Paint Mkg, 24" W	PAVEMENT MARKINGS	LF
13.07026	Paint Mkg, 24" G	PAVEMENT MARKINGS	LF
13.07100	Paint Mkg, Lt Arrow	PAVEMENT MARKINGS	EA
13.07101	Paint Mkg, Rt Arrow	PAVEMENT MARKINGS	EA
13.07102	Paint Mkg, Straight Arrow	PAVEMENT MARKINGS	EA
13.07103	Paint Mkg, Lt/St Arrow	PAVEMENT MARKINGS	EA
13.07104	Paint Mkg, Rt/St Arrow	PAVEMENT MARKINGS	EA
13.07110	Paint Mkg, "RR Xing"	PAVEMENT MARKINGS	EA
13.07111	Paint Mkg, "ONLY"	PAVEMENT MARKINGS	EA
13.07112	Paint Mkg, Triangles	PAVEMENT MARKINGS	EA
13.07113	Paint Mkg, Speed Table	PAVEMENT MARKINGS	EA

Standard Item No.	Standard Item Description	Section	Unit
13.07120	Paint Mkg, Bike	PAVEMENT MARKINGS	EA
13.07121	Paint Mkg, Bike Arrow	PAVEMENT MARKINGS	EA
13.07122	Paint Mkg, Bike End	PAVEMENT MARKINGS	EA
13.07123	Paint Mkg, Bike Sharrow	PAVEMENT MARKINGS	EA
13.08010	Raised Pavt Markers	PAVEMENT MARKINGS	EA
13.09001	Tubular Markers, Channel Mount	PAVEMENT MARKINGS	EA
13.09002	Tubular Markers, Surface Mount	PAVEMENT MARKINGS	EA
13.11004	Temp Mkg, 4"	PAVEMENT MARKINGS	LF
13.11008	Temp Mkg, 8"	PAVEMENT MARKINGS	LF
13.11012	Temp Mkg, 12"	PAVEMENT MARKINGS	LF
14.01010	Traffic Sign, < 4 Sq Ft	SIGNING	EA
14.01011	Traffic Sign, FYG, < 4 SQ FT	SIGNING	EA
14.01012	Traffic Sign, 4 Sq Ft < 9 Sq Ft	SIGNING	EA
14.01013	Traffic Sign, FYG, 4 SQ FT < 9 SQ FT	SIGNING	EA
14.01014	Traffic Sign, 9 Sq Ft or >	SIGNING	EA
14.01015	Traffic Sign, FYG, 9 SQ FT or >	SIGNING	EA
14.01110	Remove Traffic Sign Only	SIGNING	EA
14.01111	Remove Traffic Sign and Post	SIGNING	EA
14.01112	Rel Sign and Post	SIGNING	EA
14.03210	"U" Channel Sign Posts	SIGNING	LF
14.03211	Ground Sleeve	SIGNING	EA
14.04010	Street Name Posts (Round)	SIGNING	LF
14.05001	Dead End Barricade	SIGNING	EA
14.05002	Rem Dead End Barricade	SIGNING	EA
15.05001	Dynamic Message Sign	TRAFFIC CONTROL	DAY
15.09001	Traffic Control for Const	TRAFFIC CONTROL	LS
15.09110	Small Work Zone Sign	TRAFFIC CONTROL	DAY
15.09120	Medium Work Zone Sign	TRAFFIC CONTROL	DAY
15.09130	Large Work Zone Sign	TRAFFIC CONTROL	DAY
15.09202	Type II Barricade	TRAFFIC CONTROL	DAY
15.09203	Type III Barricade	TRAFFIC CONTROL	DAY
15.09210	Flashing Arrow Panels	TRAFFIC CONTROL	DAY
15.09300	Flagging	TRAFFIC CONTROL	DAY
15.09400	Conc Protect Barrier	TRAFFIC CONTROL	LF
15.09410	Relocate Conc Protect Barrier	TRAFFIC CONTROL	LF
15.09500	Ex Pave Marking Rem	TRAFFIC CONTROL	LF
15.09504	Temp Pave Mkg, 4"	TRAFFIC CONTROL	LF
15.09508	Temp Pave Mkg, 8"	TRAFFIC CONTROL	LF
15.09512	Temp Pave Mkg, 12"	TRAFFIC CONTROL	LF
15.09516	Temp Pave Mkg, 16"	TRAFFIC CONTROL	LF
15.09524	Temp Pave Mkg, 24"	TRAFFIC CONTROL	LF
15.09600	Grabber Cone, 42"	TRAFFIC CONTROL	DAY
15.09610	Tubular Marker, 42"	TRAFFIC CONTROL	DAY
20.05001	Found Material	UTILITIES & STRUCTURES	CY
20.06106	Directional Drilling for 6" Water Main	WATER	LF
20.06108	Directional Drilling for 8" Water Main	WATER	LF

Standard Item No.	Standard Item Description	Section	Unit
20.06110	Directional Drilling for 10" Water Main	WATER	LF
20.06112	Directional Drilling for 12" Water Main	WATER	LF
20.06116	Directional Drilling for 16" Water Main	WATER	LF
20.07001	Conc for Collars, Elbows, Plugs & Hdwls	STORM DRAINAGE	CY
20.07002	Reinf Steel for Collars, Elbows, Plugs & Hdwls	STORM DRAINAGE	LBS
20.08001	Conc for Plugs & Collars	WASTEWATER	CY
20.08002	Reinf Steel for Collars	WASTEWATER	LBS
20.09001	Conc for Thrust Blocks & Anchorages	WATER	CY
20.09002	Reinf Stl for Thrust Blks & Anchorages	WATER	LBS
21.03012	Rem Storm Sewer Pipe, 12"	STORM DRAINAGE	LF
21.03015	Rem Storm Sewer Pipe, 15"	STORM DRAINAGE	LF
21.03018	Rem Storm Sewer Pipe, 18"	STORM DRAINAGE	LF
21.03021	Rem Storm Sewer Pipe, 21"	STORM DRAINAGE	LF
21.03024	Rem Storm Sewer Pipe, 24"	STORM DRAINAGE	LF
21.03030	Rem Storm Sewer Pipe, 30"	STORM DRAINAGE	LF
21.03036	Rem Storm Sewer Pipe, 36"	STORM DRAINAGE	LF
21.03042	Rem Storm Sewer Pipe, 42"	STORM DRAINAGE	LF
21.03048	Rem Storm Sewer Pipe, 48"	STORM DRAINAGE	LF
21.03054	Rem Storm Sewer Pipe, 54"	STORM DRAINAGE	LF
21.03060	Rem Storm Sewer Pipe, 60"	STORM DRAINAGE	LF
21.03066	Rem Storm Sewer Pipe, 66"	STORM DRAINAGE	LF
21.03072	Rem Storm Sewer Pipe, 72"	STORM DRAINAGE	LF
21.03115	Rem and Relay RCP Storm Sewer, 15"	STORM DRAINAGE	LF
21.03118	Rem and Relay RCP Storm Sewer, 18"	STORM DRAINAGE	LF
21.03121	Rem and Relay RCP Storm Sewer, 21"	STORM DRAINAGE	LF
21.03124	Rem and Relay RCP Storm Sewer, 24"	STORM DRAINAGE	LF
21.03130	Rem and Relay RCP Storm Sewer, 30"	STORM DRAINAGE	LF
21.03136	Rem and Relay RCP Storm Sewer, 36"	STORM DRAINAGE	LF
21.03142	Rem and Relay RCP Storm Sewer, 42"	STORM DRAINAGE	LF
21.03148	Rem and Relay RCP Storm Sewer, 48"	STORM DRAINAGE	LF
21.03154	Rem and Relay RCP Storm Sewer, 54"	STORM DRAINAGE	LF
21.03160	Rem and Relay RCP Storm Sewer, 60"	STORM DRAINAGE	LF
21.03166	Rem and Relay RCP Storm Sewer, 66"	STORM DRAINAGE	LF
21.03172	Rem and Relay RCP Storm Sewer, 72"	STORM DRAINAGE	LF
21.03215	Rem and Salv RCP Storm Sewer, 15"	STORM DRAINAGE	LF
21.03218	Rem and Salv RCP Storm Sewer, 18"	STORM DRAINAGE	LF
21.03221	Rem and Salv RCP Storm Sewer, 21"	STORM DRAINAGE	LF
21.03224	Rem and Salv RCP Storm Sewer, 24"	STORM DRAINAGE	LF
21.03230	Rem and Salv RCP Storm Sewer, 30"	STORM DRAINAGE	LF
21.03236	Rem and Salv RCP Storm Sewer, 36"	STORM DRAINAGE	LF
21.03242	Rem and Salv RCP Storm Sewer, 42"	STORM DRAINAGE	LF
21.03248	Rem and Salv RCP Storm Sewer, 48"	STORM DRAINAGE	LF
21.03254	Rem and Salv RCP Storm Sewer, 54"	STORM DRAINAGE	LF
21.03260	Rem and Salv RCP Storm Sewer, 60"	STORM DRAINAGE	LF
21.03266	Rem and Salv RCP Storm Sewer, 66"	STORM DRAINAGE	LF
21.03272	Rem and Salv RCP Storm Sewer, 72"	STORM DRAINAGE	LF

