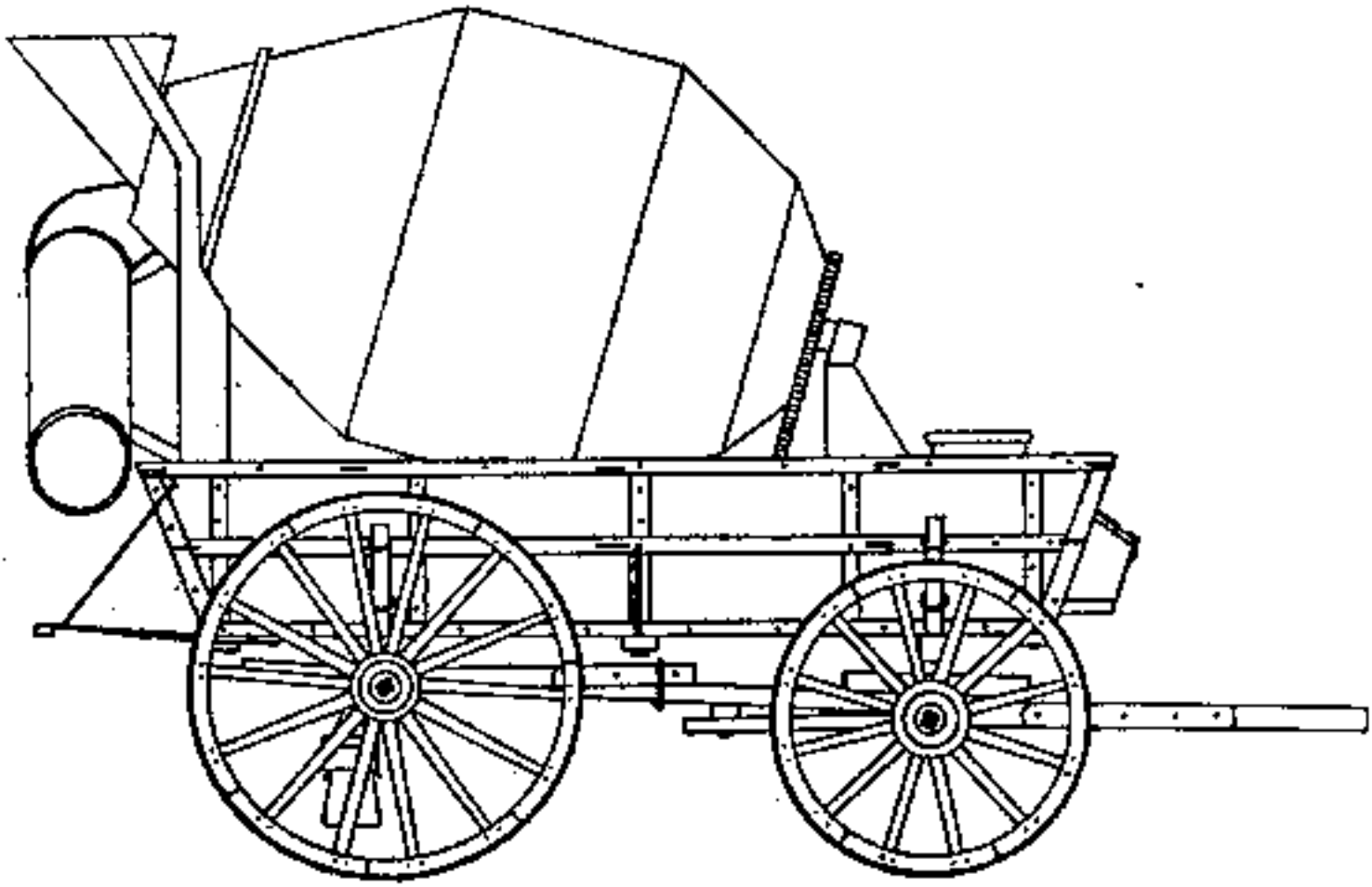
STANDARD

SPECIFICATIONS



City of
Dodge City

The City of Dodge City, Kansas presents this set of Standard Specifications for Public Works Construction.

An attempt is made to include current practice and new technological advances by utilizing recent model specifications from several sources, including some from other areas and states. Dodge City appreciates the use of this material, finding that it makes our task much easier.

Should the users of these specifications find discrepancies or wish to make suggestions which they feel will improve the specifications, please feel free to contact the City Engineer's Office in Dodge City.

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CITY OF DODGE CITY STANDARD DRAWINGS

DIVISION ONE
GENERAL CONDITIONS

101 DEFINITIONS AND ABBREVIATION

101.1.00 Definitions

101.2.00 Abbreviations

101 DEFINITIONS AND ABBREVIATIONS

Unless otherwise defined in the contract documents, the following definitions and abbreviations shall apply whenever used.

The words directed, required, permitted, ordered, requested, instructed, designated, considered necessary, prescribed, approved, acceptable, satisfactory, or words of like import, refer to actions, expressions and prerogative of the Engineer.

Command type sentences are used throughout the contract documents. In all cases, the command expressed or implied is directed to the Contractor.

101.1.00 DEFINITIONS

Acts of God: An act of God is to be construed to mean an earthquake, flood, cloudburst, tornado, hurricane or other phenomenon of nature or catastrophic proportions or intensity.

Addendum: A written or telegraphic amendment or revision to the contract documents or drawings issued to bidders prior to the opening of bids.

Advertisement: The public announcement inviting bids for work to be performed or materials to be furnished.

Approved Equal: A product, component or process whose use in or on a particular project is specified as a standard for comparison purposes only. The "equal" product, component or process shall be the same or better than that named in function, performance, reliability, quality and general configuration. Determination of equality in reference to the project design requirements will be made by the Engineer, pursuant to subsection 106.7.00.

Attorney: The attorney representing the Owner.

Bid Bond: The bond required to be submitted with each proposal as described in section 102.5.00 as a proposal guarantee.

Bidder: An individual, firm, co-partnership or corporation submitting a proposal in response to the advertisement calling for bids on the work, items or products contemplated.

Calendar Day: Any day shown on the calendar beginning and ending at midnight.

Change Order: A written order, approved by the Owner, and issued by the Engineer to the Contractor, covering changes in either the plans, specifications, or quantities within the scope of the contract and as further described in subsections 104.5.00 and 104.6.00.

101.1.00 DEFINITIONS, Continued

Contract: A part of the contract documents which stipulates conditions on which the work is agreed to be performed, executed by the Owner and the Contractor.

Contract Price: The aggregate amount of price promised to be paid by the Owner to the Contractor upon fulfillment of the contract.

Contract Documents: The written agreement covering the performance of the work, the advertisement calling for bids, the proposal, plans, all specifications, addenda, permits, contract, contract bonds, change orders in the course of the work, and any approved revisions made during the performance of the work to any of the above listed documents.

Contract Item: A specific unit of work for which a price or basis of payment is provided in the contract.

Contracting Agency: The legal entity for which the work is being performed.

Contractor: Any individual, firm, co-partnership, corporation or any combination thereof who has entered into the contract with the Owner. In the case of work being done under permit issued by the Owner, the permittee shall be construed to be the Contractor.

Easement: The right to use a defined area of property for a specific purpose or purposes as set forth in a document which has been accepted, obtained or otherwise acquired by the Owner or other authorized agency and which has been filed and is of record.

Engineer: The Engineer who represents the Owner either directly or through his authorized representatives and designated by the contracting agency to supervise the work during its execution.

Extra Work: An item of work not provided for in the contract as awarded but determined by the Engineer as essential to the proper completion of the contract within its intended scope.

Highway: The whole area within the boundaries of a public right of way which is reserved for and secured for public use in constructing and maintaining a roadway and it appurtenances.

Inspector: The authorized representative of the Engineer entrusted with making detailed inspections of the work or materials.

KDOT Standard Specifications: The latest edition of the specification document published by the State of Kansas Department of Transportation entitled "Standard Specifications for State Road and Bridge Construction", available from the Kansas Department of Transportation, Topeka, Kansas.

Legal Holiday: The following, subject to subsequent change by law, are legal holidays: Sunday; New Years Day, January 1; Lincoln's Birthday, February 12; Washington's Birthday, the third Monday in February; Memorial Day, the last Monday in May; Independence Day, July 4th; Labor Day, the first Monday in September; Columbus Day, the second Monday in October; Veterans Day, the eleventh day of November; Thanksgiving Day, the fourth Thursday in November; Christmas Day, December 25th. When a legal holiday falls on Sunday, other than Sunday, and is not already described as a Monday holiday, the immediately following Monday is a legal holiday.

Lump Sum: A method of payment providing for one all-inclusive cost for the work or for a particular portion of the work.

Notice: A written communication delivered to the authorized individual, member of the firm or officer of the corporation for which it is intended. If delivered or sent by mail, it shall be addressed to the last known business address of the individual, firm or corporation. In the case of a contract with two (2) or more persons, firms or corporations, notice to one shall be deemed as notice to all.

Notice to Proceed: A written notice to the Contractor from the Engineer or Owner, designating the date the contract term is begun and the date for final completion of the contract.

Owner: The legal entity or contracting agency for which the work is being performed.

Performance Bond: The form of security approved by the Owner, furnished by the Contractor and his surety, guaranteeing the complete and faithful performance of all the obligations and conditions placed upon the Contractor by the contract.

Plans: The official plans, profiles, cross sections, elevations, details and other working, supplementary and detail drawings, or reproductions thereof, signed by the Engineer, which show the location, character, dimension and details of the work to be performed. Plans may either be bound in the same book as the balance of the contract documents or bound in separate sets, and are a part of the contract documents, regardless of the method of binding.

Prequalifications: See definition and provisions, subsection 102.1.00.

Project: The specific work together with all appurtenances and construction to be performed thereon under the contract.

Proposal: The offer of the bidder to perform work at the prices quoted, submitted on the Owner's official proposal form, properly signed and guaranteed.

Proposal Guaranty: The security furnished with a proposal to assure that the bidder will enter into the contract if the proposal is accepted.

Provide: When related to an item of work, provide shall be understood to mean furnish and install the work complete in place.

Reference Specifications: Bulletins, standards, rules, methods of analysis or test, codes and specifications of other agencies, Engineering societies, or industrial associations referred to in the contract documents. All such references specified herein refer to the latest edition thereof, including any amendments thereto, which are in effect and published at the time of advertising for bids.

Right of Way: A general term denoting land, property, or interest therein, acquired for or devoted to public use.

Road: Every road or roadway, thoroughfare, and place including bridges, viaducts and other structures used or intended for use of vehicles.

Shown: As used herein, the work shown, or as shown, shall be understood to refer to work shown on the plans in the contract documents.

Special Specifications or Special Provisions: Requirements peculiar to the project and changes and modifications of the standard specifications. Special specifications are used interchangeably with special provisions.

Specified: As used herein the work specified, or as specified, means as required by the contract documents.

Standard Plans or Drawings: Details of structures, devices, or instructions adopted by the Owner as a standard and referred to in the contract documents by title or number.

Standard Specifications: The terms, directions, provisions and requirements set forth in this document, together with all subsequent addenda and supplements thereto identified as such.

Station: A distance of 100 feet measured horizontally along a surveyed centerline.

Statutory Bond: In addition to a Performance Bond, as required in General Conditions, the Contractor shall furnish a Statutory Bond to the State of Kansas in an amount equal to 100 percent of the Contract Price.

Street: Any road, highway, parkway, freeway, avenue, alley, walk, or way, including sidewalks, parking strips and all other structures including utilities above and below the surface, land and improvements within the public right of way between property lines.

Subcontractor: An individual, partnership, firm, corporation, or any acceptable combination thereof, or joint venture to whom the Contractor, with the written consent of the Owner, sublets part of the contract.

Surety: The corporate body which is bound with and for the Contractor, for the acceptable performance of the contract, and for his payment of all obligations arising out of the contract. Where applying to the "Proposal Guaranty", it refers to the corporate body which engages to be responsible for the bidder's execution of a satisfactory contract when and if his bid is accepted by the Owner.

Ton: The short ton of 2,000 pounds avoirdupois.

Unit Price: A contract item of work providing for payment based on a specified unit of measurement; e.g. linear foot or cubic yard.

Utility: Tracks, overhead or underground wires, pipelines, conduits, ducts, or structures, owned, operated, or maintained in or across a public or private right-of-way or easement.

Work: That which is proposed to be constructed or performed under the contract or permit, including the furnishing of all material, labor, tools, machinery and appurtenances necessary to complete the contract.

Working Day: Any and every calendar day excluding Saturdays and legal holidays.

101.1.00 DEFINITIONS, Continued

Working Drawings: Stress sheets, shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data which the Contractor is required to submit to the Engineer for approval.

101.2.00 ABBREVIATIONS

AAN	American Association of Nurseryman
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AGA	American Gas Association
AGC	Associated General Contractors of America
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
CRSI	Concrete Reinforcing Steel Institute
DFPA	Division of Product Approval of American Plywood Association
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
ITE	Institute of Traffic Engineers
JIC	Joint Industry Conferences of Hydraulic Manufacturers
KDHE	Kansas Department of Health and Environment
KDOT	Kansas Department of Transportation
KSA	Kansas Statutes Annotated
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NLMA	National Lumber Manufacturer's Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
UBC	Uniform Building Code
UL	Underwriter's Laboratories, Inc.
WWPA	Western Wood Products Association

102 PROPOSAL REQUIREMENTS

102.1.00 Prequalification of Bidders

102.1.00 Form of Proposal

102.3.00 Withdrawal, Modification or Alteration of Proposal

102.4.00 Late Proposal

102.5.00 Proposal Guaranty

102.6.0 Examination of Plans, Standard Plans or Drawings, Specifications and Site of Work

102.7.00 Interpretation of Contract Documents

102.8.00 Addenda to Contract Documents

102.9.00 Familiarity with Laws and Ordinances

102.10.00 Amount of Work to Be Done

102.11.00 Bid Prices to Cover Entire Work

102.12.00 Rejection of Proposals

102 PROPOSAL REQUIREMENTS

102.1.00 Prequalification of Bidders: Each bidder, when requested, shall furnish the Owner satisfactory evidence of his competency to perform the proposed work. Such evidence of competency, unless otherwise specified, shall consist of statements covering the bidder's past experience on similar work, a list of equipment that would be available for the work, and a list of key personnel that would be available. In addition, each bidder shall furnish the Owner satisfactory evidence of his financial responsibility. Such evidence of financial responsibility, unless otherwise specified, shall consist of a confidential statement or report of the bidder's financial resources and liabilities as of the last calendar year or the Contractor's last fiscal year. Such statements or reports shall be certified by a public accountant. At the time of submitting such financial statements or reports, the bidder shall further certify whether his financial responsibility is approximately the same as stated or reported by the public accountant. If the bidder's financial responsibility has changed, the bidder shall qualify the public accountant's statement or report to reflect his (bidder's) true financial condition at the time such qualified statement or report is submitted to the Owner.

Unless otherwise specified, a bidder may submit evidence that he is prequalified with the State Highway Division and is on the current "Bidder's List" of the State in which the proposed work is located. Such evidence of State Highway Division prequalification may be submitted as evidence or financial responsibility in lieu of the certified statements or reports hereinbefore specified.

102.2.00 Form of Proposal: Bidders shall enclose the proposal, bid bond, or certified check or cashier's check in a sealed envelope, labeled and addressed and file as required.

All proposals shall be clearly and distinctly typed or written. Changes may be made, provided the change is initialed.

All proposals shall be on the form furnished by the Owner, and in addition to the necessary unit price items and total prices in the column of totals to make a complete bid, all applicable blanks giving general information must be filled in and the bid signed by the Contractor or a duly authorized agent. Any statement accompanying and tending to qualify a bid may cause rejection of such bid, unless such statement is required or permitted.

102.2.00 Form of Proposal, Continued

Unless otherwise specified, bidders shall bid on all bid items included in the proposal and the lower bidder shall be determined in accordance with subsection 103.1.00

102.3.00 Withdrawal, Modification or Alteration of Proposal: A proposal may be withdrawn upon written request of the bidder prior to the scheduled closing time for filing bids. Negligence on the part of the bidder in preparing his proposal confers no right to withdraw his proposal after the scheduled closing time for filing bids.

Change in a delivered proposal will be permitted only if a request for making such modification is made in writing, signed by the bidder, and the specific modification is stated and received prior to the scheduled closing time for filing bids.

102.4.00 Late Proposals: Proposals received after the scheduled closing time for filing bids will not be opened or considered by the Owner unless such bid, if sent through the mails, shows a legible postmark or post office cancellation proving the time of mailing was at least 48 hours prior to the scheduled closing time for filing bids, and such proposal is received before the award has been made.

102.5.00 Proposal Guaranty: Unless covered by an annual bid bond in an unencumbered amount sufficient to cover all pending bids which is filed with the Owner, all proposals must be accompanied by a proposal guarantee in the form of a certified check payable to the order of the Owner, or a bidder's bond for the single bid submitted, in an amount as specified in the proposal. Such proposal guarantee may be forfeited as liquidated damages in case the bidder shall fail or neglect to furnish a performance bond and insurance, as required, or to execute the contract within ten days after receiving said contract from the Owner for execution.

102.6.00 Examination of Plans, Standard Plans or Drawings, Specifications and Site of Work: Bidders shall determine for themselves all the conditions and circumstances affecting the project or the cost of the proposed work by personal examination of the site, the Contract Documents, and by such other means as they may choose. It is understood and agreed that information regarding underground or other conditions or obstructions indicated in the Contract Documents has been obtained by the Owner from data at hand. There is no express or implied agreement that such conditions are fully or correctly shown and the bidder must take into consideration the possibility that conditions affecting the cost or quantity of work may differ from those indicated.

102.7.00 Interpretation of Contract Documents: If it should appear to a bidder that the work to be done or matters relative thereto are not sufficiently described or explained in the Contract Documents or that the Contract Documents are not definite and clear, the bidder may make written inquiry regarding same to the Engineer at least five (5) days before the scheduled closing time for filing bids. Then, if in the judgement of the Engineer, additional information or interpretation is necessary such information will be supplied in the form of an addendum which will be delivered to all individuals, firms and corporations who have taken out Contract Documents. Such addendum shall have the same binding affect as though contained in the main body of the Contract Documents. ORAL INSTRUCTIONS OR INFORMATION CONCERNING THE CONTRACT DOCUMENTS OR THE PROJECT GIVEN OUT BY OFFICERS, EMPLOYEES OR AGENTS OF THE OWNER TO PROSPECTIVE BIDDERS SHALL NOT BIND THE OWNER.

102.8.00 Addenda to Contract Documents: Any addendum or addenda issued by the Engineer which may include changes, corrections, additions, interpretations or information, and issued seventy-two (72) hours or more before the scheduled closing time for filing bids, Saturday, Sunday and legal holidays not included, shall be binding upon the bidder. The Owner shall send copies of such addenda to all Contractors who have obtained copies of the Contract Documents for the purpose of bidding. Receipt of any such addendum shall be signed by the bidder and submitted with the bid proposal or acknowledged on the bid proposal forms.

102.9.00 Familiarity with Laws and Ordinances: The bidder is assumed to be familiar with all Federal, State and local laws, ordinances, and regulations which in any manner affect those engaged or employed in the work or the materials or equipment used in the proposed construction, or which in any way affect the conduct of the work, and no plea of misunderstanding will be considered on account of ignorance thereof. If the bidder, or Contractor shall discover any provision in the Contract Documents which is contrary to or inconsistent with any law, ordinance, or regulation, he shall forthwith report it to the Owner in writing.

102.10.00 Amount of Work to be Done: The Owner reserves the right to increase or decrease the amount of any class or portion of the work. No such change in the work shall be considered as a waiver of any condition of the contract nor shall such change invalidate any of the provisions thereof.

The estimate of quantities of work to be done under unit price bids is approximate and is given only as a basis of calculation for comparison of bids and award of the contract. The Owner does not by implication agree that the actual amount of the work will correspond precisely to the amount as shown or estimated.

102.10.00 Amount of Work to be Done, Continued

The scheduled quantities of work to be done and materials to be furnished may each be increased, decreased, or omitted. Payment will be made at the unit prices under the contract only for the work performed or materials furnished except as specified in subsection 104.5.00.

102.11.00 Bid Prices to Cover Entire Work: Bidders must include in their bid prices the entire cost of each item of work set forth in the proposal, and it is understood and agreed that there is included in each lump sum or unit price bid the entire cost of materials and labor incidental or necessary to the completion of that portion of the work covered, unless such incidental work is expressly included in other lump sum or unit price bids in the proposal.

102.12.00 Rejection of Proposals: The Owner reserves the right to reject all bid proposals.

103 AWARD AND EXECUTION OF CONTRACT

103.1.00 Award of Contract

103.2.00 Execution of Contract

103.3.00 Failure to Execute Contract

103.4.00 Return of Proposal Guaranty

103.5.00 Assignments

103.6.00 Performance Bond

103.7.00 Owners Immunity from Liability

103.8.00 Proof of Carriage of Insurance

103.9.00 Certificates of Compliance

103 AWARD AND EXECUTION OF CONTRACT

103.1.00 Award of Contract: The award will be made by the Owner to the bidder submitting the lowest acceptable bid, discounts if any, the time of completion or delivery proposed as compared to equal bids, the relative merits and performance of any item specifically proposed by the bidder, any variation in maintenance and guaranty period specially proposed by the bidder in excess of any minimums specified, the realistic balance of prices in the proposals for various parts or units of the work, and the experience and ability of the bidder to perform the work. The Owner reserves the right to waive any informalities and/or irregularities in said proposals.

While price extensions are required as a matter of convenience, in the event of error in extensions, the unit prices bid shall govern. In the event of discrepancy between the written and numerical amounts, the written prices will govern.

Determination of the lowest acceptable bidder and award may be subject to review and determination by the attorney as to legal sufficiency of any bid submitted.

The award of contract, if it be awarded, shall be made within thirty (30) calendar days after the date of opening of bids, and shall be a notice in writing mailed or delivered at the office designated on the proposals.

Existing State Law (KSA 75-3740a) requires that to the extent permitted by federal law and regulations the Owner, when letting contracts for bids, must require any successful Bidder-Contractor domiciled outside the State of Kansas to submit a bid the same percent less than the lowest bid submitted by a responsible Kansas Contractor as would be required of such Kansas domiciled Contractor to succeed over the bidding Contractor domiciled outside Kansas on a like Contract let in the foreign bidder's domiciled state. All bids are received on this condition and if it is determined by the Owner that the apparent lowest and best bidder is a foreign domiciled Contractor who has failed to comply with this State requirement, such bid shall be rejected.

103.2.00 Execution of Contract: Within ten (10) days after the date the bidder receives notification of award of contract as evidenced by receipt from the Owner of properly prepared contract documents, the bidder to whom award is made shall execute and return the contract in the required number of copies, and shall furnish a performance bond and other required bonds and insurance satisfactory to the Owner.

103.3.00 Failure to Execute Contract: Failure on the part of the bidder to whom the contract is awarded to execute the contract and to deliver the contract and required performance

103.3.00 Failure to Execute Contract, Continued

bond as described in subsection 103.6.00, shall be just cause for cancellation of the award, withdrawal of the contract and forfeiture of the proposal guaranty. The forfeited proposal guaranty shall become the property of the Owner. Award may then be made to the next lowest acceptable bidder, or the work may be readvertised, or it may be constructed under contract or otherwise, as the Owner may decide.

103.4.00 Return of Proposal Guaranty: Upon execution of the contract and bond by the successful bidder, his proposal guaranty shall be returned to him. The bidder who has a contract awarded to him and who fails promptly and properly to execute the contract or bond shall forfeit the proposal guaranty that accompanied his bid. The proposal guaranty shall be taken and considered as liquidated damages and not as a penalty for failure of the bidder to execute the contract and bond. The proposal guaranty of unsuccessful bidders will be returned after the bids have been opened and the contract has been awarded, and shall not be retained after the contract has been duly signed. The Owner reserves the right to retain the bid security of the three (3) lowest bidders until the awarded contract has been signed and returned.

103.5.00 Assignments: Neither the contract nor any interest therein shall be transferred to any other party or parties without the prior written consent of the Owner. In case of such attempted transfer without permission, the Owner may refuse to carry out the contract either with the transferor or the transferee, but all rights of action for any breach of the contract by said Contractor are reserved to the Owner. No person employed in the Owner's service, is or shall be permitted any share or part of the contract or is or shall be entitled to any benefit which may arise therefrom.

103.6.00 Performance Bond and Statutory Bond: At the time of execution of the contract, the successful bidder shall furnish a performance bond and statutory bond approved by the Owner in an amount equal to the amount of the contract, conditioned upon compliance with the fulfillment of the provisions of the contract and requirements of law.

103.7.00 Owner's Immunity from Liability: The Contractor shall save, keep and hold harmless and defend, the Owner, the Engineer and his consultants, and all employees, officers and agents thereof from all damages, costs or expenses in law or equity that may at any time arise or be set up because of damages to property or of personal injury received either by reason of or in the course of performing said work which may be occasioned by employees, or any Subcontractor performing any of the work.

103.7.00 Owner's Immunity from Liability, Continued

The Owner shall not be liable or responsible for any accident, loss or damage happening to the work referred to in the contract prior to the completion and acceptance thereof.

103.8.00 Proof of Carriage of Insurance: Work shall not commence until all insurance required in the contract has been obtained nor until such insurance has been approved by the Owner, nor shall any Subcontractor commence work until he also has first obtained insurance applicable to such work. The Contractor shall maintain insurance throughout the life of the contract which will hold the Owner harmless and shall indemnify the Owner for any and all losses to third persons or to the Owner arising out of the operations, including any contingent liability arising therefrom.

The Owner will only accept coverage from an insurance carrier who offers proof that it is licensed to do business in the State of Kansas.

103.9.00 Certificates of Compliance: Prior to the acceptance of the work, the Owner may require a certificate in form substantially as follows: "I (We) hereby certify that all work has been performed and materials supplied in accordance with the Contract Documents for the above work, and that:

1. Not less than the prevailing rates of wages has been paid to laborers, workers and mechanics employed on those projects required by Federal or State regulation or if specifically required by the Special Provisions;
2. There have been no unauthorized substitutions; nor have any subcontracts been entered into without the names of the Subcontractors having been submitted to the Engineer prior to the start of such subcontracted work;
3. No subcontract was assigned or transferred or performed by any Subcontractor other than the original Subcontractor, without prior notice having been submitted to the Engineer together with the names of all Subcontractors;
4. All claims for material and labor and other service performed in connection with these specifications have been paid;
5. All monies due the State of Kansas, or any kind or character have been paid, and hospital associations and/or others have been paid."

104 SCOPE OF WORK

104.1.00 Intent of Contract

104.2.00 Plans and Specifications

104.3.00 Precedence of Contract Documents

104.4.00 Shop Drawings

104.5.00 Changes in Work
104.5.01 Changes Requested by the Contractor
104.5.02 Changes Initiated by the Owner

104.6.00 Changed Conditions

104.7.00 Disputed Work

104.8.00 Records

104.9.0 Extra Work
104.9.01 General
104.9.02 Payment
104.9.02A Labor
104.9.02B Materials
104.9.02C Equipment Rental

104.1.00 Intent of Contract: The intent of the contract is to provide for the construction and completion of the work described. The Contractor shall furnish all labor, materials, equipment, tools, transportation and supplies required to complete the work in accordance with the plans, specifications and terms of the contract.

The Contractor shall perform all work in accordance with the lines, grades, typical cross sections, dimensions and other data shown on the plans or as modified by written orders of the Engineer, and all other work determined by the Engineer as necessary to proper prosecution and completion of the project.

104.2.00 Plans and Specifications: The plans, specifications and other contract documents will govern the work. The contract documents are intended to be complementary and cooperative and to describe and provide for a complete project. Anything in the specifications and not on the plans, or on the plans and not in the specifications, shall be as though shown or mentioned in both. Reference specifications and standard plans are a part of the contract documents.

While it is believed that much of the information pertaining to conditions which may affect the cost of the proposed work will be shown on the plans or indicated in the specifications, the Owner does not warrant the completeness or accuracy of such information. It is the Contractor's responsibility to ascertain the existence of any conditions affecting the cost of the work which would have been disclosed by reasonable examination of the site.

The Contractor shall, upon discovering any error or omission in the plans or specifications, immediately call it to the attention of the Engineer.

104.3.00 Precedence of Contract Documents: If there is a conflict between contract documents, the document highest in precedence shall control. The precedence shall be:

1. Permits from other agencies as may be required by law.
2. Special Provisions.
3. Plans
4. Standard plans
5. Standard specifications
6. Reference specifications

Change orders, supplemental agreements and approved revisions to plans and specifications will take precedence over documents listed above. Detailed plans shall have precedence over general plans.

104.4.00 Shop Drawings: When shop drawings are required by the Engineer, they shall be prepared in accordance with current modern Engineering practice and at the Contractor's expense. Drawings shall be of a size and scale to show clearly all necessary details and shall be transmitted by letter to the Engineer for approval or correction before commencing the work.

Materials shall not be furnished or fabricated nor any work done for which drawings are required, before approval of the drawings.

Approval of drawings by the Engineer shall not relieve the Contractor from the responsibility for errors or omissions in the drawings or from deviations from the contract documents unless such deviations were specifically called to the attention of the Engineer in the letter of transmittal submitted with the drawings. The Contractor shall be responsible for the corrections of the drawings, for shop fits and field connections, and for the results obtained by use of such drawings.

104.5.00 Changes in Work

104.5.01 Changes Requested by the Contractor: Changes in specified methods of construction may be made at the Contractor's request when approved in writing by the Engineer.

Changes in the plans and specifications, requested in writing by the Contractor, which do not materially affect the work and which are not detrimental to the work or to the interests of the Owner, may be granted by the Engineer. Payment to be made per Section 109 of these specifications.

104.5.02 Changes Initiated by the Owner: The Owner reserves the right to make such alterations in the plans or in the quantities of work as may be considered necessary. Such alterations shall be in writing by the Engineer and shall not be considered as a waiver of any conditions of the contract nor to invalidate any of the provisions thereof; provided, however, that the execution of a supplemental agreement acceptable to both parties of the contract will be necessary before any alteration is made which involves (1) an extension or shortening of the length of the project by more than 25%, (2) an increase or decrease of more than 25% of the total cost of the work calculated from the original proposal quantities and the unit contract prices, or (3) an increase or decrease of more than 25% in the quantity of any one major contract item. For condition (3) above, a major item is defined as any item, unless otherwise indicated on the plans or designated in the special provisions, the contract price for which amounts to 5% or more of the total contract price as determined by the original unit contract prices.

Alterations involving an increase of more than 25% in the net of any one minor contract item will not require a supplemental agreement.

104.5.02 Changes Initiated by the Owner, Continued

Change orders shall be in writing and state the dollar value of the change or established method of payment, any adjustments in contract time and, when negotiated prices are involved, shall provide for the Contractor's signature indicating acceptance.

Payment for all work to be made per Section 109 of these specifications.

104.6.00 Changed Conditions: The Contractor shall notify the Engineer in writing of the following work site conditions, hereinafter called changed conditions, promptly upon their discovery and before they are disturbed:

(a) Subsurface or latent physical conditions differing materially from those represented in the contract; and

(b) Unknown physical conditions of an unusual nature differing materially from those ordinarily encountered and generally recognized as inherent in work of the character being performed.

The Engineer will promptly investigate conditions of which notified or any conditions discovered by the Engineer which appear to be changed conditions. If it is determined that the conditions are changed conditions and that they will materially increase or decrease the costs or any portion of work, a change order will be issued by the Engineer adjusting the compensation for such portion of the work. If the Engineer determines that conditions of which notified by the Contractor do not justify an adjustment in compensation, the Contractor will be so advised in writing. Should the Contractor disagree with such determination, a notice of potential claim may be submitted to the Engineer.

104.7.00 Disputed Work: If unable to reach agreement under any of the foregoing procedures, the Owner may direct the Contractor to proceed with the work. Payment shall be as later determined by an appeals board when such a procedure is provided for by the Owner, or as fixed in a court of law.

Although not to be construed as proceeding under extra work provisions, the Contractor shall keep and furnish records or all disputed work.

104.8.00 Records: The Contractor shall maintain records in such a manner as to provide a clear distinction between the direct cost of extra work paid for on the force account basis and the costs of other operations performed in connection with the contract.

The Contractor shall furnish to the Engineer daily reports in duplicate of the extra work to be paid for on a force account basis. The reports shall itemize the materials used and shall set forth the direct cost of labor and the charges for equipment rental whether furnished by the Contractor, or Subcontractor. The reports shall provide the names or identifications and classifications of workers, the hourly rate of pay and hours worked together with the size, type and identification number of equipment and hours of equipment operations.

Failure to present claims on extra work in proper form within thirty (30) days after the close of the month in which the work covered was performed shall constitute a waiver on the part of the Contractor of his right to present such claim thereafter or to receive payment thereof.

All reports shall be signed by the Contractor or an authorized representative.

The Engineer will compare records with the reports furnished by the Contractor, make any necessary adjustments and then compile the costs of extra work paid for on a force account basis on forms furnished by the contracting agency. When these extra work reports are agreed upon and signed by both parties, they shall become the basis of payment for the work performed.

104.9.00 Extra Work

104.9.01 General: New or unforeseen work will be classed as "extra work" when the Engineer determines that it is not covered by contract unit prices or stipulated unit prices and the character of such work is substantially different from than on which the Contractor bid.

104.9.02 Payment: Payment for extra work will be established by agreement between the Contractor and the Owner. If no agreement can be reached, payment will be made on the basis of Section 109.6.00 Payment for Force Account Work.

The Contractor shall maintain records sufficient to distinguish the direct cost of extra work from the cost of other operations.

The Contractor shall furnish daily reports of extra work. The reports shall itemize all costs for labor, materials, and equipment rental. The reports shall include for workers hours worked, rates of pay, names and classifications; and for equipment, shall include size, type, identification number and hours of operation.

104.9.02 Payment, Continued

All records and reports shall be made immediately available to the Engineer upon request.

All reports shall be signed by the Contractor or an authorized representative.

The Engineer's records will be compared with the Contractor's report, and the necessary adjustments and compilation of the costs of extra work will be made. When extra work reports are agreed upon and signed by both parties, they shall become the basis of payment.

104.9.02A Labor: On those projects required by Federal or State regulations to pay prevailing wage scales, labor costs shall be based on the prevailing wage scale for each craft or type of worker. On projects where regulations do not require the payment of wage scales established by Federal or State agencies, labor costs shall be based on the rate normally paid by the Contractor. Each worker will be paid for the classification of work being done. Over-classification will not be permitted or paid for. Employer payments for payroll taxes and insurance, health and welfare, pension, vacation and other direct labor costs shall be included.

104.9.02B Materials: The cost of materials incorporated in the work will be the cost to the purchaser, whether Contractor, Subcontractor or other forces, from the supplier thereof, except as follows:

(a) If materials are procured by the purchaser by any method which is not a direct purchase from and a direct billing by the actual supplier to such purchaser, the cost of such materials shall be deemed to be the price paid the actual supplier as determined by the Engineer. No markup except, for actual costs incurred in the handling of such materials will be permitted.

(b) If the materials are obtained from a supplier or source owned wholly or in part by the purchaser, payment therefor will not exceed the price paid by the purchaser for similar materials furnished from said source on contract items or the current price of such materials delivered to the job site, whichever price is lower.

(c) The Owner reserves the right to furnish such materials as it deems advisable, and the Contractor shall have no claims for costs and profit on such furnished materials.

104.9.02C Equipment Rental: The Contractor will be paid for the use of equipment on the basis of, but not exceeding the prevailing hourly rental rates established by the Kansas Department of Transportation and recognized by the Associated General Contractors for the area where such equipment is required to be operated.

104.9.02C Equipment Rental, Continued

On any equipment for which no rental rate has been established by the Kansas Department of Transportation, or where the required operation of the equipment is less than four hours or in excess of one week, rental rates shall be proposed by the Contractor and agreed upon in writing by the Engineer prior to the start of force account work.

Equipment that is in operational condition and is standing by with the Engineer's approval for participation in force account work, will be paid for at 50 percent of the agreed upon rental rate. All equipment to be used for extra work shall be approved by the Engineer.

Rental time will not be allowed while equipment is inoperative due to breakdowns for periods in excess of 30 minutes. Rental time shall be computed in ½ hour increments. In computing rental time of equipment in actual operation, less than 30 minutes will be considered ½ hour.

The rental rates paid, as above provided, shall include the cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repair and maintenance of any kind, depreciation, storage, insurance and all incidentals.

All equipment shall, in the opinion of the Engineer, be in good working condition and suitable for the purpose for which the equipment is to be used.

Unless otherwise specified, manufacturer's ratings and manufacturer approved modifications shall be used to classify equipment for the determination of applicable rental rates. Equipment which has no direct power unit shall be powered by a unit of at least the minimum rating recommended by the manufacturer.

Individual pieces of equipment or tools having a replacement value of $100.00 or less, whether or not consumed by use, shall be considered to be small tools and no payment will be made therefor.

The rental time to be paid for equipment on the work shall be the time the equipment is in operation on the extra work being performed and, in addition, shall include the time required to move the equipment to be used at the site of the extra work on other than such extra work. Loading and transporting costs will be allowed, in lieu of moving time, when the equipment is moved by means other than its own power, except that no payment will be made if the equipment is used at the site of the extra work on other than such extra work.

The rental period shall begin at the time the equipment is unloaded at the site of the extra work, shall include each day that the equipment is at the site of the extra work, excluding Saturdays and legal holidays unless the extra work is perform on such days, and shall terminate at the end of the day on which the Engineer directs the Contractor to discontinue the use of such equipment. The maximum rental time to be paid per day will not exceed eight hours unless the equipment is in operation for a longer time.