Standard Item No.	Standard Item Description	Section	Unit
21.03315	RCP Storm Sewer, CI III, 15"	STORM DRAINAGE	LF
21.03318	RCP Storm Sewer, CI III, 18"	STORM DRAINAGE	LF
21.03321	RCP Storm Sewer, CI III, 21"	STORM DRAINAGE	LF
21.03324	RCP Storm Sewer, CI III, 24"	STORM DRAINAGE	LF
21.03330	RCP Storm Sewer, CI III, 30"	STORM DRAINAGE	LF
21.03336	RCP Storm Sewer, CI III, 36"	STORM DRAINAGE	LF
21.03342	RCP Storm Sewer, CI III, 42"	STORM DRAINAGE	LF
21.03348	RCP Storm Sewer, CI III, 48"	STORM DRAINAGE	LF
21.03354	RCP Storm Sewer, CI III, 54"	STORM DRAINAGE	LF
21.03360	RCP Storm Sewer, CI III, 60"	STORM DRAINAGE	LF
21.03366	RCP Storm Sewer, CI III, 66"	STORM DRAINAGE	LF
21.03372	RCP Storm Sewer, CI III, 72"	STORM DRAINAGE	LF
21.03415	RCP Storm Sewer, CI IV, 15"	STORM DRAINAGE	LF
21.03418	RCP Storm Sewer, CI IV, 18"	STORM DRAINAGE	LF
21.03421	RCP Storm Sewer, CI IV, 21"	STORM DRAINAGE	LF
21.03424	RCP Storm Sewer, CI IV, 24"	STORM DRAINAGE	LF
21.03430	RCP Storm Sewer, CI IV, 30"	STORM DRAINAGE	LF
21.03436	RCP Storm Sewer, CI IV, 36"	STORM DRAINAGE	LF
21.03442	RCP Storm Sewer, CI IV, 42"	STORM DRAINAGE	LF
21.03448	RCP Storm Sewer, CI IV, 48"	STORM DRAINAGE	LF
21.03454	RCP Storm Sewer, CI IV, 54"	STORM DRAINAGE	LF
21.03460	RCP Storm Sewer, CI IV, 60"	STORM DRAINAGE	LF
21.03466	RCP Storm Sewer, CI IV, 66"	STORM DRAINAGE	LF
21.03472	RCP Storm Sewer, CI IV, 72"	STORM DRAINAGE	LF
21.03515	RCP Storm Sewer, CI V, 15"	STORM DRAINAGE	LF
21.03518	RCP Storm Sewer, CI V, 18"	STORM DRAINAGE	LF
21.03521	RCP Storm Sewer, CI V, 21"	STORM DRAINAGE	LF
21.03524	RCP Storm Sewer, CI V, 24"	STORM DRAINAGE	LF
21.03530	RCP Storm Sewer, CI V, 30"	STORM DRAINAGE	LF
21.03536	RCP Storm Sewer, CI V, 36"	STORM DRAINAGE	LF
21.03542	RCP Storm Sewer, CI V, 42"	STORM DRAINAGE	LF
21.03548	RCP Storm Sewer, CI V, 48"	STORM DRAINAGE	LF
21.03554	RCP Storm Sewer, CI V, 54"	STORM DRAINAGE	LF
21.03560	RCP Storm Sewer, CI V, 60"	STORM DRAINAGE	LF
21.03566	RCP Storm Sewer, CI V, 66"	STORM DRAINAGE	LF
21.03572	RCP Storm Sewer, CI V, 72"	STORM DRAINAGE	LF
21.03614	Ellip RCP Storm Sewer, 14" x 23"	STORM DRAINAGE	LF
21.03619	Ellip RCP Storm Sewer, 19" x 30"	STORM DRAINAGE	LF
21.03624	Ellip RCP Storm Sewer, 24" x 38"	STORM DRAINAGE	LF
21.03629	Ellip RCP Storm Sewer, 29" x 45"	STORM DRAINAGE	LF
21.03634	Ellip RCP Storm Sewer, 34" x 53"	STORM DRAINAGE	LF
21.03638	Ellip RCP Storm Sewer, 38" x 60"	STORM DRAINAGE	LF
21.03643	Ellip RCP Storm Sewer, 43" x 68"	STORM DRAINAGE	LF
21.03648	Ellip RCP Storm Sewer, 48" x 76"	STORM DRAINAGE	LF
21.03653	Ellip RCP Storm Sewer, 53" x 83"	STORM DRAINAGE	LF
21.03700	Precast RC Box Storm Sewer	STORM DRAINAGE	LF