105 CONTROL OF WORK

105.1.00 Authority of the Engineer

105.2.00 Authority and Duties of Inspectors

105.3.00 Disputed Work

105.4.00 Responsibility of the Contractor

105.5.00 Notifications Relative to Contractor's Activities

105.6.00 Utilities and Existing Improvements

105.7.00 Survey Service

105.8.00 Protection of Survey Markers

105.9.00 Other Surveyors

105.10.00 Protection of Property

105.11.00 Temporary Traffic Control

105.12.00 Protection of Work

105.13.00 Maintenance of Work after Acceptance

105.14.00 Use of Light, Power, and Water

105.15.00 Subsurface Data

105.16.00 Verbal Agreements

105.17.00 Dust Control

105.18.00 Removal of Defective or Unauthorized Work

105.19.00 Cleanup

105.20.00 Final Inspection

105 CONTROL OF WORK

105.1.00 Authority of the Engineer: Subject to such authority as is delegated by the Owner, the Engineer will decide all questions which may arise as to the quantity, quality and acceptability of materials furnished and work performed, the rate of progress of the work; change orders and time extensions; interpretation of the plans and specifications; the measurement of all quantities; the acceptable fulfillment of the contract on the part of the Contractor. The Engineer's estimates and decisions in these matters shall be final, binding and conclusive upon all parties of the contract.

It is further understood that all work to be done under the contract will not be considered completed until it has passed final inspection by the Engineer and is accepted by the Owner. It is further understood that the authority of the Engineer is such that the Contractor shall at all times carry out and fulfill the instructions and directions of the Engineer insofar as they concern the work to be done under the contract.

Upon failure on the part of the Contractor to comply with any order made under the provisions of this subsection, the Engineer shall have the authority to suspend the work for cause as set forth in Section 108, particularly subsection 108.5.00.

Approval by the Engineer signifies favorable opinion and qualified consent; it does not carry with it certifications, nor assurance of completeness nor assurance of quality nor assurance of accuracy concerning details, dimensions and quantities. Such approval will not relieve the Contractor from responsibility for errors, for improper fabrication, for nonconformance to requirements or for deficiencies within his control.

105.2.00 Authority and Duties of Inspectors: The Engineer may appoint assistants to inspect all materials used and all work done. Such inspection may extend to any or all parts of the work and to the preparation or manufacture of the materials to be used. The inspectors will not be authorized to revoke, alter, enlarge or relax the provisions of these specifications. An inspector is placed on the work to set the necessary lines and grades and to keep the Engineer informed as to the process of the work and the manner in which it is being done; also to call the attention of the Contractor to any infringements upon plans or specifications, but failure of the inspection or the Engineer to call the attention of the Contractor to faulty work or infringements upon plans or specifications shall not constitute acceptance of said work.

105.2.00 Authority and Duties of Inspectors, Continued

An inspector will not be authorized to approve or accept any portion of the work or to issue instructions contrary to the plans and specifications. The inspector will have the authority to reject defective material and to suspend any work that is being improperly done, subject to the final decision of the Engineer. The inspector will exercise such additional authority as may, from time to time, be especially delegated to him by the Engineer.

105.3.00 Disputed Work: If the Contractor considers any work demanded of him to be outside he scope of the contract or considers any ruling of the Engineer to be unfair, upon such work being demanded or such ruling being made, the Contractor shall proceed without delay to perform the work or to conform to the ruling. The Contractor shall within ten days after the date of receipt of the instructions or ruling, file a written protest with the Engineer, stating clearly and in detail the basis of objection, and include an itemized statement of any extra costs which may have resulted. Except for such protests or objections as are made of record in the manner herein specified and within the time limit stated, the records, rulings, instructions or decisions of the Engineer will be final and conclusive.

105.4.00 Responsibility of the Contractor: The Contractor shall do all the work and furnish all labor, materials, equipment, tools and machines necessary for the performance and completion of the project in accordance with the contract documents within the specified time.

Material and construction details of plants, forms, shoring, falsework and other structures built by the Contractor but not a part of the permanent project shall meet the approval of the Engineer, but such approval shall not relieve the Contractor from responsibility for their safety and sufficiency.

The Contractor shall be responsible for all expense involved in making any required changes in the plans or specifications to accommodate a substitution approved by the Engineer for the convenience of the Contractor or to circumvent an unforeseen difficulty in obtaining a specified article.

The Contractor shall assume all responsibility for the work. As between him and the Owner, the Contractor shall bear all losses and damages directly or indirectly resulting to him, to the Owner or to others on account of the character of performance of the work, unforeseen difficulties, accidents or any other cause whatsoever. The Contractor shall assume the duty to defend,

105.4.00 Responsibility of the Contractor, Continued

Indemnify and save harmless the Owner, its officers and employees from all claims, liability, loss, damage and injury of every kind, nature and description, directly or indirectly resulting from the Contractor's activities in the performance of the contract, the Ownership, maintenance or use of motor vehicles in connection herewith, or the acts, omissions, operations, or conduct of the Contractor or any Subcontractor under the contract, or in any way arising out of the contract, irrespective of whether fault is the basis of the liability of claim, and irrespective of whether any act, omission or conduct of the Owner connected with the contract is a condition or contributory cause of the claimed liability, loss, damage or injury and irrespective of whether act, omission or conduct of the Contractor of Subcontractor is merely a condition rather than a cause of the claim, liability, loss, damage or injury. The Contractor shall not be liable for, nor be required to defend or indemnify the Owner relative to claims for damage or damages resulting solely from acts or omissions of the Owner, its officers, agents, or employees.

The Contractor shall be responsible to notify the Engineer 24 hours in advance for inspection of all portions of the work, and all forms shall be inspected prior to placement of concrete.

105.5.00 Notifications Relative to Contractor's Activities: The Contractor shall obtain prior approval from the Engineer for the closing or partial closing of any road, street, alley or other public thoroughfare. The Contractor shall give at least 24 hour advance notice of such closure to all agencies providing emergency services, including, but not limited to, the sheriff, police, fire and ambulance services.

The Contractor shall notify all utilities before commencing work including, but not limited to, gas, communications, power, water, sewerage and drainage.

Utilities may not be located as shown or marked as the location may have been established from records and not from on-site inspection. The Contractor shall notify utilities at least two working days prior to commencing work of the date on which work will commence, in order to give the utilities a reasonable opportunity to establish the location of utilities by on-site examination prior to commencing the work. The Contractor shall adhere to the above notification requirements during the progress of the work where the work is such that location of utilities is necessary as the work progresses.

The Contractor shall notify all agencies involved by the operations so as to properly coordinate and expedite the work in such a manner as to cause the least amount of conflict and interference between such operations and those of other agencies.

105.5.00 Notifications Relative to Contractor's Activities, Continued

Notification shall include, but not be limited to, the time of commencement and completion of work, names of streets or location of alleys to be closed, schedule of operations and routes of detours where possible.

Damages or claims resulting from improper or insufficient notification of the affected agencies shall be the responsibility of the Contractor.

105.6.00 Utilities and Existing Improvements: Any information shown as to the location of existing water courses, drains, sewer lines or utility lines which cross or are adjacent to the project has been compiled from the best available sources, but is not guaranteed to be accurate.

The Contractor shall provide for the flow of sewers, drains or water courses interrupted during the progress of the work, and shall restore such drains or water courses as approved by the Engineer. The Contractor shall make excavations and borings ahead of the work as necessary, to determine the exact location of interfering utilities or underground structures.

Ordinarily, utility companies responsible for facilities located with the right-of-way will be required to complete any installation, relocation, repair, or replacement prior to the commencement of work by the Contractor. However, when this is not feasible or practicable or the need for such work was not foreseen, such utility owners or the Owner shall have the right to enter upon the right-of-way and upon any structure therein for the purpose of making new installations, changes or repairs. The Contractor shall conduct operations so as to provide the time needed for such work to be accomplished during the progress of the improvement.

The Contractor shall be responsible for all costs for the repair of damage to the contract work or to any utility, previously known or disclosed during the work, as may be caused by operations. The Contractor shall maintain in place utilities not shown on the drawing to be relocated or altered by others and shall maintain utilities which are relocated by others in their relocated positions in order to avoid interference with structures which cross the project work. All costs for such work shall be included in the prices bid for the various items or work.

105.7.00 Survey Service: The Contractor shall give notice to the Engineer not less than two working days in advance of when survey services will be required in connection with the laying out of any portion of the work.

The Owner will furnish and set construction stakes establishing lines and grades as determined necessary by the Engineer for all work under the contract, including lines and grades for street excavation and fill, finished subgrade, finished base material, curbs and gutters, walks, structures and utilities, and will furnish the Contractor all the necessary information relative to the lines and grades.

The Owner will furnish appropriate offset lines and grades for all projects.

Any errors found shall be brought to the attention of the Engineer immediately. Such stakes and markings, as the Engineer may set for either his own or the Contractor's guidance, shall be carefully preserved by the Contractor. In case of negligence on the part of the Contractor or his employees, resulting in the destruction of such stakes or markings, they shall be replaced by the Engineer at the Contractor's expense.

The Contractor shall be responsible for the transfer of the line and grade from the stakes to the work and the method of transfer shall be acceptable to the Engineer and adequate to insure construction within allowable tolerances.

All grades indicated in the field and on the drawings, unless otherwise stated, shall be as follows:

1.	Streets	Top back of curb
2.	Alleys	Finish grade at the outside margin.
3.	Sidewalks	Finish grade nearest street.
4.	Sewers and Pipes	Invert elevation at centerline of pipe.

105.8.00 Protection of Survey Markers

105.8.01 Permanent Survey Markers: The Contractor shall notify the Engineer not less than seven days prior to starting work in order that the Engineer may take necessary measures to insure the preservation of survey monuments, stakes and bench marks. The Contractor shall not disturb permanent survey monuments, stakes, or bench marks without the consent of the Engineer, and shall notify the Engineer and bear the expense of replacing any that may be disturbed without permission. Replacement shall be done by a registered land surveyor at no expense to the Owner.

When a change is made in the finished elevation of the pavement of any roadway in which a permanent survey monument is located, the monument cover shall be adjusted to the new grade.

105.8.02 Lines and Grades: The Contractor shall preserve construction survey stakes and marks for the duration of their usefulness during construction. If any construction survey stakes are lost or disturbed, and in the judgement of the Engineer need to be replaced, such replacement shall be by the Engineer at no expense to the Owner. The cost of replacement shall be charged against, and shall be deducted from, the payment of the work.

105.8.03 Lot Stakes and Monuments: Unless otherwise directed by the Engineer or shown in the plans, the Contractor shall preserve existing survey stakes or monuments that mark property lines and corners. Any stakes or monuments that become lost or disturbed by his operations shall be replaced by a registered land surveyor at no expense to the Owner.

105.9.00 Other Surveyors: Surveying by private land surveyors on permit projects or any other work under the control of the Owner shall conform in all respects to the quality and practice required of the Owner's surveyors as set forth in subsection 105.7.00.

105.10.00 Protection of Property: The Contractor shall protect all public and private property insofar as it may be endangered by operations and take every reasonable precaution to avoid damage to such property.

The Contractor shall restore and bear the cost of any public or private improvement, facility or structure within the right-of-way which is damaged or injured directly or indirectly by or on account of any act, omission or neglect in the execution of the work and which is not designated for removal and is visibly evident or correctly shown on the plans. The Contractor shall restore to a condition substantially equivalent to that existing before such damage or injury occurred, by repairing, rebuilding or otherwise affecting restoration thereof, or if this is not feasible, make a suitable settlement with the owner of the damaged property, all at no expense to the Owner.

The Contractor shall give reasonable notice to occupants of buildings on property adjacent to the work to permit the occupants to remove vehicles, trailers and other possessions as well as salvage or relocate plants, trees, fences, sprinkler systems or other improvements in the right-of-way which are designated for removal or which might be destroyed or damaged by work operations. All depressions or holes below subgrade, whether caused by grubbing or otherwise, shall be backfilled with suitable compacted material to subgrade level.

The Contractor shall protect all designated trees and planted areas within the right-of-way easements, and shall exercise care and conduct operations so as to minimize damages to other planted areas.

105.10.00 Protection of Property, Continued

The Contractor shall review with the Engineer the location, limits and methods to be used prior to clearing work. Clearing and grubbing shall be performed in strict compliance with all local, state and federal laws and requirements pertaining to cleaning and burning.

Mail boxes to be removed during the course of construction shall be temporarily relocated in accordance with the Postal Department requirements at the expense of the Contractor. Upon completion of the project, the mail boxes shall be returned to their original location by the Contractor in as good or better condition than existed prior to removal and in accordance with the Postal Department regulations. Unless shown as being a pay item, such work shall be considered as incidental work for which no additional payment will be made.

105.11.00 Temporary Traffic Control: The Contractor shall provide and be responsible at all times for such flagmen, signs and other devices not otherwise specified to be furnished by the Owner. The Contractor shall erect and maintain all barricades, guards, standard construction signs, warning signs and detour signs, as are necessary to warn and protect the public at all times from injury or damage as a result of the work operations on highways, roads or streets affected by such operations.

Upon failure to immediately provide the necessary flagmen or to provide, erect, maintain and remove barricades, lights and standard signs when so ordered, the Engineer shall be at liberty, without further notice to the Contractor or the Contractor's surety, to do so and deduct all of the costs thereof from any payments due or coming due the Contractor.

Refer to section 202, in the General Specifications for the City of Dodge City, Kansas, TEMPORARY TRAFFIC CONTROL for additional requirements.

105.12.00 Protection of Work: Until acceptance of the project, the Contractor shall at all times protect from damage all public property and private property which may be affected by the work and preserve all materials, supplies, equipment of any description, and all work already performed, from the conduct of the work, the actions of the elements, and damage by any person or persons or from any other cause whatsoever.

105.13.00 Maintenance of Work After Acceptance: Upon the request of the Contractor and with the approval of the Engineer, or upon the order of the Engineer, the Contractor will be relieved of the duty of maintaining and protecting certain portions of the work which are approved to be placed in service and which have been completed in accordance with the contract documents, including cleanup.

105.13.00 Maintenance of Work After Acceptance, Continued

In addition, such action by the Engineer will relieve the Contractor of the responsibility for injury or damage to said completed portions of the work resulting from use by public traffic or from the action of the elements or from any other cause, excepting injury or damage resulting from the Contractor's own operations or negligence. The Contractor will not be required to again clean up such portions of the improvement prior to field acceptance, excepting for such items of work as result from the Contractor's operations. However, nothing in this section shall be construed as relieving the Contractor from full responsibility for making good defective work or materials found to be defective.

105.14.00 Use of Light, Power and Water: The Contractor shall furnish temporary light, power and water complete with connecting piping, wiring, lamps and similar equipment necessary for the work as approved. The Contractor shall install, maintain and remove temporary lines upon completion of the work. The Contractor shall obtain all permits and bear all costs in connection with the temporary services and facilities at no expense to the Owner.

105.15.00 Subsurface Data: All information obtained by the Engineer regarding subsurface information and groundwater elevations will be available for inspection at the office of the Engineer upon request. Known utilities and structures expected to be adjacent to or encountered in the work are shown on the plans. Such information is offered as supplementary information only. Neither the Engineer nor the Owner assumes any responsibility for the completeness or interpretation of such supplementary information.

Logs of test holes, test pits, soils reports, groundwater levels and other supplementary subsurface information are offered as the best available information of underlying materials and conditions at the locations actually tested. The Owner will not be liable for any loss sustained by the Contractor as a result of any variance between conditions contained in or interpretations of test reports and the actual conditions encountered during progress of work.

The Contractor shall examine the site and available records, as set forth in subsection 102.6.00. The submission of a proposal shall be conclusive evidence that the bidder has investigated and is satisfied as to the subsurface conditions to be encountered, as to the character, quality and quantities of work to be performed and materials to be furnished and as to the requirements of the contract documents.

105.15.00 Subsurface Data, Continued

The Contractor shall contact all utility companies as to underground utilities in the area of work as set forth in section 105.5.00. Relocation of underground utilities which lie within the construction area or trench width necessary to complete the work shall be the responsibility of the Owner. Damage to existing utilities shall be the responsibility of the Contractor.

105.16.00 Verbal Agreements: No verbal agreement or conversation with any officer, agent or employee of the Owner, either before or after execution of the contract, shall affect or modify any of the terms or obligations contained in any of the documents comprising the contract. Any such verbal agreement or conversation shall be considered as unofficial information and in no way binding upon the Owner.

105.17.00 Dust Control: During all phases of the construction work, and when directed, the Contractor shall take precautions to abate dust nuisance by cleaning up, sweeping, sprinkling with water, or other means as necessary to accomplish the suppression of dust.

105.18.00 Removal of Defective or Unauthorized Work: All work which does not conform to the requirements of the contract shall be considered as unacceptable.

The Contractor shall remove all unacceptable and defective work. The Contractor shall perform replacement by work and materials which conform to the contract documents, or remedy otherwise in an approved manner. The provision shall have full effect regardless of the fact that the unacceptable work may have been done or the defective materials used with the full knowledge of the inspector. The fact that the inspector in charge may have previously overlooked such defective work shall not constitute an acceptance of any part of such work. Correction of all defective work shall be at no expense to the Owner.

The Contractor shall do no work without lines and grades having been given by the Engineer. Work done contrary to or regardless of the instructions of the Engineer, work done beyond the lines shown or as directed, except as herein provided, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at no expense to the Owner.

105.18.00 Removal of Defective or Unauthorized Work, Continued

In the event any defect in work is of a minor nature and the Engineer determines that it is not of such consequence as to result in a dangerous or undesirable condition, the Owner shall have the right to retain such work and make such deductions in the payment therefore as determined reasonable and in the public interest. Such determinations by the Owner shall be final.

105.19.00 Cleanup: During all phases of construction, the Contractor shall keep the site free and clean from all rubbish and debris and shall promptly clean up all or any portion of the site when notified to do so by the Engineer. Care shall be taken to prevent spillage on the streets over which hauling is done, and any such spillage debris deposited on streets due to the Contractor's operations shall immediately be cleaned up. Upon failure to do so within 24 hours after directed, the work may be done by the Owner and the cost thereof be deducted from any payment due the Contractor. All costs of cleanup including all charges for water, are to be absorbed in the prices bid for the various bid items.

After all other work embraced in the contract is completed and before final acceptance of the contract, the entire right-of-way and easement area including the roadbed, planting, sidewalk, shoulders, driveways, alley and side street approaches, slopes, ditches, utility trenches, and construction areas shall be neatly finished to the lines, grades and cross sections shown and as specified.

As a condition precedent to final acceptance of the project, the Contractor shall remove all equipment and temporary structures, and all rubbish, waste and generally clean up the right-of-way and premises to conform substantially to conditions as they existed before the commencement of work.

105.20.00 Final Inspection: At such time as all construction work on the project is complete and all extra work bills, forms and documents required under the contract are submitted, the Contractor shall so notify the Engineer in writing. The Engineer will make an inspection of the project and project records within fifteen days of receiving said notice. If, at such inspection, all construction provided for and ordered under the contract is found completed and satisfactory and all certificates, bills, forms and documents have been properly submitted, such inspection shall constitute the final inspection.

If any work in whole or in part is found unsatisfactory, or it is found that all certificates, bills, forms, and documents have not been properly submitted, the Engineer will give the Contractor

105.20.00 Final Inspection, Continued

The necessary instructions as to replacement of material and performance or reperformance of construction work necessary and prerequisite to satisfactory final completion or construction work and will give the Contractor the necessary instructions for submission of bills, forms and documents, and the Contractor forthwith shall comply with and execute such instructions.

When the Contractor receives the notification he will have seven calendar days in which to complete the instructions from the Engineer. At the end of seven days, the day count will resume and will continue until all instructions have been complied with and executed.

106 CONTROL OF MATERIALS

106.1.00 Quality of Materials

106.2.00 Sampling and Testing

106.3.00 Certification

106.4.00 Inspection Requirements

106.5.00 Inspection by Others

106.6.00 Storage and Protection of Materials

106.7.00 Trade Names, Approved Equals and Substitutions

106.8.00 Mineral Deposits

106.9.00 Owner Furnished Material

106 CONTROL OF MATERIALS

106.1.00 Quality of Materials: The Contractor shall use only new materials, parts, products and equipment in the work which conform to the specified requirements. The Contractor shall determine the kind of work, amount of work and other factors that may be necessary or involved in furnishing the specified products and materials. Materials and products which, after approval, have become unsuitable or unacceptable for use, regardless of cause, will be rejected by the Engineer and shall not be used.

106.2.00 Sampling and Testing: Tests of materials will be made by the Owner in accordance with the methods described or designated in the applicable specifications, and at any time during the production, fabrication, preparation and use of the materials.

The Owner reserves the right to require samples and to test products for compliance with pertinent requirements irrespective of prior certification of the products by the manufacturer thereof as set forth in Section 106.3.00.

When tests of materials are necessary, as determined by the Engineer, such tests will be made by, and at the expense of, the Owner unless otherwise specified. The Contractor shall afford such facilities as required for collecting and forwarding samples where practical and withhold from use the materials represented by the samples until tests have been made and the materials found equal to the requirements of the specifications or to approved samples. In all cases, the Contractor shall furnish and make available the required samples without charge. Samples shall be made available in ample time to permit testing of the materials prior to use, and no claim will be allowed for any delay caused by awaiting test results. To facilitate and make safe the sampling of materials at plants, the Contractor shall provide safety measures and devices to protect those who take the samples.

In absence of any reference specification, it shall be understood that such materials shall meet the specifications and requirements of the American Society for Testing and Materials (ASTM). When there is no pertinent coverage under ASTM, the material concerned shall meet specifications and requirements of applicable commercial standards of the Commodity Standards Division of the US Department of Commerce. Lacking such coverage, the materials shall meet requirements established by reputable industry for a high quality product of the kind involved.

All testing shall be performed by or handled through the testing laboratory of the Owner, or as directed by the Engineer.

106.2.00 Sampling and Testing, Continued

In the event the Owner requests tests and materials fail, the Contractor shall bear all costs for all subsequent testing necessary to meet the specified requirements.

106.3.00 Certification: For commercial products inclusive of industry standardized products, in lieu of normal sampling and testing procedures by the Contractor and the Owner, the Engineer may accept from the Contractor the manufacturer's certification with respect to the product involved, under the conditions set forth as follows:

1. The certification shall state that the named product conforms to the Owner's requirements and the representative samples thereof have been sampled and tested as specified.

2. The certification shall either be accompanied with a certified copy of the test results, or certify that such test results are on file with the manufacturer and will be furnished to the Engineer upon request.

3. The certification shall give the name and address of the manufacturer and the testing agency and the date of tests; and shall set forth the means of identification which will permit field determination of the product delivered to the project as being the product covered by the certification.

4. The certification shall be in duplicate with one copy to be sent with the shipment of the covered product to the Engineer, and with one copy sent to the Owner.

5. The Owner will not be responsible for any costs of certification or for any costs of the sampling and testing of products in connection therewith.

106.4.00 Inspection Requirements: The Contractor shall allow access to the Engineer or the Engineer's representative to all parts of the work and to the plants of producers and fabricators at all times and will furnish them with every reasonable facility for ascertaining whether or not the work is in accordance with the requirements and intent of the contract documents. The Contractor shall furnish such samples as are customarily required for testing purposes at no expense to the Owner.

106.5.00 Inspection by Others: Inspection of the work by persons other than representatives of the Owner will not constitute inspection by the Owner, except as set forth in section 106.3.00.

106.6.00 Storage and Protection of Materials: Materials shall be stored so as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the right-of-way may be used for storage purposes and for the placing of the Contractor's plant and equipment, but any additional space required therefor shall be provided by the Contractor at his expense. The Contractor shall not use private property for storage purposes without written permission of the property owner or lessee. When requested, the Contractor shall furnish copies of such written permission to the Engineer.

106.7.00 Trade Names, Approved Equals or Substitutions: In order to establish a basis of quality, certain processes, types of machinery and equipment, or kinds of materials may be specified either by description or process or by designating a manufacturer by name and referring to that brand or product designation, or by specifying a kind of material. It is not the intent of the specifications to exclude other processes, equipment or materials of equal value, utility or merit.

Whenever a process is designated, or a manufacturer's name, brand or item designation is given, or whenever a process or material covered by patent is designated or described, it shall be understood that the words "or approved equal" follow such name, designation or description, whether in fact they do so or not.

If it is desirable to furnish items of equipment by manufacturers other than those specified, as a substitute after the contract is executed, the Contractor shall secure approval prior to placing a purchase order or furnishing the same.

If the proposal includes a list of equipment, materials, or articles for which the Contractor must name the manufacturer at the time of submission of the bid, no substitutions therefor will be permitted after a proposal has been accepted without the express consent of the Owner.

106.8.00 Mineral Deposits: The quality of material in specified mineral deposits will be acceptable in general, but the Contractor shall determine for himself the amount of equipment and work required to produce a material meeting the specifications. It shall be understood that it is not feasible to ascertain from samples the limit for an entire deposit, and that variations shall be considered as usual and are to be expected. The Engineer may order procurement of material from any portion of a deposit and may reject portions of the deposit as unacceptable.

106.8.00 Mineral Deposits, Continued

Unless otherwise specified, the Owner will acquire and make available to the Contractor the right to take materials from the sources shown or described, together with the right to use such property for plant site, stockpiles and hauling roads.

If the Contractor elects to use material from sources other than those shown or described, the Contractor shall acquire the necessary rights to take materials from the sources and shall bear all costs related thereto including those for development and exploration and any costs which may result from an increase in length of haul. The use of material from such sources will not be permitted until the Engineer determines, from representative samples obtained and tested at the expense of the Contractor, that an adequate amount of satisfactory materials are available in the source. Additional samples may be required of the Contractor for inspection and testing prior to approval of and authorization to use the source.

If crushed aggregate is produced from local gravel pits or quarries, all material encountered therein with diameter of 12 inches or less shall be crushed and used.

When work areas, gravel pits or other than commercially operated borrow pits are located in or adjacent to live streams or other bodies of water, operations at the sites shall be so controlled, both during and after completion of the work, that erosion will be minimized and sediment will not enter streams of other bodies of water. This may require segregating such areas by a dike or other barrier, treatment of pollutants by filtration, a settling basin or other means sufficient to reduce the sediment content to not more than that of the body of water into which it is discharged.

106.9.00 Owner Furnished Materials: Any material furnished by the Owner will be delivered or made available to the Contractor at the locations specified or shown. The cost of handling and placing such materials after they are delivered to the Contractor will be considered as included in the contract price for the item in connection with which they are used. The Contractor will be held responsible for all material delivered to the Contractor by the Owner and deductions will be made from any monies due to make good any shortages, deficiencies, and damages which may occur after such delivery, and for any demurrage charges.

107 LEGAL RELATIONS AND RESPONSIBILITIES

107.1.00 Performance Bond and Statutory Bond

107.2.00 Laws and Regulations

107.3.00 Assignment of Contract and Subletting

107.4.00 Subcontractors

107.5.00 No Waiver of Legal Rights

107.6.00 Other Contracts

107.7.00 Insurance

107.8.00 Royalties and Patents

107.9.0 Permits, Licenses, and Taxes
107.9.01 State Taxes

107.10.00 Wage Rates

107.11.00 Employers' Contract for Medical Care of Employees

107.12.00 Payment of Obligations

107.13.00 Protection of Other Governmental Authorities

107.14.00 Public Safety and Convenience

107.15.00 Personal Safety

107.16.00 Detours

107.17.00 Labor

107.18.00 Working Conditions

107.19.00 Use of Explosives

107.20.00 Railroad Crossings or Right-of-Way

107.21.00 Rights-of-Way and Easements

107.22.00 Waste Sites

107.23.00 Vermin Control

107.24.00 Warrantee and Maintenance

107.25.00 Indemnification

107 LEGAL RELATIONS AND RESPONSIBILITIES

107.1.00 Performance and Statutory Bond: The Contractor shall provide and maintain performance bonds and statutory bonds as set forth in subsection 103.6.00.

107.2.00 Laws and Regulations: The Contractor shall keep fully informed of all federal, state and local laws, ordinances and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affects the conduct of the work. The Contractor shall at all times observe and comply with all such laws, ordinances, regulations, order and decrees. The Contractor shall protect and indemnify the Owner and his representatives against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by the Contractor, his Subcontractors, suppliers or materials or services, or others engaged by the Contractor or the employees of any of them.

The Contractor's attention is directed to the statutes of the State of Kansas for public works contracts, Kansas Statutes Annotated, as amended or superseded, including the latest additions and revisions, are incorporated by reference as a part of the contract documents.

Federal and state agencies normally having a responsibility relating to the environment include, but are not limited to, the following:

U.S. Environmental Protection Agency
U.S. Corps of Engineers
Kansas Department of Health and Environment
Kansas State Bureau of Mines

107.3.00 Assignment of Contract and Subletting: No contract or any portion thereof may be assigned or sublet without consent of the Owner except that money due the Contractor may be assigned as specified below.

The Contractor may assign money due or to become due him under the contract and such assignment will be recognized by the Owner, if given written notice thereof, to the extent permitted by law, but any assignment of money shall be subject to all proper setoffs and withholdings in favor of the Owner and to all deductions provided for in the contract, and particularly all money withheld, whether assigned or not, shall be subject to being used by the Owner for completion of the work in the event the Contractor should be in default therein.

107.4.00 Subcontractors: No part of the work shall be transferred or subcontracted without prior written consent of the Owner, or approval at the time of award, and no such consent or approval shall release the Contractor from any obligation to the Owner or to persons employed by the Subcontractors, or to those supplying materials to the Subcontractors. In all cases, Subcontractors will be considered by the Owner as an employee and liable to be replaced for incompetency, neglect of duty or misconduct.

107.5.00 No Waiver of Legal Rights: The Owner shall not be precluded or estopped by any measurement, estimate, or certificate made either before or after the completion and acceptance of the work or payment therefore, from showing the true amount and character of the work performed and materials furnished by the Contractor, or from showing that any such measurement, estimate, or certificate is untrue or incorrectly made, or that the work or materials do not conform in fact to the contract. The Owner shall not be precluded or estopped, not withstanding any such measurement, estimate or certificate, or payment in accordance therewith, from recovering from the Contractor and the Contractor's sureties such damages as may be sustained by reason of failure to comply with the terms of the contract, or from enforcing compliance with the contract. Neither the acceptance by the Owner, nor any payment for all or any part of the project, shall operate as a waiver of any portion of the contract or of any power herein reserved, or any right to damages herein provided. A waiver of any breach of the contract shall not be held to be a waiver of any other subsequent breach.

107.6.00 Other Contracts: The Owner shall have the right to let other contracts be coordinated with this contract. The Contractor shall cooperate with and afford such other Contractors reasonable opportunity for introduction and storage of materials and for execution of their work. Any matter of dispute shall be decided by the Engineer, and that decision shall be binding. If any part of the work depends for its proper execution upon the work of any such other Contractor, the Contractor shall inspect and promptly report to the Engineer any defects that affect the subsequent work. Failure to do so shall constitute an acceptance of such other Contractor's work as fit and proper for the reception and attachment of the Contractor's own work and equipment.

107.7.00 Insurance: The Contractor shall provide and maintain insurance as set forth in subsection 103.8.00.

WORKER'S COMPENSATION AND EMPLOYER'S LIABILITY: This insurance shall protect the Contractor against all claims under applicable state worker's compensation laws. The Contractor shall also be protected against claims for injury, disease, or death of employees which, for any reason, may not fall within the provisions of a worker's compensation law. This policy shall include an "all states" endorsement.

107.7.00 Insurance, Continued

The liability limits shall be not less than:

Worker's Compensation	Statutory
Employer's Liability	$100,000 each occurrence

COMPREHENSIVE AUTOMOBILE LIABILITY: This insurance shall be written in comprehensive form and shall protect the Contractor against all claims for injuries to members of the public and damage to property of others arising from the use of motor vehicles, and shall cover operation on or off the site of all motor vehicles licensed for highway use, whether they are owned, nonowned, or hired.

The liability limits shall not be less than:

Bodily Injury	$250,000 each person $500,000 each occurrence
Property Damage	$250,000 each occurrence $500,000 aggregate

COMPREHENSIVE GENERAL LIABILITY: This insurance shall be written in comprehensive form and shall protect the Contractor against all claims arising from injuries to persons other than his employees or damage to property of the Owner or others arising out of any act or omission of the Contractor or his agents, employees, or Subcontractors. The policy shall also include protection against claims insured by usual personal injury liability coverage, a "protective liability" endorsement to insure the contractual liability assumed by the Contractor under the indemnification provisions in General Conditions, and "Completed Operations and Products Liability" coverage which shall remain in force during the correction period.

To the extent that the Contractor's work, or work under his direction, may require blasting, explosive conditions, or underground operations, the comprehensive general liability coverage shall contain no exclusion relative to blasting, explosion, collapse of buildings, or damage to underground property.

107.7.00 Insurance, Continued

The liability limits shall be not less than:

Bodily Injury	$250,000 each person $500,000 each occurrence
Property Damage	$500,000 each occurrence $1,000,000 aggregate

UMBRELLA LIABILITY POLICY: This insurance shall protect the Contractor against all claims in excess of the limits provided under the workmen's compensation and employer's liability, comprehensive automobile liability, and general liability policies. The liability limits of the umbrella liability policy shall not be less than $1,000,000.

SETTLEMENT OF INSURANCE CLAIMS: Losses insured under policies that include the Owner as a named insured shall be adjusted with the Owner and made payable to the Owner as trustee for the insureds, as their interests may appear.

The Owner and Contractor waive all rights against each other for damages caused by fire or other perils to the extent covered by insurance, except such rights as they may have insurance proceeds held by the Owner as trustee. The Contractor shall require similar waivers by Subcontractors as provided in the General Conditions.

For contracts involving work at railroad crossings, the Contractor shall provide and carry additional insurance as required by Special Provisions included in Proposals and contracts for such work.

107.8.00 Royalties and Patents: The Contractor shall be liable for all suits brought against the Owner by reason of infringement of patent rights on any material, machine or appliance that may be used on the work or incorporated into the finish job, except where specifically exempted by the special provision. Unit prices named in the proposal shall include payment of royalties, if any.

107.9.00 Permits, Licenses and Taxes: The Contractor shall procure all permits and licenses, pay all charges, fees and taxes and give all notices necessary and incidental to the due and lawful prosecution of the work except that the Owner will retain and pay for the following:

1. All permits required by the Coast Guard for crossing navigable streams.

107.9.00 Permits, Licenses and Taxes, Continued

2. All permits required by the Corps of Engineers for encroachments on navigable streams where such encroachments are called for the by plans for the project.

3. All permits required by the State of Kansas for removal of materials from or depositing materials in waterways where such work is specifically required by the State for operations in any Owner controlled source of materials listed in the special provisions.

4. All permits required by the State Bureau of Mines for operations in any Owner controlled source of materials or any disposal area listed in the special provisions.

5. All permits required from local agencies for construction of buildings where such work is required by the plans for the project.

107.9.01 State Taxes: It is the intent of the City to supply the Contractor, whenever necessary or appropriate, with a Sales and Compensating Tax Exemption Certificate for use in purchasing materials and supplies used on City projects. The Contractor shall, in preparing his proposal, omit from his computed costs all appropriate Sales and Compensation Taxes. If in doubt as to whether such Exemption Certificate is appropriate, inquiries should be directed to the City Clerk.

After the award of the bid, it shall be the responsibility of the Contractor to notify the City Clerk that he needs an Exemption Certificate. The City Clerk will, when appropriate, obtain a tax exemption number for the Contractor.

Upon completion of the project, two copies of the Project Completion Certification must be signed by the Contractor and returned to the City Clerk. The Clerk will forward one copy of the Completion Certification to the Kansas Department of Revenue and retain one copy. All invoices must be retained by the Contractor for a period of five years and are subject to audit by the Kansas Department of Revenue. Final payment will not be made to the Contractor until the City has received the Completion Certificate from the Contractor.

107.10.00 Wage Rates: Minimum wage rates applicable to work done under the contract shall be based upon payment by the Contractor and his Subcontractors of wage rates not less than the prevailing hourly wage rate for each craft or classification of workmen engaged on the work. On projects where State or Federal regulations require, prevailing wage rates shall be provided in KSA Chapter 44, Article 2, and amendments thereto or where applicable, by the United States Secretary of Labor.

107.10.00 Wage Rates, Continued

The regulations do not prohibit payment of more than the prevailing rate of wages.

107.11.00 Employer's Contract for Medical Care of Employees: The Contractor shall make payment promptly, as due, to any person, co-partnership, association or corporation furnishing medical, surgical and hospital care, or other needed care and attention, incident to sickness or injury, to employees, of all sums which have been agreed to by paid for such services and all moneys and sums which: (1) may or shall be deducted from the wages of employees for such services pursuant to the terms of any contract entered into; or, (2) are collected or deducted from the wages of employees pursuant to any law, contract or agreement for the purpose of providing or paying for such services.

107.12.00 Payment of Obligations: The Contractor shall make payment promptly as due, to all persons supplying labor or materials for the prosecution of work under the contract. The Contractor shall not permit any lien or claim to be filed or prosecuted against the Owner on account of any labor or material furnished. Contractor shall pay to the State Department of Revenue sums withheld from employees pursuant to Kansas Statutes Annotated.

Failure to make prompt payment of any claim when due, for labor or services supplied for the prosecution of work under the contract, including labor or material supplied to Subcontractors, may necessitate Owner paying such claim to the person furnishing the labor or services and charging the amount of payment against funds due or to become due to the Contractor by reason of his contract. Such payment shall not relieve the Contractor or his surety from obligations with respect to any unpaid claims.

107.13.00 Protection of Other Governmental Authorities: Whenever work under the contract affects or may affect public property owned by or under the jurisdiction of any governmental authority, agency or district, including a governmental subdivision other than the Owner's, the Contractor shall indemnify and save harmless such governmental authority, its officers, agents and employees from any loss, damage or claim of loss or damage to such property or the use thereof, arising from work under the contract. The Contractor shall supply any bond or insurance and make any special guarantee deposit required by such governmental authority, before beginning any portion of the work which affects or may affect the property of such governmental authority or the use thereof.

107.14.00 Public Safety and Convenience: The Contractor shall conduct the project with proper regard for the safety and convenience of the public. When the project involves the use of public ways, the Contractor shall provide flagmen when directed and install

107.14.00 Public Safety and Convenience, Continued

and maintain means of free access to all fire hydrants, service stations, warehouses, stores, houses, garages, and other property.