Standard Item No.	Standard Item Description	Section	Unit
21.05001	Tap Ex Storm Sewer MH & Replace	STORM DRAINAGE	EA
21.05002	Tap Ex Storm Sewer Inlet & Replace	STORM DRAINAGE	EA
21.05003	Tap Ex RC Pipe	STORM DRAINAGE	EA
21.05004	Tap Ex RC Box	STORM DRAINAGE	EA
21.06001	Reinf Steel for Structures	STORM DRAINAGE	LBS
21.06002	Conc for Structures	STORM DRAINAGE	CY
21.07015	Storm Sewer MH, 15" - 30"	STORM DRAINAGE	EA
21.07036	Storm Sewer MH, to 36"	STORM DRAINAGE	EA
21.07042	Storm Sewer MH, 42"	STORM DRAINAGE	EA
21.07048	Storm Sewer MH, 42"-48"	STORM DRAINAGE	EA
21.07054	Storm Sewer MH, 54"	STORM DRAINAGE	EA
21.07060	Storm Sewer MH, 54"-60"	STORM DRAINAGE	EA
21.07066	Storm Sewer MH, 66"	STORM DRAINAGE	EA
21.07072	Storm Sewer MH, 66"-72"	STORM DRAINAGE	EA
21.07078	Storm Sewer MH, 78"	STORM DRAINAGE	EA
21.08001	Storm Sewer Inlet, 72"	STORM DRAINAGE	EA
21.08002	Canted Storm Sewer Inlet, 72"	STORM DRAINAGE	EA
21.08003	Radius Storm Sewer Inlet, 72"	STORM DRAINAGE	EA
21.08010	Grate Inlet, Ty "E"	STORM DRAINAGE	EA
21.08011	Grate Inlet, Ty "F-1"	STORM DRAINAGE	EA
21.08012	Grate Inlet, Ty "F-2"	STORM DRAINAGE	EA
21.08013	Grate Inlet, Ty "F-3"	STORM DRAINAGE	EA
21.08014	Grate Inlet, Ty "H"	STORM DRAINAGE	EA
21.09001	Convert Inlet to MH	STORM DRAINAGE	EA
21.10001	Channel Excavation	STORM DRAINAGE	CY
21.11002	RC Low Flow Liner, 2'	STORM DRAINAGE	LF
21.11003	RC Low Flow Liner, 3'	STORM DRAINAGE	LF
21.11004	RC Low Flow Liner, 4'	STORM DRAINAGE	LF
21.11005	RC Low Flow Liner, 5'	STORM DRAINAGE	LF
21.11006	RC Low Flow Liner, 6'	STORM DRAINAGE	LF
21.11007	RC Low Flow Liner, 7'	STORM DRAINAGE	LF
21.11008	RC Low Flow Liner, 8'	STORM DRAINAGE	LF
21.11009	RC Low Flow Liner, 9'	STORM DRAINAGE	LF
21.11010	RC Low Flow Liner, 10'	STORM DRAINAGE	LF
21.12015	Rem RC FES, 15"	STORM DRAINAGE	EA
21.12018	Rem RC FES, 18"	STORM DRAINAGE	EA
21.12021	Rem RC FES, 21"	STORM DRAINAGE	EA
21.12024	Rem RC FES, 24"	STORM DRAINAGE	EA
21.12030	Rem RC FES, 30"	STORM DRAINAGE	EA
21.12036	Rem RC FES, 36"	STORM DRAINAGE	EA
21.12042	Rem RC FES, 42"	STORM DRAINAGE	EA
21.12048	Rem RC FES, 48"	STORM DRAINAGE	EA
21.12054	Rem RC FES, 54"	STORM DRAINAGE	EA
21.12060	Rem RC FES, 60"	STORM DRAINAGE	EA
21.12066	Rem RC FES, 66"	STORM DRAINAGE	EA
21.12072	Rem RC FES, 72"	STORM DRAINAGE	EA

Standard Item No.	Standard Item Description	Section	Unit
21.12115	Rem & Reset RC FES, 15"	STORM DRAINAGE	EA
21.12118	Rem & Reset RC FES, 18"	STORM DRAINAGE	EA
21.12124	Rem & Reset RC FES, 24"	STORM DRAINAGE	EA
21.12130	Rem & Reset RC FES, 30"	STORM DRAINAGE	EA
21.12136	Rem & Reset RC FES, 36"	STORM DRAINAGE	EA
21.12142	Rem & Reset RC FES, 42"	STORM DRAINAGE	EA
21.12148	Rem & Reset RC FES, 48"	STORM DRAINAGE	EA
21.12154	Rem & Reset RC FES, 54"	STORM DRAINAGE	EA
21.12160	Rem & Reset RC FES, 60"	STORM DRAINAGE	EA
21.12166	Rem & Reset RC FES, 66"	STORM DRAINAGE	EA
21.12172	Rem & Reset RC FES, 72"	STORM DRAINAGE	EA
21.12215	RC FES, 15"	STORM DRAINAGE	EA
21.12218	RC FES, 18"	STORM DRAINAGE	EA
21.12224	RC FES, 24"	STORM DRAINAGE	EA
21.12230	RC FES, 30"	STORM DRAINAGE	EA
21.12236	RC FES, 36"	STORM DRAINAGE	EA
21.12242	RC FES, 42"	STORM DRAINAGE	EA
21.12248	RC FES, 48"	STORM DRAINAGE	EA
21.12254	RC FES, 54"	STORM DRAINAGE	EA
21.12260	RC FES, 60"	STORM DRAINAGE	EA
21.12266	RC FES, 66"	STORM DRAINAGE	EA
21.12272	RC FES, 72"	STORM DRAINAGE	EA
21.12315	RC FES, w/Grate, 15"	STORM DRAINAGE	EA
21.12318	RC FES, w/Grate, 18"	STORM DRAINAGE	EA
21.12324	RC FES, w/Grate, 24"	STORM DRAINAGE	EA
21.12330	RC FES, w/Grate, 30"	STORM DRAINAGE	EA
21.12336	RC FES, w/Grate, 36"	STORM DRAINAGE	EA
21.12342	RC FES, w/Grate, 42"	STORM DRAINAGE	EA
21.12348	RC FES, w/Grate, 48"	STORM DRAINAGE	EA
21.12354	RC FES, w/Grate, 54"	STORM DRAINAGE	EA
21.12360	RC FES, w/Grate, 60"	STORM DRAINAGE	EA
21.12366	RC FES, w/Grate, 66"	STORM DRAINAGE	EA
21.12372	RC FES, w/Grate, 72"	STORM DRAINAGE	EA
21.13001	Rem Ex Manhole	STORM DRAINAGE	EA
21.13002	Rem Ex Inlet	STORM DRAINAGE	EA
21.13003	Rem Ex Junction Box	STORM DRAINAGE	EA
21.13004	Rem Ex Grate Inlet	STORM DRAINAGE	EA
21.13005	Rem Ex Hdwl	STORM DRAINAGE	EA
21.14001	Rip-Rap	STORM DRAINAGE	TON
21.14002	Rip-Rap w/Filter Fabric	STORM DRAINAGE	TON
21.15001	Wire Gabion	STORM DRAINAGE	EA
21.15002	Wire Gabion PVC Coated	STORM DRAINAGE	EA
21.16001	Geotextile Filter Fabric	STORM DRAINAGE	SY
22.03001	Tap Ex MH and Replace Invert	WASTEWATER	EA
22.03002	Convert Ex MH to Drop MH	WASTEWATER	EA
22.03101	Rem Ex Sanitary Sewer MH	WASTEWATER	EA

Standard Item No.	Standard Item Description	Section	Unit
22.03102	Fill and Abandon Ex MH	WASTEWATER	EA
22.04001	Abandonment of Sanitary Sewer Main	WASTEWATER	EA
22.05000	Sanitary Sewer Pipe (C900 PVC), 8"	WASTEWATER	LF
22.05008	Sanitary Sewer Pipe, 8"	WASTEWATER	LF
22.05010	Sanitary Sewer Pipe, 10"	WASTEWATER	LF
22.05012	Sanitary Sewer Pipe, 12"	WASTEWATER	LF
22.05015	Sanitary Sewer Pipe, 15"	WASTEWATER	LF
22.05018	Sanitary Sewer Pipe, 18"	WASTEWATER	LF
22.05021	Sanitary Sewer Pipe, 21"	WASTEWATER	LF
22.05024	Sanitary Sewer Pipe, 24"	WASTEWATER	LF
22.05027	Sanitary Sewer Pipe, 27"	WASTEWATER	LF
22.05048	Sanitary Sewer Pipe, 48"	WASTEWATER	LF
22.05208	Sanitary Sewer Plug, 8"	WASTEWATER	EA
22.05210	Sanitary Sewer Plug, 10"	WASTEWATER	EA
22.07001	Std MH, Ty "G"	WASTEWATER	EA
22.07002	Std MH, Ty "P"	WASTEWATER	EA
22.07003	Std MH, Ty "S"	WASTEWATER	EA
22.07101	Std MH, Ty "G" VF	WASTEWATER	VF
22.07102	Std MH, Ty "P" VF	WASTEWATER	VF
22.07103	Std MH, Ty "S" VF	WASTEWATER	VF
22.07201	Std Drop MH, Ty "H"	WASTEWATER	EA
22.07202	Std Drop MH, Ty "Q"	WASTEWATER	EA
22.07203	Std Drop MH, Ty "R"	WASTEWATER	EA
22.07301	Std Drop MH, Ty "H" VF	WASTEWATER	VF
22.07302	Std Drop MH, Ty "Q" VF	WASTEWATER	VF
22.07303	Std Drop MH, Ty "R" VF	WASTEWATER	VF
22.08084	Wye, 8" X 4"	WASTEWATER	EA
22.08086	Wye, 8" x 6"	WASTEWATER	EA
22.08104	Wye, 10" x 4"	WASTEWATER	EA
22.08106	Wye, 10" x 6"	WASTEWATER	EA
22.08201	Construct Sanitary Sewer Service	WASTEWATER	EA
22.08202	Reconstruct Sanitary Sewer Service	WASTEWATER	EA
22.08304	Pipe Sewer Service, 4"	WASTEWATER	LF
22.08306	Pipe Sewer Service, 6"	WASTEWATER	LF
22.08308	Pipe Sewer Service, 8"	WASTEWATER	LF
22.08400	Boring for Sewer Service Pipe	WASTEWATER	LF
23.04004	Rem 4" Water Main	WATER	LF
23.04006	Rem 6" Water Main	WATER	LF
23.04008	Rem 8" Water Main	WATER	LF
23.04010	Rem 10" Water Main	WATER	LF
23.04012	Rem 12" Water Main	WATER	LF
23.04016	Rem 16" Water Main	WATER	LF
23.04020	Rem 20" Water Main	WATER	LF
23.04024	Rem 24" Water Main	WATER	LF
23.04030	Rem 30" Water Main	WATER	LF
23.04036	Rem 36" Water Main	WATER	LF

Standard Item No.	Standard Item Description	Section	Unit
23.04101	Rem & Salvage Hydrant	WATER	EA
23.04102	Rem & Salvage Plug	WATER	EA
23.04103	Rem & Salvage Anchoring Coupling	WATER	EA
23.04104	Rem & Salvage Anchoring Pipe	WATER	EA
23.04105	Rem & Salvage Gate Valve and Box	WATER	EA
23.04106	Rem & Salvage Reducer	WATER	EA
23.04107	Rem & Salvage Bend	WATER	EA
23.04108	Rem & Salvage Cross	WATER	EA
23.04109	Rem & Salvage Tee	WATER	EA
23.04111	Rem & Reset Hydrant	WATER	EA
23.04112	Rem & Reset Plug	WATER	EA
23.04113	Rem & Reset Anchoring Coupling	WATER	EA
23.04114	Rem & Reset Anchoring Pipe	WATER	EA
23.04115	Rem & Reset Gate Valve and Box	WATER	EA
23.04116	Rem & Reset Reducer	WATER	EA
23.04117	Rem & Reset Bend	WATER	EA
23.04118	Rem & Reset Cross	WATER	EA
23.04119	Rem & Reset Tee	WATER	EA
23.04121	Rem Hydrant	WATER	EA
23.04122	Rem Plug	WATER	EA
23.04123	Rem Anchoring Coupling	WATER	EA
23.04124	Rem Anchoring Pipe	WATER	EA
23.04125	Rem Gate Valve and Box	WATER	EA
23.04126	Rem Reducer	WATER	EA
23.04127	Rem Bend	WATER	EA
23.04128	Rem Cross	WATER	EA
23.04129	Rem Tee	WATER	EA
23.07004	Water Main, 4"	WATER	LF
23.07006	Water Main, 6"	WATER	LF
23.07008	Water Main, 8"	WATER	LF
23.07012	Water Main, 12"	WATER	LF
23.07016	Water Main, 16"	WATER	LF
23.07024	Water Main, 24"	WATER	LF
23.07030	Water Main, 30"	WATER	LF
23.07070	Anchoring Elbow, MJ, 6"	WATER	EA
23.07071	Anchoring Coupling, MJ (L=12"), 6"	WATER	EA
23.07072	Anchoring Coupling, MJ (L=18"), 6"	WATER	EA
23.07073	Anchoring Coupling, MJ (L=24"), 6"	WATER	EA
23.07074	Anchoring Coupling, MJ (L=36"), 6"	WATER	EA
23.07075	Anchoring Coupling, MJ (L=13"), 8"	WATER	EA
23.07080	Reducer, MJ, 6" X 4"	WATER	EA
23.07081	Reducer, MJ, 8" X 6"	WATER	EA
23.07082	Reducer, MJ, 12" X 6"	WATER	EA
23.07083	Reducer, MJ, 12" x 8"	WATER	EA
23.07084	Reducer, MJ, 16" X 6"	WATER	EA
23.07085	Reducer, MJ, 16" x 8"	WATER	EA