Private residential driveways shall be closed only with approval of the Engineer or specific permission of the property owner. The Contractor shall not interfere with normal operation of public transit vehicles unless otherwise authorized. The Contractor shall not obstruct or interfere with travel over any public street or sidewalk without approval. Where detours are necessary, they shall be maintained with good surface and shall be clearly marked. The Contractor shall provide open trenches and excavations with adequate barricades of an approved type which can be seen from a reasonable distance. At night, the Contractor shall mark all open work and obstructions by lights. The Contractor shall install and maintain all necessary signs, lights, flares, barricades, railings, runways, stairs, bridges and facilities. The Contractor shall observe all safety instructions received from the Engineer or governmental authorities, but following of such instructions shall not relieve the Contractor from the responsibility or liability for accidents to workers or damage or injury to person or property.

Emergency traffic such as police, fire and disaster units shall be provided reasonable access to the work area at all times.

The Contractor shall be liable for any damages which may result from failure to provide such reasonable access or failure to notify the appropriate authority.

107.15.00 Personal Safety: The Contractor shall be responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. Safety provisions shall conform to the applicable federal, state, county and local laws, ordinances and codes. Where any of these are in conflict, the more stringent requirement shall be followed.

The Contractor shall maintain at the office or other well-known place at the job site, all articles necessary for giving first aid to the injured and establish the procedure for the immediate removal to a hospital or a doctor's care of employees and other persons who may be injured on the job site.

The Contractor shall provide an maintain in a neat and sanitary condition such accommodations for the use of his employees as may be necessary to comply with requirements and regulations of the State Department of Health and Environment and of other bodies or officers having jurisdiction thereover. He shall permit no public nuisance.

107.15.00 Personal Safety, Continued

The duty of the Engineer to conduct construction reviews of the Contractor's performance is not intended to include a review of the adequacy of the Contractor's safety measures in, on or near the construction site.

All accidents causing death or serious injuries or damages shall be reported immediately by telephone or messenger to both the Engineer and the Owner. In addition, the Contractor shall promptly report in writing to the Engineer all accidents whatsoever arising out of, or in connection with, the performance of the work, whether on or adjacent to the site, giving full details and statements of witnesses.

If any claim is made by anyone against the Contractor or any Subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Engineer, giving full details of the claim.

107.16.00 Detours: Detours outside the limits of the project shall be the sole responsibility of the Contractor unless otherwise provided in the special provisions. Detours within the limits of the project such as side street crossings, temporary bridges over freshly placed concrete, utilization of one or more lanes of the construction area for maintenance of traffic and such related facilities for the maintenance of traffic shall be the responsibility of the Contractor, the costs for which shall be included in the unit contract prices unless otherwise provided in the special provisions.

Upon failure to immediately provide, maintain or remove suitable detours or detour bridges when ordered to do so by the Engineer, the Owner may without notice to the Contractor or his surety, provide, maintain or remove the detour and deduct the costs thereof from any payment due the Contractor.

The Contractor shall construct and maintain temporary detours to provide adequate passage of public traffic and protection of the work at all times.

If, if the judgement of the Engineer, one-way piloted traffic is necessary, it shall be provided for as set forth in Section 202. In the event that flagging and piloting are required after working hours, such piloting and flagging shall be provided by the Contractor at no expense to the Owner.

107.16.00 Detours, Continued

The Contractor shall protect the work and traffic at all times regardless of flagging and pilot car services furnished by the Owner.

107.17.00 Labor: Upon notification in writing from the Engineer, the Contractor shall remove immediately from the job for its duration any laborer, worker, mechanic, foreperson, superintendent or other person employed who is found to be incompetent, intemperate, troublesome, disorderly or otherwise objectionable, or who fails or refuses to perform work properly and acceptably.

Attention is directed to provisions regarding Equal Opportunity Programs and certification thereunder, and to the provisions of K.S.A. relative to unlawful employment practices and discrimination by employers against any employee or applicant for employment because of race, religion, color, sex or national origin. Particular reference is made to provisions which state that it is an unlawful employment practice for an employer, because of race, religion, color, sex or national origin of any individual to refuse to hire or employ or to bar or discharge from employment such individual or to discriminate against such individual in compensation or in terms, conditions or privileges of employment.

If the event of the Contractor's noncompliance with the non-discrimination clauses of a contract so funded, or with any such rules, regulations or orders, the contract may be cancelled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order number 11246, and such other sanctions may be imposed and remedies invoked as provided in Executive Order number 11246, or by rule, regulation or order of the Secretary of Labor, or as otherwise provided by law.

The Contractor shall not employ or use workers below the age of sixteen (16). In any event, compliance with local, State, and Federal requirements regarding employment of underage workers shall be observed by the Contractor and his subcontractors.

107.18.00 Working Conditions: The Contractor agrees that no person shall be employed for more than 40 hours in any one week, except in case of necessity, emergency, or where the public policy absolutely requires it, and in such cases the worker shall be paid at least time and a half for all overtime in excess of 40 hours per week and for work performed on any legal holiday specified, except Veteran's Day, unless time and a half payment for work over 8 hours per day is required by State or Federal Regulation. However, when specifically agreed to under a written

labor-management negotiated labor agreement, a worker may be paid at least time and a half pay for work performed on Veteran's Day or on any legal holiday specified. This paragraph does not apply to labor performed in the manufacture or fabrication of any material ordered by the Contractor or manufactured or fabricated in any plant or place other than the place where the main contract is to be performed.

107.19.00 Use of Explosives: Any blasting or use of explosives on any of the Owner's projects requires a permit and is subject to all the provisions, laws, orders and regulations of any other governmental authority in whose jurisdiction such work may be done.

107.20.00 Railroad Crossings or Right-of-Way: Whenever the project or work thereunder involves the crossing of any railroad line or the encroachment of any railroad right-of-way, the Contractor shall submit a program of proposed operations within the railroad right-of-way area which shall be approved by the appropriate officials and the Engineer before the work is started within such area. The Contractor shall pay for services of flagmen and/or watchmen furnished by the railroad company and provide drive piling, set cribbing, build bridges or tunnels, install enclosing pipe and do all other work required by the railroad company or necessary for the safety or maintenance of railroad traffic. The Contractor shall furnish any bond or insurance required of the Owner by the railroad company as a result of such intended operations and indemnify the Owner for any and all expenses incurred by the Owner, and assume any and all liability or claims thereof imposed on the Owner as a result of operations in the railroad right-of-way area. The Contractor shall bear all costs resulting from interferences, obstructions or liabilities set forth in this specification, whether or not herein specifically mentioned.

107.21.00 Right-of-Way and Easements: The Contractor shall confine construction activities within property lines, limits of easements and limits of construction permits as shown or specified in the contract documents, unless arrangements are made with Owner(s) of adjacent private property. Prior to the use of any private property outside these specified boundaries, the Contractor shall file with the Engineer a written permission of the property Owner(s), and upon terminating such usage, file with the Engineer a release from all damages, signed by the property Owner(s).

The Contractor shall not unreasonably encumber the specified work areas with materials and equipment, and shall obtain and bear the cost of permits for special occupancy and the use of the specified work areas from the proper agencies. The Contractor shall comply with the Engineer's directions regarding signs, advertisements, fires and smoking.

107.22.00 Waste Sites: Excavated materials not suitable or not required for backfill or embankment shall be deposited on one or both of the following waste sites: (1) predesignated waste sites contained in the contract documents, and (2) waste sites provided by the Contractor. All costs for disposing of this excess material shall be incidental to other items of work contained in the proposal.

The Contractor shall operate either type of waste site in such a manner as to meet all safety and health requirements of state and local agencies. Sites, operations or the result of such operations which create a nuisance problem, or which result in damage to public or private properties will not be permitted.

The Owner will provide permits for dumping at waste sites designated in the contract documents. The Contractor will be responsible for obtaining the necessary permits for dumping at waste sites provided by the Contractor.

107.23.00 Vermin Control: At the time of occupancy by the Owner, any structure or structures entirely constructed under the contract shall be free of rodents, insects, vermin or pests. The Contractor shall arrange and pay for extermination work as may be necessary as part of the contract work within the contract time. Work shall be performed by a licensed agency in accordance with the requirements of governing authorities. The Contractor shall assume responsibility for any injury to persons or property resulting from extermination work and for the elimination of any offensive odors resulting from extermination operations.

107.24.00 Warranty and Maintenance: The Contractor shall make all necessary repairs and replacements to remedy, in a manner satisfactory to the Engineer and at no cost to the Owner, any and all defects, breaks, or failures of the work occurring within one (1) year following the date of acceptance of the work due to: faulty or inadequate materials or workmanship, and for damage or disturbances to other improvements under, within, or adjacent to the work, whether or not caused by settling, washing or slipping when such damage or disturbance is caused, in whole or in part, from activities of the Contractor in performing the duties and obligations under this contract.

The Owner shall notify the Contractor, in writing, of any defective work that requires correction. If, within twenty days after notification, the Contractor fails to perform the work, the Owner may do the work, and the Contractor and his surety shall be liable for all the costs thereof.

107.25.00 Indemnification: In case any action in court is brought against the Owner or Owner's Representatives, or any officer or agent of either of them, for the failure, omission, or

107.25.00 Indemnification, Continued

Neglect of the Contractor to perform any of the covenants, acts, matters or things of this Contact undertaken; or for injury or damage caused by the alleged negligence of the Contractor or his Subcontractors or his or their agents; or in connection with any claim based on lawful demands of Subcontractors, workmen, materials or suppliers; the Contractor shall indemnify and save harmless the Owner and Owner's Representatives and their officers and agents, from all losses, damages, costs, expenses, judgements, or decrees arising out of such action.

108 PROSECUTION AND PROGRESS OF WORK

108.1.00 Contractors Construction Schedule

108.2.00 Preconstruction Conference

108.3.00 Notice to Proceed

108.4.00 Contract Time

108.5.00 Suspension of Work

108.6.00 Delays and Extensions

108.7.00 Liquidated Damages

108.8.00 Contractor's Representative

108.9.00 Contractor's Equipment

108.10.00 Conflicts, Errors, and Omissions

108.11.00 Owner's Right to Do Work

108.12.00 Use of Improvement During Construction

108.13.00 Termination of Contract

108.14.00 Default by Contractor

108.15.00 Completion and Acceptance

108.16.00 Dispute Settlement

108 PROSECUTION AND PROGRESS OF WORK

108.1.00 Contractor's Construction Schedule: Prior to beginning any work, the Engineer may require the Contractor to submit a written schedule to the Engineer showing the proposed order of work and indicating the time required for completion of the major items of work.

The schedule shall be in bar graph form or other form approved by the Engineer. This working schedule shall take into account the passage or handling of traffic with the least practicable interference therewith and the orderly, timely and efficient prosecution of the work.

The Engineer shall approve or disapprove the submitted schedule within five (5) days after receipt from the Contractor, excluding Saturdays and legal holidays.

Disapproved or unacceptable schedules shall be revised and resubmitted for approval and no work shall commence until such schedule is approved as stated above.

The construction schedule, when approved by the Engineer, but without responsibility for its adequacy or accuracy, shall become the basis for determination of delays as provided for under the Contract.

The Contractor shall not deviate from the sequence of construction shown on the approved schedule. Should a deviation become necessary, the Contractor shall prepare a revised schedule for the Engineer's approval; and, if accepted by the Engineer the new schedule will then become the new basis for determination of delays as provided under the contract.

108.2.00 Preconstruction Conference: A preconstruction conference may be scheduled by the Contractor or the Owner prior to the commencement of any work. The meeting may include, but not necessarily be limited to, representatives of the following groups: Owner or Engineer, Contractor and Subcontractor, and affected utility companies.

The purpose of the conference will be to discuss the construction schedule set forth in subsection 108.1.00 and items of the work which require special coordination.

108.3.00 Notice to Proceed: Written notice to proceed will be given after the contract has been executed and the performance bond and all required insurances have been filed with and approved by the Owner.

The Contractor shall notify the Owner of the time and location that the work will begin at least 48 hours prior to beginning work.

108.4.00 Contract Time: The contract time, unless otherwise specified, will begin with the tenth calendar day (excluding legal holidays) following the date upon which the notice to proceed is mailed.

The contract time shall be in terms of either calendar days or work days, and shall be in calendar days unless otherwise specified.

Work days shall be defined as every day except Saturdays, and legal holidays observed by the State of Kansas subject to the exclusions hereinafter described.

Exclusions to the definitions of calendar days and work days will be those days to the nearest one half day when the Contractor is prevented from performing work under the contract for one or another of the causes or reasons:

1. Acts of God as such are defined in subsection 101.1.00.

2. Epidemics, quarantine restrictions, strikes, labor disputes, freight embargoes and acts of the public enemy.

3. Periods when the work is temporarily suspended upon written order of the Engineer.

108.5.00 Suspension of Work: The Owner may, for good and sufficient reason, temporarily suspend the Contractor's operations on the project or upon any part of it. In the event of such suspension, the Owner shall, except in emergency, give the Contractor three (3) days notice and the work shall be resumed within five (5) days after notice has been given by the Owner to the Contractor to do so. The Owner shall allow the Contractor an extension of time for completion corresponding to the total period of the temporary suspension, and shall reimburse the Contractor for necessary rental and unused equipment, services of watchmen, and other unavoidable expenses accruing by reason of the suspension without fault of Contractor. The Contractor shall not be entitled to damages, intangible or overhead costs, or anticipated profits arising from such temporary suspension.

Pursuant to sections 105.1.00 and 105.2.00, the Engineer shall have the authority to suspend the work wholly or in part for cause. The Engineer will have the authority to suspend the work wholly or in part due to: failure of the Contractor to correct conditions unsafe for the workers, the general public or the Owner's employees; for failure to carry out the provisions of the contract; for failure to carry out orders; for such periods as

108.5.00 Suspension of Work, Continued

The Engineer may deem necessary due to conditions considered unsuitable for the performance of the work or for any reason deemed to be in the public interest.

Pursuant to subsection 108.6.00, if the Contractor voluntarily suspends operations because of seasonal conditions or other unsuitable conditions, an order to suspend the work may not be required or issued. However, in all cases of suspension of construction operations, the work shall not again be resumed until permitted by order of the Engineer.

At the commencement of and during any suspension of the work, the Contractor shall be responsible for the care of the work performed and take every precaution to prevent any damage or deterioration of the work including temporary protection devices to warn, safeguard, protect, guide and inform traffic, during suspension the same as though its performance had been continuous and without interferences.

If the suspension of the work is due to failure on the part of the Contractor to correct conditions unsafe for workers or the general public, or to carry out orders given, or to perform any provisions of the contract, then and in such event, the Contractor shall be solely responsible for making suitable provisions for necessary traffic and bear the costs of maintaining the work under the contract during the period of suspension. If the Contractor at any time fails to provide for traffic and to maintain the work, the Engineer may immediately proceed to maintain such work and the entire cost of this maintenance will be deducted from monies due or to become due the Contractor on the contract.

The Contractor's voluntary or involuntary suspension or slowdown, with or without the approval of the Engineer, and suspension of the work ordered by the Engineer will not be grounds for claims by the Contractor for damages, idle equipment or labor, or extra compensations. No allowance or compensation will be made on account of such suspension or work except as provided hereinbefore and as provided in subsections 108.4.00 and 108.6.00.

The Contractor shall be responsible for damage to the work that may occur during suspensions of work the same as though the damage had occurred while the work was in progress.

108.6.00 Delays and Extensions: The Owner may grant extensions of time to the extent it finds reasonable and justified when the delay is due solely to causes beyond the control of the Contractor and Subcontractor and without any fault or negligence or participation by them.

108.6.00 Delays and Extensions, Continued

Causes which will be given consideration for an extension of contract time include, but are not limited to, the following:

1. Errors, changes or omission in the plans, or errors or changes in the specifications.

2. Failure of the Owner, its representatives and its other Contractors to act promptly in carrying out obligations and duties.

3. Failure of the Owner to submit the contract and bond to the Contractor for execution.

4. Performance of Extra Work as described in subsection 104.9.00.

5. Court orders enjoining the prosecution of the project or an act of the Owner not authorized by the contract or permitted by law.

The Owner will not consider an extension of contract time based on shortage or inadequacy of labor and equipment, negligence or fault of the Contractor, and other deficiencies or lacks which are within the province of the Contractor's control or responsibility. Nor will the Owner consider an extension of contract time due to seasonal weather or seasonal inclement weather.

If, in the judgement of the Engineer, insufficient force is being employed, or inadequate equipment and methods are used, or if progress is for any reason unduly delayed, the Engineer may instruct the Contractor in writing to increase the force or equipment, or adopt improved methods to expedite the work, and the Contractor shall heed and follow such instructions, but conformity to the Engineer's instructions shall not relieve the Contractor of any responsibilities under this contract.

An extension of contract time will be considered only if the Contractor has given written notice to the Owner of the cause of delay, and makes claim for such extension not more than 30 days after the beginning of such delay, unless the Owner shall grant a further period of time prior to the date of final completion of the contract. The decision by the Owner of the term of any extension or denial thereof shall be final.

108.7.00 Liquidated Damages: It is hereby understood and mutually agreed, by and between the Contractor and Owner, that time shall be considered the essence of the contract and that the time for the completion of the work described herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual conditions prevailing in this locality.

108.7.00 Liquidated Damages, Continued

If the Contractor shall neglect, fail or refuse to complete the work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as part consideration for the awarding of this contract, to pay to the Owner the amount specified in the contract, not as a penalty but as liquidated damages for such breech of contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the contract for completing the work.

SCHEDULE FOR LIQUIDATED DAMAGES			
Original Amount of Contract		Per Diem Amount of Liquidated Damages	
For More Than	Up to and Including	Calendar Day*	Workday
$ 0	$ 25,000	$30	$42
25,000	50,000	$50	$70
50,000	100,000	$75	$105
100,000	500,000	$100	$140
500,000	1,000,000	$150	$210
1,000,000	2,000,000	$200	$280
2,000,000	Over 2,000,000	$300	$420

*Calendar day amounts are applicable when the contract time is expressed on the calendar day, or fixed date basis.

The said amount is fixed and agreed upon by the between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current partial payments.

Permitting the Contractor to continue and finish the work or any part thereof after the contract time or adjusted contract time, as pertinent, has expired shall in no way operate as a waiver on the part of the Owner to any of its rights under the contract.

It is further agreed that time is of the essence of each and every portion of this contract and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the contract an additional

108.7.00 Liquidated Damages, Continued

Time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this contract. PROVIDED, that the Contractor shall not be charged with liquidated damages or any excess cost when the Owner determines that the Contractor is without fault and the Contractor's reasons for the time extension are acceptable to the Owner. PROVIDED, FURTHER, that the Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due:

1. To any preference, priority or allocation order duly issued by Federal or State Government.

2. To unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unseasonable weather, and

3. To any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsection (1) and (2) of this article.

Payment of liquidated damages shall not release the Contractor from obligations in respect to the fulfillment of the entire contract, nor shall the payment of such liquidated damages constitute a waiver of the Owner's right to collect any additional damages which may be sustained by failure of the Contractor to carry out the terms of the contract, it being the intent of the parties that said liquidated damages be full and complete payment only for failure of the Contractor to complete the work on time.

108.8.00 Contractor's Representative: The Contractor shall designate in writing before starting work an authorized representative, who shall have complete authority to represent and to act for the Contractor in his absence from the work site, in all directions given to him by the Engineer. The Contractor or the authorized representative shall give efficient supervision to the work, using his best skill and personal attention to the prosecution of the work, and shall be present on the site continually during its progress.

If called for in the contract documents, the Contractor shall maintain an office on or adjacent to the site of the project. The Contractor shall keep a complete copy of the plans and specifications on or near the site at all times. If the Contractor and the authorized representative are not present on any part of the work where it may be necessary to give instructions, directions may be given

108.8.00 Contractor's Representative, Continued

By the Engineer to the superintendent or foreperson who may have charge of that particular part of the project, and such order shall be received and followed. Such directions shall not be deemed to change the status of Contractor or Subcontractor, nor to make the Owner an employer, nor to give the Owner direct responsibility for the methods and manner of the work. Such directions of major importance will be confirmed in writing. Any direction will be so confirmed in each case on written request from the Contractor.

Incompetent, careless or negligent employees or agents shall be forthwith discharged by the Contractor upon written request of the Engineer, and failure to comply with such request shall be sufficient grounds for termination of the contract.

108.9.00 Contractor's Equipment: The Contractor shall at all times employ sufficient and suitable equipment for prosecuting the work to full completion in the manner and time required by the terms of the contract.

On force account work the equipment and tools used shall be adequate in all respects for efficient performance of the force account work. The Engineer shall have the authority to refuse the use of equipment and tools on force account work which, in the Engineer's judgement are unsuitable for the work.

Should the Contractor fail to furnish suitable and sufficient equipment for the proper prosecution of the work, the Engineer may suspend the work by written notice until such orders are complied with and such deficiencies are corrected as provided in subsection 108.5.00.

108.10.00 Conflicts, Errors and Omissions: The Contractor shall check and compare all plans prior to construction and notify the Engineer of any discrepancies or omissions in order to permit correction by the Engineer. Coordination of plans and specifications is intended. The Contractor shall furnish labor and materials required for the work if indicated on one and not the other as fully as if mentioned or indicated on both; and should any work or materials be reasonably required or intended for carrying the project to completion which are inadvertently omitted on the plans or specifications, the Contractor shall furnish the same as fully as if particularly delineated or described.

It is understood to be the intent of the plans and specifications to show and describe a complete project within the limits shown. Dimensions shown on the plans shall be used rather than scaled measurements. Whenever it may appear that the contract plans are not sufficiently detailed or

108.10.00 Conflicts, Errors and Omissions, Continued

Explicit, the Engineer may furnish additional detail drawings or written instructions and the Contractor shall perform the work to such additional details or instructions. In case of conflict between the requirements set forth in the contract documents, the provisions for order of precedence in subsection 104.3.00 shall apply.

108.11.00 Owner's Right to Do Work: If the Contractor should neglect to prosecute the project properly, or fail or refuse to perform any of the terms or conditions of the contract, the Owner may, without prejudice to any other remedy, supply or correct any deficiency or defect. Such action by the Owner shall be taken only after three days notice by the Engineer to the Contractor and his surety, unless in the judgement of the Engineer an emergency or danger to the work or to the public exists, in which event action of the Owner as set forth above may be taken without any notice whatsoever. The cost of such action by the Owner shall be deducted from the payment, then or thereafter due the Contractor. The Contractor shall pay to the Owner any excess of cost over such payment due.

108.12.00 Use of Improvement During Construction: The Owner shall have the right to take possession of, and use any completed or partially completed portions of the work. Such use shall not be considered as final acceptance of any portion of the work. If such prior use increases the cost of, or delays the work, the Contractor shall be entitled to such extra compensation or extension of time, or both, as the Engineer may determine.

108.13.00 Termination of Contract: All terms and conditions of the contract are considered material, and failure by the Contractor to comply with any of said terms or conditions shall, at the Owner's option, be deemed a breach of the contract. Upon such failure, the Owner shall have the right, whether an alternative right is provided or not, to declare the contract terminated. The issuance by the Owner or by the Engineer of an order stating that the contract is terminated, and service of a copy of said order upon the Contractor and the Contractor's surety shall be deemed a complete termination of the contract. Upon the contract being so terminated, the Owner may retain all sums due under the contract and both the Contractor and his sureties shall be liable under the bond for all losses, expenses and damages caused to the Owner by reason of failure to complete the contract and the surety shall be required, at the Owner's option, to complete the project. Not withstanding such termination, the Contractor and the Contractor's sureties shall remain liable under the terms of the contract for work performed prior to such termination.

108.13.00 Termination of Contract, Continued

The Owner and Contractor may agree to terminate the contract:

1. If work under the contract is suspended by an order of a public agency for any reason considered to be in the public interest other than by a labor dispute or by reason of any third party judicial proceeding relating to the work other than a suit or action filed in regards to a labor dispute; and

2. If the circumstances or conditions are such that it is impracticable within a reasonable time to proceed with a substantial portion of the work.

In the event of termination of a public contract, provision shall be made for the payment of compensation to the Contractor. In addition to a reasonable amount of compensation for preparatory work and for all costs and expenses arising out of termination, the amount to be paid to the Contractor:

1. Shall be determined on the basis of the contract price in the case of any fully completed separate item or portion of the work for which there is a separate or unit contract price; and

2. May, with respect to any other order, be a percent of the contract price equal to the percentage of the work completed.

108.14.00 Default by Contractor: If the Contractor fails to begin work as required by the contract, or be adjudged bankrupt, or make a general assignment for the benefit of his creditors, or a receiver is appointed on account of insolvency, or if at any time when work has been resumed after a Suspension of Work (pursuant to subsection 108.5.00) the Contractor refuses, neglects or fails to correct the deficiency(s) or reason(s) for the suspension, or if the Contractor abandons the work, the Engineer may give written notice of default to the Contractor and the Contractor's surety, and shall discontinue or not begin the work, and any or all payment due or that may become due the Contractor may be withheld by the Owner until the completion by the Owner, surety, or another person of all work included in the contract, and until expiration of any maintenance and/or warranty period.

After service on the Contractor of such order to desist from work or part thereof, or notice of termination as set forth in subsection 108.13.00, the Owner may take possession of the project or such designated part thereof, and may use all or any part of the Contractor's plant, tools, equipment, materials or other property on the project, none of which shall be removed by the Contractor as long as they may be required for the work, and the Owner may, by contract or otherwise, provide supervision of workers, materials, appliances and equipment necessary for the completion of, and may complete the project or such designated part thereof.

108.14.00 Default by Contractor, Continued

The expense so incurred for completion of the project or part thereof, together with all damages, liquidated or otherwise sustained or to be sustained by the Owner shall be deducted from the fund or appropriation set aside for the purpose of the contract and shall be charged to the Contractor as if paid. In case the amount of such expenses and damages exceeds the sum which would have been payable under the contract if completed entirely by the Contractor, the amount of such excess shall be paid to the Owner by the Contractor and both the Contractor and the Contractor's sureties shall be liable to the Owner therefore; in case the amount of such expenses and damages shall be less than the sum which would have been payable under the contract the difference will be paid to the Contractor, subject to written consent by the surety. If completed entirely by the Contractor, he shall be entitled only to payment in accordance with contract terms for the work the Contractor actually performed, subject, however, to all terms of said contract.

The Contractor shall complete all work unless an order to desist as provided above has been received, and shall cooperate with and in no way hinder or interfere with forces employed by the Owner or others.

Upon completion of the project by others, the Contractor shall be entitled to the return of all material which has not been used in the work or which has not been paid for, and for all plant, tools, equipment and other property, provided, however, that no claim will be allowed because of usual and ordinary depreciation, loss, wear and tear.

None of the foregoing provisions, or the provisions in subsection 108.13.00 shall be construed to require the Owner to complete the work, nor to waive or in any way limit or modify the provisions of the contract relating to the fixed and liquidated damages suffered by the Owner on account of the failure of the Contractor to complete the project within the time prescribed.

108.15.00 Completion and Acceptance: After completion of all items or work specified in the contract, and completion of final inspection as set forth in subsection 105.20.00, the Engineer will recommend to the Owner that the work be accepted and payment be made as provided for in subsection 109.11.00.

It is mutually agreed between the parties to the contract that a certificate of completion of the project, submitted by the Engineer or other officer of the Owner and approved by the governing body of the Owner, shall constitute final acceptance of the work and materials included in the contract on the date of such approval. It is provided further that such approval shall not constitute an acceptance of any authorized work, that no payment made under the contract except

108.15.00 Completion and Acceptance, Continued

The final payment shall be evidence of the performance of the contract, either wholly or in part, and that no payment shall constitute and acceptance of unauthorized for defective work or improper material.

The acceptance of the contract work shall not prevent the Owner from making claim against the Contractor for any defective work if same is discovered with the guaranty period.

All work shall be and is guaranteed by the Contractor for a period as specified after the date of final acceptance of all the work by the Owner.

If, within said guaranty period, repairs or changes are required in connection with guaranteed work, which, in the opinion of the Engineer, is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the contract, the Contractor shall, promptly upon receipt of notice from the Owner, and without expense to the Owner, (a) place in satisfactory condition in every particular all of such guaranteed work, correct all defects therein, and (b) make good all damage to the building or site, or equipment or contents thereof, which in the opinion of the Engineer, is the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the contract; and (c) make good any work or material, or the equipment and contents of building, structure or site disturbed in fulfilling any such guarantee.

If the Contractor, after notice, fails within ten (10) days to proceed to comply with the terms of this guaranty, the Owner may have the defects corrected, and the Contractor and his surety shall be liable for all expense incurred, provided, however, that in case of an emergency where, in the opinion of the Engineer, delay would cause serious loss or damage, repairs may be made without notice being given to the Contractor and the Contractor shall pay the cost thereof.

108.16.00 Dispute Settlement: All claims, disputes and other matters in question arising out of or relating to the contract documents, the work contemplated by the contract documents or at anytime arising during the terms of this agreement, except for claims which have been waived by the making and acceptance of final payment shall be litigated only in the District Court of Ford County, Kansas, and the Contractor waives the right to bring any action against Owner arising out of their contact relationship in any other court than said court, and specifically, waives the right to bring any action in any Federal court.

Both parties waive their right to trial by jury and agree that any dispute arising out of this agreement shall be submitted to a judge sitting without a jury.

109 MEASUREMENT AND PAYMENT

109.1.00 Measurement and Quantities

109.2.00 Scope of Payment

109.3.00 Compensation for Alteration of Contract

109.4.00 Eliminated Items

109.5.00 Payment for Extra Work

109.6.00 Payment for Force Account Work

109.7.00 Advances on Materials

109.8.00 Allowance for Materials Left on Hand

109.9.00 Progress Payments

109.10.00 Deferment of Payments

109.11.00 Final Estimate and Payment

109.12.00 Acceptance of Final Payment

109.13.00 Final Guaranty

109 MEASUREMENT AND PAYMENT

109.1.00 Measurement of Quantities: Payments shall be based on measurements of the completed work in accordance with United States Standard Measures. The units of measurement for payment shall be as shown or specified. In calculating quantities, all lengths and areas will be based on horizontal and vertical measurements, unless otherwise specified.

Basis is defined as the particular standard unit of measurement which will be applied to a particular item of work as shown.

Each basis of measurement herein set forth is generally applicable and will be in effect.

Linear measurement of pay lengths will be by the linear foot, measured along the line and grade of the item involved as actually placed and accepted.

Volume of earthwork, particularly excavation and embankment, will be computed by the average end area method or by other methods of equivalent accuracy.

Volumes of materials measured in the vehicles by which they are transported, termed Vehicle Measurement, will require computing of the volume of the vehicle to the nearest 0.1 cubic yard for its approved capacity, and identification of the vehicle and its capacity. Pay quantities will be determined by vehicle measurement at the point of delivery with no allowance of settlement of material during transit. Loads shall be level and uniform. Measurement will not be made for material in excess of the approved capacity of the vehicle and deductions will be made for loads below the approved capacity.

Volumes of concrete and masonry in structures will be measured according to neat lines as shown on the plans or as altered on order of the Engineer.

When requested by the Contractor and approved by the Engineer in writing, material specified to be measured by the cubic yard may be weighed and such weights will be converted to cubic yards for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

When payment for materials other than bituminous cements is on a weight basis and unless otherwise set forth in the specification under which the materials is to be furnished, the pay quantities will be determined by weighing the material on weigh scales provided by the Contractor as set forth hereinafter.

Such weighing is to be of material in the hauling vehicle as loaded for delivery of the material to the place of its incorporation in the work. The determination of tare weights and the weight of loaded vehicles will be to the nearest ten pounds. Tare weights will be determined by weighting empty vehicles at intervals of such frequency as the Engineer deems necessary to insure accuracy of pay load weights.

Portland cement will be measured by the pound, hundredweight, ton, sack, bag or barrel. The term Barrel of cement will mean 376 pounds, avoirdupois. The terms Sack and Bag of cement will mean 94 pounds, avoirdupois.

The quantities of asphalt cements, liquid asphalt materials and other bituminous cements normally shipped in tank cars or tank trucks, when they are to be paid for by the gallon (US Standard) or by the ton, will be determined from volume computations of the materials when at a temperature of 60 degrees F, with standard recognized correction factors applied when the materials are measured at any temperature other than 60 degrees F. Net certified scale weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when bituminous material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work. When bituminous materials are shipped by truck or transport, net certified weights or volume, subject to correction for loss of foaming, may be used for computing quantities.

Weights of materials and of metallic coatings will be determined on the basis as set forth in the specification under which their use is required.

The term “Lump Sum” when used as the basis of payment will mean complete payment for the work described to be done, complete and accepted without further measurement, as such work is covered under the applicable lump sum pay item.

The term “All Required” when used as the item of payment will mean that measurement for the item of work is to be on an All Required basis and that the corresponding payment is to be at a lump sum bid price. It is understood that the lump sum payment will be in effect without further measurement unless changes are ordered in writing by the Engineer. Under the All Required basis, the estimated quantities of the work to be performed thereunder will be listed in the Special Provisions for the purpose of providing a basis for adjustment of payment, as set forth in subsection 109.3.00, in the event changes in the work are ordered by the Engineer. These estimated quantities are to be considered as approximately only and are made on a reasonable interpretation of plans and intent, and no guarantee is made that computations based on the details and dimension shown on the plans will equal the estimated quantities.

109.1.00 Measurement of Quantities, Continued

If no changes are made in the work, no allowance will be made in the event the quantities based on the Contractor's computations overrun or underrun the estimated quantities.

When the contract specifies for materials which are to be measured by weighing on scales, the Contractor shall provide the scales at no expense to the Owner and shall transport the materials so they can be weighed on the scales provided.

The scales shall be of a size, capacity, kind and type suitable for the weighing to be done, and shall be properly and adequately installed. Before use of scales is commenced, and as frequently thereafter as the Engineer may deem necessary to insure accuracy, the Contractor shall, at the Contractor's expense, have the scales certified by an approved scale company or the Weights and Measures Division of the Kansas State Board of Agriculture.

The Contractor shall be responsible for maintaining the scales in an accurate condition at all times.

The Contractor shall furnish scales and so locate the scales so that the amount of hauling involved in the delivering of the materials is no greater than if no weighing were required. If hauling of materials is to be paid for as a separate pay item, the pay distance shall include only the distance via the most direct practicable route from the place of loading to the place of deposit and no allowance will be made for any extra hauling required to reach the scales.

109.2.00 Scope of Payment: The Contractor shall accept the compensations, as herein provided, in full payment for furnishing all materials, labor, tools and equipment necessary to the completed work and for performing all work contemplated and embraced under the contract; also for loss or damage arising from the nature of the work, or from the action of the elements, or from any unforeseen difficulties which may be encountered during the prosecution of the work until the final acceptance by the Owner, and for all risks of every description connected with the prosecution of the work; also for expenses incurred in consequence of the suspension or discontinuance of the work as herein specified; and for completing the work according to the plans and specifications.

Neither the payment of any estimate nor of any retained percentage shall relieve the Contractor of any obligation to make good any defective work or material.

The unit contract prices for the various bid items of the contract shall be full compensation for all labor, materials, supplies, equipment, tools and all things of whatsoever nature required for the complete incorporation of the item into the work the same as though the item were to read "In Place", unless the plans and special provisions shall provide otherwise.

109.3.00 Compensation for Alteration of Contract: When the character of the work or the unit costs thereof are materially changed, pursuant to subsection 104.6.00, compensation for such work will be made on such basis as may have been agreed to in advance of the performance of the work. When no such basis has been previously agreed upon, then an allowance may be made, either for or against the Contractor, in such amount as the Engineer may determine to be fair and equitable.

109.4.00 Eliminated Items: The Engineer shall have the right to eliminate, omit or cancel (herein collectively termed elimination) the portions of the contract relating to the construction of any item or part of any item herein by payment to the Contractor of a fair and equitable amount covering all items of actual cost incurred directly in connection with the eliminated work and prior to the date of elimination of the work by order of the Engineer. Where practicable, the work completed before elimination shall be paid for at unit prices, otherwise the Contractor will be allowed a profit percentage on the materials used and construction work actually performed at rates as provided in subsection 109.6.00 for force account work, but no allowance will be made for anticipated profits. Acceptable materials ordered by the Contractor, delivered on the work or properly stored at sites approved by the Engineer prior to the date of elimination of the work by order of the Engineer, will be purchased from the Contractor by the Owner at actual cost, and thereupon shall become the property of the Owner.

109.5.00 Payment for Extra Work: Upon written order by the Engineer, the Contractor shall carry out such work at prices agreed upon between the Contractor and the Owner, but in no event exceeding the unit prices established in the contract. When such order pertains to work of a class or classes for which no unit prices are so established, then the agreed adjustment shall be based either on unit prices decided on fair and equitable grounds or shall be a lump sum similarly decided, as the Owner may determine, or such work may be done on a force account basis. In no case shall be Contractor make any claim for extra work unless ordered as such.

109.6.00 Payment for Force Account Work: When extra work is ordered to be done on a force account basis, such work will be paid for on the basis of cost plus certain percentage allowances.

109.6.00 Payment for Force Account Work, Continued

The items of cost for which payment will be made and to which payment will be restricted, together with the percentage, allowance applicable to the respective items, are as follows:

Items of Cost for Which Payments Will be Made	Percentage Allowance Additional to Actual Cost
Labor, including time of foreperson, while engaged directly upon for account work.	20
Industrial accident insurance, unemployment compensation contributions and social security for old age assistance contributions incurred or required under statutory law and these standard specifications.	20
The amount paid do, or in behalf of, workers by reason of subsistence and travel allowances, health and welfare benefits, pension fund benefits or other benefits, when such amounts are required by collective bargaining agreement or other employment contract generally applicable to the classes of labor employed on the work.	20
Materials and supplies actually used in the force account work.	15
Rental on each piece of equipment having a value in excess of five hundred dollars, shall be as agreed by the Engineer and Contractor in writing, provided the rental rate does not exceed the current rates established by in Section 104.9.02C of these specifications.	15

The payment to be made for labor used in the work will be computed at the rates actually paid by the Contractor or Subcontractor, plus the allowance set forth above, unless these rates are in excess of the current local rates, in which event the payment shall be computed at the current local rate, plus allowances. The time allowed shall be the number of hours worked directly on force account operations.