Standard Item No.	Standard Item Description	Section	Unit
23.07086	Reducer, MJ, 16" X 12"	WATER	EA
23.07087	Reducer, MJ, 24" X 12"	WATER	EA
23.07088	Reducer, MJ, 24" X 16"	WATER	EA
23.07089	Reducer, MJ, 30" X 12"	WATER	EA
23.07090	Reducer, MJ, 30" X 16"	WATER	EA
23.07091	Reducer, MJ, 30" X 24"	WATER	EA
23.07100	Deg Bend, MJ, 4" x 90	WATER	EA
23.07101	Deg Bend, MJ, 6" X 90	WATER	EA
23.07102	Deg Bend, MJ, 8" x 90	WATER	EA
23.07103	Deg Bend, MJ, 12" X 90	WATER	EA
23.07104	Deg Bend, MJ, 16" X 90	WATER	EA
23.07105	Deg Bend, MJ, 24" X 90	WATER	EA
23.07106	Deg Bend, MJ, 30" X 90	WATER	EA
23.07110	Deg Bend, MJ, 6" X 45	WATER	EA
23.07111	Deg Bend, MJ, 8" X 45	WATER	EA
23.07112	Deg Bend, MJ, 12" X 45	WATER	EA
23.07113	Deg Bend, MJ, 16" X 45	WATER	EA
23.07114	Deg Bend, MJ, 24" X 45	WATER	EA
23.07115	Deg Bend, MJ, 30" X 45	WATER	EA
23.07121	Deg Bend, MJ, 6" X 22.5	WATER	EA
23.07122	Deg Bend, MJ, 8" X 22.5	WATER	EA
23.07123	Deg Bend, MJ, 12" X 22.5	WATER	EA
23.07124	Deg Bend, MJ, 16" X 22.5	WATER	EA
23.07125	Deg Bend, MJ, 24" X 22.5	WATER	EA
23.07126	Deg Bend, MJ, 30" X 22.5	WATER	EA
23.07131	Deg Bend, MJ, 6" X 11.25	WATER	EA
23.07132	Deg Bend, MJ, 8" X 11.25	WATER	EA
23.07133	Deg Bend, MJ, 12" X 11.25	WATER	EA
23.07134	Deg Bend, MJ, 16" X 11.25	WATER	EA
23.07135	Deg Bend, MJ, 24" X 11.25	WATER	EA
23.07136	Deg Bend, MJ, 30" X 11.25	WATER	EA
23.07200	Cross, MJ, 8" x 6"	WATER	EA
23.07201	Cross, MJ, 6" X 6"	WATER	EA
23.07202	Cross, MJ, 8" x 8"	WATER	EA
23.07203	Cross, MJ, 12" X 6"	WATER	EA
23.07204	Cross, MJ, 12" X 12"	WATER	EA
23.07205	Cross, MJ, 16" X 6"	WATER	EA
23.07206	Cross, MJ, 16" X 12"	WATER	EA
23.07207	Cross, MJ, 16" X 16"	WATER	EA
23.07208	Cross, MJ, 24" X 6"	WATER	EA
23.07209	Cross, MJ, 24" x 8"	WATER	EA
23.07210	Cross, MJ, 24" X 12"	WATER	EA
23.07211	Cross, MJ, 24" X 16"	WATER	EA
23.07212	Cross, MJ, 24" X 24"	WATER	EA
23.07213	Cross, MJ, 30" X 6"	WATER	EA
23.07214	Cross, MJ, 30" X 12"	WATER	EA

Standard Item No.	Standard Item Description	Section	Unit
23.07215	Cross, MJ, 30" X 16"	WATER	EA
23.07216	Cross, MJ, 30" X 24"	WATER	EA
23.07217	Cross, MJ, 30" X 30"	WATER	EA
23.07218	Cross, MJ, 12" X 8"	WATER	EA
23.07300	Tee, MJ, 6" X 4"	WATER	EA
23.07301	Tee, MJ, 6" X 6"	WATER	EA
23.07302	Tee, MJ, 8" X 6"	WATER	EA
23.07303	Tee, MJ, 8" X 8"	WATER	EA
23.07304	Tee, MJ, 12" X 6"	WATER	EA
23.07305	Tee, MJ, 12" X 8"	WATER	EA
23.07306	Tee, MJ, 12" X 12"	WATER	EA
23.07307	Tee, MJ, 16" X 6"	WATER	EA
23.07308	Tee, MJ, 16" X 8"	WATER	EA
23.07309	Tee, MJ, 16" X 12"	WATER	EA
23.07310	Tee, MJ, 16" X 16"	WATER	EA
23.07311	Tee, MJ, 24" X 6"	WATER	EA
23.07312	Tee, MJ, 24" X 8"	WATER	EA
23.07313	Tee, MJ, 24" X 12"	WATER	EA
23.07314	Tee, MJ, 24" X 16"	WATER	EA
23.07315	Tee, MJ, 24" X 24"	WATER	EA
23.07316	Tee, MJ, 30" X 6"	WATER	EA
23.07317	Tee, MJ, 30" X 8"	WATER	EA
23.07318	Tee, MJ, 30" X 12"	WATER	EA
23.07319	Tee, MJ, 30" X 16"	WATER	EA
23.07320	Tee, MJ, 30" X 24"	WATER	EA
23.07321	Tee, MJ, 30" X 30"	WATER	EA
23.07350	Swivel Tee, MJ, 6" X 6"	WATER	EA
23.07351	Swivel Tee, MJ, 8" X 6"	WATER	EA
23.07352	Swivel Tee, MJ, 12" X 6"	WATER	EA
23.07353	Swivel Tee, MJ, 16" X 6"	WATER	EA
23.07354	Swivel Tee, MJ, 24" X 6"	WATER	EA
23.07355	Swivel Tee, MJ, 30" X 6"	WATER	EA
23.07400	Offset, 12" Drop, MJ, 6"	WATER	EA
23.07401	Offset, 18" Drop, MJ, 6"	WATER	EA
23.07402	Offset, 24" Drop, MJ, 6"	WATER	EA
23.07403	Offset, 12" Drop, MJ, 8"	WATER	EA
23.07404	Offset, 18" Drop, MJ, 8"	WATER	EA
23.07405	Offset, 24" Drop, MJ, 8"	WATER	EA
23.07406	Offset, 12" Drop, MJ, 12"	WATER	EA
23.07407	Offset, 18" Drop, MJ, 12"	WATER	EA
23.07408	Offset, 12" Drop, MJ, 16"	WATER	EA
23.07409	Offset, 18" Drop, MJ, 16"	WATER	EA
23.07506	Solid Sleeve, MJ (L=12"), 6"	WATER	EA
23.07507	Solid Sleeve, MJ (L=18"), 6"	WATER	EA
23.07508	Solid Sleeve, MJ (L=12"), 8"	WATER	EA
23.07509	Solid Sleeve, MJ (L=18"), 8"	WATER	EA

Standard Item No.	Standard Item Description	Section	Unit
23.07512	Solid Sleeve, MJ (L=12"), 12"	WATER	EA
23.07516	Solid Sleeve, MJ (L=15"), 16"	WATER	EA
23.07524	Solid Sleeve, MJ (L=15"), 24"	WATER	EA
23.07530	Solid Sleeve, MJ (L=15"), 30"	WATER	EA
23.07604	Dual Purpose Sleeve, MJ (L=12"), 4"	WATER	EA
23.07606	Dual Purpose Sleeve, MJ (L=12"), 6"	WATER	EA
23.07608	Dual Purpose Sleeve, MJ (L=12"), 8"	WATER	EA
23.07612	Dual Purpose Sleeve, MJ (L=12"), 12"	WATER	EA
23.07616	Dual Purpose Sleeve, MJ (L=15"), 16"	WATER	EA
23.07704	Plug, MJ, 4"	WATER	EA
23.07706	Plug, MJ, 6"	WATER	EA
23.07708	Plug, MJ, 8"	WATER	EA
23.07712	Plug, MJ, 12"	WATER	EA
23.07716	Plug, MJ, 16"	WATER	EA
23.07724	Plug, MJ, 24"	WATER	EA
23.07730	Plug, MJ, 30"	WATER	EA
23.07804	Retainer Glands, MJ, 4"	WATER	EA
23.07806	Retainer Glands, MJ, 6"	WATER	EA
23.07808	Retainer Glands, MJ, 8"	WATER	EA
23.07812	Retainer Glands, MJ, 12"	WATER	EA
23.07816	Retainer Glands, MJ, 16"	WATER	EA
23.07824	Retainer Glands, MJ, 24"	WATER	EA
23.07830	Retainer Glands, MJ, 30"	WATER	EA
23.07904	Restraint Adaptor, MJ, 4"	WATER	EA
23.07906	Restraint Adaptor, MJ, 6"	WATER	EA
23.07908	Restraint Adaptor, MJ, 8"	WATER	EA
23.07912	Restraint Adaptor, MJ, 12"	WATER	EA
23.08006	Gate Valve, MJ, 6"	WATER	EA
23.08008	Gate Valve, MJ, 8"	WATER	EA
23.08012	Gate Valve, MJ, 12"	WATER	EA
23.08112	Butterfly Valve, MJ, 12"	WATER	EA
23.08116	Butterfly Valve, MJ, 16"	WATER	EA
23.08124	Butterfly Valve, MJ, 24"	WATER	EA
23.08130	Butterfly Valve, MJ, 30"	WATER	EA
23.08201	Tapping Sleeve & Valve, MJ, 4" x 4"	WATER	EA
23.08202	Tapping Sleeve & Valve, MJ, 6" x 4"	WATER	EA
23.08203	Tapping Sleeve & Valve, MJ, 6" x 6"	WATER	EA
23.08204	Tapping Sleeve & Valve, MJ, 8" x 4"	WATER	EA
23.08205	Tapping Sleeve & Valve, MJ, 8" x 6"	WATER	EA
23.08206	Tapping Sleeve & Valve, MJ, 8" x 8"	WATER	EA
23.08208	Tapping Sleeve & Valve, MJ, 12" x 4"	WATER	EA
23.08209	Tapping Sleeve & Valve, MJ, 12" x 6"	WATER	EA
23.08210	Tapping Sleeve & Valve, MJ, 12" x 8"	WATER	EA
23.08211	Tapping Sleeve & Valve, MJ, 12" x 12"	WATER	EA
23.08212	Tapping Sleeve & Valve, MJ, 16" x 4"	WATER	EA
23.08213	Tapping Sleeve & Valve, MJ, 16" x 6"	WATER	EA

Standard Item No.	Standard Item Description	Section	Unit
23.08214	Tapping Sleeve & Valve, MJ, 16" x 8"	WATER	EA
23.08215	Tapping Sleeve & Valve, MJ, 16" x 12"	WATER	EA
23.08216	Tapping Sleeve & Valve, MJ, 16" x 16"	WATER	EA
23.08217	Tapping Sleeve & Valve, MJ, 20" x 4"	WATER	EA
23.08218	Tapping Sleeve & Valve, MJ, 20" x 6"	WATER	EA
23.08219	Tapping Sleeve & Valve, MJ, 20" x 8"	WATER	EA
23.08220	Tapping Sleeve & Valve, MJ, 20" x 12"	WATER	EA
23.08221	Tapping Sleeve & Valve, MJ, 20" x 16"	WATER	EA
23.08222	Tapping Sleeve & Valve, MJ, 24" x 4"	WATER	EA
23.08223	Tapping Sleeve & Valve, MJ, 24" x 6"	WATER	EA
23.08224	Tapping Sleeve & Valve, MJ, 24" x 8"	WATER	EA
23.08225	Tapping Sleeve & Valve, MJ, 24" x 12"	WATER	EA
23.08226	Tapping Sleeve & Valve, MJ, 24" x 16"	WATER	EA
23.08355	Hydrant, L=5.5'	WATER	EA
23.08365	Hydrant, L=6.5'	WATER	EA
23.08400	Hydrant Extension	WATER	EA
23.09001	Temporary Hydrant and Blow-off	WATER	EA
23.10075	Copper Water Service Pipe, 0.75"	WATER	LF
23.10100	Copper Water Service Pipe, 1"	WATER	LF
23.10125	Copper Water Service Pipe, 1.25"	WATER	LF
23.10150	Copper Water Service Pipe, 1.5"	WATER	LF
23.10200	Copper Water Service Pipe, 2"	WATER	LF
23.10475	Boring For 0.75" Water Service Pipe	WATER	LF
23.10500	Boring For 1" Water Service Pipe	WATER	LF
23.10525	Boring For 1.25" Water Service Pipe	WATER	LF
23.10550	Boring For 1.5" Water Service Pipe	WATER	LF
23.10600	Boring For 2" Water Service Pipe	WATER	LF
23.10700	Loop Water Service	WATER	EA
23.10900	Construct Water Service	WATER	EA
23.10901	Reconstruct Water Service	WATER	EA
23.11001	Abandonment of Water Main	WATER	LS
24.01000	Rem Traffic Signal	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01001	Rem Pedestrian Signal	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01010	Rem Mast Arm Pole	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01011	Rem Span Wire Pole	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01012	Rem Street Light Pole	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01013	Rem Pedestal Pole	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01014	Rem Cabinet	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01015	Rem Down Guy	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01016	Rem Riser	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01022	Rem Pull Box	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01023	Rem Concrete Pull Box	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01030	Rem Cable	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.01040	Rem Overhead Cable	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.01050	Rem Head On Mast Arm	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01051	Rem Head On Shaft	TRAFFIC SIGNAL, ITS & LIGHTING	EA