Payment for purchased materials and supplies used on force account work will be computed at the prices billed to the Contractor or Subcontractor by the supplier, less all discounts plus the allowance set forth hereinbefore. It shall be presumed that the Contractor or Subcontractor has taken advantage of all possible discounts on bills for materials and supplies, and such discounts shall be distracted from the total amounts of bills regardless of any failure of the Contractor to take advantage of same.

109.6.00 Payment for Force Account Work, Continued

Freight and express on material and supplies will be considered to be a part of the cost of the materials and supplies and will be paid for as materials and supplies.

Materials and supplies produced by the Contractor or a Subcontractor will be paid for at prices to be agreed upon between the Contractor and the Engineer.

Rental on equipment used will be computed at the rates actually paid by the Contractor or Subcontractor plus the allowance unless these rates are in excess of the current local rates, or unless the equipment is owned by the Contractor or Subcontractor. In either of which events payments shall be computed at rates to be agreed upon between the Contractor and the Engineer prior to beginning work, which rates shall in no case be greater than the current local rates.

When a piece of equipment and the operators thereof are hired, rented, or furnished as a unit, the additional percentage to be allowed shall be 5 percent, and the Contractor shall not be entitled to 15 percent on the time of the operators of such equipment. Neither shall the Contractor be entitled to payment for contributions made under the terms of the Workman's Compensation Act, the Unemployment Compensation Act, or the Social Security Act to cover the time of operators of equipment hired, rented or furnished on this basis.

For equipment rented on a day or hour basis, rental will be allowed for only those days or hours during which the equipment is in actual use. For equipment rented on a monthly basis, straight time rental will be allowed from the day the equipment is first used on the particular piece of force account work until and including the last day on which it is used on that particular work, excluding, however, the time during which the equipment is used on other work during the period, and further excluding the time that the equipment is idle for a continuous period of more than six days.

The rentals allowed for equipment will in all cases be understood to cover all fuel, supplies, repairs, and renewals, and no further allowances will be made for those items unless specific agreement to that affect is made in writing before the work is commenced. Individual pieces of equipment having a value of one hundred dollars or less will be considered to be tools or small equipment, and no rental shall be allowed on such.

The percentage allowances made to the Contractor in accordance with the terms outlined above will be understood to be reimbursement and compensation for all superintendence, use of tools and small equipment, overhead expense, bond cost, insurance premiums, profits, indirect costs and losses of all kinds, and all other items or cost not specifically designated herein as items for which payment is to be made, whether the services, costs and other items involved are furnished or incurred by the Contractor or by the Subcontractor. No other reimbursement, compensation or payment shall be made for any such services, costs or other items.

109.6.00 Payment for Force Account Work, Continued

Should any percentage allowance or other corresponding allowance be made by the Contractor to a Subcontractor in connection with force account work, such allowance shall be at the sole expense of the Contractor and the Contractor shall not be reimbursed or otherwise compensated for the same by the Owner.

All claims for extra work done in any month shall be filed in writing by the Contractor with the Engineer before the fifth of the following month, and such claims shall show the names and number of each worker employed thereon, the date and the number of hours so employed, the character of the work, an the wages paid or to be paid; also the claim shall show the materials delivered for the extra work, the quantity and character of such materials, from whom purchased, and the net amount paid, or to be paid therefore.

109.7.00 Advances of Materials: Allowances will be made in the partial payments to the Contractor for acceptable nonperishable materials which are to become an integral part of the completed project, subject to the following conditions:

Aggregates must be those specifically produced for the project and must be acceptably stockpiled on property acceptable to the Engineer.

Materials must have a value, as determined by the Engineer, of not less than $2,500.

Allowances will be made in the partial payments to the Contractor for precast structural concrete members acceptably stored in the fabricator's yard or at a site acceptable to the Engineer.

The above allowances shall be in amounts not exceeding the net cost to the Contractor of the material f.o.b. the work or approved site, and from such allowances there shall be retained the percentages regularly provided for in connection with partial payments.

As a basis for estimating materials on hand and the cost thereof, the Contractor shall make available to the Engineer paid invoices, freight bills, and other information concerning the materials in question, as the Engineer may request.

Payment for materials on hand shall be issued with the next regular scheduled payment following the receipt of the request for material reimbursement. Reimbursement for materials on hand shall be a one-time payment, and shall not be reflected in subsequent partial payments.

109.7.00 Advances of Materials, Continued

In the event the contract is terminated or cancelled and the Owner elects to terminate the employment of the Contractor, as provided in subsection 108.13.00, the Contractor or his surety shall provide the Owner with immediate and peaceful possession of all materials on which the Contractor has received any partial payments as above provided and if, for any reason, the Contractor or the Contractor's surety cannot provide peaceful possession of the said materials, then the Contractor or the Contractor's surety shall immediately refund to the Owner the total amount of all the partial payments which have been advanced to the Contractor by the Owner for the said materials.

109.8.00 Progress of Payments: The Contractor shall submit pay requests to the Engineer 13 days prior to the first Monday of the following month. Pay requests shall included the quantity of completed work and supporting documents for cost reimbursement of materials on hand as set forth in subsection 109.7.00.

The sum of these values will hereinafter be collectively referred to in this subsection as the "value of completed work". With these estimates as a base, a partial payment will be made to the Contractor, which partial payment shall be equal to the value of completed work, less such amounts as may have been previously paid, less such other amounts as may be deductible or as may be owing and due to the Owner for any cause, and less an amount to be retained in protection of the Owner's interests.

The minimum amount to be retained from any given partial payment will be such that when added to the sum of amounts previously retained will bring the total of amounts retained equal to ten percent of the value of completed work. After the work is at least 50% complete, and subject to the satisfactory progress and compliance with the provisions of the Contract Documents, the OWNER may, at its discretion, elect to reduce the retainage to a minimum of not less than five percent of the value of the completed work.

Such amount of retainage shall be withheld and retained by Owner until it is included in and paid to Contractor as part of the final payment of the contract amount.

If the Contractor fails to complete the project within the specified contract time, or any extension thereof, liquidated damages will be deducted from the payments in the amount specified in the contract.

The making of progress payments shall, under no circumstances, be construed as an acceptance of any of the work or materials under the contract.

109.8.00 Progress of Payments, Continued

When the progress estimate indicates that the progress payment would be less than five hundred dollars, no progress payment will be made for that estimate period.

Payments for all work under the contract will be made at the price or prices bid therefore, and the prices shall include full compensation for all incidental work.

109.9.00 Deferment of Payments: No payment will be made until all orders made by the Engineer to the Contractor in accordance with the specifications are complied with, nor until all claims or liens filed or prosecuted against the Owner, its officers or employees contrary to the provisions of the contract are satisfied.

In the event a complaint or charge of unlawful employment practices pursuant to the provisions of KSA Chapter 44 is filed against the Contractor resulting in the issuance of a cease and desist order, no further payments will be made on the contract until such time as all of the provisions of the cease and desist order have been complied with by the Contractor.

109.10.00 Final Estimate and Payment: The Contractor shall notify the Engineer when work is considered complete and the Engineer shall, within fifteen (15) days after receiving the notice, either accept the work or notify the Contractor of work yet to be performed on the contract. If accepted, the Engineer shall so notify the Contractor and will make a final estimate and recommend acceptance of the work as of a certain date. Upon approval and acceptance by the Owner, the Contractor will be paid a total payment equal to the amount due under the contract including all retainage.

Prior to final payment, the Contractor shall deliver to the Owner, a receipt for all amounts paid or payable to the Contractor and a release and waiver of all claims against the Owner arising from or connected with the contract and shall furnish satisfactory evidence that all amounts due for labor, materials and all other obligations have been full and finally settled, or are fully covered by insurance.

109.11.00 Acceptance of Final Payment: The acceptance by the Contractor of the final payment shall release the Owner and the Engineer as agent of the Owner from all claims and all liability to the Contractor for all things done or furnished in connection with the work, and every act of the Owner and others relating to or arising out of the work. No payment, however, final or otherwise, shall operate to release the Contractor or the Contractor's sureties from obligations under the contract and the performance, payment and other bonds and warranties, as herein provided.

109.12.00 Final Guaranty: All work shall be and is guaranteed by the Contractor for a specified period from and after the date of final acceptance of all the work by the Owner.

If, within said guaranty period, repairs or changes are required in connection with guaranteed work, which, in the opinion of the Engineer is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the contract, the Contractor shall promptly upon receipt of notice from the Owner, and without expense to the Owner; (a) place in satisfactory condition in every particular all of such guaranteed work, correct all defects therein; (b) make good all damage to the building or site, or equipment or contents thereof, which in the opinion of the Engineer, is the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the contract; and (c) make good any work or material, or the equipment and contents of building, structure or site disturbed in fulfilling any such guarantee.

If the Contractor, after notice, fails within 20 days to proceed to comply with the terms of this guaranty, the Owner may have the defects corrected, and the Contractor and the Contractor's surety shall be liable for all expenses incurred, provided, however, that in case of an emergency where, in the opinion of the Engineer, delay would cause serious loss or damage, repairs may be made without notice being given to the Contractor and the Contractor shall pay the cost thereof.

DIVISION TWO
STREETS AND RELATED WORK

201 MOBILIZATION

201.1.00 Description

201.2.00 Materials

201.3.00 Construction
201.3.01 General

201.4.00 Measurement and Payment
201.4.01 Lump Sum Basis
201.4.02 Incidental Basis

201 MOBILIZATION

201.1.00 Description: This section covers the work necessary to move in personnel and equipment, set up all offices, building and facilities, and prepare for construction.

201.2.00 Materials: The Contractor shall provide all materials required to accomplish the work as specified.

201.3.00 Construction

201.3.01 General: The Contractor shall set up construction facilities in a neat and orderly manner within designated or approved work areas.

201.4.0 Measurement and Payment

201.4.01 Lump Sum Basis: When listed in the proposal as a pay item, payment for mobilization will be made on a lump sum basis.

201.4.02 Incidental Basis: When neither specified nor listed in the proposal for separate payment, mobilization will be considered incidental work for which no separate payment will be made.

202 TEMPORARY TRAFFIC CONTROL

202.1.00 Description

202.2.00 Materials
202.2.01 Uniform Traffic Control Devices

202.3.00 Construction
202.3.01 General
202.3.02 Traffic Control with the Project
202.3.03 Construction and Maintenance of Detours
202.3.04 One Way Piloted Traffic Control

202.4.00 Measurement and Payment
202.4.01 Lump Sum Basis
202.4.02 Incidental Basis

202 TEMPORARY TRAFFIC CONTROL

202.1.00 Description: This section covers all work necessary to conduct construction operations so as to offer the least possible obstruction and inconvenience to the public and to protect pedestrian and vehicular traffic.

202.2.00 Materials:

202.2.01 Uniform Traffic Control Devices: Flagmen, barricades, signs and traffic control devices shall conform to the Manual on Uniform Traffic Control Devices, published by the U.S. Department of Transportation. Copies may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

202.3.00 Construction:

202.3.01 General: The Contractor shall provide and maintain such signs, barricades and warning lights as are necessary to warn and protect the public at all times on highways, roads or streets affected by the work operations. In addition, the Contractor shall also provide all flagmen and guards necessary to warn and protect the public.

The Contractor shall patrol the traffic control area and reset all disturbed signs and traffic control devices immediately, and will remove or cover all nonapplicable signs during periods not needed.

202.3.02 Traffic Control Within the Project: Public traffic shall be permitted to pass through the work area, or on an approved detour, with as little inconvenience and delay as possible.

The Contractor shall provide access to private properties at all times except during urgent stages of construction when it is impractical to carry on the construction and maintain traffic simultaneously.

The Contractor shall give occupants of property fronting a street at least 24 hours notice before more than half the street is closed to vehicular traffic.

When, in the judgement of the Engineer, vehicular parking is a hazard to through traffic or to the work, the Contractor shall furnish and place no parking signs on any street which is directly involved in the construction work.

202.3.03 Construction and Maintenance of Detours: The Contractor shall construct and maintain approved temporary detours for the protection of the work and the safe passage of traffic through, and/or around the work area.

202.3.04 One Way Piloted Traffic Control: When detours are not available, the Contractor shall confine operations to a width which provides for the safe passage of traffic. If, in the judgement of the Engineer, one way piloted traffic is necessary, the Contractor shall provide at least two (2) flagpersons to control traffic, one flagperson being stationed at each end of the roadway being limited to restricted use and furnish a pilot car and driver to lead traffic. All pilot cars shall be identified with an appropriate information sign mounted on the rear of the vehicle. At the end of each day, the Contractor shall leave work in such condition that it can be traveled without damage to the work and without danger to the public.

202.4.00 Measurement and Payment:

202.4.01 Lump Sum Basis: When listed in the proposal as a separate pay item, payment for Temporary Traffic Control will be made on a lump sum basis.

202.4.02 Incidental Basis: When neither specified nor listed in the proposal as a separate pay item, Temporary Traffic Control will be considered incidental work for which no separate payment will be made.

203 CLEARING AND GRUBBING

203.1.00 Description

203.2.00 Materials

203.3.00 Construction
203.3.01 Disposal
203.3.02 Merchantable Trees or Timber
203.3.03 Clearing
203.3.04 Grubbing
203.3.04A Excavation Areas
203.3.04B Embankment Areas

203.4.00 Measurement and Payment
203.4.01 Acreage Basis
203.4.02 Lump Sum Basis
203.4.03 Incidental Basis

203 CLEARING AND GRUBBING

203.1.00 Description: This section covers the work necessary to clear, remove and dispose of all debris and vegetation such as stumps, trees, logs, roots, shrubs, vines, grass and weeds within the designated limits, and to preserve from injury or defacement such objects and vegetation as are designated to remain in place.

Clearing is defined as the cutting and removal of trees, bushes, vines and other vegetative growth at or above the surface of the ground.

Grubbing is defined as the removal of vegetative growth and wood items remaining at or below the ground surface following the clearing operation.

203.2.00 Materials: None required.

203.3.00 Construction

203.3.01 Disposal: Clearing and grubbing vegetation, unless otherwise specified, shall be disposed of by the Contractor in a manner satisfactory to the Engineer and in compliance with federal, state, and local laws and ordinances.

203.3.02 Merchantable Trees or Timber: Merchantable trees or timer shall become the property of the Contractor unless otherwise specified.

203.3.03 Clearing: Trees and brush shall be cut such that no stump extends above the ground surface more than six inches.

203.3.04 Grubbing:

203.3.04A Excavation Areas: All roots and embedded wood shall be removed to a depth not less than six inches below the subgrade or slope surface to which the excavation is constructed. All stumps shall be completely removed.

203.3.04B Embankment Areas: All stumps, roots, and embedded wood shall be removed to a depth not less than one foot below the subgrade or slope surface to which the embankment is to be constructed.

203.4.00 Measurement and Payment

203.4.01 Acreage Basis: Measurement and payment for clearing and grubbing will be made on an acreage basis for the area cleared and grubbed within the limits specified; measured to the nearest 0.1 acre.

203.4.02 Lump Sum Basis: Measurement and payment for clearing and grubbing will be made on a lump sum basis for the area cleared and grubbed within the limits specified.

203.4.03 Incidental Basis: When not specified for payment, clearing and grubbing will be considered incidental work for which no separate payment will be made.

204 EARTHWORK

204.1.00	Description
204.1.01	General
204.1.02	Unclassified Excavation
204.1.03	Classified Excavation
204.1.03A	Rock Excavation
204.1.03B	Common Excavation
204.1.04	Borrow Excavation
204.2.00	Materials
204.2.01	Borrow and Embankment Materials
204.3.00	Construction
204.3.01	Preservation of Existing Improvement
204.3.02	Excavation of Existing Improvements and Miscellaneous
204.3.03	Disposition of Excavated Materials
204.3.04	Over-Excavation
204.3.05	Use of Explosives
204.3.06	Preparation of Embankment Foundations
204.3.07	Embankment Construction
204.3.08	Compaction and Density Requirements
204.3.09	Slide Removal and Repair
204.3.10	Finishing Roadbed and Slopes
204.4.00	Measurement and Payment
204.4.01	Unclassified and Classified Excavation
204.4.02	Embankment
204.4.03	Finish Roadbed and Slopes
204.4.04	Payment

204 EARTHWORK

204.1.00 Description

204.1.01 General: This section covers the work necessary for excavating and grading the roadway, side streets, sidewalk and planting areas, alleys, cuts, embankments, slopes, roadway ditches, side streets, driveway and alley approaches and all other earth-moving work required in the construction of the project including disposal of all surplus material.

When specifically included and provided for as incidental work for particular items or parts of work covered and included under other sections, such excavation and grading will not be included in this section.

204.1.02 Unclassified Excavation: Unclassified excavation is defined as all excavation regardless of the type, nature, or condition of the materials encountered. The Contractor shall assume full responsibility to estimate the kind and extent of the various materials to be encountered in order to accomplish the work.

204.1.03 Classified Excavation

204.1.03A Rock Excavation: Rock excavation is defined as the removal of all material which by actual demonstration cannot be reasonable excavated with a D8 dozer with ripper or equivalent grading equipment which is, in fact, systematically drilled and blasted or broken by power operated hand tools. The Engineer may waive the demonstration if the material encountered is well defined rock. The term "Rock Excavation" shall be understood to indicate a method of removal and not a geological formation.

If material which would be classified as rock by the above definition is mechanically removed with grading equipment of a larger size than specified, it shall be understood that any added costs for the removal of the material by this method shall be included in the unit price for common excavation.

204.1.03B Common Excavation: Common excavation is defined as removal of all material not classified as rock excavation.

204.1.04 Borrow Excavation: Borrow material is defined as material obtained from borrow sources lying outside of, separated from and independent of, planned roadbed excavation or other required excavation occurring within the project limits.

204.2.00 Material

204.2.01 Borrow and Embankment Materials: The Contractor shall provide embankment and borrow materials of approved earth, sand, gravel, rock or combination thereof, free of peat, humus, muck, vegetative matter, organic matter or other materials detrimental to the construction of firm, dense and sound embankment.

The Contractor shall use all approved materials originating from the required excavations as far as practicable in the formation of embankments and subgrade, and for bedding, backfilling and other work as shown or directed.

204.3.00 Construction

204.3.01 Preservation of Existing Improvements: The Contractor shall conduct operations in such a manner that existing highway facilities, utilities, railroad tracks and other non-highway facilities which are to remain in place will not be damaged as specified in "Control of Work" in the general requirements. The Contractor shall furnish and install sheet piling, cribbing, bulkheads, shores or whatever means may be necessary to support material carrying existing facilities or to support the facilities themselves, and maintain such supports until no longer needed. The Contractor shall protect temporary pavements, facilities, utilities and installations until they are no longer required. When temporary supports and other protective means are no longer required, the Contractor shall remove and dispose of them as directed.

204.3.02 Excavation of Existing Improvements and Miscellaneous: Earthwork includes excavating, hauling and depositing existing pavements, walks, driveways, surfacings, slabs, curbs, gutters and similar cement concrete structures or bituminous materials and of all rock or gravel road surfacing materials when such materials are within the limits of the excavation.

The Contractor shall remove and dispose of sewers, pipes, conduits, logs, timbers, concrete and other structures, materials, objects and matter encountered in the excavations, excepting only items for which removal is otherwise specifically provided, as a part of the earthwork. The volumes of such items from within the excavation areas shown will be included in the excavation quantities.

The Contractor shall remove the remaining ends of abandoned pipes or portions of other items partially removed under this work which would be left exposed on side slopes or at subgrade to a minimum of one (1) foot of the finished slope or below subgrade.

The Contractor shall plug or seal the ends of abandoned pipes in embankment areas as approved.

204.3.02 Excavation of Existing Improvements and Miscellaneous, Continued

If possible, existing culvert pipe shall be salvaged during the course of construction and becomes the property of the abutting property owner; or the City of Dodge City. The Contractor shall contact the Owners of the culvert pipe and the City. If the Owners and the City do not want the pipe, it shall become the property of the Contractor.

204.3.03 Disposition of Excavated Materials: Excavated material in excess of that needed to complete the work shall be disposed of at no expense to the Owner. The Contractor shall replace any shortage of material caused by premature disposal at no expense to the Owner.

204.3.04 Over-Excavation: The Contractor shall remove unapproved subgrade material to such depths as directed. Excavation below subgrade shall be of the same classification as that above subgrade provided it is removed in the same operation as the excavation above subgrade. When the roadway excavation has been completed and it is required to move equipment back in to excavate the unsuitable material, or where additional excavation depth requires special equipment because of the presence of shallow utilities or other unforeseen conditions, the work shall be performed as directed and payment for excavation below grade will be made on the basis of extra work as provided in the general requirements.

The Contractor shall excavate below grade and backfill as required to restore the surface as directed at no expense to the Owner, when required by negligence in work operations.

Overbreak is defined as that portion of any materials which is excavated, displaced or loosened outside and beyond the slopes, lines or grades as staked or reestablished, with the exception of slides as defined in Subsection 204.3.09, regardless of whether the overbreak is due to blasting, to the inherent character of any formation encountered, or to any other cause. Removal and disposal of all overbreak will be by the Contractor at no expense to the Owner.

204.3.05 Use of Explosives: The use and security of explosives shall conform to the applicable provisions of "Legal Relations and Responsibilities" in the general requirements.

The use of explosives shall be avoided as far as practicable, and in no case shall tunnel blasting methods be used. Such blasting as must be done shall be controlled in a manner which will avoid possible shattering or loosening of materials back of the slope lines to which the excavations are to be made.

204.3.05 Use of Explosives, Continued

Where excavations in hard, solid rock are to be made to depths of 10 feet or more, the blasting thereof shall be done by the pre-splitting or pre-shearing method unless other methods are approved by the Engineer. The pre-splitting shall be by line drilling relief holes of 2 ½ to 4 inch diameter at uniform intervals of 2 ½ feet along the top line and along the specified slope line to subgrade depth, but not to exceed a vertical depth of 30 feet in any instance.

Explosive charges of predetermined amount and at predetermined spacings shall be attached to a section of primacord placed in each line hole to the full depth thereof and the hole filled or stemmed with fine stone chips or gravel. A primacord trunk line shall be attached to a series of the line hole primacords and detonated with an electric blasting cap. Detonation may be prior to or following other blasting of the rock but in no case shall other drilling and blasting occur closer than 10 feet from the line drilling nor shall it disturb material at or beyond specified neat side slope and subgrade lines.

The Contractor shall provide a state certified powderman to supervise the drilling and blasting operations.

No separate or additional measurement or payment will be allowed for any extra operations involved in the performance of controlled blasting as herein specified, it being understood that the extra costs thereof are covered and included in the pay quantities of excavation measured in original position (position prior to excavation) and the applicable contract unit price set forth in the bid schedule.

204.3.06 Preparation of Embankment Foundations: Prior to the constructing of embankments, the Contractor shall excavate unstable material or unsuitable foundation material and dispose of it as directed. The Contractor shall limit excavation to the lines, grades and cross sections shown or approved. The Contractor shall backfill basements, trenches and holes which occur within the embankment limits with approved material which may include small pieces of broken concrete and masonry. The Contractor shall break concrete floors of basements as approved prior to backfill. The Contractor shall break up and roughen the ground surface before embankment material is placed, as approved. The Contractor shall compact the natural ground underlying embankments to the depth of the grubbing or a minimum of 12 inches, to the density specified for the embankment material to be placed.

204.3.07 Embankment Construction: The Contractor shall place embankments and fills of all kinds in approximately horizontal layers of a maximum of 8 inches in thickness and compact each layer separately and thoroughly to the density specified.

In the immediate vicinity of curbs, walks, driveways, inlets, manholes and similar structures, in holes and where embankment and fill materials cannot be reached by the normal compacting equipment, the Contractor shall compact to specified density by approved methods.

204.3.07 Embankment Construction, Continued

Where embankments are constructed predominantly of rock fragments, the Contractor shall place material in layers of the thickness as directed, but not greater than 3 feet. Placing of individual rock fragments having dimensions greater than 3 feet will be permitted provided that they have no dimension greater than 6 feet, that clearances between adjacent fragments provide adequate space for the placing and compacting of material in horizontal layers as specified, and that no part comes within 4 feet of subgrade. The Contractor shall distribute and manipulate rock so that the interstices between the larger pieces are filled with smaller pieces, forming a dense and compact mass.

The Contractor shall exercise precaution to insure that embankment construction and fill does not move, endanger or overstress any structure. The Contractor shall place and compact embankments at the end of bridges prior to the time that work begins on the bridge.

Embankments shall not be constructed when the embankment material, the foundation, or the embankment on which it would be placed is frozen.

204.3.08 Compaction and Density Requirements: The density of compacted materials in place will be determined by AASHTO T191, T205 or T238 and the maximum density by AASHTO T99 or T180.

The Contractor shall compact all embankments, fills and backfills within 3 feet of established subgrade elevation to a minimum density in place of 95 percent of maximum density. Below said 3 foot limit, compaction shall be a minimum density in place of 90 percent of maximum density.

Roadbed cuts and foundations for structures to a depth of 1 foot below established subgrade or foundation elevation shall be 3 inch maximum material and shall be compacted to a minimum density in place of 95 percent of maximum density.

The Contractor shall backfill holes resulting from grubbing, removal work, basements and trenches which lie outside the limits of required excavation or embankment construction with approved roadbed excavation material. The Contractor shall smooth and shape to blend with the surrounding area.

Embankment or backfill materials shall not be placed in final position until moisture in excess of optimum moisture has been removed.

204.3.09 Slide Removal and Repair: Side slopes shall be made as staked or re-established. In case a slope finished to the lines as staked or re-established slides back of the established slope into the roadway prism or out of an embankment before final acceptance of the work, the Contractor shall remove slide material from the roadway, or replace in the embankment and refinish slope as directed. The resloping will be paid for as extra work.

The Contractor shall obtain materials to replace embankment slides from an approved source. The Contractor shall repair slopes undercut at the base or destroyed in any manner due to negligence during the work by resloping parallel to the damaged slope or as approved at no expense to the Owner.

204.3.10 Finishing Roadbed and Slopes: After the main excavation in rock or rocky cuts is completed, the Contractor shall test slopes of the cuts thoroughly with bars, or by other approved means, and remove all loose, detached, broken or otherwise unstable rock. The Contractor shall remove jutting points and bring the entire cut slope to a safe, trim and neat condition as approved. The Contractor shall dispose of the materials removed under this provision in the same manner as other excavated material.

As a part of the earthwork, the Contractor shall perform special grading on areas which are shown as planting areas. The Contractor shall finish planting areas to smooth flowing lines and to the grades and cross sections established or approved. Rock, boulders, vegetative matter and debris determined objectionable to intended development shall be removed from the areas as directed.

The Contractor shall blend the tops of cutbanks with the adjacent terrain by rounding of the top of cutbanks as shown. When rock extends to the top of cuts making rounding impractical, it will not be required.

The Contractor shall trim all roadbeds, ditches and other excavations and embankments reasonably close to the established lines, grades and cross sections. The Contractor shall leave all surface features in a neat and well finished condition prior to the time the project is completed and accepted.

Immediately prior to completion of the earthwork, the Contractor shall clean the entire right-of-way area of debris and foreign matter of all kinds and dispose of as directed.

204.4.00 Measurement and Payment

204.4.01 Unclassified and Classified Excavation: Quantities for unclassified and classified excavation work will be measured on a cubic yard basis in original position prior to excavation. Pay quantities shall be computed to the neat lines of the cross sections as staked.

When shown in the proposal, this work will be measured and paid on a lump sum basis.

204.4.02 Embankment: Quantities of embankment in place or stone embankment will be measured on a cubic yard basis by cross section measurement of the material in the approved embankment position of the work within the neat lines above the ground or base elevations existing at the time embankment construction begins. No measurements or payment will be made for quantities required due to subsidence and settlement of the ground or foundation, for settlement of materials within the embankments or for shrinkage, settlement, washout, slippage or loss regardless of cause, subject however to the provisions of "Responsibility of the Contractor" in the general requirements.

When shown in the proposal, this work will be measured and paid on a lump sum basis.

204.4.03 Finish Roadbed and Slopes: Measurement will be made horizontally by the station to the nearest 1 foot, or by the foot to the nearest 0.1 foot, along the centerline of the main roadway roadbed, excluding the length of bridges or openings for bridges.

204.4.04 Payment: Payment will be made for the following items when listed as pay items:

Pay Item	*Unit of Measurement*
1. Unclassified excavation	C.Y. or Lump Sum
2. Classified excavation:	
a. rock excavation	C.Y. or Lump Sum
b. common excavation	C.Y. or Lump Sum
3. Borrow excavation	C.Y. or Lump Sum
4. Embankment in place	C.Y. or Lump Sum
5. Finish roadbed and slopes	Sta. or L.F.

205 WATERING

205.1.00 Description

205.2.00 Materials
205.2.01 Water
205.2.02 Binders and Additives

205.3.00 Construction

205.4.00 Measurement and Payment
205.4.01 Measurement
205.4.01A Water by Volume
205.4.01B Water by Weight
205.4.01C Binders and Additives
205.4.02 Payment
205.4.02A Water on Incidental Basis
205.4.02B Water by Volume
205.4.02C Water by Weight
205.4.02D Binders and Additives

205 WATERING

205.1.00 Description: This section covers the work necessary to furnish and apply water or combinations of water and compatible binders or additives for roadway excavations, embankments, subgrades, roadbeds, backfills, subbases, bases and surfacings and water for the alleviation or prevention of dust nuisance within the project limits as directed.

Excluded from this section is watering used in connection with Portland cement concrete construction, wetting foundations preparatory to placing concrete thereon, curing concrete and watering which is specified as incidental to particular items or parts of the work in other sections.

205.2.00 Materials:

205.2.01 Water: Water used in the work shall be free of silts and other matter deleterious to the quality of the material to which it is applied or with which it is mixed. The Contractor shall make all necessary arrangements for obtaining water and pay all costs involved in its procurement. The Contractor shall maintain an adequate supply of water at all times.

205.2.02 Binders and Additives: When shown, specified or directed, the Contractor shall use a mixture of water and an approved compatible binder or additive material.

205.3.00 Construction: Watering work shall at all times be under the direction and control of the Engineer.

The Contractor shall water by means of tank trucks equipped with spray bars, by hose and nozzle or by other approved equal means which insures uniform and controlled application. The use of splash boards will not be permitted without prior approval.

The Contractor shall perform watering at any hour of the day and on any day of the week necessary for proper performance or protection of the work and for adequate alleviation of dust nuisance. The Contractor shall sprinkle directly on the road only at night or in the early morning hours when loss by evaporation is at a minimum, unless otherwise directed.

When compatible binder material or additive is combined with water in the work, the Contractor shall mix it in conformance with the manufacturer's directions or as directed.

The Contractor shall avoid wastage of water or watering which is detrimental to other items of work.

205.4.00 Measurement and Payment

205.4.01A Water by Volume: Quantities of water determined by volume will be measured in units of 1,000 gallons (M-gals.) to the nearest 0.1 unit, exclusive of binders and additives mixed therewith. Measurement will be made in tanks or tank trucks of predetermined and approved capacities or by reliable approved meters provided by the Contractor. Measurement and payment will be made only for quantities as are approved for use in the work.

205.4.01B Water by Weight: Quantities of water determined by weight will be measured in tons so the nearest 0.1 ton. Measurement will be the actual tons used based on weight tickets from state certified scales presented for approval on the day the water is delivered. No measurement or payment will be allowed on tickets not so delivered and approved.

205.4.01C Binders and Additives: Quantities of compatible binders or additives combined with water for watering purposes will be determined separately from the water and will be measured as specified and shown in the proposal.

205.4.02 Payment

205.4.02A Water on Incidental Basis: When neither specified nor shown in the proposal for separate payment, all water will be considered incidental to the other items of work and no separate payment will be made.

205.4.02B Water by Volume: Payment for water will be made on a 1,000 gallon (M-gal.) basis.

205.4.02C Water by Weight: Payment for water will be made on a ton basis.

205.4.02D Binders and Additives: Payment for compatible binders or additives combined with water for watering purposes will be paid for at the applicable contract unit price as set forth in the proposal. Payment shall constitute full compensation for the binder material or additive, for the combining of it with the water and for all extra costs involved in the use of the binder material or additive in the watering work.

206 SUBGRADE

206.1.00	Description
206.1.01	Untreated Subgrade
206.1.02	Treated Subgrade
206.2.00	Materials
206.2.01	Soil Stabilizing Materials
206.2.02	Water
206.3.00	Construction
206.3.01	Preparation
206.3.02	Untreated Subgrade
206.3.03	Treated Subgrade
206.3.03A	General
206.3.03B	Addition of Stabilizing Material
206.3.03C	Mixing
206.3.04	Compaction
206.3.05	Tolerances
206.3.06	Curing Treated Subgrade
206.4.00	Measurement and Payment
206.4.01	Measurement
206.4.01A	Incidental Work
206.4.01B	Work Paid in Other Sections
206.4.01C	Untreated Subgrade
206.4.01D	Soil Stabilizing Materials
206.4.01E	Treated Subgrade
206.4.02	Payment
206.4.02A	Soil Stabilizing Materials
206.4.02B	Treated Subgrade

206 SUBGRADE

206.1.00 Description: This section covers the work necessary for the preparation of the subgrade. Subgrade is defined as the area of new or existing roads, streets, alleys, driveways, sidewalks, or other public places upon which additional materials are to be placed as a part of the work covered in other sections or by future work. Where applicable, subgrade is considered to extend over the full width of the specified base course. Subgrade is classified as untreated or treated.

206.1.01 Untreated Subgrade: The uppermost material placed in embankments or unmoved from cuts in the normal grading of the roadbed and which is brought to true line and grade, shaped and compacted as necessary to provide a foundation for the pavement structure constitutes untreated subgrade.

206.1.02 Treated Subgrade: Subgrade which is improved by the addition of stabilizers and prepared as in untreated subgrade constitutes treated subgrade.

206.2.00 Materials

206.2.01 Soil Stabilizing Materials: Soil stabilizing materials shall conform to the following requirements:

Material	*Type*	*Grade*
Hydrated Lime	AASHTO M 216, Type a	Grade A
Granular Quicklime (Ca0)	AASHTO T 27 and T 219 for grading and hydroxide content, with minimum 85% calcium hydroxide	100% passing 3/8” sieve, maximum 15% passing 100 sieve
Calcium Chloride	AASHTO M 144, sample and testing in accordance with AASHTO T 143	

206.2.01 Soil Stabilizing Materials, Continued

Aggregates for subgrade stabilization shall be of the types shown in the following table and shall meet the following requirements:

TYPE AND MATERIAL					
Sieve Size	SR-3 Crushed Stone Screening*	SR-5 Sand**	SR-7 Sand/Gravel	SR-8 Chat	SR-9 Sand/Gravel
PERCENT RETAINED					
¾	0	0	0	0	--
3/8	0-5	--	--	--	--
4	--	--	--	35+	--
8	--	--	--	60+	30-100
16	--	--	5-50	--	--
30	--	--	--	85+	--
50	--	--	85-100	--	--
200	See "material passing 200 sieve"				
* This material shall not contain more than 7% moisture when delivered.					
** This material shall not contain more than 10% moisture when delivered.					

(a) Deleterious Substances: The deleterious substances shall not exceed the following percentages by weight:

(1) For crushed limestone, sand-gravel, and chat

Soft or friable particles	5.0
Clay lumps	3.0
Sticks (wet)	1.0
Shale or shale-like material	3.0
Material Passing No. 200 sieve	15.0

No combination of these substances shall exceed 15.0%

(2) For sand (blow, jig, etc.)

Sticks	1.0
Materials passing No. 200 sieve	15.0
Clay lumps	5.0

No combination of these substances shall exceed 15.0%

Storage of materials shall conform to the requirements of Subsection 106.7.00.

206.2.02 Water: Shall conform to the requirements of Section 205.

206.3.00 Construction

206.3.01 Preparation: In advance of setting line and grade, the Contractor shall clear and dispose of brush, weeds, vegetation, grass and debris from the subgrade. The Contractor shall drain all depressions or ruts which contain water. The Contractor shall blade and shape subgrade to remove irregularities and secure a uniform surface.

Prior to starting subgrade work, including backfill, all underground work contemplated in the area of the subgrade shall be completed. This requirement includes work in the contract, and work to be performed by the Owner, or by others.

206.3.02 Untreated Subgrade: The Contractor shall excavate and shape subgrade to line, grade and cross section and compact to not less than 95 percent of maximum density as determined by AASHTO T99. Testing methods for density requirements shall be determined by AASHTO T 191, T 205, or T238.

The Contractor shall remove all soft or otherwise unsuitable material as directed and replace with approved material from the excavation. The Contractor shall compact to a line one foot beyond the edge of paving, curb or form.

Subgrade areas which cannot be compacted to specified density, but in the judgement of the Engineer otherwise meet the requirements herein, shall be scarified and aerated to provide an optimum moisture content all at no additional expense to the Owner. If required, the Engineer may authorize the removal and/or stabilizing of material as an extra work item.

206.3.03 Treated Subgrade

206.3.03A General: The Contractor shall blade, disc, harrow or otherwise scarify and thoroughly break up surfaces of areas to be treated or aerated to the full depth and width as shown. The Contractor shall dry and reduce the cemented soil clods to the moisture content and size specified. The Contractor shall shape and size the subgrade material blanket to the size that can pass through the mixing machine. The Contractor shall apply stabilizing materials only when the temperature is above freezing, or when wind or other weather conditions are not detrimental to the work or to the public. The Contractor shall take all precautions necessary to prevent injury to persons, livestock or property. Any material which is spilled or deposited at places other than on areas designated to be treated shall be immediately picked up, buried or made harmless at the expense of the Contractor.

206.3.03B Construction Requirements: The quantity of aggregate for subgrade modification, shown on the Plans, shall be hauled, windrowed, and the windrow brought to a uniform cross section. The windrowed material shall be mixed with the binder materials obtained from the top portion of the roadbed or from the shoulder, slopes, ditches, and back slopes. If the Plans require that the binder be obtained from the roadbed, the roadbed shall be scarified to the width and depth shown on the Plans. The material thus obtained should be pulverized and mixed until not more than five (5) percent of the material is retained on the 2-inch sieve and until the aggregate for the subgrade modification and the roadbed soil are thoroughly mixed together. If lime or calcium chloride is designated on the plans to be added to the mixture, it shall be added at the rate shown on the Plans. The lime or calcium chloride shall be thoroughly and uniformly mixed with the aggregate and roadbed materials.

After thoroughly mixing, the mixed material shall be brought to the specified moisture content. If required by the Engineer, the surface of the prepared subgrade shall be thoroughly sprinkled before spreading the material to insure an adequate bond between the subgrade and the modification materials.

If called for on the Plans, a second application of calcium chloride at the rate shown on the Plans, shall be applied uniformly over the surface. The surface shall then be sprinkled lightly, if necessary, as directed.

206.3.04 Compaction: Immediately after mixing of a treated subgrade, the Contractor shall spread the mixture to specified line, grade and cross section and compact the entire depth of the mixture to not less than 95 percent of maximum density as determined by AASHTO T 99. Testing methods for density requirements shall be determined by AASHTO T 191, T 205, and T 238.

The Contractor shall compact and finish the surface within 12 hours after compaction begins. If not compacted and finished after 12 hours, the Contractor shall loosen the mixture and add stabilizing material and water as directed, remix the freshened materials, relay and compact all at no additional expense to the Owner. During compaction, the Contractor shall maintain the surface of the mixture at proper grade and cross section and lightly water if necessary to retain optimum moisture content.

The Contractor shall accomplish final finishing by rolling accompanied by light watering and reshaping as required.

206.3.05 Tolerances: The Contractor shall rework areas found to be deficient in thickness by more than 0.04 foot, except that fresh stabilizing material shall be added in an amount equal to one half of the original amount, as above specified. The Contractor shall accomplish all reworking at no expense to the Owner.

206.3.05 Tolerances, Continued

The finished surface of treated and untreated subgrade shall not vary more than 0.04 foot from the established grade and cross section at any point. The finished surface, when tested with a 10-foot straightedge shall not vary from the testing edge by more than 0.04 foot at any point.

206.3.06 Curing Treated Subgrade: The Contractor shall limit traffic over treated subgrade to wheel loads which do not cause any damage to the subgrade and which do not visibly deflect, ravel or wear the surface. The Contractor shall keep the finished surface moist and protected from rutting, spalling, displacement and disfiguration for a period of 7 days or until a subsequent course of planned construction which will prevent drying of the mixture by evaporation or absorption is placed thereon.

206.3.07 Soil Sterilant: Unless otherwise noted, all subgrade for both rigid and flexible pavement shall be treated to eliminate growth of vegetation. Soil sterilant shall be commercially available agricultural grade sterilant, and shall be approved by the Engineer prior to its application on the subgrade. Application rates shall be in accordance with the manufacturer's recommendations. As verification of the application, the Contractor shall save the sterilant containers for the Engineer.

206.4.00 Measurement and Payment

206.4.01 Measurement

206.4.01A Incidental Work: No measurement will be made for work involved in clearing the subgrade of vegetation and other debris, draining water from the subgrade, smoothing the subgrade in preparation for staking, blading, shaping, and compacting the subgrade including roadbed materials to a depth of one foot below the subgrade, to final line, grade and cross section. All work involved in these processes will be considered incidental to the other items or work.

206.4.01B Work Paid in Other Sections: Additional materials required for completing the subgrade will be measured and paid for at the unit price for the type of material furnished as provided in Section 204.

Excavation of soft, spongy or yielding spots, when directed, will be measured and paid for as provided in Section 204.

Suitable backfill material, when furnished and placed as directed, will be measured and paid at the unit price for the type of material involved as provided in Section 204.

Water used in the work will be measured and paid for as provided in Section 205.

206.4.01C Untreated Subgrade: No measurement and payment will be made for preparation of untreated subgrade unless otherwise specified.

206.4.01D Soil Stabilizing Materials: Quantities for soil stabilizing materials will be measured by the ton, dry weight, or the nearest 0.01 ton, for the materials incorporated in the work at the rate and in the quantity specified or directed. Measurement and payment of stabilizing materials will not include any which are lost, displaced, used in reworking, used in restoration work or used contrary to direction. Packaged materials will be accepted at the net weight shown by the manufacturer, subject to periodic verification and approval. The Contractor shall provide a certificate with each shipment together with a certified copy of the weight of each delivery.

206.4.02 Payment

206.4.02A Soil Stabilizing Materials: Payment for soil stabilizing materials will be made on a ton basis for the type or types specified and used in the work.

206.4.02B Treated Subgrade: Payment for treated subgrade will be made on a square yard basis for the type or types specified and used in the work.

207 AGGREGATE BASES

207.1.00 Description

207.2.00 Material
207.2.01 Fracture of Gravel
207.2.02 Durability
207.2.03 Sand Equivalent
207.2.04 Liquid Limit and Plasticity
207.2.05 Grading Requirements
207.2.06 Acceptance

207.3.00 Crushing
207.3.01 Stockpile
207.3.02 Mixing
207.3.03 Placing
207.3.03A Weather Limitations
207.3.03B Equipment
207.3.03C Thickness of Lifts
207.3.04 Compaction
207.3.04A Equipment
207.3.04B Density Requirements
207.3.05 Surface Finish

207.4.00 Measurement and Payment
207.4.01 Measurement
207.4.01A Square Yard Basis
207.4.01B Cubic Yard In-Place Basis
207.4.01C Cubic Yard Vehicle Measure Basis
207.4.01D Cubic Yard in Stockpile
207.4.01E Ton Basis
207.4.02 Payment

207 AGGREGATE BASES

207.1.00 Description: This section covers the work necessary to furnish and place one or more courses of aggregates and water, as subbase or base, on a prepared surface.

207.2.00 Material: Aggregates for aggregate base shall be crushed gravel or crushed rock, including sand.

207.2.01 Fracture of Gravel: Base material produced from gravel shall have at least one mechanically fractured face based on the following percentage of particles retained on the ¼" sieve for the designated size:

Designated Size	*Minimum Percent Fractures Particles of Material, KDOT Test Method KT-31*
Retained on ¼" Sieve	
1 ½" – 0 and larger	50
Smaller than 1 ½" – 0	70

The fractured particles shall be reasonably well distributed in proportion to the component fractions of the base aggregate larger than the ¼" sieve as set forth in the table entitled "Grading Requirements" in Subsection 207.2.05.

207.2.02 Durability: The source material from which aggregate base materials are obtained, produced or manufactured, shall meet the following qualifying test requirements:

Test	*Test Method*	*Requirements*
Soundness of Aggregates	KDOT Standard Test, 1980 Edition	0.75
Abrasion or Wear	AASHTO T 96	35% Maximum

Note: The requirements for soundness and abrasion or wear do not apply to sand-gravel aggregates having less than 10% retained on the No. 8 sieve.

207.2.03 Sand Equivalent: Base aggregates to be incorporated in the work shall have a sand equivalent of not less than 30 when tested in conformance with AASHTO T 176.

207.2.04 Liquid Limit and Plasticity: Base aggregate shall meet the following requirements:

Quality	*Test Method*	*Requirements*
Liquid Limit	AASHTO T 89	NP or 25 Maximum
Plasticity Index	AASHTO T 90	NP or 6 Maximum

For Type AB-3 aggregates, the Liquid Limit shall not be more than 30.

207.2.05 Grading Requirements: Base aggregates shall be uniformly graded from course to fine and shall conform to one or another of the following grading requirements:

SEPARATE GRADATIONS				
	Type			
Sieve Size	AB-1	AB-2	AB-3[3]	AB-4[4]
	Percentages Retained (by weight)			
2”	0		0	
1 ½”	0-5		0-5	
1”		0		
¾”	0-30		5-30	0
3/8”		1-35		0-20
No. 4	30-60		35-60	20-40
No. 8	45-70	25-50	45-70	40-62
No. 40	60-84	60-75	60-84	70-84
No. 200	75-92[1]	78-90[1]	80-92[2]	80-92[1]

[1] The fraction passing the No. 200 sieve shall not be greater than 2/3 of the fraction passing the No. 40 sieve.

[2] The fraction passing the No. 200 sieve shall not be greater than ¾ of the fraction passing the No. 40 sieve.

[3] The combined material for this grading shall be 85% or more produced by the mechanical crushing of limestone or dolomite.

[4] The combined material for this grading shall be at least 85% material obtained from the milling of zinc and lead ore (predominately chat).

207.2.05 Grading Requirements, Continued

Where a tolerance range is set forth in the above grading requirements, it shall be understood that the midpoint of the tolerance range is the target value and the product shall conform as closely as realistically possible to this target value. The purpose of the tolerance range is only to permit occasional minor variations from the target values that are, for practical reasons, unavoidable.

The determination of sizes and grading shall be in conformance with AASHTO T 27.

207.2.06 Acceptance: Materials will be subject to acceptance as specified by one of the following methods:

A. In its final state on the roadbed after all processing and prior to the placement of subsequent surfacing materials.

B. In the stockpile after all shaping work has been completed.

C. Immediately after crushing.

207.3.00 Crushing

207.3.01 Stockpiling: Stockpiling shall consist of the furnishing of crushed rock, crushed gravel or other aggregate in stockpiles at the places and in the manner hereinafter specified. Wherever in this specification the terms material or materials are used, it shall be understood to refer to crushed rock, crushed gravel or other aggregates.

The materials to be furnished in stockpiles shall be of the kinds, sizes and quality as stated in the contract documents. Sampling and testing of materials for determination of compliance with specified requirements may be at the point of manufacture, at the stockpile, or both, as the Engineer may elect.

The materials shall be placed in stockpiles at locations approved by the Owner. The quantities of each designated size of material to be furnished in the stockpiles shall be as specified in the contract documents.

Each designated size of material shall be placed in a separate stockpile, with no intermingling of materials.

The method used in placing the material in the stockpile shall be such as to minimize segregation of the aggregate particles.

207.3.02 Mixing: Mixing shall provide a mixture of unsegregated materials. The Contractor shall add water during mixing in an amount sufficient to provide optimum moisture content plus or minus two percentage points.

The Contractor shall mix the subbase or base course material by any one of the following methods:

Stationary Plant Method – Materials mixed by means of a pug mill or other type of mixer, transported to the project at proper moisture content and placed by an aggregate spreader.

Travel Plant Method – Materials mixed and placed on the project in a continuous operation.

Road Mix Method – Materials mixed on the project by motor graders or other acceptable equipment.

207.3.03 Placing

207.3.03A Weather Limitations: When, in the judgement of the Engineer, the weather is such that satisfactory results cannot be secured, the Contractor shall suspend operations until the weather is favorable. No surfacing materials shall be placed in the snow or on a soft, muddy or frozen subgrade. The Owner shall not be liable for damages or claims of any kind or description by reason of operations suspended by the Engineer.

207.3.03B Equipment: Equipment necessary for construction of aggregate base will vary depending upon method of mixing chosen by the Contractor, however, equipment furnished shall provide for efficient and continuous operations insofar as is practicable.

Equipment used shall conform to the following requirements:

Hauling Equipment – Vehicles for hauling aggregate or mixture of aggregate and water shall be capable of depositing the material within the receiving hopper of spreading equipment or windrowing device or in windrows of reasonably uniform size in front of spreading equipment with minimum of mix segregation.

Spreading Equipment – Spreading equipment shall have an adjustable screed or strike-off assembly and it may have a receiving, mixing and distribution system. It may be a complete and integral unit, self-propelled and powered; a crawler-track or wheeled type tractor intimately combined with a receiving, mixing, spreading and screeding unit attached thereto; or a heavy-duty self-propelled grader, equipped with at least an 8-foot blade. Equipment used shall be capable of spreading and striking off material to the designated line, grade and transverse slope with surface texture of uniform appearance without excessive segregation or fracture of material.

207.3.03C Thickness of Lifts: If the required compacted depth of the subbase or base course exceeds 6 inches, it shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches. Each layer shall be placed in spreads as wide as practicable and to the full width of the course before a succeeding layer is placed.

207.3.04 Compaction

207.3.04A Equipment: Equipment used to compact aggregate bases shall be self-propelled steel wheel or pneumatic tire rollers. Rollers shall be capable of compacting materials to a firm, even surface. Steel wheel rollers shall be capable of providing a weight of not less than 200 pounds per inch width of the compression roll. Pneumatic tire rollers shall be capable of exerting a ground pressure of not less than 80 pounds per square inch of tire contact area. Vibratory rollers shall provide compaction of demonstrated equivalency to that of prescribed steel wheel or pneumatic tire rollers.

207.3.04B Density Requirements: At the time the compacting begins, the materials shall be at the moisture content specified or directed within a tolerance of plus or minus two percent. The Contractor shall begin compaction of each layer as soon as practicable after the material is spread and continue until a density of not less than 95 percent of the maximum density has been achieved. Maximum density will be determined by AASHTO T 99. In-place density will be determined by AASHTO T 191, T 205, T 238 or in accordance with such other methods as may be specified.

The Contractor shall maintain the surface of each layer during compaction operations in such a manner that a uniform texture is produced and the aggregates are firmly keyed. When needed for proper compaction, the Contractor shall apply water to the materials.

207.3.05 Surface Finish: The aggregate base surface shall parallel the cross section and grade of the finished surface within 0.05 foot, and when tested with a 10 foot straightedge, shall not vary from the testing edge by more than 0.04 foot at any point.

207.4.00 Measurement and Payment

207.4.01 Measurement

207.4.01A Square Yard Basis: Measurement of aggregate base will be made on a square yard basis. Measurement will be made of width and length of each separately constructed strip of aggregate base incorporated in the work and accepted, wherein the width is the design width or edge-to-edge width of aggregate base, whichever is the lesser, and the length is from end to end along the center of the strip. Measurement shall be on the surface of the aggregate base to the nearest 0.1 foot and the square yardage shall be to the nearest full square yard.

207.4.01B Cubic Yard in Place Basis: Measurement of aggregate base will be made on a cubic yard in-place basis. Depth tests or cores will be taken, as directed, at the rate of one depth test for each 300 square yards of base course, or by means of average end areas on the completed work computed from elevations to the nearest 0.01 foot. On individual depth measurements, thicknesses more than ½ inch in excess of that shown shall be considered as specified thickness, plus ½ inch in computing the yardage for payment.

207.4.01C Cubic Yard Vehicle Measure Basis: Measurement of aggregate base will be made on a cubic yard basis. Measurement of the materials will be made in the hauling vehicle at the points of deposit, with no allowance for settlement of material during transit. Loads shall be made level or uniform in shape as necessary to assure accurate measurement thereof. To facilitate measurement in this manner, the Contractor, by striking off or other suitable means, shall bring the top of each load to a level surface with all corners filled.

207.4.01D Cubic Yard in Stockpile: Measurement of aggregates will be made on a cubic yard in-place basis. Measurement will be by cross section measurement of the completed stockpile computed to the nearest 0.1 curb yard. No allowance will be made for settlement or shrinkage.

207.4.01E Ton Basis: Measurement of aggregates will be made on a ton basis for the number of tons aggregate as weighed on approved and tested scales. Weight scales are to be furnished by the Contractor. The determination of the weights and the weight of the loaded vehicles will be to the nearest 10 pounds. Tare weights will be determined by weighing empty vehicles at intervals of such frequency as the Engineer deems necessary to insure the accuracy of pay load weights.

207.4.02 Payment: Payment will be made on a square yard, cubic yard, or ton basis as specified.

208 ASPHALT TREATED BASES

STANDARDS NOT COMPLETE AT THIS TIME

209 CEMENT TREATED BASES

STANDARDS NOT COMPLETE AT THIS TIME

210 ASPHALT SURFACE TREATMENTS

210.1.00	Description
210.1.01	Cutback Asphalt
210.1.02	Emulsified Asphalt
210.1.03	Mineral Filler
210.1.04	Asphalt Aggregate
210.1.04A	Fine Aggregate
210.1.04B	Coarse Aggregate
210.1.05	Asphalt Macadam
210.1.06	Prime Coat
210.1.07	Tack Coat
210.1.08	Seal Coats
210.1.08A	Aggregate Seal
210.1.08B	Emulsion Slurry Seal
210.2.00	Materials
210.2.01	Asphalt Concrete
210.2.02	Asphalt Macadam
210.2.02A	Asphalt
210.2.02B	Aggregate
210.2.03	Prime Coat
210.2.03A	Asphalt
210.2.03B	Aggregate
210.2.04	Tack Coat Asphalt
210.2.05	Aggregate Seal
210.2.05A	Asphalt
210.2.05B	Aggregate
210.2.06	Emulsion Slurry Seal
210.2.06A	Asphalt
210.2.06B	Aggregate
210.3.00	Construction
210.3.01	Asphalt Concrete
210.3.02	Asphalt Macadam
210.3.02A	Weather and Seasonal Limitation
210.3.02B	Equipment
210.3.02C	Sequence of Operations
210.3.02D	Shaping and Compacting
210.3.02E	Application of Asphalt
210.3.02F	Hauling and Spreading Aggregates
210.3.02G	Surface Tolerance
210.3.02H	Provision for Traffic
210.3.02I	Establishment
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210.3.03A Application Rates
210.3.03B Establishment
210.3.04 Tack Coat
210.3.04A Application
210.3.05 Seal Coats
210.3.06 Emulsion Slurry Seal

210.4.00 Measurement and Payment
210.4.01 Asphalt Concrete
210.4.02 Asphalt Macadam
210.4.02A Aggregate
210.4.02B Asphalt
210.4.03 Prime Coat
210.4.04 Tack Coat
210.4.05 Seal Coat
210.4.06 Payment

210 ASPHALT SURFACE TREATMENTS

210.1.00 Description: This section covers the work necessary for the application of asphalt materials to a prepared roadway surface with or without aggregate cover materials to obtain a surface thoroughly bonded to the roadway and constructed to the cross section shown.

210.1.01 Cutback Asphalt: Cutback asphalt is an asphalt which has been rendered liquid by mixing it with naphtha or kerosene.

210.1.02 Emulsified Asphalt: Emulsified asphalt is a mixture of asphalt and water in which the asphalt is finely dispersed and is held in suspension by an emulsifying agent.

210.1.03 Mineral Filler: Mineral filler consists of a finely divided mineral product at least 65% of which will pass a No. 200 sieve. It normally consists of pulverized limestone, stone dust, hydrated lime or Portland cement.

210.1.04 Asphalt Aggregate: Asphalt aggregate may be either crushed quarry stone, crushed gravel, screenings, chat and sand-gravel.

210.1.04A Fine Aggregate: Fine aggregate consists of crushed aggregate that passes a No. 8 sieve.

210.1.04B Coarse Aggregate: Coarse aggregate consists of crushed aggregate that is retained on a No. 8 sieve.

210.1.05 Asphalt Macadam: Asphalt macadam consists of multiple applications of asphalt and graded aggregate in successive spreads to bind the aggregates together into a firm surfacing.

210.1.06 Prime Coat: A prime coat is a single application of cutback or emulsified asphalt to a prepared aggregate base. It may also include the placing of cover aggregate.

210.1.07 Tack Coat: A tack coat is a single light application of emulsified asphalt to an existing pavement prior to placing an overlying course of asphalt paving.

210.1.08 Seal Coats: A seal coat is one or more applications of emulsified asphalt to an existing pavement with or without aggregate cover.

210.1.08A Aggregate Seal: An aggregate seal consists of one or more applications of emulsified asphalt followed by an aggregate cover as specified in the Special Provisions or on the Plans.

210.1.08B Emulsion Slurry Seal: An emulsion slurry seal is a mixture of emulsified asphalt, fine aggregate and mineral filler applied to an existing pavement surface.

210.2.00 Materials

210.2.01 Asphalt Concrete: Asphalt concrete shall conform to the requirements of Section 211.

210.2.02 Asphalt Macadam

210.2.02A Asphalt: Asphalt shall conform to the applicable requirements of Section 211.

Asphalt shall be asphalt cement, emulsified asphalt or cutback asphalt as specified, and shall be one or a combination of the following:

Asphalt Cement	Emulsified Asphalt	Cutback Asphalt
AC-5	CRS-1H	RC-70
AC-7	RS-1H	RC-250
		RC-800
		MC-70

210.2.02B Aggregate: Penetration macadam aggregate may be sand-gravel, crushed stone, crushed sandstone, chat, or crushed limestone.

The material from which the aggregates are produced or manufactured shall meet the following qualifying test requirements:

Test	Test Method	Requirements
Soundness of Aggregates	KDOT Standard Test, 1980 Edition	0.75
Abrasion or Wear	AASHTO T 86	35% maximum

Unless the aggregate furnished by the Contractor for use in the work has a record of satisfactory performance, it may be subjected to the Stripping Test for Bituminous Aggregate Mixtures, AASHTO T182, using a sample of the asphalt to be used in the major portion of the work, and when so tested, the retention of the asphalt shall be observation be above 95 percent. Aggregate so tested and failing to conform to this requirement will not be permitted to be used in the work unless the Contractor provides approved anti-stripping additives or employs other approved measures which correct the deficiency.

If the use of anti-stripping additives is determined by the Engineer as necessary, separate payment for the additives will be made as extra work.

210.2.02B Aggregate, Continued

The determination of sizes and gradings will be in conformance to AASHTO T27. The gradings of the several designated sizes that may be required in the work shall conform to the following table:

GRADING REQUIREMENTS ASPHALT MACADAM AGGREGATES			
	Designated Sizes		
Sieve Size	¾” – ½”	½” – ¼”	¼” - #10
	Percentages (by weight) Retained		
1”	0		
¾”	0-10	0	
½”	85-100	0-15	0
¼”	97-100	85-100	0-15
#10		96-100	85-100
#40			96-100

Where a tolerance range is set forth in the above grading requirements, it shall be understood that the midpoint of the tolerance range is the target value and the product shall conform as closely as realistically possible to this target value. The purpose of the tolerance range is only to permit occasional and for practical reasons, unavoidable, minor variations from the target value.

At the time of spreading, the aggregate shall be surface dry and shall have no adherent films or coatings of dirt, clay, dust or other deleterious matter that could impede adherence of bituminous cement.

210.2.03 Prime Coat

210.2.03A Asphalt: Prime coat asphalt shall be emulsified asphalt and shall be either RS-1 anionic grade or CRS-1 cationic grade as specified, and shall conform to the applicable requirements of Section 211.

210.2.03B Aggregate: Prime coat aggregate shall be a clean fine sand, chat, sand or other material as approved.

210.2.04 Tack Coat Asphalt: Tack coat asphalt shall be one or another of the following asphalts as designated by the Engineer: SS-1H, CSS-1H, or RC 800. Tack coat asphalt shall conform to the application requirements of Section 211.

210.2.05 Aggregate Seal

210.2.05A Asphalt: Aggregate seal asphalt shall be emulsified or cutback asphalt conforming to the requirements of Section 211, and shall be one or other of the following as specified:

Cutback Asphalt	Emulsified Asphalt
	RS-1H
RC-800	CRS-1H

210.2.05B Aggregate: Aggregate seal aggregate shall conform to the requirements of this section:

Percentage Retained – Square mesh sieves (after removal of all deleterious substances)							
Type	Composition	¾”	½”	3/8”	4	8	50
CM-A	Sand-gravel	0	0-5	0-20	30-100	85-100	--
CM-E	Chat	--	--	0-15	45-100	90-100	--
CMK	Crushed limestone	0	0-5	20-35	45-85	95-100	--

Quality Requirements shall be as follows when tested by standard KDOT tests:

1 Soundness 0.90

2 Abrasion or Wear 40%

3 Deleterious substances shall not exceed the following percentages by weight:

Materials Passing 200 sieve	2.0%
Shale or Shalelike material	1.5%
Soft or friable particles	3.0%
Coal	0.5%
Clay lumps	0.5%
Sticks (wet)	0.1%

Note: Any combination of deleterious substances shall not exceed the following:

All types 0.5%

210.2.06 Emulsion Slurry Seal

210.2.06A Asphalt: Emulsion slurry seal asphalt shall be emulsified asphalt conforming to the requirements of Section 211, and shall be SS-1H, or CSS-1H as specified.

210.2.06B Aggregate: Emulsion slurry seal aggregate shall be chat which is a by-product of the milling of lead and zinc ores or clean sharp sand combined to meet the following gradation requirements:

U.S. Standard Sieve Size	Total Percent Retained
Type I	
3/8" Sieve	0%
No. 4 Sieve	0-2%
No. 8 Sieve	10-25%
No. 16 Sieve	25-50%
No. 30 Sieve	50-70%
No. 50 Sieve	65-82%
No. 200 Sieve	85-95%
Type II	
½"	0%
3/8" Sieve	0-1%
No. 4 Sieve	6-14%
No. 8 Sieve	35-55%
No. 16 Sieve	54-75%
No. 30 Sieve	65-85%
No. 50 Sieve	75-90%
No. 200 Sieve	85-95%

The aggregate shall have a sand equivalent value of forty (40) or more when tested in accordance with AASHTO T176. Durability shall conform to the requirements of subsection 210.2.02B.

210.3.00 Construction

210.3.01 Asphalt Concrete: Asphalt concrete construction shall conform to the requirements of Subsection 211.3.00.

210.3.02 Asphalt Macadam

210.3.02A Weather and Seasonal Limitations: Asphalt macadam shall not be placed on any wet surface, or when the air temperature is below 60 degrees F, or when the Engineer determines that weather conditions are detrimental to proper construction.

Normally, the work shall be done between May 1 and October 15. After September 15 and upon written order of the Engineer, the asphalt material may be changed from an emulsion to a cutback asphalt.

210.3.02B Equipment: The equipment to be used shall include power broom, self-propelled mechanical aggregate spreader, asphalt pressure distributor, roller, heating equipment, hauling vehicles, hand spreading, spotting and patching equipment, power graders and tools; all as necessary for efficient operations and construction to meet specified results. Power brooms, self-propelled aggregate spreaders, asphalt distributor and hauling vehicles shall be pneumatic tired. Equipment shall be provided in such number and capacities as will provide coordinated and uniform progress.

Mechanical spreaders for spreading aggregate of less than one inch in maximum size shall be of a design which will place the larger fraction ahead of the finer fraction of the aggregate.

Asphalt distributor shall be so designed, equipped, maintained and operated that asphalt at even heat may be applied uniformly on variable widths of surface up to 15 feet at readily determinable and controlled rates from 0.05 to 2.0 gallons per square yard, with uniform pressure, and with an allowable variation from any specified rate not to exceed 0.02 gallon per square yard. Distributor equipment shall include a tachometer, pressure gauges, accurate volume measuring devices or a calibrated tank, and a thermometer for measuring temperature of the tank contents. Distributors shall have a power unit for the pump and full circulation spray bards adjustable laterally and vertically.

Rollers shall be self-propelled steel wheel or pneumatic tire type. They shall be capable of compacting the materials to a firm, even surface. Steel wheel rollers shall be capable of providing a weight of not less than 200 pound per inch width of the compression roll or rolls. Pneumatic tire rollers shall be capable of exerting a ground pressure of no less than 80 pounds per square inch of tire contact area. Vibratory rollers shall provide compaction of demonstrated equivalency to that of prescribed steel wheel or pneumatic tire rollers.

210.3.02C Sequence of Operations: The order of the several spreads of aggregates and asphalt shall be as specified. Spreads of aggregate shall be placed while the immediately preceding spread of bituminous material is at or near its application temperature. Each spread of designated size aggregate shall be shaped and compacted and shall be at established line and grade use prior to being covered. The seal coat spread of bituminous material and aggregate shall not be applied until the underlying spreads have been in place for at least three days and have become stabilized.

210.3.02D Shaping and Compacting: Each spread of each designated size of aggregate shall be shaped to prescribed line, grade and cross section and shall then be dry rolled until the material is interlocked, firm, partially bound with underlying asphalt, and until the aggregate does not creep or wave ahead of the roller.

Rolling shall normally commence at the low side of the prescribed cross section and progress with passes parallel to the roadway center line and each pass shall overlap the preceding pass by at least one half of the width of the roller.

Along curbs, walls and at all places not accessible to or not compacted by specified rollers, the aggregate shall be tamped thoroughly with mechanical tampers or with hand tampers.

Irregularities in surface smoothness, non-uniformity of texture, segregation of materials, dirt pockets, spots of excess asphalt and other deficiencies and defects shall be corrected by removal, replacement, addition or material, repetition of construction operations or other suitable means, as directed or approved by the Engineer.

210.3.02E Application of Asphalt: Each spread of asphalt shall be uniformly applied at the rate specified. Building paper shall be placed over the end areas of previously place spreads and the adjoining application shall start on the paper, after which the paper shall be removed and disposed of.

Rates of application shall not vary from prescribed rates by more than 10 percent. Misses and thinnesses shall be corrected by approved means. The Contractor shall protect structures and vegetation from being spattered, stained or marred, and shall remove stains and remedy disfigurements.

Hand application or other approved means shall be used on areas inaccessible to the distributor.

210.3.02F Hauling and Spreading Aggregates: Hauling and spreading equipment shall not be operated on uncovered asphalt. Hand spreading shall be done to correct deficiencies or on areas inaccessible to mechanical equipment. Hauling over aggregate-covered asphalt shall be held to a practicable minimum until the surface has become firm. All hauling on asphalt macadam shall be at moderate speeds which do not create loss of or hazardous movement of materials. Hauling shall be routed as uniformly as is practicable over the full width of material in place.

210.3.02G Surface Tolerance: The surface of the course, when finished and established, will be tested by the Engineer for trueness to specified grade and transverse slope at selected locations. Testing will be with a 10-foot straightedge. The variation of the surface from the testing edge of the straightedge between any two contact points with the surface shall at no point exceed 0.03 foot.

210.3.02H Provision for Traffic: In addition to other required provisions for traffic, the following shall apply: Traffic shall be permitted to travel over any spread of aggregate after it has been shaped and compacted. During application of asphalt and until it is covered with aggregate, traffic shall be controlled by flagmen or pilot cars.

210.3.02I Establishment: During the period preceding construction of the seal coat, during periods when partial construction is open to traffic and for one calendar week following the original completion of the course throughout the length of the project, which periods will be collectively referred to herein as "the curing period," the Contractor shall perform the following operations:

A. The course shall be bladed or broomed to correct bleeding of asphalt, to provide coverage with aggregates, to keep the surface free of ravel, traffic grooves, holes and other deformations and to eliminate other defects that may appear.

B. Rolling and compacting of materials shall be performed to maintain or restore firmness and stability to the materials.

C. Abutting shoulders shall be trimmed and materials which come into side ditches shall be removed and wasted in a manner satisfactory to the Engineer.

The above operations shall be performed under traffic and at frequencies which the Engineer determines as being necessary to develop and establish the course to uniform firmness and stability throughout.

210.3.03 Prime Coat: Except as herein otherwise set firth, the prime coat shall be constructed in conformance to the requirements of Subsections 210.3.02A through 210.3.02H.

210.3.03A Application Rates: The prime coat shall be constructed with single spread of asphalt following immediately with a single spread of aggregate cover material.

Asphalt shall be spread at a uniform rate normally within a range of 0.25 to 0.40 gallon of residual asphalt per square yard of surface.

Cover aggregate shall be spread at a uniform rate normally within a range of 0.006 to 0.009 cubic yards, inclusive, per square yard of surface. The cover aggregate may be spread by spreader boxes, provided no part of the spreading equipment contacts the liquid asphalt prior to placement of cover aggregate.

The actual rates of spread, both asphalt and aggregate, shall be as directed by the Engineer.

210.3.03B Establishment: Following construction of the prime coat, it shall be allowed to cure and harden for a period of up to three days, as directed by the Engineer, before a succeeding course is placed upon it. If so directed by the Engineer, traffic shall be permitted to travel over the prime coat at any time after its construction. During the curing period, when in use by traffic, and until it is covered by a succeeding course, the prime coat shall be maintained by the Contractor to the specified shape and condition, as directed by the Engineer.

210.3.04 Tack Coat: Tack coat shall be applied in accordance with the requirements of Subsection 210.3.02E. The surface upon which the tack coat is applied shall be dry and shall be made free of dirt, dust or other matter foreign to the surface or detrimental to the adherence of asphalt thereto.

210.3.04A Application: The asphalt shall be spread by means of pressure-spray equipment which will provide uniformity of application at prescribed rates. Normally, asphalt shall be applied to the prepared surface at a rate within a range of 0.02 to 0.06 gallon of residual asphalt per square yard of surface, the actual rate to be as directed by the Engineer. The tack coat shall not be applied during wet or cold weather or during darkness and shall be constructed only so far in advance as is appropriate to insure a tacky, sticky condition of the asphalt at the time of placing a course thereon. The tack coat shall be applied in such a manner to offer the least interference to traffic and to permit one-way traffic without pickup or tracking of the asphalt.

210.3.05 Seal Coats: Except as herein otherwise set forth, seal coats shall be constructed in conformance to the requirements of Subsections 210.3.02A through 210.3.02H. The application rates of asphalt and aggregate shall be within the tolerance ranges specified in the following table. The exact rates shall be as directed.

Rates of Application Per Square Yard				
Type	Composition	Emulsion Type	CY of Aggregate	Residual Asphalt, Gallons
CM-A	Sand-gravel	CRS-1H	0.0090	0.24
CM-E	Chat	CRS-1H	0.0085	0.30
CM-K	Crushed Limestone	CRS-1H	0.0090	0.24

210.3.05A Emulsion Slurry Seal: Asphalt emulsion slurry treatment shall be placed only when the temperature is 60 degrees F or above. The mixture shall not be placed if the weather is foggy or rainy.

Materials shall be combined in the following proportions to provide a mixture of the desired consistency:

1. Aggregate – 100 pounds.
2. Asphalt emulsion (as directed by the Engineer) – 2.5 – 3.0 gallons.
3. Water – as required for proper consistency.

Immediately prior to the application of the slurry seal, the surface of the pavement and all crack faces shall be wetted thoroughly with water. All surfaces shall be in a uniformly damp condition and no free water will be allowed on the surface or in the cracks when the slurry seal is applied.

The slurry mixture shall be prepared in a slurry machine. The mixture shall be charged with materials in the proportions specified and the following order.

1. Water
2. Aggregate
3. Asphalt Emulsion

When mineral filler is required to obtain the desired gradation, it shall be added slowly to the other aggregate prior to the addition of the asphalt emulsion.

Variations from the above sequence of charging may be permitted by the Engineer provided a slurry of creamy, uniform consistency is obtained.

The mixing cycle shall be sufficient to produce a uniform coating of the aggregate. It shall continue until the slurry mixture is discharged into the spreader box. The entire batch shall be discarded if there is evidence that the emulsion has broken.

The slurry mixture shall be chuted into the moving spreader box at a sufficient rate to maintain an ample supply of the mixture across the full width of the strike-off squeegee at all times. The strike-off squeegee shall be adjusted to provide a slurry thickness of the depth specified by the Engineer, but not to exceed ¼ inch for a single course.

Weighted burlap, or carpeting (face down) trailing behind the spreader box, may be required by the Engineer if necessary to smooth joints between lanes. The burlap or carpeting shall be hosed off thoroughly or immersed in water after each use to maintain its flexibility.

210.3.05A Emulsion Slurry Seal, Continued

In restricted areas where hand spreading is necessary, the slurry mixture shall be poured into a small windrow along one edge of the surface to be covered. The mixture then shall be spread uniformly by a hand squeegee.

All traffic shall be kept off the slurry seal until it has cured to a firm condition that will prevent pick-up of the mixture. Where two applications of the slurry seal mixture are required, the initial treatment shall be cured thoroughly prior to placing the succeeding application.

When extensive scaled areas are filled with emulsion slurry, each application shall be rolled with a pneumatic-tired roller after the slurry has cured.

On old, dry bituminous pavements and on rigid pavements, a tack coat shall be applied prior to placing the slurry seal. The tack coat shall be a diluted asphalt emulsion of the same type and grade specified for the slurry mix. The ratio of asphalt emulsion to water shall be 1:3 and the diluted material shall be applied uniformly with a pressure distributor at the rate of 0.05 to 0.10 gallon per square yard, as directed by the Engineer.

The tack coat shall be cured thoroughly prior to the application of the slurry seal.

210.4.00 Measurement and Payment

210.4.01 Asphalt Concrete: Measurement and payment for asphalt concrete shall conform to the requirements of Section 211.

210.4.02 Asphalt Macadam

210.4.02A Aggregate: Measurement of aggregate will be made on a cubic yard basis. Measurement of the materials will be made in the hauling vehicle at the points of deposit, with no allowance for settlement of material during transit. Loads shall be made level or uniform in shape as necessary to assure accurate measurement thereof. To facilitate measurement in this manner, the Contractor, by striking off or other suitable means, shall bring the top of each load to a level surface with all corners filled.

210.4.02B Asphalt: Measurement of asphalt will be made on a ton basis. Quantities will be determined from volume computations of the materials when at a temperature of 60 degrees F, with standard recognized correction factors applied when the materials are measured at any temperature other than 60 degrees F. When asphalt materials are shipped by truck or transport, net certified weights or volume, subject to correction for loss or foaming, may be used for computing quantities.

210.4.02B Asphalt, Continued

Water added to emulsion will not be paid for as emulsified asphalt. The pay quantity shall be the amount of undiluted emulsion used.

210.4.03 Prime Coat: Measurement and payment of prime coat shall be in accordance with the requirements of Subsection 210.1.02.

210.4.04 Tack Coat: Measurement and payment for tack coat shall be in accordance with the requirements of Subsection 210.4.02B.

210.4.05 Seal Coat: Measurement and payment for seal coat shall be in accordance with the requirements of Subsection 210.4.02.