Standard Item No.	Standard Item Description	Section	Unit
24.01052	Rem Pedestrian Push Button	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01053	Rem Luminaire	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01100	Rel Mast Arm Pole	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01101	Rel Span Wire Pole	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01102	Rel Street Light Pole	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01110	Rel Cable	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.01120	Rel Head On Mast Arm	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01121	Rel Metro Street Name Sign	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01122	Rel LED Sign	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.01130	Rotate Traffic Signal Head to Vertical	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.02000	Inst and Rem Temp Traffic Signal	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.02001	Inst and Rem Temp Head	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.03115	Conduit, 1 1/2", Bored	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.03120	Conduit, 2", Bored	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.03130	Conduit, 3", Bored	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.03140	Conduit, 4", Bored	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.03161	Conduit, Main Line Group Bored	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.03205	Conduit, 1/2", Trenched	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.03215	Conduit, 1 1/2", Trenched	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.03220	Conduit, 2", Trenched	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.03230	Conduit, 3", Trenched	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.03240	Conduit, 4", Trenched	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.03261	Conduit, Main Line Group Trenched	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.05006	Pull Box, T6	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.05009	Pull Box, T9	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.05027	Pull Box, TR27	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.05048	Pull Box, T48	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.06015	Riser, 1 1/2"	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.06020	Riser, 2"	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.06040	Riser, 4"	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.07001	Electrical Meter Pedestal	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08100	Pole, Inst Mast Arm, MA-1 to 46'	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08101	Pole, Inst Mast Arm, MA-1>46'	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08110	Pole, Inst MA-1 to 46', Less Mast Arm	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08111	Pole, Inst MA-1>46', Less Mast Arm	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08120	Pole, Inst Mast Arm, MA-1 Twin Mast Arm	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08200	Pole, Inst Mast Arm, MA-2 to 46'	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08201	Pole, Inst Mast Arm, MA-2>46'	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08210	Pole, Inst MA-2 to 46' Twin Luminaire	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08211	Pole, Inst MA-2>46' Twin Luminaire	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08220	Pole, Inst MA-2 to 46' Less Mast Arm	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08221	Pole, Inst MA-2>46' Less Mast Arm	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08230	Pole, Inst MA-2 to 46' Twin Lum, Less MA	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08231	Pole, Inst MA-2>46' Twin Lum Less MA	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08240	Pole, Inst MA-2 Twin Mast Arm	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08250	Pole, Inst MA-2 Twin Mast Arms Less MAs	TRAFFIC SIGNAL, ITS & LIGHTING	EA

Standard Item No.	Standard Item Description	Section	Unit
24.08300	Inst Mast Arm	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08301	Rotate Mast Arm	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08430	Pole, Street Light, SL-A-C-30-6-3	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08435	Pole, Street Light, SL-A-C-35-6-3	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08440	Pole, Street Light, SL-A-C-40-12T-5	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08445	Pole, Street Light, SL-A-C-45-12T-5	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08450	Pole, Street Light, SL-A-C-50-12T-5	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08530	Pole, Street Light, SL-A-PI-30-6-3	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08535	Pole, Street Light, SL-A-PI-35-6-3	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08540	Pole, Street Light, SL-A-PI-40-12T-5	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08545	Pole, Street Light, SL-A-PI-45-12T-5	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08550	Pole, Street Light, SL-A-PI-50-12T-5	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08700	Pole, Inst Pedestal, PPB	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08701	Pole, Inst Pedestal, 1	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08703	Pole, Inst Pedestal, 3	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08860	Pole, Inst Traffic Monitoring, 60'	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08870	Pole, Inst Traffic Monitoring, 70'	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08930	Pole, Street Light, SL-EM-30-6-3	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08935	Pole, Street Light, SL-EM-35-6-3	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08940	Pole, Street Light, SL-EM-40-12T-5	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08945	Pole, Street Light, SL-EM-45-12T-5	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.08950	Pole, Street Light, SL-EM-50-12T-5	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.09000	Ground Rod	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.10005	Detector, Loop, Under Cover	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.10015	Detector, Loop, Saw Cut	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.10020	Detector, Inst Non-Intrusive	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.10200	Detector, Inst Pedestrian Push Button	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.10300	Detector, Inst Camera	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.10301	Detector, Inst Emergency	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.11007	Cabinet, Inst ITS, Pole Mount	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.11008	Cabinet, Inst ITS, Pad Mount	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.11009	Cabinet, Inst Signal, Pad Mount	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.12003	Cable, 3/C Traffic Signal	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12005	Cable, 5/C Traffic Signal	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12007	Cable, 7/C Traffic Signal	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12012	Cable, 12/C Traffic Signal	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12016	Cable, 16/C Traffic Signal	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12101	Cable, Lead-In	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12103	Cable, Emergency Detector	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12104	Cable, Ethernet Communications	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12184	Cable, RRFB	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12204	Cable, No 4 Circuit Ground	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12206	Cable, No 6 Circuit Ground	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12208	Cable, No 8 Circuit Ground	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12304	Cable, No 4 Service	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12306	Cable, No 6 Service	TRAFFIC SIGNAL, ITS & LIGHTING	LF

Standard Item No.	Standard Item Description	Section	Unit
24.12308	Cable, No 8 Service	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12404	Cable, No 4 Circuit Ground Direct Buried	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12406	Cable, No 6 Circuit Ground Direct Buried	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12408	Cable, No 8 Circuit Ground Direct Buried	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12502	Cable, No 2 Street Light	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12504	Cable, No 4 Street Light	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12506	Cable, No 6 Street Light	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12508	Cable, No 8 Street Light	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12602	Cable, No 2 Street Light Direct Buried	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12604	Cable, No 4 Street Light Direct Buried	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12606	Cable, No 6 Street Light Direct Buried	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12608	Cable, No 8 Street Light Direct Buried	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12610	Cable, No 10 Street Light Direct Buried	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12704	Cable, No 4 Street Light Triplex	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.12706	Cable, No 6 Street Light Triplex	TRAFFIC SIGNAL, ITS & LIGHTING	LF
24.13013	Head, Inst Pedestrian Signal, PS-1, T13C	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13030	Head, Inst Traffic Signal, BS-1, T31	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13031	Head, Inst Traffic Signal, TS-1, T31	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13032	Head, Inst Traffic Signal, TS-1L, T32	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13033	Head, Inst Traffic Signal, TS-1R, T33	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13034	Head, Inst Traffic Signal, TS-1L, T34	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13035	Head, Inst Traffic Signal, TS-1R, T35	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13041	Head, Inst Traffic Signal, TS-1LL, T41	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13047	Head, Inst Traffic Signal, TS-1LB, T47	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13050	Head, Inst Traffic Signal, TS-1LL, T51	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13051	Head, Inst Traffic Signal, TS-1LL, T51B	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13052	Head, Inst Traffic Signal, TS-1RR, T52	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13053	Head, Inst Traffic Signal, TS-1RR, T52B	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13060	Sign, Inst Metro Street Name	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13061	Sign, Inst LED	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13062	Sign, Mast Arm	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13070	Inst Speed Zone on Mast Arm	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13071	Inst Speed Zone on Shaft	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13072	Inst Prepare To Stop on Mast Arm	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13073	Inst Prepare To Stop on Shaft	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13074	Inst Speed Indicator on Shaft	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.13075	Rectangular Rapid Flashing Beacon, Inst	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.14261	Luminaire, 26' Grey LED-PC	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.14262	Luminaire, 26' Black LED-PC	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.14331	Luminaire, 33' Grey LED-PC	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.14332	Luminaire, 33' Black LED-PC	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.14381	Luminaire, 38' Grey LED-PC	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.14382	Luminaire, 38' Black LED-PC	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.14521	Luminaire, 52' Grey LED-PC	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.14522	Luminaire, 52' Black LED-PC	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.14801	Luminaire, 80' Grey LED-PC	TRAFFIC SIGNAL, ITS & LIGHTING	EA