210.4.06 Payment: Payment will be made for the following items when listed as pay items:

1.	Asphalt Macadam	
	Aggregate (size)	C.Y.
	Asphalt (type)	Ton
2.	Prime Coat	
	Aggregate (size)	C.Y.
	Asphalt (type)	Ton
3.	Tack Coat	
	Asphalt (type)	Ton
4.	Seal Coat	
	Aggregate (size)	C.Y.
	Asphalt (type)	Ton

211 ASPHALT CONCRETE PAVEMENT

211.1.00 Description
211.1.02 Asphalt Concrete
211.1.02 Tack Coat

211.2.00 Materials
211.2.01 General
211.2.02 Asphalt
211.2.03 Aggregate
211.2.04 Mineral Filler
211.2.05 Additives
211.2.06 Classes of Concrete and Proportions of Mixtures
211.2.07 Prime Coat Asphalt
211.2.08 Prime Coat Aggregate
211.2.09 Tack Coat Asphalt

211.3.00 Construction
211.3.01 Preparation of Foundation
211.3.02 Reconditioning Old Roadbed
211.3.02A Subgrade
211.3.02B Aggregate Bases
211.3.02C Pavement Surfaces
211.3.03 Prime Coat
211.3.04 Tack Coat
211.3.05 Asphalt Concrete
211.3.05A Placing
211.3.05B Compaction

211.4.00 Measurement and Payment
211.4.01 Payment

211 ASPHALT CONCRETE PAVEMENT

211.1.00 Description: This section covers the work necessary for the construction of hot mix asphalt concrete pavements upon prepared foundations or base surfaces.

211.1.01 Asphalt Concrete: Asphalt concrete is defined as a mixture of asphalt cement; aggregate; mineral filler and additives as required; heated and plant mixed into a uniformly coated mass.

211.1.02 Tack Coat: Tack coat shall be as described in Subsection 210.1.07.

211.2.00 Materials

211.2.01 General: Asphalt and aggregate will be subject to approval preceding mixing. Asphalt concrete will be subject to approval after blending and mixing, either at the plant or at the place of delivery prior to rolling. Final approval will be based on the specified product being placed and compacted as specified.

211.2.02 Asphalt: Asphalt shall be AC-3, AC-5, AC-7 asphalt cement as specified by the Engineer and shall conform to the specifications for asphalt materials as published by the Kansas Department of Transportation.

211.2.03 Aggregate: Aggregate shall conform to the requirements of the following specifications:

Sieve Analysis	AASHTO T27 or KDOT Test KT-2
Sand Equivalent	AASHTO T176
Abrasion	AASHTO T96
Soundness	AASHTO T104 or KDOT Standard Test
Unit Weight	AASHTO T19 or KDOT Test KT-5
Specific Gravity	
Coarse Aggregate	AASHTO T85 or KDOT Test KT-6
Fine Aggregate	AASHTO T84 or KDOT Test KT-6

211.2.03 Aggregate, Continued

The sieve analysis of aggregate shall be as follows for each designated size (by weight):

		Percent Retained – Square Mesh Sieves						
Designation	Material	1”	½”	3/8”	4	8	200	** Max P.I.
Individual Aggregates								
CS-1	Crushed Stone	0*					96-100	
CS-2	Crushed Stone Screenings		0	0-5			60-100	6
CG-1	Crushed Gravel	0*			80-100		96-100	
CG-2 (B)	Crushed Gravel		0			50-100	96-100	
CG-3	Crushed Gravel	0*					96-100	
CH-1	Chat	Gradation shall blend with other aggregate in the mix.						
SSG	Sand and Sand-gravel	0*					80-100	6 (A)

		Percent Retained – Square Mesh Sieves					
Designation	Material	3/8”	4	8	30	200	** Max P.I.
Mineral Filler Supplements							
MFS-1	Portland Cement or Crushed Stone	0		0-5	0-8	0-40	6
MFS-2	Crushed Limestone			0-10		60-80	6
MFS-3	Silt	0	0-5			0-40	6
MFS-4	Hydrated Lime	Shall meet specification requirements.					
MFS-5	Volcanic Ash	0		0-5	0-8	0-40	6
MFS-6	Fly Ash	Shall meet specification requirements.					
MFS-7	Processed Chat Sludge	0		0-5	0-8	0-40	6

*For producing Mix Designations BM-2 (Base Course), BM-2B and BM-4 only. See maximum sizes of aggregates permitted for other Mix Designations.

**Plastic Index tests need not be conducted on individual aggregates that contain 4.0 percent or less material passing the No. 200 sieve.

(A) This P.I. limit does not apply to sand and sand-gravel used to produce Mix Designations BM-4 or BM-6.

(B) CG-2 is restricted to use in Mix Designation BM-1 only.

211.2.03 Aggregates, Continued

Where a tolerance range is set forth, it shall be understood that the midpoint of the tolerance range is the target value and the product shall conform as closely as realistically possible to this target value. The purpose of the tolerance range is only to permit occasional minor variations from the value that are, for practical reasons, unavoidable.

The respective sizes and gradings of the aggregate shall be such that when mixed, the respective resultant mixtures will be of the sizes and gradings specified in Subsection 211.2.06.

211.2.04 Mineral Filler: Mineral filler shall conform to the requirements of AASHTO M17.

Collector dust may be used as mineral filler, in whole or in part, provided the dust or the resultant mineral filler mixture conforms to the above requirements.

211.2.05 Additives: Additives and admixtures may be used to prevent stripping or separation of bituminous coatings for aggregates, and to aid in the mixing or use of bituminous mixes or for experimental purposes. Admixtures and additives shall be standard recognized products of known value for the intended purpose and shall be approved by the Engineer on the basis of laboratory tests prior to their use in the work. They shall have no deleterious effect on the bituminous material and shall be completely miscible.

211.2.06 Classes of Concrete and Proportions of Mixtures: The class of asphalt concrete to be used shall be as shown and shall conform to the following requirements:

MIX DESIGNATION												
Percent Retained – Square Mesh Sieves												
Master Gradation Limits	1 ½”	1”	¾”	½”	3/8”	4	8	16	30	50	100	(4) 200
BM-1				0	0-8	18-39	35-53	50-68	60-80	70-88	80-92	90-96
BM-2			0		10-40		42-72		64-88			90-96
BM-2B		0	0-5		10-40		42-72		64-88			90-96
BM-3			0				30-65		63-86			89-96
BM-4 (2)		0	0-12		2-35		30-66		60-82			84-93
BM-6 (2)	0	0-15			1-35		20-65		51-80			85-93
Job Mix Tolerances, (Plus or Minus):												
BM-1						6	6	6	5	5	4	2
BM-2 2B (3)					7	7	5	5	4	4	4	2
BM-3					7	7	5	5	4	4	4	2
BM-4 (1)					7	7	6	6	6	6	5	3

Notes:
(1) Tolerances do not apply to road mix.
(2) Material retained on Dry 200 sieve shall be 84-95 and shall apply to road mix only.
(3) BM-2 used in base construction may be either gradation as shown for BM-2 or BM-2B.
(4) Maximum P.I. shall be 6 for all gradations.

211.2.06 Classes of Concrete and Proportions of Mixtures, Continued

No less than two weeks before the beginning of plant mix operations, the Contractor shall submit the following to the Engineer:

1. Source, approximate gradation, gradation limits, and percentage of each individual aggregate and mineral filler supplement that is to be used in producing the final mix.

2. A proposed design job-mix grading that is within the master grading limits and which establishes a single percentage of material to be retained on each sieve. The grading shall be such that when the job-mix tolerances are applied, the resulting band will be wholly within the Master Grading Limits.

   Changes in the individual limits or proportions may be made only with the approval of the Engineer.

3. The Engineer shall have the right to require the Contractor to provide a sufficient quantity of each asphalt, aggregate and mineral filler supplement that he proposes to use to a certified testing laboratory so that tests can be conducted on individual and combined materials to determine whether the Contractor's design job-mix grading will meet the project requirements.

   No asphaltic materials shall be delivered to the project until the necessary tests are completed and the Contractor's design job-mix gradation has been tentatively approved by the Engineer. If test results show that the mix meets project requirements at an asphalt content that will provide an adequately coated mixture, the Contractor's design job-mix grading will be tentatively approved and an asphalt percentage will be established by the Engineer. The Contractor may then begin delivery of the bituminous mixture to the project. The cost of the necessary tests shall be at the expense of the City, however, should it be necessary to run more than one evaluation on materials or on portions of materials, such duplicate evaluations shall be at the expense of the Contractor.

   Revisions to the job-mix formula may require new laboratory evaluations prior to approval. Such evaluations shall be at the expense of the Contractor.

211.2.07 Prime Coat Asphalt: Prime coat asphalt shall be emulsified asphalt and shall be either RS-1 anionic grade or CRS-1 cationic grade as specified.

211.2.08 Prime Coat Aggregate: Prime coat aggregate shall be a clean fine sand, chat sand or other material as approved.

211.2.09 Tack Coat Asphalt: Tack coat asphalt shall be one or another of the following emulsified asphalt or cutback asphalts as designated by the Engineer: SS-1H, CSS-1H or RC-800.

211.3.00 Construction

211.3.01 Preparation of Foundation: All bases and foundations shall be constructed to the condition prescribed under the applicable specification.

If so directed by the Engineer or the specifications, depressed areas of existing pavements or bituminous surfaces shall receive a tack coat in conformance with the applicable requirements of Section 210, then filled with asphalt concrete and compacted to the prescribed density.

Broken or ragged edges of existing Portland cement concrete or bituminous surfaces underlying or abutting the new pavement shall be trimmed back to firm material. Contact surfaces of structures, including curbs, in the paving area shall be treated with an asphalt tack coat prior to placing the asphalt concrete.

Underlying surfaces of Portland cement concrete and designated areas of asphalt-deficient, fine-cracked or spalled bituminous material shall be treated with an asphalt tack coat prior to placing the asphalt concrete.

211.3.02 Reconditioning Old Roadbed: This work shall consist of the reconditioning of previously constructed roadbed subgrades, aggregate bases, and pavement surfaces upon which material is to be placed, as stated in the contract.

Where unstable or unsuitable materials are encountered, they shall be removed and disposed of as directed by the Engineer and replaced with material as specified by the Engineer. The replacement materials shall be placed, compacted and finished in accordance with the requirements of the appropriate section of these specifications.

Removing, disposing of, and replacing unstable or unsuitable materials shall be extra work and payment will be in accordance with the requirements of Subsection 104.9.01.

211.3.02A Subgrade: Existing roadbed subgrades shall be bladed, leveled, loosened, reshaped and otherwise brought in reasonably close conformity to the line, grade, slope and cross section established by the Engineer. While the above work is underway, the materials shall be watered and rolled and the reconditioned and prepared subgrade shall be compacted to densities required for similar new work.

211.3.02B Aggregate Bases: Existing aggregate bases shall be bladed, scarified and shaped as the Engineer may determine to be necessary to bring the surface thereof in reasonably close conformity to lines, grades and cross section established by the Engineer. The materials shall be watered and compacted as necessary to obtain densities required for similar new work.

211.3.02C Pavement Surfaces: Existing pavements surfaces shall be cleaned of all loose material, dirt and dust by brooming, by flushing with water or by other approved methods.

211.3.03 Prime Coat: Prime coat shall be applied at a rate normally within a range of 0.25 to 0.40 gallons per square yard of surface. Cover aggregate if required shall be applied at a rate of 0.006 to 0.009 cubic yards per square yard of surface.

The temperature of the asphalt material at the time of application shall be within the limits for the type and grade being used, as shown in the following table:

Type and Grade of Asphalt	Distributor Spraying Temperature	
	Minimum	Maximum
RS-1, RS-1H	100	180
CRS-1, CRS-1H	100	180

Asphalt shall not be applied on any wet surfaces, or when the air temperature is less than 60 degrees F.

Prior to starting operations, the asphalt distributor spray bar shall be checked and adjusted, if necessary, to assure that all nozzles are properly adjusted and the bar height set for a double or triple overlap. Each application of asphalt shall commence on building paper placed across the width of the spread to ensure proper operation of the bar and provide precise meet lines at transverse junctions in the spreading operation.

The asphalt distributor shall have controls for regulating and monitoring the spread of asphalt at a uniform temperature on variable widths of surface up to 15 feet and at rates from 0.05 to 2.0 gallons per square yard with uniform pressure. The variation from the specified rate of application shall not exceed 0.02 gallons per square yard. Spray bards shall be full circulating and be adjustable both laterally and vertically.

Rollers shall be self-propelled pneumatic tire type capable of exerting a ground pressure of not less than 80 pounds per square inch of tire contact area.

Operation of the asphalt distributor and aggregate spreader shall be carefully controlled to ensure that the asphalt is covered with aggregate as soon as possible. Asphalt cements shall be covered within two minutes of application and emulsified asphalts before any breaking of the emulsion occurs.

211.3.03 Prime Coat, Continued

Following construction of the prime coat, it shall be allowed to cure for a period of up to three days before a succeeding course is placed upon it.

211.3.04 Tack Coat: Tack coat asphalt shall be applied to existing bituminous and Portland cement concrete surfaces prior to placing asphalt concrete. The application rate shall normally be within a range of 0.02 to 0.06 gallons per square yard of surface.

The temperature of the asphalt material at the time of application shall be within the limits for the type and grade being used as shown in the following table:

Type and Grade of Asphalt	Spraying Temperature	
	Minimum	Maximum
SS-1H	None	150
CSS-1H	None	150
RC-800	150	250

Asphalt shall not be applied to any wet surfaces or when the air temperature is less than 60 degrees F.

The asphalt shall be applied by pressure-spray equipment capable of providing a uniform application at the prescribed rate. It shall be applied only so far in advance of the asphalt concrete paving operations as is necessary in order to provide a tacky surface upon which to place the asphalt concrete.

211.3.05 Asphalt Concrete

211.3.05A Mixing: Mix the asphalt concrete by combining aggregate, asphalt and additives at an approved central mixing plant equipped with controls to accurately measure and monitor the various components of the mix to produce a uniform homogeneous mixture at the specified temperature.

The discharge temperature of the mix will vary with the type of mixing plant, climatic conditions and other variables. The temperature, however, shall be sufficient to provide thorough mixing and coating and to provide a mass viscosity of the mix on the grade which will permit compaction to the required density. Mix temperatures and asphalt in storage shall not exceed 324 degrees F.

211.3.05B Placing: Asphalt concrete shall be at a temperature of between 250 and 300 degrees F at the time it is placed. It shall normally be placed on dry prepared surfaces and when the air temperature in the shade is 40 degrees F or warmer. Placing during rain or other adverse weather conditions normally will not be permitted, except that material in transit at the time adverse conditions may occur may be placed provided it is of proper temperature, has been covered during transit, and is placed on a foundation free from pools or flow of water.

Asphalt concrete shall be placed in panels of such width as to hold a practical minimum the number of longitudinal joints required. The longitudinal joints in any panel shall offset those joints in underneath panels by not less than six inches. Special care shall be taken at longitudinal joints to provide the required bond and density.

The placing of asphalt concrete shall be a continuous operation as nearly as practicable. If the capacity of the paving machine exceeds the capacity of the hauling vehicles, the paving machine shall be operated at a reduced uniform speed so as to maintain a continuous operation.

211.3.05C Compaction: Unless otherwise specified, the degree of compaction shall be 92% of relative maximum density, as determined by AASHTO T230. Rollers shall be capable of transmitting sufficient static or dynamic force necessary to compact the material to the specified degree of compaction.

Longitudinal joints shall be rolled directly behind the paving machine. The first panel shall have vertical edges, and the abutting panel shall be tightly crowded against its edge. Material from the second panel shall be pushed over the surface of the first panel so as to develop an overlay of from three to six inches.

Breakdown rolling shall immediately follow the rolling of the longitudinal joint and edges. Rollers shall be operated as close to the paving machine as necessary to obtain adequate density without causing undue displacement. The breakdown roller shall be operated with the drive roll or wheels nearest the paving machine. Exceptions may be made when working on steep slopes or super-elevated curves.

Pneumatic-tired rolling will be allowed after breakdown rolling as occurred. This rolling shall follow the breakdown rolling as closely as possible and while the material is at a temperature that will result in the specified degree of compaction being achieved.

Roller wheels shall be kept moist with only enough water to avoid picking up the material. Rollers shall move at a uniform speed not to exceed 3 mph for steel-wheeled rollers or 5 mph for pneumatic tired rollers. Rollers shall be in good condition and capable of being reversed without backlash. The line of rolling shall not be suddenly changed nor the direction of rolling suddenly reversed. Any pronounced change in the direction of the roller shall be made on stable material. If rolling causes displacement of the material, the affected areas shall be loosened and restored to the original grade with loose material before being rerolled. Heavy equipment, including rollers, shall not be allowed to stand on the finished surface before it has thoroughly cooled or set.

211.3.05C Compaction, Continued

The finished surface shall be true to line and grade, free of irregularities and roller wheel tracks.

211.3.05D Tolerance: The surface shall not vary more than 0.02 of a foot when tested with a 10-foot straightedge applied parallel with the centerline, and/or perpendicular to the centerline.

211.4.00 Measurement and Payment: Unless otherwise specified, measurement and payment for asphalt concrete will be made on a ton basis for the class of asphalt concrete specified.

211.4.01 Payment:

Class (Specify)	Unit of Measure
Asphalt Concrete	Ton

Should the scale weight tonnage exceed the theoretical tonnage the Engineer may increase the quantity for payment, but not to exceed 10% of the theoretical tonnage.

In the event the total scale weight tonnage is less than that determined by the paragraph above, the Contractor shall determine the cause therefore to the satisfaction of the Engineer.

A. If it is determined that the cause will not weaken or in any way shorten the life of the structure, then the structure may be accepted and payment be made for the constructed thickness of asphalt actually in the structure.

B. Should it be determined that the cause of low tonnage might weaken and shorten the life of the pavement structure, then the Contractor shall properly rectify the structure in accordance with these specifications and to the satisfaction of the Engineer.

212 PORTLAND CEMENT CONCRETE PAVEMENT

212.1.00 Description

212.2.00 Materials

212.3.00 Construction
212.3.01 General
212.3.02 Hauling
212.3.03 Reinforcement, Forms, Handling, and Placing
212.3.04 Slip Form Paving
212.3.05 Tamping and Screeding
212.3.06 Roadway and Alley Finishing
212.3.07 Joints
212.3.08 Tolerances
212.3.09 Curing
212.3.10 Protection

212.4.00 Measurement and Payment
212.4.01 Measurement
212.4.02 Payment

212 PORTLAND CEMENT CONCRETE PAVEMENT

212.1.00 Description: This section covers the work necessary for construction of Portland cement concrete pavements, with or without reinforcement, on a prepared subgrade or base course, complete.

212.2.00 Materials: Portland cement concrete, joint materials and curing materials shall conform to the applicable requirements of Section 503. Reinforcement shall conform to the applicable requirements of Section 504.

212.3.00 Construction

212.3.01 General: The plant, equipment and tools required in the performance of the work must be approved as to design, capacity and condition to efficiently perform their respective functions of the work. The Contractor shall coordinate all operations involved in constructing the pavement so that regardless of the daily or seasonal variations in weather, temperature and humidity under which the work is permitted to proceed, such work will result in a finished pavement conforming in all respects to specified requirements. The Contractor shall provide and have available at all times adequate equipment, tools, materials and labor to achieve these results and failure to so provide will be cause for discontinuance of the work upon order of the Engineer. All procedures shall conform to the applicable requirements of concrete construction in Section 503, CONCRETE STRUCTURES.

212.3.02 Hauling: Hauling of Portland cement concrete shall conform to the provisions of AASHTO M 157.

212.3.03 Reinforcement, Forms, Handling and Placing: Reinforcement shall conform to the applicable requirements of Section 504. Forms, handling and placing shall conform to the applicable requirements of Section 503.

212.3.04 Slip Form Paving: The Contractor shall place the concrete uniformly in its final position by the slip form method in one complete pass in such a manner that a minimum of finishing will be necessary to provide a dense and homogeneous pavement in conformance to true grade and cross section. The machine shall vibrate the concrete for the full width of the pavement being placed. Such vibration shall be accomplished with the vibrating tubes or arms working in the concrete. The sliding forms shall be rigidly held together to prevent spreading of the forms. Forms of sufficient length shall be used so that no appreciable slumping of the concrete will occur.

212.3.04 Slip Form Paving. Continued

The Contractor shall operate the slip form paver with as nearly continuous forward movement as possible and coordinate all operations of mixing, delivery and spreading concrete to provide uniform progress. Stopping and starting of the paving machine shall be held to an absolute minimum. If for any reason it is necessary to stop the forward motion of the paver, the vibratory and tamping elements shall be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

The Contractor shall ensure that supports of the slip form paver and other equipment which rides on previously placed pavement is offset over that pavement sufficiently to prevent breakage of the edge thereof and provide such supports with suitable protective means to avoid marring or chipping of the previously placed pavement.

212.3.05 Tamping and Screeding: The Contractor shall compact the concrete pavement by means of vibratory screeds, mechanical tampers, tamping templates and such other implements as approved. A vibrating screed or an automatic screeding and tamping machine may be substituted for a tamping template, subject to approval. The Contractor shall operate the equipment in such a manner that a satisfactory compaction of the concrete is produced and the surface of the pavement is uniform, true to grade and cross section.

Immediately after placing concrete upon the subgrade and before initial set has occurred, the Contractor shall strike off the concrete and tamp by means of a tamping template, used at right angles to the centerline of the street, until the concrete is thoroughly consolidated to specified grade and crown section and sufficient mortar is brought to the surface for finishing purposes. If the design or location of the base is such as to preclude the possibility of tamping as previously described, such as a variable crown section, curb being constructed monolithic with base, in alleys, or where the grade exceeds 10 percent, the Contractor shall employ other approved methods to obtain the prescribed results.

212.3.06 Roadway and Alley Finishing: After the concrete is placed and compacted, the Contractor shall strike it true to line, grade and cross section as shown and float to a smooth, even texture with an approved long handled wood float having a troweling and smoothing surface from 6 to 12 inches wide, or other approved floating device. The Contractor shall apply the float to the surface of the concrete with its length parallel to the centerline of the street and operate it from bridges, planing off high places and filling the low places. Preceding applications of the float shall be lapped by at least one-half its length. If, after such planing, low places are discovered in the surface of the concrete, the Contractor shall add additional concrete to fill in and bring such low places to grade, as approved. Floating shall leave the surface finish at specified grade, cross section and surface tolerance with a surface free from laitance, soupy mortar, marks or irregularities.

212.3.06 Roadway and Alley Finishing, Continued

Following the float finish and at the proper set, the surface shall be broom finished. The Contractor shall draw the broom transversely across the pavement with not more than one stroke per width of broom. Any areas of minor honeycomb or other minor defect in composition of the concrete shall be filled along the exposed edges with a stiff mortar or cement and fine aggregate applied to the moistened concrete in a professional manner. Areas showing serious defects in composition shall be cause for removal of the affected pavement and replacement with pavement of specified quality for the full width of strip between longitudinal joints or edges and for a length not less than 10 feet.

The Contractor shall tool the free edges of the new pavement and joints with previously placed Portland cement concrete with an approved edging tool to remove laitance and mortar resulting from finished operations and to provide a clean rounded edge to the new pavement. Tooling shall not form ridges on the surface of the concrete. Tooling of edges at transverse joints shall be performed as directed.

212.3.07 Joints

General – Joints shall be of the respective kinds called for by the plans and shall be constructed where called for by the plans or where directed by the Engineer. Joints in pavement will be classed and refereed to as longitudinal contraction, construction and expansion; any of which may be transversely or longitudinally with the pavement as called for by the plans or as directed by the Engineer. All joints and joint filler shall extend clearly to pavement edges or to each other, as the case may be.

All transverse joints shall be constructed normally to the surface of the pavement. Joints shall not vary from specified or indicated line by more than ¼ inch. The tops of joint filler, when required, shall be true to pavement cross section within 1/8 inch. Top edges of filler shall be protected from damage to concreting operations.

All joints, including load transfer devices and tie bars in conjunction therewith, shall be subject to inspection after installation but prior to the hardening of the concrete and shall be replaced in their entirety together with disturbed areas of concrete if found faulty in any respect. The Contractor shall expose such joints as are to be inspected by removing and replacing materials as required. If the joint is found faulty, the costs of removing and replacing of materials will be paid for as extra work.

Normally, all joints which contained preformed filler are to be constructed prior to the final floating and surface finishing of the concrete.

Longitudinal Joints – Longitudinally joints shall be the contact type or weakened plane type as called for by the plans.

212.3.07 Joints, Continued

Longitudinal Contact Joints – Longitudinal contact joints shall be constructed when fresh concrete is poured against hardened concrete, between strips of pavement or between a strip of pavement and a concrete gutter. Such joints shall be saw cut and sealed in the same manner as weakened plane-type joints.

Longitudinal Weakened Plane Type Joints – Weakened plane type joints shall be constructed by sawing to the depth and maximum width called for by the plans without tearing, raveling or uncontrolled cracking of the concrete. Sawing shall be performed as soon as the concrete has set enough to permit sawing without tearing. Saws may be single or tandem as the Contractor may elect and shall be controlled by guides to true line.

If full conformance with all requirements is not obtained, joint sawing shall be abandoned and pavement areas containing uncontrolled cracks shall be removed and replaced by the Contractor at the Contractor's expense, at the direction of the Engineer. Curing agents broken or damaged by the sawing operations shall be restored.

The joint shall be filled with a preformed joint filler, or with approved filled, with the top thereof established slightly but not more than 1/8 inch below and paralleling finished pavement grade and cross section.

Contraction Joints – Contraction joints shall be constructed by sawing to the depths, widths and at the locations called for by the plans. Sawing of contraction joints shall be performed in conformance with the requirements hereinbefore set forth for sawed longitudinal joints except that they shall be sawed with a gang saw assembly incorporating not less than two separate saws for each traffic lane width of pavement being sawed and each separate saw shall saw a proportionate length of joint as a nearly simultaneous operation.

Transverse contraction joints of the weakened plane or dummy type shall be constructed at such locations as are required to confide the contraction joint spacing to a maximum of 15 feet. The joints shall be formed to a depth of 1/3 of the thickness of concrete and to a width of approximately ¼ inch.

Construction Joints – Construction joints shall be constructed when there is an interruption of more than 30 minutes in the concreting operations. No construction joint shall be constructed within 10 feet of an expansion joint or contraction joint. If sufficient concrete has not been mixed at the time of interruption to form a slab at least 10 feet long, the excess concrete back to the last preceding joint shall be removed an disposed of as directed.

212.3.07 Joints, Continued

With continuously reinforced pavement, construction joints shall be formed with a special header board. Care shall be exercised in the forming of construction joints to assure that the reinforcement and its supports are not displaced, distorted or otherwise disturbed in any way. At the recommencement of concreting, the header board shall be carefully removed in a manner which will not in any way disturb the reinforcement and which will not disturb the bond between the reinforcement and the previously placed concrete.

Any debris at and beyond the joint shall be cleaned out, spilled concrete removed, and the reinforcement supported in proper position. The new concrete place contiguous to the joint shall closely conform to the proportions and consistency of the previously placed concrete and shall be vibrated and consolidated to a greater degree and with more care than is usual in normal construction.

Expansion Joints – Preformed expansion joint filler shall be provided in lengths requiring a minimum number of pieces, and in widths and thicknesses called for by the plans or as directed. Joints in the filler shall be clipped or laced butt type, and openings shall be made in the filler to provide for load transfer devices when required. The support of the filler while concrete is being placed adjacent to and in contact with it shall be firm and adequate to insure specified permanent position, and the top of the filler shall be set below and paralleling finished pavement surface at a depth equal to the width of the performed joint filler.

Expansion joints shall be a right angles to the alignment, vertical to the surface, and shall provide complete separation of the Portland cement concrete. Expansion joints shall be constructed opposite existing expansion joints.

212.3.08 Tolerances: At the conclusion of the finishing operation, the surface of the pavement shall not vary from a true surface when tested with a 10-foot testing straightedge, more than .01 foot in 10 feet.

The finished surface shall not vary more than 0.03 foot from the plan elevations at any point.

If the surface smoothness of the pavement after curing is found to exceed the tolerance permitted, the high spots shall be ground until they meet the tolerance. The practicable extent of grinding shall not exceed 0.5 inch, shall not create spalling of aggregate and shall not create deficiencies in pavement thickness. All grinding shall be at no expense to the Owner.

212.3.09 Curing: Immediately after the final floating, surface finishing and edging has been completed and while the concrete surface is still moist, the entire exposed surface of the newly laid concrete shall be covered and cured in accordance with one or another of the following provisions as the Contractor may elect:

A. Liquid Membrane-Forming Compounds – Membrane-forming compound shall be of the white pigmented type and shall be applied uniformly to damp concrete by pressure-spray methods at a rate which will form an impervious membrane when tested in accordance with AASHTO T155.

B. White Polyethylene Sheeting – The white polyethylene sheeting shall be applied to damp concrete as soon as the sheeting can be placed without marring the surface. The sheeting shall be placed in intimate contact with the surface, shall extend over and beyond the sides or edges of the slabs or forms and shall be weighted as required to hold it in position as a waterproof and moisture proof covering. Laps shall be of dimensions and design in place to maintain tightness equivalent to the sheeting.

C. Waterproof paper – Waterproof paper shall be applied to damp concrete as soon as it can be placed without marring the surface. The paper shall be placed in intimate contact with the surface, shall extend over and beyond the sides or edges of the slabs or forms and shall be weighted as required to hold it in position as a waterproof and moisture proof covering. Transverse laps shall be at least 18 inches and longitudinal seams shall be cemented.

D. Cotton or Jute Mats – Cotton or jute mats shall be applied to damp concrete as soon as the surface has set sufficiently to prevent marring thereof. Just prior to placing, the mats shall be saturated with water and shall be kept fully wetted during the curing period. The mats shall be maintained in intimate contact with the concrete surface and shall be extended over the edges and beyond sufficiently to be well weighted down alongside the pavement edges.

212.3.10 Protection: The Contractor shall erect and maintain suitable barriers to protect the concrete from traffic or other detrimental trespass until the pavement is opened to traffic. If necessary, the Contractor shall maintain watchmen to insure that barriers are not removed or destroyed and that trespass upon the pavement does not occur.

Whenever it is necessary that traffic, including Contractor's vehicle and equipment, be carried from one side of the pavement to the other, the Contractor shall construct and maintain suitable bridges over the pavement as directed.

212.3.10 Protection, Continued

The concrete shall have attained the specified compressive strength and shall be free from scarring, abrasion, stones, loose mortar and other matter apt to be deleterious to the concrete prior to allowing equipment to use the new surface. All equipment shall be operated without damage to the new concrete.

The Contractor shall repair or replace any part of the pavement, as directed, which has been damaged by traffic or from any other cause prior to its official acceptance, at no expense to the Owner.

Traffic shall not be allowed to travel on the concrete until it has obtained 65 percent of its 28-day design strength.

212.4.00 Measurement and Payment

212.4.01 Measurement: Measurement of Portland cement concrete pavement will be made on a square yard basis for the payment complete in place as specified and accepted. Measurement will be made of width and length of each separately constructed strip of pavement, whichever is the lesser, and the length is from end to end of pavement to the nearest 0.1 foot and the square yardage shall be to the nearest square yard.

Extra thickness of pavement, when shown or specifically directed to be placed, will be measured by conversion on a proportionate volume basis to an equivalent number of square yards of specified standard thickness pavement.

212.4.02 Payment: Payment will be made for the following items when listed as pay items:

	Payment Item	Unit of Measure
1.	Continuous Reinforced Concrete Pavement (specify class, thickness, reinforcing steel)	Per S.Y.
2.	Reinforced Concrete Pavement (specify class, thickness, reinforcing steel)	Per S.Y.
3.	Plain Concrete Pavement (specify class, thickness)	Per S.Y.

Payment for concrete pavement, whether continuously reinforced, reinforced, or plain, shall be full compensation for furnishing and placing all materials including water, reinforcement, joint materials, dowels, tie-bars, and performing all work specified to complete the item including preparation of the base.

213 CURBS AND GUTTERS

213.1.00 Description

213.2.00 Materials
213.2.01 Portland Cement Concrete
213.2.02 Asphalt Concrete
213.2.03 Aggregate
213.2.04 Metal Reinforcement
213.2.05 Dowels
213.2.06 Preformed Expansion Joint Filler
213.2.07 Epoxy Cement
213.2.08 Curing Materials

213.3.00 Construction
213.3.01 Preparation of Base
213.3.01A Earthwork
213.3.01B Aggregate Foundation or Bedding
213.3.01C Base for Portland Cement Concrete
213.3.01D Base for Asphalt Concrete
213.3.02 Forms and Equipment
213.3.02A Forms
213.3.02B Equipment
213.3.03 Placing, Finishing, and Curing
213.3.03A General
213.3.03B Asphalt Concrete Structures
213.3.03C Portland Cement Concrete Structures
213.3.04 Transverse Joints
213.3.05 Dowels, Tie-Bars, Reinforcement

213.4.00 Measurement and Payment
213.4.01 Measurement
213.4.01A Curb
213.4.01B Curb and Gutter
213.4.01C Curb, Gutter, and Sidewalk
213.4.01D Pre-cast Concrete Curb
213.4.01E Concrete Valley Gutter
213.4.01F Traffic Islands
213.4.02 Payment

213 CURBS AND GUTTERS

213.1.00 Description: This section covers the work necessary for the construction of curbs, gutters, combination curb and gutter, combination curb, gutter, and sidewalk, islands, and traffic separators, hereinafter referred to collectively as structures.

213.2.00 Materials

213.2.01 Portland Cement Concrete: Portland cement concrete shall conform to the applicable requirements of Section 503.

Portland cement concrete in formed or extruded structures shall attain a compressive strength of not less than 3,000 pounds per square inch when tested at 28 days.

Portland cement concrete in pre-cast units shall attain a compressive strength of not less than 4,000 pounds per square inch when tested at 28 days.

213.2.02 Asphalt Concrete: Asphalt concrete shall conform to the applicable requirements of Section 211, and shall be of the class specified.

213.2.03 Aggregate: Aggregate materials for base, foundation courses, leveling courses or bedding shall conform to the applicable requirements of Section 207.

213.2.04 Metal Reinforcement: Metal reinforcement shall conform to the applicable requirements of Section 504.

213.2.05 Dowels: Dowels shall conform to the requirements of Subsection 504.2.04.

213.2.06 Preformed Expansion Joint Filler: Preformed expansion joint filler shall conform to the requirements of Subsection 503.2.06A.

213.2.07 Epoxy Cement: Epoxy cement shall be a two-compound epoxy resin adhesive conforming to the requirements of AASHTO M235.

213.2.08 Curing Materials: Curing materials shall conform to the requirements of Subsection 503.2.05.

213.3.00 Construction

213.3.01 Preparation of Base

213.3.01A Earthwork: When roadway earthwork is called for in connection with other items of work under the same contract which includes structure construction under this section, all

213.3.01A Earthwork, Continued

excavation, backfilling and berm construction for the structures and in the vicinities thereof as required or as shown, shall conform to the applicable requirements of Section 204. When the contract which includes structure construction under this section does not call for roadway earthwork to be performed as set forth in Section 204, the Contractor shall perform required earthwork as follows: Make excavations for the structures to required depth and widths and the bottoms thereof to a firm, even surface. Remove all soft and unsuitable material and replace with material as directed. Backfill prior excavations at sites and in the vicinity of the new structures with approved material placed and compacted in successive layers to a dense and firm condition. Areas adjacent to the work shall be trimmed and shaped to a neat condition and disturbed areas restored to their original condition.

213.3.01B Aggregate Foundation or Bedding: Curb structures will not require aggregate foundation unless specified.

When structures are to be constructed on areas where approved aggregate materials is already in place, such materials may be salvaged and reused as bedding, at no cost to the Owner.

Foundation courses or beddings involving the furnishing of new material shall be constructed in conformance to the applicable requirements of Section 207.

213.3.01C Base for Portland Cement Concrete: All bases upon which new cement concrete structures are to be constructed shall be firm and free of all extraneous matter. Thoroughly dampen surfaces upon which new cement concrete is to be placed prior to placement of concrete. No payment will be made for water and the work for placing base materials. The cost of preparing bases shall be considered as incidental.

When concrete is placed by the mechanical extrusion method, vertical dowel fastening to underlying concrete or asphalt may be eliminated and the bond between new concrete and underlying concrete or asphalt may be provided with epoxy cement applied in conformance with the manufacturer's recommendations.

213.3.01D Base for Asphalt Concrete: The Contractor shall construct the base of asphalt concrete structures to proper grade, firm, dry and free of extraneous matter.

Where asphalt concrete is to come in contact with previously placed Portland cement concrete, asphalt concrete or bituminous surfaces, the area of contact shall be given an application of epoxy cement as herein specified for use with Portland cement concrete or a light coating of emulsified asphalt of the type designated by the Engineer and conforming to the requirements for Tack Coat in Section 211.

213.3.01D Base for Asphalt Concrete, Continued

Where dowel fastenings between new asphalt concrete and the underlying foundation are shown, the dowels may be eliminated when the asphalt concrete is placed by the mechanical extrusion method provided an application of epoxy cement, as set forth herein for use with Portland cement concrete, is used to provide positive bond between the new and old materials.

213.3.02 Forms and Equipment

213.3.02A Forms: All materials and procedures shall conform to the applicable requirements of Section 503.

213.3.02B Equipment: Equipment as described in Section 211 and Section 212, may be modified as approved by the Engineer.

The machine for extruding Portland cement concrete curb or asphalt concrete curb shall be of the self-propelled type equipped with a material hopper, distributing screw and adjustable curb forming devices capable of placing and compacting cement concrete or asphalt concrete to the lines, grades and cross section as shown, in an even homogeneous manner.

The forming tube portion of the extrusion machine shall be readily adjustable vertically during the forward motion of the machine to provide, when necessary, a variable height of curb conforming to the predetermined curb grade. A grade line gauge or pointer shall be attached to the machine in such a manner that a continual comparison can be made between the curb being placed and the established curb grade as indicated by the offset guide line.

213.3.03 Placing, Finishing and Curing

213.3.03A General: The top and face of finished curb shall be true and straight and the top surface of curbs shall be of uniform width, free from humps, sags, honeycombs, or other irregularities. When a straightedge 10 feet long is laid on the top or face of the curb or on the surface of gutters, the surface shall not vary more than 0.02 foot from the edge of the straightedge, except at grade changes or vertical curves.

The Contractor shall construct all structures within 0.02 foot of true line, within 0.02 foot of established surface grade, cross section and slope, and within 0.01 foot of specified thickness.

No asphalt or concrete shall be placed until the surface and forms, where used, have been inspected and approved by the Engineer.

213.3.03B Asphalt Concrete Structures: Asphalt concrete structures may be placed either by mechanical extrusion methods or between suitable forms, as the Contractor may elect.

The Contractor shall furnish and place asphalt concrete in conformance with the applicable requirements of Section 211.

213.3.03C Portland Cement Concrete Structures: Portland cement concrete structures may be placed either by mechanical extrusion methods or between suitable forms, as the Contractor may elect.

If the structures are constructed by mechanical extrusion methods, the slump shall be between one and two inches. The Contractor shall feed the concrete into the extruding machine at a uniform rate and operate the machine under sufficient restraint in a forward motion to produce a well-compacted mass of concrete.

If forms are used, the slump of concrete shall be between two and four inches. The Contractor shall remove forms from formed structures after the concrete has taken initial set and while the concrete is still green. Minor defects shall be repaired with mortar containing one part Portland cement and two parts sand. Plastering will not be permitted on the faces and exposed surfaces. Honeycombed and other structurally defective concrete shall be removed and replaced at no expense to the Owner. While the concrete is still green, the Contractor shall finish exposed surfaces as required to provide a uniform texture and smooth surface.

After the concrete has been placed and finished, it shall be cured by application of a white pigmented liquid membrane-forming compound applied uniformly to the damp concrete by pressure spray methods, or by keeping the concrete protected and moist for at least 72 hours. The concrete structure shall be kept from contact and strain for at least seven days.

When constructing pre-cast concrete curbs, the proportions of sand, gravel and cement, the type of forms used, and the method of compacting the concrete in the forms shall all be such that a dense, smooth and uniform surface is obtained on the finished units. The faces that are to be exposed shall be free from chips, cracks, air holes, honeycomb or other imperfections except that if there are no more than five percent of the curb units having slight cracks, small chips not larger than ½ inch in diameter or depth, the imperfections will not be deemed grounds for rejection.

213.3.04 Transverse Joints: Transverse expansion joints in Portland cement concrete curb shall be provided opposite abutting expansion joints, over expansion joints in underlying concrete, and at the end of curved portions of curbs and at connections to existing curbs. Additional transverse expansion joints shall be provided at other locations as required to confine the expansion joint spacing to a maximum distance of 45 feet for formed curb. Extruded concrete curb will not have a maximum distance. The width of joints and thickness of filler shall

213.3.04 Transverse Joints, Continued

match those of the joints in abutting or underlying concrete; elsewhere, the filler thickness shall be not less than ½ inch. Each expansion joint shall be at right angles to the structure alignment, vertical to the structure surface, and shall provide complete separation of new cement concrete.

Expansion joints shall be provided between driveways and Portland cement concrete pavements; transversely in walks at corners as shown, transversely in walks opposite expansion joints in adjoining curbs; and elsewhere at such locations so that the distance between transverse expansion joints does not exceed 45 feet; around poles, posts, boxes and other fixtures which protrude through, into to against the structures.

Transverse contraction joints of the weakened plane or dummy type shall be formed in the exposed surfaces of the Portland cement concrete structures opposite contraction joints in concrete underlying the new concrete and at other locations in the new structures as required to confine the contraction joint spacing to a maximum of 15 feet. The joints shall be formed by grooving, by insertion and removal of plates or other devices, by the insertion and leaving in place of preformed bituminous filler, by sawing or by other means approved by the Engineer. The top width of the joint shall be not less than 1/8 inch, not greater than ¼ inch, and the depth of the joint shall be severed. The edges of joints shall be tooled, unfilled grooves shall be clean and neat, and joint filler shall be even and flush with the surface of the concrete. If the joints are constructed by sawing, the sawing shall be performed as soon as practicable after pouring and prior to the occurrence of any uncontrolled cracking.

Existing curbs, walks, driveways and other such structures shall be cut back to permit the new construction and where the new structure are to be constructed against or within four inches of the end, edge or side of other structures, the new construction shall include the construction of approved connections therewith, using the same kind of concrete as is used in the new construction. The joint between the old and new material shall be made with a saw cut. In this work, preformed expansion joint filler, minimum ½ inch thickness, shall be furnished and placed between the old and new Portland cement concrete.

213.3.05 Dowels, Tie-Bars, Reinforcement: The Contractor shall provide metal reinforcement when and as shown. When shown, provide and place dowels with “slip sleeves” as load transfer mediums. Provide and place dowels, but without “slip sleeves”, as fastenings or ties between new concrete and existing underlying concrete when shown. Place reinforcement, dowels, and tie-bars in conformance to the applicable requirements of Section 504.

213.3.06 Weep Holes: Weep holes may be required at all points where natural drainage flow is impaired by the curb and opposite house down spouts and subsurface drainage. When required, at least 1 weep hole shall be provided per lot unless otherwise noted. Weep holes shall be formed with 3 inch plastic drain pipe or equal, as approved by the Engineer. Flow lines of weep

213.3.03 Weep Holes, Continued

holes shall be ½ inch above the gutter flow line. Concrete which laps over the weep holes shall be broken away and grouted smooth. The ends of the pipe shall be cut with a cutter which leaves no frayed edge or jagged edges.

A contraction joint shall be constructed at each weep hole and to the required depth in the adjacent gutter.

Weep holes shall be constructed only when specifically required and shall be considered as incidental to the construction of curb and gutter.

213.4.00 Measurement and Payment

213.4.01 Measurement

213.4.01A Curb: Curb will be measured on a linear foot basis along the face of the curb for the actual length constructed.

213.4.01B Curb and Gutter: Curb and Gutter will be measured on a linear foot basis along the face of the curb for the actual length constructed.

213.4.01C Curb, Gutter and Sidewalk: For purposes of measurement and payment, the combined curb, gutter and sidewalk will be considered as two component sections.

The first component, sidewalk, shall comprise that portion of the combined section beginning six inches behind the face of the curb and shall be measured on a square yard basis for the actual square yards of sidewalk constructed.

The second component, curb and gutter, shall comprise that portion of the combined section beginning at the back of curb and through the gutter section, and shall be measured on a linear foot basis along the face of the curb for the actual linear feet of curb and gutter constructed.

213.4.01D Pre-cast Concrete Curb: Pre-cast concrete curb will be measured on a linear foot basis along the face of the curb constructed, or on a per each basis for the actual number of pre-cast concrete curb sections constructed.

213.4.01E Concrete Valley Gutter: Concrete valley gutter will be measured on a square yard basis and shall include the related concrete fillets if appropriate.

213.4.01F Traffic Islands: Traffic islands will be measured by component parts of curb and sidewalk.

213.4.02 Payment: Payment will be made for the following items when listed as pay items:

Payment Item	*Unit of Measure*
Curb (specify asphalt or concrete)	L.F.
Pre-Cast Concrete Curb	L.F. or EACH
Concrete Curb and Gutter	L.F.
Sidewalk (specify asphalt or concrete)	S.Y.
Concrete Valley Gutter	S.Y.

214 DRIVEWAYS AND APPROACHES

214.1.00 Description

214.2.00 Materials
214.2.01 Portland Cement Concrete
214.2.02 Asphalt Concrete
214.2.03 Aggregate
214.2.04 Reinforcement
214.2.05 Dowels
214.2.06 Preformed Expansion Joint Filler
214.2.07 Epoxy Cement
214.2.08 Curing Materials

214.3.00 Construction
214.3.01 Preparation of Subgrade and Base Including Grading
214.3.02 Forming
214.3.03 Joints
214.3.04 Placing Surfacing
214.3.05 Finishing Portland Cement Concrete
214.3.06 Curing Portland Cement Concrete
214.3.07 Dowels, Tie-Bars, Reinforcement

214.4.00 Measurement and Payment
214.4.01 Measurement
214.4.01A Driveways
214.4.01B Sawed Joints
214.4.01C Aggregate Base
214.4.02 Measurement and Payment, Incidental
214.4.03 Payment

214 DRIVEWAYS AND APPROACHES

214.1.00 Description: This section covers the work necessary for the construction of asphalt concrete or Portland cement concrete paved driveways and approaches.

214.2.00 Materials:

214.2.01 Portland Cement Concrete: Shall conform to the applicable requirements of Section 503.

214.2.02 Asphalt Concrete: Shall conform to the applicable requirements of Section 211. Unless otherwise specified, asphalt concrete shall be Class BM-2 or BM-4 as specified.

214.2.03 Aggregate: Materials for base, foundation and leveling courses or bedding shall conform to the requirements of Section 207 or as specified on the Plans or in the Special Provisions.

214.2.04 Reinforcement: Shall conform to the applicable requirements of Section 504.

214.2.05 Dowels: Shall conform to the requirements of Subsection 504.2.04.

214.2.06 Preformed Expansion Joint Filler: Shall conform to the requirements of Subsection 503.2.06A.

214.2.07 Epoxy Cement: Epoxy cement shall be a two-compound epoxy resin adhesive conforming to the requirements of AASHTO M235.

214.2.08 Curing Materials: Shall conform to the requirements of Subsection 503.2.05.

214.3.00 Construction

214.3.01 Preparation of Subgrade and Base Including Grading: Preparation work shall conform to the requirements of Section 215.

214.3.02 Forming: Forming shall conform to the requirements of Subsection 215.3.03, except as herein specified in Dowels, Tie-Bars, and Reinforcement.

214.3.03 Joints: Joints shall conform to the requirements of Subsection 215.3.04.

214.3.04 Placing and Surfacing: The placing of Portland cement concrete and asphalt concrete surfacing shall conform to the applicable requirements of Section 215.

214.3.05 Finishing Portland Cement Concrete: The concrete shall be floated with wood floats and finished at the proper time with a steel float. Joints shall be edged with ¼ inch radius edger and the driveway return edges shall be tooled with ½ inch radius edger or as shown on the plans.

The surface shall be brushed in a transverse direction in relation to the centerline of the driveway with a brush of approved type.

Driveways shall not be constructed at the same time the pavement is placed, unless authorized by the Engineer.

Finished surfaces shall be free from humps, sags, or other irregularities and shall be constructed within ¼ inch of true line, grade, cross section and slope, and within 1/8 inch of the specified thickness.

214.3.06 Curing Portland Cement Concrete: Curing shall conform to the requirements of Subsection 215.3.08, in addition thereto, vehicular traffic shall be kept off the surface for at least seven days, and longer if so directed.

214.3.07 Dowels, Tie-Bars, Reinforcement: The Contractor shall provide dowels, tie-bars, and reinforcement as shown. Dowels with slip sleeves shall be placed as load transfer mediums in new concrete. Dowels without slip sleeves shall be placed as fasteners or ties between new and existing underlying concrete as shown. The placement of dowels, tie-bars, and reinforcement shall conform to the requirements of Subsection 504.3.03.

214.4.00 Measurement and Payment:

214.4.01 Measurement

214.4.01A Driveways: Measurement for driveways will be made on a square yard basis, or on a per each basis.

If on a square yard basis, measurement will be made of the surface of the Portland cement concrete or asphalt concrete driveways and computed to the nearest 0.1 square yard.

If on a per each basis, measurement will be made on the number of driveways constructed.

214.4.01B Sawed Joints: Sawed joints shall be considered incidental work for which no separate payment will be made.

214.4.01C Aggregate Base: Pay quantities of aggregate base materials will be measured on a square yard basis for the thickness bid, in place.

214.4.02 Measurement and Payment Incidental: Excavation, selected materials, water and compaction for all work in this section will be measured and paid for in accordance with the applicable sections only when they are shown in the proposal; otherwise the work and materials involved will be considered as incidental to the construction and shall be included in the items of work listed.

214.4.03 Payment: Payment will be made for the following items when listed as pay items:

Payment Item	*Unit of Measure*
Driveways (specify thickness, type and kind)	Per SY or Per EACH
Aggregate Base (specify thickness)	Per SY

215 SIDEWALKS AND PATHWAYS

215.1.00	Description
215.2.00	Materials
215.2.01	Aggregate Base
215.2.02	Asphalt Concrete
215.2.03	Portland Cement Concrete
215.2.04	Joint Materials
215.2.05	Curing Materials
215.3.00	Construction
215.3.01	Earthwork
215.3.02	Aggregate Base
215.3.03	Forming
215.3.04	Expansion Joints
215.3.04A	Portland Cement Concrete
215.3.04B	Asphalt Concrete
215.3.05	Portland Cement Concrete
215.3.06	Asphalt Concrete
215.3.07	Finishing
215.3.07A	Portland Cement Concrete
215.3.08	Curing Portland Cement Concrete
215.4.00	Measurement and Payment
215.4.01	Lump Sum
215.4.02	Linear Foot
215.4.03	Square Yard
215.4.04	Sawed Joints
215.4.05	Aggregate Base
215.4.05A	Incidental
215.4.05B	Square Yard

215 SIDEWALKS AND PATHWAYS

215.1.00 Description: This section covers the work necessary for the construction of Portland cement concrete, or asphalt concrete sidewalks and pathways.

215.2.00 Materials

215.2.01 Aggregate Base: Aggregate base materials shall be as specified, and shall conform to the requirements of Section 207.

215.2.02 Asphalt Concrete: Asphalt concrete shall be Class BM-2 or BM-4 as specified, and shall conform to the requirements of Section 211.

215.2.03 Portland Cement Concrete: Portland cement concrete shall be Class 3500, unless otherwise specified, and shall conform to the requirements of Section 503.

215.2.04 Joint Materials: Joint materials shall conform to the requirements of Section 503.

215.2.05 Curing Materials: Curing materials shall conform to the requirements of Section 503.

215.3.00 Construction

215.3.01 Earthwork: Earthwork shall conform to the applicable requirements of Section 204. Compaction shall conform to the requirements of Subsection 204.3.08.

215.3.02 Aggregate Base: Aggregate base shall conform to the requirements of Section 207. The aggregate base shall be thoroughly dampened prior to placing Portland cement concrete.

215.3.03 Forming: Forming shall conform to the requirements of Section 503.

215.3.04 Expansion Joints

215.3.04A Portland Cement Concrete: Expansion joints shall be at right angles to the alignment, vertical to the surface, and shall provide complete separation of the Portland cement concrete.

Expansion joints shall be constructed opposite existing expansion joints, over expansion joints in underlying concrete, at each point of tangency, at connections to existing curbs, driveways, sidewalks and pathways, around objects which protrude through, into, or about the sidewalk or pathway, and at spacings not to exceed 45 feet as measured longitudinally along the centerline of the sidewalk or pathway. The width of the expansion joint filler shall be ½ inch, unless otherwise specified.

215.3.04A Portland Cement Concrete, Continued

Uneven or jagged existing surfaces to be joined shall be sawcut unless otherwise specified.

215.3.04B Asphalt Concrete: Expansion joints will not be required unless specified.

215.3.05 Portland Cement Concrete: Placing of Portland cement concrete shall conform to the applicable requirements of Section 212.

215.3.06 Asphalt Concrete: Placing of asphalt concrete shall conform to the applicable requirements of Section 211.

215.3.07 Finishing

215.3.07A Portland Cement Concrete: Portland cement concrete shall have a broomed surface unless otherwise specified. Brooming shall be transverse to the direction of traffic.

The surface shall be marked into rectangles with a scoring tool which will leave the edges rounded. The dimensions of the rectangles shall be as directed.

Transverse contraction joints of the weakened plane or dummy type shall be constructed at such locations as are required to confine the contraction joint spacing to a maximum of 15 feet. The joints shall be formed to a depth of 1/3 of the thickness of concrete and to a width of about 1/8 inch. Joint edges shall be tooled.

The surface shall not vary more than 0.02 foot from a 10 foot straightedge, except at grade changes, and the finished surface shall be free from blemishes. All work shall be within ¼ inch of true line, within ¼ inch of established surface grade, cross section and slope, and within 1/8 inch of specified thickness.

215.3.08 Curing Portland Cement Concrete: Curing shall conform to the requirements of Section 503.

215.4.00 Measurement and Payment

215.4.01 Lump Sum: Measurement and payment for sidewalks and pathways will be made on a lump sum basis for the type, width, depth, and length specified and constructed.

215.4.02 Linear Foot: Measurement and payment for sidewalks and pathways will be made on a linear foot basis for the type, width, depth and length specified and constructed.

215.4.03 Square Yard: Measurements and payment for sidewalks and pathways will be made on a square yard basis for the type, width, depth, and length specified and constructed.

215.4.04 Sawed Joints: Sawed joints shall be considered as incidental work for which no separate payment will be made.

215.4.05 Aggregate Base

215.4.05A Incidental: Unless otherwise specified, no separate payment will be made for aggregate base, it being considered incidental to the other items of work.

215.4.05B Square Yard: When shown as a pay item, measurement and payment for aggregate base will be made on a square yard basis for the various depths specified and placed.

216 ADJUSTMENT OF INCIDENTAL STRUCTURES TO GRADE

216.1.00 Description

216.2.00 Materials
216.2.01 General
216.2.02 Portland Cement Concrete
216.2.03 Asphalt Concrete
216.2.04 Aggregate Base
216.2.05 Tack Coat
216.2.06 Seal Coat
216.2.07 Precast Concrete Manhole Sections
216.2.08 Frames, Grates and Covers
216.2.09 Mortar
216.2.10 Metal Reinforcement

216.3.00 Construction
216.3.01 Excavation and Backfill
216.3.02 Frames, Grates and Covers
216.3.03 Raising Tops of Masonry Structures
216.3.04 Lowering Topes of Masonry Structures
216.3.05 Adjusting Metal Structures

216.4.00 Measurement and Payment
216.4.01 Incidental
216.4.02 Per Each

216 ADJUSTMENT OF INCIDENTAL STRUCTURES TO GRADE

216.1.00 Description: This section covers the work necessary for adjusting the tops of manholes, sumps, catch basins, inlets, valve boxes, meter boxes, monument boxes and similar structures to the required elevation and/or horizontal alignment.

216.2.00 Materials

216.2.01 General: Materials used in the adjustment of incidental structures may be materials salvaged from the existing installation and brought to a condition approved for reuse, new materials as listed herein, or materials conforming to the requirements of related work referred to herein.

216.2.02 Portland Cement Concrete: Portland cement concrete shall conform to the requirements of Section 503.

216.2.03 Asphalt Concrete: Asphalt concrete shall conform to the requirements of Section 211.

216.2.04 Aggregate Base: Aggregate base shall conform to the requirements of Section 207.

216.2.05 Tack Coat: Tack coat shall conform to the requirements of Section 211.

216.2.06 Seal Coat: Seal coat shall conform to the requirements of Section 210.

216.2.07 Precast Concrete Manhole Sections: Precast concrete manhole sections shall conform to the requirements of ASTM C478.

216.2.08 Frames, Grates and Covers: Frames, grates and covers shall conform to the requirements of Section 307.

216.2.09 Mortar: Mortar shall conform to the requirements of ASTM C387 or proportioned one part Portland cement to two parts clean, well-graded sand which will pass a 1/8 inch screen. Admixtures may be used not exceeding the following percentages of weight of cement: hydrated lime, 10 percent; diatomaceous earth or other inert materials, 5 percent.

216.2.10 Metal Reinforcement: Metal reinforcement shall conform to the requirements of Section 504.

216.3.00 Construction

216.3.01 Excavation and Backfill: Excavation and backfill shall conform to the requirements of Section 301.

Excavation shall be unclassified and shall include whatever materials are encountered to the depths shown.

216.3.02 Frames, Grates and Covers: Frames, grates and covers may be salvaged from structures to be adjusted and, if of suitable size and condition, may be reused in the work, and such as are damaged or which are unfit for reuse, as determined by the Engineer, shall be replaced with similar items which are comparable in all respects to those which they are to replace and which are adequate for the intended purpose.

Salvaged components to be reused shall be cleaned of foreign material by methods that will not harm the component but will restore it to a nearly new condition.

216.3.03 Raising Tops of Masonry Structures: After existing frames, covers and grates have been removed, the exposed top surface on which new mortar or concrete is to be placed, shall be chipped away to a depth of at least ¼ inch to expose firm concrete and the new surface shall be cleaned by brushing and shall be moistened with water at the time of placing new concrete thereon. New concrete shall be placed to the required grade and cured at least three days, after which the frame shall be seated in fresh mortar and brought to the proper grade. Masonry of bricks or concrete blocks shall be raised with new bricks, blocks, mortar or combinations thereof or with Portland cement concrete or with precast concrete risers, as conditions may require or permit. Concrete boxes may be lifted and placed on precast concrete box extensions on new brick or on cast-in-place concrete as may be suitable.

Mortar for building up existing masonry shall not be placed to a depth more than two inches. Concrete shall not be placed to a depth of less than 3 ½ inches. To conform to these requirements, the existing shells or walls of structures to be raised shall be cut down as necessary to provide space for the new construction.

Fabricated metal rings or plates may be furnished and used in the adjustment work, provided the metal and its fabrication design is at least equal to the pertinent characteristics of strength and support required of the covers or grates to be placed, that uniform bearing surfaces is assured, and positive provision is afforded against displacement when in service.

216.3.04 Lowering Tops of Masonry Structures: Where the top of an existing masonry structure construction is to be lowered, the masonry portion of the structure shall be exposed to required depth, cut off or removed to an elevation below that established for the bottom of the metal frame or cover which is to be reset on masonry and shall then be built up with mortar, concrete, brick, concrete blocks, precast concrete risers, or with metal rings or places to required elevation and top design. The joining of new material to old, the minimum thickness of new mortar and concrete, the limitations, the curing and other details shall be as specified in Subsection 216.3.03.

216.3.05 Adjustment Metal Structures: Metal inlets, valve boxes, meter boxes, monument boxes and other like structures shall normally be raised or lowered to grade by resetting the entire structure on a firm foundation. In the case of raising the structure to a point where it would not enclose or protect its contents, the Contractor shall add metal extensions of like design below the original structure. The Contractor may replace the structure with a new structure of adequate design as approved. Salvaged structures not re-used on the project shall remain the property of the Owner, unless otherwise specified.

216.3.06 Precast Manholes: Precast manholes within the area to be paved and those within the public right-of-way so designated will be adjusted to the finished street or sidewalk grade.

Minor manhole adjustment shall consist of the adjustments required with 24-inch diameter precast concrete risers and/or mortared joints.

Major manhole adjustment shall consist of the adjustments in cases where lowering or raising infringes into the cone section. The cone shall be removed and precast concrete risers of the proper diameter added or removed and the cone replaced. Twenty-four inch diameter risers may then be used to attain desired grade. In cases where the adjustment precludes the use or reuse of the cone, a precast, flat top slab shall be used. Twenty-four inch diameter precast risers may then be used to attain the desired grade.

The maximum height of 24-inch diameter raisers that may be used shall be 24 inches whether in minor or major adjustments. The Contractor shall adjust manhole tops after final paving by cutting a 5 foot square portion of the pavement, centered on the manhole casting, adjust the casting as required, place four number 4 rebars 4 ½ feet long, place Class 3300 Portland cement concrete, and finish according to Section 214.3.05.

Valve boxes and monument boxes shall be adjusted after paving as with manhole tops except that the portion of the pavement cut, removed and replaced with concrete shall be 30 inches square with number 4 rebars 2 feet long.

216.4.00 Measurement and Payment

216.4.01 Incidental: When not specified for payment, adjustment of incidental structures to grade will be considered incidental work for which no separate payment will be made.

216.4.02 Per Each: Measurement and payment for adjusting incidental structures to grade will be made on a per each basis for the number and type of structure adjusted to grade.

217 ILLUMINATION

217.1.00 Description
217.1.01 General

217.2.00 Materials
217.2.01 Portland Cement Concrete
217.2.02 Metal Reinforcement
217.2.03 Nuts, Bolts and Washers
217.2.04 Anchor Rods
217.2.05 Poles
217.2.05A Wood
217.2.05B Steel
217.2.05C Aluminum
217.2.06 Conduit
217.2.06A Metallic
217.2.06B Non-Metallic
217.2.06C Fittings
217.2.07 Electrical Wire
217.2.08 Direct Burial Cable
217.2.09 Splice Materials
217.2.10 Junction Boxes
217.2.10A Metallic
217.2.10B Concrete
217.2.11 Cabinets

217.3.00 Construction
217.3.01 Shop Drawings
217.3.02 Excavation
217.3.03 Portland Cement Concrete
217.3.04 Metal Reinforcement
217.3.05 Poles
217.3.05A Wood
217.3.05B Metal
217.3.06 Conduit
217.3.07 Electrical Service
217.3.08 Grounding
217.3.09 Wiring
217.3.10 Luminaries
217.3.11 Cabinets

217.4.00 Measurement and Payment
217.4.01 Lump Sum Basis
217.4.02 Incidental Basis

217 ILLUMINATION

217.1.00 Description: This section covers the work necessary for furnishing and installing illumination equipment and materials and removing or modifying existing facilities.

217.1.01 General: Electrical materials, equipment and workmanship shall conform to the requirements of the National Electrical Manufacturers Association, the Underwriters Laboratories, Inc., The National Electrical Code, the National Electrical Safety Code, the American National Standards Institute, and local ordinances as applicable.

217.2.00 Materials

217.2.01 Portland Cement Concrete: Portland cement concrete shall conform to the requirements of Section 503 and shall be Class 3000, unless otherwise specified.

217.2.02 Metal Reinforcement: Metal reinforcement shall conform to the requirements of Section 504. Bar reinforcement shall be Grade 40, unless otherwise specified.

217.2.03 Nuts, Bolts and Washers: Nuts, bolts and washers shall conform to the requirements of ASTM A325, and shall be galvanized in accordance with the requirements of ASTM A153, unless otherwise specified.

217.2.04 Anchor Rods: Anchor rods shall conform to the requirements of ASTM A449, A687 or A354, Grade BC, unless otherwise specified.

217.2.05 Poles

217.2.05A Wood: Wood poles shall be treated and shall conform to the requirements of ANSI specification 05.1 for Class 4 machine shaved Pacific Coast Douglas Fir, Southern Pine or approved equal. Treatment shall conform to the requirements of AWPA standards C1 and C4. Treatment shall be with oilborne pentachlorophenol with a minimum retention of 0.4 P.S.F. of dry salt. Poles shall be round, sound, well proportioned from butt to tip, without short kinks or crooks and of the dimensions specified by ANSI.

217.2.05B Steel: Steel pole material shall conform to the requirements of ASTM 283 Grade D, or approved equal. Steel plate material shall conform to the requirements of ASTM A36 or approved equal. Steel members shall be galvanized in accordance with the requirements of ASTM A123 unless otherwise specified.

217.2.05C Aluminum: Aluminum poles shall be fabricated from one piece of seamless aluminum alloy tapered tubing conforming to the requirements of ASTM B429, alloy 6061-T6.

217.2.06 Conduit

217.2.06A Metallic: Metallic conduit shall be galvanized rigid metal manufactured of mild steel conforming to the requirements of Underwriters Laboratory standard for Rigid Metal Conduit, publication UL 6.

Galvanizing shall conform to the requirements of ASTM A123.

217.2.06B Non-Metallic: Non-metallic conduit shall be heavy wall, extruded, rigid PVC (polyvinyl chloride) conforming to the requirements of Underwriters Laboratories, Inc. standard for Rigid Non-metallic Conduit, publication UL 651 for 90 degrees C wire rated conduit.

217.2.06C Fittings: Expansion fittings shall be weatherproof, malleable iron expansion head and body with a hot-dipped galvanized finish. Where plans do not specify an equipment ground wire in the conduit run, fitting shall be furnished with external bonding jumpers.

Expansion-Deflection fittings shall be watertight in conformance with NEMA 4 for rigid metallic conduit and shall be furnished with an integral bonding jumper.

Condulets shall be corrosion resistant with a zinc coating and lacquer dip finish. Covers for condulets shall be furnished with a moisture-proof gasket.

217.2.07 Electrical Wire: Electrical wire shall be standard copper meeting the requirements of ASTM B3 and ASTM B8, unless otherwise specified.

Insulation shall be 600-volt plasticized polyvinyl chloride, polyethylene or chemically cross linked polyethylene, conforming to the applicable portions of ASTM D2219, D2220, D1351, D2655 and D2656. Polyethylene compounds shall not be used where exposed to sunlight. Where TW grade is selected, it shall be "extra heavy wall" as follows:

No. 10 AWG and smaller, 4/64 inch thick.

No. 8 AWG to No. 2 AWG, 5/64 inch thick.

The wire size shall be as specified.

Color coding shall conform to the wiring color code specified.

Where certain colors are not readily available, the Contractor shall have the striping applied by commercial methods or apply the stripe using striping tape made for that purpose. Such striping shall be clearly visible for the length of wire wherever exposed.

217.2.08 Direct Burial Cable: Direct-burial cable shall be approved by the UL and labeled as Type USE. Type USE wire shall be solid or stranded conductors. Type UF cable may be substituted where permitted by the Code.

217.2.09 Splice Materials: Plastic electrical tape shall conform to the requirements of ASTM D2301, Type 2.

Friction tape shall conform to the requirements of ASTM D69. Electrical insulating varnish shall conform to the requirements of Federal Specification Mil-V-1137A, Type AW, Grade CA.

217.2.10 Junction Boxes

217.2.10A Metallic: Metallic junction boxes shall be constructed of cast iron or 1/8 inch thick nominal welded sheet steel. Sheet steel shall be of commercial quality. Metallic boxes and covers shall be hot-dip galvanized after fabrication in accordance with the requirements of ASTM A385 and ASTM A386. Each box shall have a cover gasket that will, with cover in place, for a NEMA 4 watertight fit. Covers shall be provided with brass, tamper-proof screws. Screw heads shall be recessed in the cover.

217.2.10B Concrete: Concrete junction boxes shall be precast concrete, water meter type, with cast iron cover held down by brass bolts and hexagon head nuts recessed in the cover.

217.2.11 Cabinets: Cabinets shall be constructed of 10 gauge sheet steel and shall be got-dip galvanized after fabrication in accordance with the requirements of ASTM A385 and ASTM A386, unless otherwise specified.

217.3.00 Construction

217.3.01 Shop Drawings: Shop drawings shall be submitted in accordance with the requirements of Subsection 104. Two sets of drawings will be required unless otherwise specified.

Shop drawings are construed to include brochures, technical bulletins, parts lists, instructions, wiring diagrams and working drawings providing information relative to the materials and equipment. It shall also include isocandela diagrams indicating the vertical light distribution, vertical control limits and the lateral light distribution classifications for each type of luminaire submitted for approval.

217.3.02 Excavation: It will be the responsibility of the Contractor to make the necessary contacts with utility companies and others who have underground facilities in the project area to determine locations of said facilities prior to making any excavations. Any damage to existing facilities shall be repaired by the Contractor at his own expense. Any underground pipes which are exposed and which become a part of a foundation shall be wrapped with a heavy grade tar or roofing paper prior to pouring the foundation.

Unless otherwise specified, the Contractor shall do all excavation, backfilling and resurfacing work, including removal and replacement of curbs, sidewalks, paved surfaces and other materials necessary to complete the work in accordance with the plans and specifications.

Excavation work shall conform to the applicable requirements of Section 301.

217.3.03 Portland Cement Concrete: Portland cement concrete work shall conform to the applicable requirements of Section 503.

Forms shall be rigid and shall be held in place until the concrete has set. Conduit ends and anchor bolts shall be placed in proper position and to proper height and shall be held in place by means of a template until the concrete has set.

217.3.04 Metal Reinforcement: Metal reinforcements shall conform to the applicable requirements of Section 504.

217.3.05 Poles

217.3.05A Wood: Wood poles shall be raked away from the direction of the applied load unless specified otherwise. Backfill around wood poles shall be thoroughly compacted.

Poles shall be set in soil and rock in accordance with the following table:

Length of Pole – Feet	Depth in Ordinary Soil – Feet	Depth in Rock – Feet
25	5.0	3.5
30	5.5	3.5
35	5.5	4.0
40	6.0	4.0
45	6.5	4.5
50	7.0	5.0
55	7.5	5.0
60	8.0	5.5
65	8.5	6.0
70	9.0	6.5
75	9.5	6.5

217.3.05A Wood, Continued

Where ordinary soil is underlaid with rock, the depth of hole in the rock portion is to be 0.7 of the depth required if it were soil, except that depth in rock should not be more than for the full rock setting.

Example:	50 ft pole – Soil 2 feet over rock	
	Required depth of hole for all soil setting	= 7.0 ft.
	Actual soil depth	= 2.0 ft
	Difference	= 5.0 ft
	X	0.7
	Depth of hole required in rock portion	= 3.5 ft
	Depth of hole through soil	= 2.0 ft
	Total depth of hole	= 5.5 ft

Where poles are located on other than level areas, the setting depths shall be measured from the low side of the hole.

217.3.05B Metal: Metal poles shall be erected on concrete foundations. Poles shall be erected with sufficient rake as to assume a substantially vertical position after all attachments and appurtenances are in place.

Leveling nuts shall be used on all poles. After all appurtenances have been attached, the pole will be leveled and grouted. A nominal ¾ inch diameter weep hole shall be left in the grout.

After leveling of poles and mast arms has been completed, any bolt protruding above the nut shall be cut off to provide a minimum height of 1 inch and a maximum height of 1 ¼ inches above the nut. Sharp edges due to cutting shall be filed smooth and the top of steel bolts shall be painted with two coats of zinc dust-zinc oxide primer as specified in Subsection 513.2.01D. Breakaway or frangible pole bases with embedded shafts shall be raked as necessary prior to the concrete foundation setting up.

217.3.06 Conduit: Metal conduit may be installed by jacking or drilling methods or the open trench method as the Contractor may elect.

If the Contractor elects to install by jacking or drilling, jacking or drilling pits shall be kept a minimum of two feet from the edge of the pavement wherever possible. Excessive use of water, such that the pavement might be undermined or subgrade softened, will not be permitted. If the Contractor elects to install conduit by the open trench method, the following conditions shall be met:

1. The trench shall be held to a practicable minimum width.

2. Cuts in the existing pavement shall be clean, straight, and vertical.

3. The trench shall be backfilled with granular materials to an elevation six inches below the top of the existing pavement and the top six inches of the trench shall be filled with asphalt concrete or Portland cement concrete paving materials compacted and finished to provide a smooth riding surface.

Installation of nonmetallic type conduit under existing pavement will be permitted if a hole larger than the conduit is predrilled and this conduit installed by hand.

Work shall be scheduled to permit placing of conduit prior to paving or landscaping operations.

If the trench is not backfilled the same day the conduit is placed, one end of the conduit run shall be left free until backfilling is started, or a nonmetallic conduit expansion joint shall be installed in the conduit run.

Metal conduit shall have a minimum of 24 inches of cover in roadway areas and 18 inches in other areas, except that 12 inches of cover will be permitted under sidewalks or paved, curbed medians.

Nonmetallic conduit shall have a minimum of 30 inches of cover in roadway areas and 18 inches in other areas.

Where a conduit bend is required, it shall normally be a standard factory bend. Where factory conduit bend sizes are not commercially available, or at those locations requiring special bends, bends performed on the job or in the shops shall have a radius of not less than six times the inside diameter of the conduit. The conduit shall be bent without crimping or flattening.

A galvanized steel conduit elbow shall be used where converting from an underground nonmetallic conduit to an aboveground run or extension.

217.3.06 Conduit, Continued

A conduit run must be continuous between any two poles or junction boxes. It shall be the option of the Contractor, at the Contractor's expense, to use conduit of larger size than specified. If used, it shall be for the entire length of the run from outlet to outlet. No reducer couplings will be permitted.

Conduits placed in foundations shall be so grouped that, with pole in place, it is possible to place an insulated bushing on each conduit end.

In the event the conduit run terminating in the pole base is of the metallic type, without a ground wire, the bushing shall be of the grounding type.

Where more than one piece of equipment is on the same pole, the Contractor shall place in the foundation the conduit for all electrical circuits as required by the plans and specifications.

Conduit entrances into junction boxes shall be drilled and tapped a minimum number of threads. Bosses shall be provided where the wall thickness is not sufficient for the minimum number of threads.

Conduit entering through the bottom of the junction boxes shall be located near the end walls to leave the major portion of the box clear. At all outlets, conduits shall enter from the direction of the run.

The ends of all conduits, whether shop or field cut, shall be reamed to remove burrs and rough edges. Cuts shall be made square and true so that the ends will butt or come together for the full circumference thereof. Slip joints or running threads will not be permitted for coupling conduit. When a standard coupling cannot be used for coupling metal type conduit, an approved threaded union coupling shall be used. The threads on all ferrous metal conduit shall be painted with rust preventative paint before couplings are made up. All couplings for metal conduit shall be tightened until the ends of the conduits are brought together, providing a good electrical connection throughout the entire length of the conduit run. Where the coating on metal conduit has been damaged to the extent that underlying metal is exposed, the damaged areas shall be painted with rust preventive paint.

All metal conduit ends shall be threaded and shall be capped with standard pipe caps until wiring is started. When caps are removed, the threaded ends shall be provided with conduit bushings. Nonmetallic conduit ends shall be capped until wiring is started.

Nonmetallic conduit fittings for connecting nonmetallic conduit to metal conduit shall be threaded on the metal conduit side.

217.3.06 Conduit, Continued

Conduit to be mounted on wood poles shall be mounted by use of two-hole malleable conduit clamps spaced a maximum of three feet apart, unless otherwise specified.

Conduit to be mounted on metal poles shall be mounted by use of ¾ inch stainless steel band straps. After steel bands have been drawn tight, the ends shall be cut and folded under to eliminate protruding edges. Bands shall be placed a maximum of three feet apart.

217.3.07 Electrical Services: As a part of each service installation, a meter base, approved by the serving utility, shall be furnished and installed by the Contractor unless otherwise specified.

Each service cabinet shall contain a solid copper neutral bus and the number and size of switches or circuit breakers as required by the plans or in the special provisions. All overcurrent protection and relays shall be installed in accordance with the plans using best common practice with materials and installation meeting all applicable requirements of the National Electrical Code.

The Contractor shall notify the local serving utility prior to installing any service equipment.

Circuit breakers shall be installed in the upper left side of the cabinet. The neutral block shall be installed in the lower part of the cabinet and all contactors shall be installed in the right side of the cabinet.

Circuit breakers shall be of the unenclosed molded case bolt-on type with end conductor terminals, suitable for surface mounting in the cabinet on a false back or bracket.