Standard Item No.	Standard Item Description	Section	Unit
24.14802	Luminaire, 80' Black LED-PC	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.14921	Luminaire, 92' Grey LED-PC	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.14922	Luminaire, 92' Black LED-PC	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.14991	Luminaire, Downtown Grey LED-SC	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.16001	Camera, Inst Traffic	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.17001	Radio Antenna, Inst	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.18355	Wood Pole, 35/5	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.18402	Wood Pole, 40/2	TRAFFIC SIGNAL, ITS & LIGHTING	EA
24.18403	Wood Pole, 40/3	TRAFFIC SIGNAL, ITS & LIGHTING	EA
26.02001	Fiber Marker	COMMUNICATIONS	EA
26.04001	Ground Bar	COMMUNICATIONS	EA
26.05110	Cable, Fiber Locate	COMMUNICATIONS	LF
26.05812	Cable, Fiber Optic 12 Strand, Single Mode	COMMUNICATIONS	LF
26.05824	Cable, Fiber Optic 24 Strand, Single Mode	COMMUNICATIONS	LF
26.05848	Cable, Fiber Optic 48 Strand, Single Mode	COMMUNICATIONS	LF
26.05896	Cable, Fiber Optic 96 Strand, Single Mode	COMMUNICATIONS	LF
26.06102	Fiber SC Connector	COMMUNICATIONS	EA
26.06103	Fiber SC Panel Pigtail	COMMUNICATIONS	EA
26.06105	Fiber Optic Cable Fusion Splice	COMMUNICATIONS	EA
26.06112	Fiber SC Connector, Inst	COMMUNICATIONS	EA
26.06113	Fiber SC Panel Pigtail, Inst	COMMUNICATIONS	EA
26.06201	Fiber Optic Cable Splice Enclosure, Small	COMMUNICATIONS	EA
26.06202	Fiber Optic Cable Splice Enclosure, Large	COMMUNICATIONS	EA
26.06211	Fiber Optic Cable Splice Enclosure, Small, Inst	COMMUNICATIONS	EA
26.06212	Fiber Optic Cable Splice Enclosure, Large, Inst	COMMUNICATIONS	EA
26.06300	Fiber Distribution Wall Mount Enclosure	COMMUNICATIONS	EA
26.06301	Fiber Distribution Rack Mount Enclosure	COMMUNICATIONS	EA
26.06302	Factory Terminated Patch Panel w/Pigtail, 4-Step	COMMUNICATIONS	EA
26.06303	Factory Terminated Patch Panel w/Pigtail, 6-Step	COMMUNICATIONS	EA
26.06310	Fiber Distribution Wall Mount Enclosure, Inst	COMMUNICATIONS	EA
26.06311	Fiber Distribution Rack Mount Enclosure, Inst	COMMUNICATIONS	EA
26.06312	Factory Terminated Patch Panel w/Pigtail, 4-Step, Inst	COMMUNICATIONS	EA
26.06313	Factory Terminated Patch Panel w/Pigtail, 6-Step, Inst	COMMUNICATIONS	EA
26.06422	Junction Box, 2' x 2'	COMMUNICATIONS	EA
26.06533	3", 3 Cell Fabric Innerduct	COMMUNICATIONS	LF
26.07001	ITS Field Switch, Inst	COMMUNICATIONS	EA
30.07001	Seeding, Ty "A"	EROSION CTRL	AC
30.07002	Seeding, Ty "B"	EROSION CTRL	AC
30.07003	Seeding, Ty "C"	EROSION CTRL	AC
30.07004	Seeding, Ty "D"	EROSION CTRL	AC
30.07005	Seeding, Ty "E"	EROSION CTRL	AC
30.07006	Seeding, Ty "F"	EROSION CTRL	AC
30.07007	Seeding, Ty "G"	EROSION CTRL	AC
30.07008	Seeding, Ty "H"	EROSION CTRL	AC
30.07009	Seeding, Ty "I"	EROSION CTRL	AC
30.08001	Sodding	EROSION CTRL	SF

Standard Item No.	Standard Item Description	Section	Unit
30.09001	Plugging	EROSION CTRL	SF
31.03001	Select Topsoil	EROSION CTRL	CY
32.01001	SWPPP Updating	EROSION CTRL	EA
32.02001	Synthetic Fabric Silt Fence Inst	EROSION CTRL	LF
32.02002	Synthetic Fabric Silt Fence Maint	EROSION CTRL	LF
32.02003	Synthetic Fabric Silt Fence Rem	EROSION CTRL	LF
32.03001	Construction Entrance Surfacing	EROSION CTRL	TON
32.04001	Curb Inlet Protection Inst	EROSION CTRL	EA
32.04002	Curb Inlet Protection Maint	EROSION CTRL	EA
32.04003	Curb Inlet Protection Rem	EROSION CTRL	EA
32.05001	ECB, Type I	EROSION CTRL	SY
32.05002	ECB, Type II	EROSION CTRL	SY
32.05101	BD ECB, Type I	EROSION CTRL	SY
32.05102	BD ECB, Type II	EROSION CTRL	SY
32.06001	TRM, Type I	EROSION CTRL	SY
32.06002	TRM, Type II	EROSION CTRL	SY
32.07001	Triangular Sediment Barrier Inst	EROSION CTRL	LF
32.07002	Triangular Sediment Barrier Maint	EROSION CTRL	LF
32.07003	Triangular Sediment Barrier Rem	EROSION CTRL	LF
32.08001	Rock Ditch Check Inst	EROSION CTRL	LF
32.08002	Rock Ditch Check Maint	EROSION CTRL	LF
32.08003	Rock Ditch Check Rem	EROSION CTRL	LF
32.09001	Composite Filter Sock Inst	EROSION CTRL	LF
32.09002	Composite Filter Sock Maint	EROSION CTRL	LF
32.09003	Composite Filter Sock Rem	EROSION CTRL	LF
32.10001	Biodegradable Log Ditch Check Inst	EROSION CTRL	LF
32.10002	Biodegradable Log Ditch Check Maint	EROSION CTRL	LF
32.10003	Biodegradable Log Ditch Check Rem	EROSION CTRL	LF
32.11001	Transition Mat	EROSION CTRL	SF
32.12001	Coir Fiber Log	EROSION CTRL	LF
32.12002	Coir Fiber Log Maint	EROSION CTRL	LF
50.00001	Misc EA	MISC	EA
50.00005	Misc LF	MISC	LF
50.00010	Misc CY	MISC	CY
50.00015	Misc LS	MISC	LS
50.00020	Misc AC	MISC	AC
50.00025	Misc LBS	MISC	LBS
50.00030	Misc VF	MISC	VF
50.00035	Misc TON	MISC	TON
50.00040	Misc SY	MISC	SY
50.00045	Misc SF	MISC	SF
50.00050	Misc HRS	MISC	HRS
50.00055	Misc CFT	MISC	CFT
50.00060	Misc CDAY	MISC	CDAY
50.00065	Misc GAL	MISC	GAL
50.00070	Misc BALE	MISC	BALE

Standard Item No.	Standard Item Description	Section	Unit
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