Circuit breakers shall conform to the Federal Specifications W-C-375a. All 100 ampere frame breakers shall be Class 2; 225 ampere frame breakers shall be Class 3; 400 ampere frame breakers shall be Class 4; 800 ampere frame breakers shall be Class 5.

Circuit breakers shall be labeled to indicate the circuit controlled. Labels shall be stamped plastic or metal as approved by the Engineer.

Overcurrent protection and relay equipment shall be installed according to the best common practice, with materials and installation meeting all applicable requirements of the National Electrical Code.

Contactors shall be “lighting” type specifically rated for tungsten, fluorescent and mercury lamp loads, electrically held.

217.3.08 Grounding: Metallic conduit, metal poles, nonmetallic conduit grounding wire, metallic junction boxes and cabinets shall be made mechanically and electrically secure to form a continuous system and shall be effectively grounded.

The Contractor shall ground the neutral conductor, the control cabinets and meter base to a grounding electrode in conformance with the National Electrical Code.

Ground rods shall be 5/8" x 8' nonrusting copper covered steel with bronze grounding wire clamp.

The grounding wire shall be bare No. 6 solid copper wire.

Grounding electrodes shall not have a resistance to ground of more than 25 ohms.

A grounding electrode shall be installed at each pole unless otherwise specified.

Ground rods shall be driven full length with the top approximately six inches below the finished grade. In rock locations that prevent full length driving, the Contractor may install, with the approval of the Engineer, a buried iron or copper plate.

On wood poles, all metallic components, mounted less than eight feet above ground surface shall be grounded.

217.3.09 Wiring: Wiring within cabinets and junction boxes shall be neatly arranged. Powdered soapstone, talc, or other approved lubricants shall be used when inserting conductors in conduit. Before pulling wires through underground conduit runs, the Contractor shall ascertain that the conduits are free from dirt or accumulation of moisture. Wire shall be installed so as to prevent damage to the insulation.

Prewired factory equipment shall be installed in accordance with the manufacturer's instructions. All wire and cable shall consist of copper conductors. Wire may be solid or stranded.

Any underground utility or underground circuits paralleling or crossing illumination circuits shall be physically separated as directed by the Engineer.

217.3.10 Luminaires: Luminaires shall be leveled in both the transverse and the longitudinal direction as recommended by the manufacturer. The luminaire and fitting shall provide for a minimum of three degrees adjustment in both transverse and longitudinal directions.

217.3.11 Cabinets: Cabinets shall be constructed so as to be weatherproof.

217.4.00 Measurement and Payment

217.4.01 Lump Sum Basis: When shown as a contract bid item, measurement and payment for illumination will be made on a lump sum basis as shown.

217.4.02 Incidental Basis: When not specified or shown as a pay item, payment for illumination shall be considered to be incidental to the work and no separate payment will be made.

218 UNASSIGNED

219 SIGNING AND PAVEMENT MARKINGS

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219 SIGNING AND PAVEMENT MARKINGS

219.1.00 Description: This section covers the work necessary for furnishing, fabricating, erecting and removal of signs and sign structures and furnishing and installing striping and pavement markings.

219.2.00 Materials

219.2.01 Portland Cement Concrete: Portland cement concrete shall conform to the requirements of Section 503 and shall be Class 3000, unless otherwise specified.

219.2.02 Metal Reinforcement: Metal reinforcement shall conform to the requirements of Section 504. Bar reinforcement shall be Grade 40, unless otherwise specified.

219.2.03 Wood Posts: Wood posts shall be surfaced four sides, free of heart center and of the grades specified.

219.2.03A Coast Douglas Fir and Southern Yellow Pine: Coast Douglas fir and Southern Yellow Pine posts shall be pressure treated after fabrication in accordance with AWPA standards C-1 and C-2 pertinent to the kind of preservative used. The minimum net retention shall be 0.5 lbs. for all preservatives except for chromated copper arsenate, which shall be 0.75 lbs. Minimum penetration shall be 3/8 inch.

The preservative shall be one or another of the following:

(a) Ammoniacal copper arsenate, ACA
(b) Chromated copper arsenate, CCA, Type A
(c) Fluor chrome arsenate phenol, FCAP, Type A or B
(d) Pentachlorophenol-volatile petroleum solvent (LPG) solution

The preservative to be used in treating cuts, abrasions and boltholes shall be the same as that originally used to treat the post, except if the post was originally treated with pentachlorophenol-volatile petroleum solvent (LPG) solution, cuts, abrasions and boltholes shall be treated with pentachlorophenol-mineral spirits solvent solution.

The strength of salt solutions used in treating cuts, abrasions, boltholes, etc., for field repair of pressure-treated surfaces shall be a concentrate not less than three times and not greater than five times the strength of the original treating solution.

219.2.03B West Coast Hemlock and Lodge Pole Pine: West Coast Hemlock and Lodge Pole Pine posts shall be pressure treated in conformance with the requirements of Subsection 219.2.03A.

219.2.03C Redwood: Redwood posts may be untreated.

219.3.04 Metal Sign Supports

219.2.04A Aluminum: Aluminum sign support materials shall conform to the requirements of the following:

Extruded Aluminum Shapes	ASTM B 221
Rolled or Extruded Structural Shapes	ASTM B 308
Aluminum Bars or Rods	ASTM B 211
Aluminum Sand Castings	ASTM B 26

219.2.04B Steel: Steel sign support materials shall conform to the requirements of Subsection 217.2.05B, unless otherwise specified.

219.2.05 Sign Material

219.2.05A Plywood: Plywood shall be Douglas fir, Grade B-B exterior or better, conforming to the requirements of "Product Standard PS-1 for Douglas Fir Plywood", published by the US Department of Commerce. Plywood shall be ¾ inch, high-density overlay, unless otherwise specified. Plywood signs will not be permitted unless specifically called for at certain locations.

219.2.05B Aluminum: Aluminum shall conform to the requirements of ASTM B209, allow 6061-T6, unless otherwise specified.

219.2.05C Reflective Sheeting: Reflective sheeting shall consist of spherical lens elements embedded within a transparent plastic having a smooth, flat outer surface. The sheeting shall be weather resistant and have a protected precoated adhesive backing and shall conform to the following requirements:

(1) Photometrics-Reflective sheeting shall have the following minimum brightness values at 0.2 degrees and 0.5 degrees and 1.5 degrees divergence angle expressed as average candlepower per foot – candle per square foot of material. Measurements shall be conducted in accordance with standard testing procedures for reflex reflectors of Federal Specification L-S-300A, "Sheeting and Tape, Reflective; Non-exposed Lens Adhesive Backing". The brightness of the reflective sheeting, totally wet by rain, shall not be less than 90 percent of the values in the following table:

219.2.05C Reflective Sheeting, Continued

MINIMUM BRIGHTNESS VALUES OF REFLECTIVE SHEETING						
	Silver-White			*Yellow*		
Divergence Angle (degrees)	0.2	0.5	1.5	0.2	0.5	1.5
Angle of Incidence –4	70.0	30.0	4.0	50.0	25.0	5.0
Angle of Incidence 40	14.5	8.5	1.5	11.5	7.0	1.5
	Green			*Blue*		
Divergence Angle (degrees)	0.2	0.5	1.5	0.2	0.5	1.5
Angle of Incidence –4	9.0	4.5	1.0	4.0	2.0	0.6
Angle of Incidence 40	1.8	1.0	0.2	0.9	0.4	0.08
	Red			*Orange*		
Divergence Angle (degrees)	0.2	0.5	1.5	0.2	0.5	1.5
Angle of Incidence –4	14.5	7.5	1.0	25.0	13.5	1.5
Angle of Incidence 40	3.0	1.5	0.3	1.0	0.8	0.1

(2) Color – Acceptability of the diffuse day color of the reflective sheeting will be determined by the Engineer by visual comparison to standard color chips.

(3) Adhesive – Reflective sheeting shall be adhered by a precoated adhesive which shall have no staining effect on the sheeting and shall be mildew and vandal resistant.

(4) Film:

(4-a) General – Reflective sheeting shall be sufficiently flexible to be easily cut to shape. Conditioned for 48 hours, the tensile strength shall be 5 to 20 lbs/in width when tested in accordance with ASTM D828. Following liner removal, a 9” square shall not shrink in any dimension more than 1/32” in ten minutes nor more than 1/8” in 24 hours at 75 degrees F and 50 percent relative humidity.

The sheeting when applied according to manufacturer’s recommendation to cleaned and etched .020 x 2” x 8” aluminum, conditioned (24 hours) and tested at 72 degrees F and 50 percent relative humidity shall be sufficiently flexible to show no cracking when bent around a ¾” mandrel.

If required for application, the sheeting may be pre-perforated with holes not greater than 0.02 inches in diameter. The perforations are to be approximately 0.4 inches apart in rows which are approximately 1.5 inches apart.

219.2.05C Reflective Sheeting, Continued

(4-b) Surface – The sheeting surface shall be smooth and flat, facilitate cleaning and wet performance and exhibit 85 degrees glossmeter rating of not less than 40 (ASTM D523). The sheeting surface shall be readily processed and compatible with recommended transparent and opaque process colors and show no loss of the color coat with normal handling, cutting and application.

The sheeting shall permit cutting and color processing at temperatures of 60 degrees – 100 degrees F, and relative humidities of 20-80 percent. The sheeting shall be heat resistant and permit force curing without staining of unapplied sheeting at temperatures up to 150 degrees F and up to 200 degrees F on applied sheeting. Cleaning shall be done in accordance with the manufacturer's recommendation.

(4-c) Lens Elements – The reflective sheeting shall contain stable and durable spherical lens elements.

(5) Durability – Processed and applied in accordance with recommended procedures, the reflective material shall be weather resistant, and following cleaning shall show (1) no appreciable discoloration, cracking, crazing, blistering or dimensional change and (2) not less than 80 percent of the specified minimum brightness values when exposed to 1,200 hours Atlas Twin Arc Weathering in accordance with ASTM D822. The sheeting surface shall be capable to being readily refurbished by cleaning and clear over-coating in accordance with the manufacturer's recommendations.

(6) Certification – The Contractor shall furnish certification from the manufacturer that all reflective sheeting furnished for the project meets the above requirements, except that certification for Orange will be required only upon specific request of the Engineer.

219.2.05D Nonreflective Sheeting: Nonreflective sheeting shall be durable, gloss plastic film. The sheeting shall be weather resistant and have a protected precoated adhesive backing and shall conform to the following requirements:

(1) Color – Acceptability of the color will be determined by the Engineer by visual comparison by standard color chips. The Contractor shall submit to the Engineer for testing a 4" x 4" sample of the background color for each color called for.

(2) Adhesive – Nonreflective sheeting shall be adhered by a pre-coated adhesive which shall have no staining effect on the sheeting and shall be mildew and vandal resistant.

219.2.05D Nonreflective Sheeting, Continued

(3) Film:

(3-a) General – Nonreflective sheeting shall be flexible and easily cut to shape. The minimum tensile strength shall be 5 lb/inch width.

(3-b) Surface – The sheeting surface shall be smooth and flat, facilitate cleaning and wet performance. The sheeting surface shall be readily processed and compatible with recommended transparent and opaque process inks.

The sheeting shall permit cutting and color processing at minimum temperatures of 60 degrees F. The sheeting shall be heat resistant and shall permit force curing of applied sheeting at temperatures up to 150 degrees F. The sheeting surface shall be solvent resistant. Cleaning shall be done in accordance with the manufacturer's recommendation.

(4) Durability – Processed and applied in accordance with recommended procedures, the material shall be weather resistant and following cleaning shall show no appreciable discoloration, cracking, crazing, blistering or dimensional change.

The sheeting surface shall be capable of being readily refurbished by cleaning and clear over-coating in accordance with the manufacturer's recommendations.

(5) Finish – The finishing clear coat applied to sign faces shall be compatible with the sheeting and shall conform to the requirements of the manufacturer of the sheeting.

(6) Certification – The Contractor shall furnish certification from the manufacturer that the sheeting furnished for use on the contract meets all the above requirements.

219.2.05E Porcelain Enamel Finish: Porcelain enameled signs shall have a base or ground coat, designed to develop maximum adherence, applied to all surfaces which are to be porcelainized. At least one separately fired cover coat, in addition to the base or ground coat, shall be applied to all surfaces being porcelainized. Reflector button legends fabricated from aluminum shall have one enamel cover coat applied to the surfaces prior to being porcelainized.

All porcelainized enamel shall conform to the Porcelain Enamel Institute's Specifications ALS 105.

219.2.05E Porcelain Enamel Finish, Continued

The porcelain enamel sign faces shall have a permanent imprint on the back of each individual panel which shall give the year of manufacture, the manufacturer's name and the manufacture's lot number.

(1) Gloss – Porcelain enameled sign backgrounds shall have a gloss reading of 50-70 units at an angle of 45 degrees when measured on the Photovolt meter. Porcelain enameled sign legends shall have a gloss reading of 60-80 units at an angle of 60 degrees when measured on the Photovolt meter. Tests for gloss shall be in complete conformance to ASTM C346.

(2) Surface – The porcelain enamel on all sign faces and legends shall be free of blemishes in the coating. Visual defects and manufacturing blemishes in the porcelain enamel surface will be cause for rejection.

(3) Test – Porcelain enamel finished will be tested by the Engineer in accordance with ASTM C283. The porcelain enamel finish, when tested, shall show a weight loss not greater than 20.0 mg per square inch. If any sample tested exceeds this weight loss, it shall be considered sufficient cause for rejection of all porcelain enamel panels, or that color, supplied under the contract.

(4) Test Samples – Samples shall be furnished to the Engineer for the above tests which shall be a minimum size of 12" x 12" and shall be production run samples. One sample of each color shall be taken for each 500 square feet of production.

219.2.05F Hinac Finish: Hinac coating shall be a single fired coat 0.35 mil to 0.80 mil in total thickness. All hinac shall be applied in accordance with the recommendations of the manufacturer of the coating materials. Subsequent to curing, the hinac coating shall contain a chromate matrix, not as a pigment and whereby at least 65 percent of the chromium is present as trivalent chromium.

The hinac sign faces shall have a permanent imprint in the back of each individual panel which shall give the year of manufacturer, the manufacturer's name and the manufacture's lot number.

The hinac coating shall be free of blemishes. Visual defects and manufacturing blemishes in the surface will be cause for rejection.

219.2.06 Hardware: Bolts, nuts and washers used to fabricate and erect signs shall be aluminum alloy, stainless steel or galvanized steel. Aluminum for bolts and nuts shall conform to the requirements of ASTM B211, alloys 2024-T4 or 6061-T6 as the Contractor may elect.

219.2.06 Hardware, Continued

Aluminum washers shall conform to the requirements of ASTM B209, alloy Alclad 2024-T4. Stainless steel shall conform to the requirements of ASTM A320. Galvanized steel bolts, nuts and washers shall be medium steel. Galvanizing of all steel hardware shall be done in conformance with ASTM A153.

Stainless steel-neoprene washers shall consist of a washer or each material effectively bonded together so that the bond is not broken during installation and tightening of the bolt. These washers may be used in lieu of solid metal washers.

All mounting hardware shall be of the design and type shown, or if not shown, shall be of such sizes and kinds as are consistent with first-class workmanship.

Blind rivets shall be aluminum alloy conforming to the requirements of ASTM B316, Alloys 5052 and 5056 being representative of acceptable alloys. Blind rivets used for attachment of legend shall be of the design strength and type recommended by the manufacturer. Blind rivets used to attach sign panels to closure strips or wind beams shall be either anodized or coating with hinac the same color as the sign background.

219.2.07 Pavement Marking Material

219.2.07A Thermoplastic, Type A: Type A thermoplastic material shall contain not less than 20 percent by weight of glass spheres and not less than 12 percent of titanium dioxide.

The pigment, beads and filler shall be well dispersed in the resin. The material shall be free from all skins, dirt, foreign objects and other deleterious substances. The material shall be of such composition that it will not bleed, stain or discolor when applied to pavements.

The glass beads used in the formulation shall have a refractive index of not less than 1.50 when tested by the liquid immersion method at 25 degrees C; shall consist of 75 percent minimum by count of water white true spheres; shall be free from air inclusions and shall have the following grading:

Sieve Sizes	*Percentage Passing*
No. 40	95 Minimum
No. 70	10 Maximum

Specific Gravity – The specific gravity of the material as received shall not exceed 2.12 when tested in accordance with ASTM D153, Method A. The immersion liquid shall be kerosene and the test sample shall be ground to pass a No. 30 sieve to perform the specific gravity test.

219.2.07A Thermoplastic, Type A, Continued

Physical Characteristics – The material shall not exude fumes which are toxic, obnoxious or injurious to persons or property when it is heated to a temperature range specified by the manufacturer for application. When material shall remain stable when held for four hours at the said temperature range, or when reheated repeatedly after cooling to ambient temperature.

The temperature-viscosity characteristics of the material shall remain constant throughout repeated reheatings and shall show like characteristics from batch to batch. There shall be no obvious change in color of the material as a result of repeated reheating for from batch to batch.

When applied at the specified temperature range and thickness, the material shall set to bear traffic in not more than 2 minutes when the air temperature is 50 degrees F and not more than 10 minutes when the air temperature is 90 degrees F.

The material shall readily extrude at 400 degrees F from equipment used to produce a cross section 1/8 inch to 3/16 inch thick, which shall be continuous and uniform in shape and shall have clear and sharp dimensions.

After heating for four hours at 400 degrees F, the material shall conform to the following requirements for flowability:

Four hundred grams of the material shall be stirred rapidly for 10 seconds in a cylindrical pint can approximately 3 ¾ inches high and 3 5/16 inches in diameter, with the rim removed. When poured from the can tipped at a 45 degree angle, the residue which will not flow out of the can shall not exceed 20 percent of the original weight. The apparatus used for holding the pouring can shall provide point contact with the can to prevent heat loss.

After heating for four hours at 450 degrees F, the material shall conform to the following requirements:

Reflectance – The daylight luminous reflectance of the material shall not be less than 75 percent relative to magnesium oxide after cooling to 77 degrees when tested in accordance with ASTM E97.

Impact Resistance – The impact resistance shall be not less than 10 inch-pounds at 77 degrees F after the material has been cast into bars on 1 inch cross-sectional area and 3 inches long and placed with 1 ¼ inches extending above the vise in a cantilever beam (Izod type) tester using the 25 inch-pound scale. A description of the instrument is shown in ASTM D236, except that the striking edge of the pendulum shall be 1.058 inches above the top surface of the vise.

219.2.07A Thermoplastic, Type A, Continued

Bond Strength – When two 2" x 3 ½" x 7" Portland cement concrete blocks at a temperature of 77 degrees F, are cemented together on the 3 ½" x 7" faces with a 1/16" to 1/8" layer of the material and tested in accordance with ASTM C321, the bond strength at 77 degrees F shall be not less than 150 pounds per square inch. Failure in adhesion shall be a maximum of 50 percent of the total area of the break. The remainder of the break shall be on cohesion or in concrete failure. The faces of the concrete blocks to which the material is applied shall be first abrasive blast cleaned to remove laitance and foreign material and then primed with a Buna N Rubber and Phenolic Resin Primer conforming to the following:

Composition:

Buna N Rubber/Phenolic Resin Ratio. Between 60/40 and 70/30 Solids, percent: 9-11.

Composition of Solvent	*Specifications*	*Percent by Weight*
Methyl Ethyl Ketone	TT-M-261	50
Methyl Isobutyl Ketone	TT-M-268	20
Toluene	TT-T-548	20
Di-Isobutyl Ketone	--	5
Xylene	TT-X-916	5

Yellowness Index – The yellowness index shall not exceed 0.12 after the sample is cooled to 77 degrees F when tested in accordance with Federal Test Method Standard No. 141, Method 6131.

Low Temperature Street Resistance (Cracking) – The material shall not crack or fail to adhere to the pavement when tested as follows:

A 1/8 inch thick layer of the material shall be applied to a one foot square surface of a Portland cement concrete block 4 inches thick which surface has been first abrasive blast cleaned to remove all laitance and foreign material and then primed with the primer specified in this subsection. The concrete block to which the material has been applied shall be placed in a freezer chest or other insulated cold compartment and maintained at 15 degrees F for 24 hours. The material shall be examined immediately after the concrete block is removed from the cold compartment.

219.2.07B Thermoplastic, Type B: Type B thermoplastic material shall contain not less than 14 percent or more than 18 percent by weight of glass spheres; not less than 38 percent or more than 42 percent pigments; and not less than 40 percent or more than 46 percent plastic and plasticizers.

219.2.07B Thermoplastic, Type B, Continued

The pigment shall include titanium dioxide. The glass spheres shall be colorless, clean and transparent and free from milkiness with a refractive index not less than 1.5 when tested by the liquid immersion method at 25 degrees C and shall consist of 75 percent minimum by count of glass spheres retained on a 140 mesh US Standard Screen.

The material shall be not less than 0.06 inch thick, excluding the precoated adhesive, with clear cut and true edges.

Physical Characteristics – The material shall be of such a structure that at a temperature of 80 degrees F, a piece of 3" x 6" placed on a 1 inch diameter mandrel may be bent over the mandrel until the end surfaces are parallel and 1 inch apart. There shall be no fracture lines apparent in the uppermost surface by visual inspection.

Upon removing the material from the mandrel, the material shall return to its original flat condition in not more than eight hours at a temperature of 80 degrees F on a smooth, flat, glass surface.

The material shall have tensile strength of 300 psi plus or minus 100 psi when tested in accordance with ASTM D638. Elongation shall not be greater than 50 percent utilizing a 6"x 12" material sample. The rate of pull of the test shall be 0.25 inch per minute and shall be conducted at a temperature of 80 degrees F.

The material shall have a minimum 60 degrees gloss of ten gloss units as measured according to the method described in ASTM D523.

The maximum loss in weight of the material shall not exceed 0.25 gram in 500 revolutions when abraded according to Federal Test Method Standard No. 141 (Method 6192) using H-8 calibrated wheels, with 1000-gram load on each wheel.

The material shall show no noticeable slipping or fracture of the adhesive coating when subjected to the following lateral shock-load test:

A 3" x 6" sample shall be applied to a 3" x 6" extra-coarse carborundum emery cloth or its equivalent so that a 3" x 3" overlap occurs. The application shall be such that a pressure of 50 psi is applied on the sample for 30 second. The ends shall each be applied on the sample for 30 second. The ends shall be clamped and with one end in a fixed position, a sudden load of 50 pounds shall be applied vertically to the other end. Upon immediate load release and examination, there shall be no noticeable slipping or fracture of the adhesive coating. This test shall be conducted at a temperature of 80 degrees F.

219.2.07B Thermoplastic, Type B, Continued

The precoated adhesive backing shall be pressure sensitive and shall remain stable with a controlled degree of flexibility and flow. A 3" x 6" sample shall withstand a static load of four pounds for a period of 30 minutes, as described in ASTM D816 (Method A). The slippage between the sample and the emery cloth shall not exceed 1 inch. This test shall be conducted at a temperature of 80 degrees F.

The material shall pass the following adhesive shear strength test according to ASTM D638 as modified below. The sample shall be prepared as follows:

Samples 6" x 1" shall have applied to the adhesive face of a 1" x 3" piece of carborundum extra-coarse emery cloth or its equivalent so that there is one square inch overlap. A pressure of 50 psi shall be applied over this area for a period of 30 seconds. Load is applied by gripping each end of the test piece in a suitable tensile test machine such as a Dillon or Scott Tester. The average of the load required to break the adhesive bond from three such tests shall not be less than one-fourth of the load required to break a 1 inch strip of the sample. The speed of testing shall be 0.25 inch per minute and the test shall be conducted at a temperature of 80 degrees F.

219.2.07C Primers: The primer used on concrete or asphalt pavements shall be a material designed to increase the bond of the thermoplastic material to the pavement. The primer shall be compatible for use with concrete and thermoplastic material or asphalt and thermoplastic material.

219.2.07D Striping Paint: Striping paint shall be the alkyd resin type, ready-mixed white or yellow, Type I, II, or III, conforming to the requirements of AASHTO M248. Glass beads shall conform to the requirements of AASHTO M247, Type I or II. The type of paint, paint color and type of glass beads to be used shall be as specified.

219.3.00 Construction

219.3.01 Shop Drawings: Shop drawings shall be submitted in accordance with the requirements of Subsection 104. Two sets of drawings will be required, unless otherwise specified.

219.3.02 Portland Cement Concrete: Portland cement concrete work shall conform to the applicable requirements of Section 503. Forms shall be rigid and shall be held in place until the concrete has set. Conduit ends and anchor bolts shall be placed in proper position and to proper height and shall be held in place by means of a template until the concrete has set.

219.3.03 Excavation: Excavation work shall conform to the applicable requirements of Section 301.

219.3.04 Metal Reinforcement: Metal reinforcement shall conform to the applicable requirements of Section 504.

219.3.05 Posts: Posts shall be of the length specified and set to the depths specified.

219.3.06 Signs: Sign backgrounds shall be either reflectorized or nonreflectorized as specified. The colors used for sign backgrounds shall match the "color chips" in the AASHTO Manual for Signing and Pavement Marking of the National System of Interstate and Defense Highways "Standard Interstate Colors". Where required, the colors shall conform to the color coordinates specified. If color coordinates are not specified, the color sample called for shall be subject to visual matching to determine the acceptability of the color.

In addition, all colors for which color coordinates are specified shall be subject to visual matching by the Engineer to determine that all panels in any one sign match.

219.3.06A Plywood: Plywood sign fabrication shall be done with saw blades that do not tear plywood grain and all holes shall be cut clean and uniform. Splicing will not be permitted unless called for in the Special Provisions. Mounting holes shall be located so that the mounting hardware will not cover any portion of the legend. Signs having a vertical dimension of 48 inches or greater shall have three mounting holes. The minimum number of mounting holes for any one plywood sign shall be two.

After fabrication and before the application of reflective or nonreflective sheeting (if required), all edges shall be sealed with plywood sealer that is tinted to match the color of the panel overlay material. Where reflective or nonreflective sheeting is to be applied, the surface of the face side of the sign shall be prepared in conformance with the recommendations of the sheeting manufacturer.

219.3.06B Aluminum: Aluminum signs shall be cut to size and shape and shall be free of buckles, warps, dents, cockles, burrs and defects resulting from fabrication.

Before application of reflective or nonreflective sheeting, the entire surface of the sign shall be treated with a conversion film. Such treatment shall be in strict conformance with the recommendations of the manufacturer of the sheeting.

Mounting holes – The number, size and location of mounting holes is dependent upon the sign and support to which it is attached as follows:

Signs mounted on wood and metal posts shall be provided with at least two mounting holes. Signs having a vertical dimension of 48 inches or greater shall have three mounting holes. The third mounting hole shall be fabricated near the center of the sign. Mounting holes shall be located so that the mounting hardware will not cover any portion of the legend unless otherwise specified.

219.3.06C Reflective and Nonreflective Sheeting: The application process shall be in complete conformance with the recommendations of the sheeting manufacturer. Splicing of sheeting will be permitted only at locations specified.

The sheeting for aluminum panel or plywood panel (if permitted) signs shall be applied in such a manner that the panels may be assembled so that there will be no noticeable difference, day or night, in color at the panel butt joints.

219.3.07 Pavement Marking

219.3.07A Thermoplastic, General: Prior to application of the thermoplastic pavement markings, the pavement shall be cleaned to remove old pavement markings, paint, recently applied curing compounds and all loose material. Paint or curing compounds shall be removed as the Contractor elects, either by sandblasting or the use of chemical strippers. The method used shall not adversely affect the pavement surface to a depth or of a width greater than that required to afford adequate bond between the pavement and thermoplastic pavement markings. The cleaning operation shall remove all material which would reduce the bond of the thermoplastic to the pavement. All existing painted pavement markings shall be removed and the area shall pass inspection of the Engineer prior to application of the primer coat.

After the pavement surface is cleaned, a primer shall be applied to the area receiving the thermoplastic pavement markings as required to properly bond the materials. The primer application shall effect a continuous, solid film over the pavement surface. The primer shall be applied in strict conformance to the recommendations of the primer manufacturer and the manufacturer of the thermoplastic material.

The thermoplastic pavement markings shall be applied to an initially dry pavement surface after sufficient time has elapsed to insure the primer has adequately dried and further curing of the primer will not adversely affect the thermoplastic.

219.3.07B Thermoplastic, Type A: Type A hot-laid thermoplastic material shall be applied to the pavement by an extrusion method. The pavement temperature at the time of application shall be as recommended by the manufacturer of the thermoplastic material. The width of pavement markings specified shall be applied in one or two applications. If the stripe width is obtained by two applications, they shall be made so that the adjacent applications fuse together with no apparent overlap or gap permitted. When completed, the pavement marking shall not be less than 1/8 inch nor more than 3/16 inch in thickness, exclusive of projecting surface-applied glass beads, and it shall have a continuous and uniform cross-sectional configuration with the upper surface slightly arched. The thermoplastic material shall be installed in a molten state at a temperature between 380 degrees and 420 degrees F. The ambient air temperature shall be a minimum of 50 degrees F during application.

219.3.07B Thermoplastic, Type A, Continued

Glass beads shall be separately applied to the material as it is being placed.

The glass bead dispenser shall be so designed and operated as to uniformly and properly distribute the glass beads upon the Type A material so that objectionable irregularities in the material's reflectorization will not be present. This independent application of beads shall be applied uniformly at the rate of one pound for each 50 square feet of pavement marking. The dispenser shall be located about 18 inches behind and controlled simultaneously with the pavement marking extrusion die. The beads shall be embedded in the pavement marking to a depth of at least one-half their diameters.

Workmanship shall be first-class throughout the project. Only competent workers experienced in placing thermoplastic shall be employed.

219.3.07C Thermoplastic, Type B: Type B thermoplastic material shall be applied to the pavement by a machine capable of applying the pressure-sensitive plastic material uniformly over the various widths as required. At application, the ambient air temperature shall be at least 60 degrees F. When completed, the pavement markings shall not be less than 0.06 inch in thickness, exclusive of any precoated adhesive material and shall have a uniform cross-sectional configuration. If the required pavement marking is 12 or more inches wide, it may be fabricated from 12 inch or 6 inch wide material. Longitudinal splices will be permitted, provided the gap at any splice does not exceed 1/16 inch.

Application of thermoplastic pavement markings shall be performed in a professional manner. Any error shall be corrected prior to continuing the application. Excess thermoplastic material left on the pavement shall be cleaned up prior to continuation of the operation.

219.3.07D Painting: The area to be painted shall be dry, clean and free of loose particles. The paint machine shall be of the spray type capable of satisfactorily applying the paint under pressure with a uniformity of feed through nozzles spraying directly upon the pavement. Each machine shall be capable of applying two separate stripes, either solid or skip, at the same time. Each paint tank shall be equipped with a mechanical agitator. Each nozzle shall be equipped with satisfactory cutoff valves which will apply broken or skip lines automatically. Each nozzle shall have a mechanical bead dispenser that is located directly behind and synchronized with the spray nozzle which will distribute the beads in a uniform pattern at the rate specified. Each nozzle shall also be equipped with suitable line guides consisting of metallic shrouds or air blasts.

The Contractor shall be responsible for preliminary spotting of the lines to be painted and approval of the Engineer must be obtained before striping may begin.

219.3.07D Painting, Continued

Stripes shall be four inches wide. Broken line segments (Dashed or Skip Traffic Stripe) shall be 16 feet in length with 25-foot gaps, or 4 feet in length with 4-foot gaps as shown on the drawings.

The paint shall be thoroughly mixed prior to application and shall be applied when the air temperature is above 40 degrees F.

The minimum rate of application for four-inch width solid traffic stripes shall be 16.5 gallons per miles. For broken traffic striping, the minimum rate of application shall be 6.2 gallons per mile.

For narrower or wider striping, paint shall be applied at a rate in proportion with the four-inch stripes.

219.4.00 Measurement and Payment

219.4.01 Lump Sum Basis: Measurement and payment for signing, striping and pavement markings will be made on a lump sum basis as shown.

219.4.02 Incidental Basis: When not shown as a pay item, payment for signing, striping and pavement markings shall be considered to be incidental to the work and no separate payment shall be made.

219.4.03 Unit Price Basis

219.4.03A Signing and Pavement Markings: Measurement and payment for signing and pavement markings will be made on a unit price per square foot basis as shown for the number, type and kind of signing and pavement markings furnished and installed.

219.4.03B Striping and Pavement Markings: Measurement and payment for striping pavement markings will be made on a unit price per lineal foot basis for the type of striping and pavement markings furnished and installed.

220 SAFETY STRUCTURES

220.1.00 Description

220.2.00 Materials
220.2.01 Metal Beam Rail
220.2.02 Guardrail Posts
220.2.02A Concrete
220.2.02B Steel
220.2.02C Wood
220.2.03 Guardrail Blocks
220.2.04 Hardware
220.2.04A Pins and Dowels
220.2.04B Anchor Cable
220.2.04C Anchor Rods
220.2.04D Nuts, Bolts and Washers
220.2.05 Premolded Joint Filler
220.2.06 Grout
220.2.07 Portland Cement Concrete
220.2.08 Asphalt Concrete
220.2.09 Impact Attenuators
220.2.09A Liquid Cell
220.2.09B Sand Cell
220.2.10 Guide Posts
220.2.10A Posts
220.2.10B Reflector Targets
220.2.10C Reflectors

220.3.00 Construction
220.3.01 Guardrail
220.3.02 Concrete Barrier
220.3.03 Impact Attenuators
220.3.04 Guide Posts

220.4.00 Construction
220.4.01 Guardrail
220.4.02 Guardrail End Pieces
220.4.03 Guardrail Terminal Anchors
220.4.04 Median Barrier
220.4.05 Shoulder Barrier
220.4.06 Impact Attenuators
220.4.07 Guide Posts

220 SAFETY STRUCTURES

220.1.00 Description: This section covers the work necessary for the construction of guardrail, median, shoulder barrier, impact attenuators, guide posts and other safety structures.

220.2.00 Materials

220.2.01 Metal Beam Rail: Metal beam rail shall be galvanized steel conforming to the requirements of AASHTO M180, Class A, Type 1, unless otherwise specified.

220.2.02 Guardrail Posts

220.2.02A Concrete: Concrete shall be Class 4500 and shall conform to the requirements of Section 503. Metal reinforcement shall be bar reinforcement or welded wire fabric conforming to the requirements of Section 504.

220.2.02B Steel: Steel posts shall conform to the requirements of ASTM A36 and shall be galvanized in accordance with the requirements of ASTM A123.

220.2.02C Wood: Wood posts shall be pressure treated Coast Douglas Fir, West Coast Hemlock, Southern Yellow Pine, or Lodgepole Pine.

Posts shall be surfaced four sides. Pressure treatment shall conform to the requirements of AASHTO M133 and shall be one of the following:

A. Creosote
B. Creosote-petroleum solution
C. Pentachlorophenol

Posts shall be incised on all faces a minimum depth of ¾ inch and shall be treated in conformance with the American Wood Products Association Standards C1 and C2, except the minimum retention (empty-cell process) of preservative shall be 10 pounds per cubic foot of wood (0.50 pound pentachlorophenol dry salt). The minimum penetration shall be not less than ¾ inch and 90 percent of sapwood.

220.2.03 Guardrail Blocks: Guardrail blocks shall be of wood conforming to the requirements of Subsection 220.2.02C, except for the following:

Incising will not be required and the minimum retention of preservative, determined by assay, shall be 6 lbs. per cubic foot of wood for creosote or creosote-petroleum solution or 0.30 lb. per cubic foot of pentachlorophenol dry salt. The preservative shall penetrate not less than 90 percent of sapwood, and shall penetrate not less than two inches longitudinally from block ends and bolt holes.

220.2.04 Hardware

220.2.04A Pins and Dowels: Pins and dowels shall conform to the requirements of ASTM A36 and shall be galvanized in conformance with the requirements of ASTM A153.

220.2.04B Anchor Cable: Anchor cable shall conform to the requirements of AASHTO M30, and shall be Type 1, unless otherwise specified.

220.2.04C Anchor Rods: Anchor rods shall conform to the requirements of ASTM A36 and galvanized in accordance with the requirements of ASTM A123.

220.2.04D Nuts, Bolts and Washers: Nuts, bolts, and washers shall be galvanized steel and of a quality to develop the specified strength of the splices and connections. Galvanizing shall conform to the requirements of ASTM A153.

220.2.05 Premolded Joint Filler: Premolded joint filler shall conform to the requirements of AASHTO M153 or AASHTO M213.

220.2.06 Grout: Grout shall conform to the requirements of Section 503.

220.2.07 Portland Cement Concrete: Portland cement concrete shall conform to the requirements of Section 503.

220.2.08 Asphalt Concrete: Asphalt concrete shall conform to the requirements of Section 211.

220.2.09 Impact Attenuators

220.2.09A Liquid Cell: Cells shall be vinyl plastic specially formulated from high molecular weight homopolymer vinyl resins combined with totally primary plasticizing systems. The plasticizers shall be chosen so as to produce a vinyl possessing high strengths and remaining flexible in both high and low temperatures. Ultra-violet stabilizers, heat stabilizers, anti-bacteriological agents and other additives shall be utilized to give maximum protection and long life in outdoor environments.

Cells shall have a nominal outside diameter of six inches with ¼ inch thick walls. The length shall be as specified. Cells shall be capped at both ends and furnished with an orifice near one end in order to facilitate filling and controlled release upon impact. The orifice diameter shall be as specified.

Metal shall be galvanized steel conforming to the requirements of ASTM A36, unless otherwise specified. Galvanizing shall conform to the requirements of ASTM A123.

220.2.09A Liquid Cell, Continued

Fender panels shall be fiberglassed plywood. The grade and thickness of plywood shall be as specified.

Interior panels shall be of plastic overlaid plywood. The grade and thickness shall be as specified.

220.2.09B Sand Cell: Cells shall be of high density expanded polyethylene. Metal and panels shall conform to the requirements of Subsection 220.2.09A, unless otherwise specified.

220.2.10 Guide Posts

220.2.10A Posts: Guide posts shall be of galvanized steel having a minimum yield strength of 40,000 psi and a minimum ultimate strength of 70,000 psi. Galvanizing shall conform to the requirements of ASTM A123.

220.2.10B Reflector Targets: Reflector target material shall be aluminum alloy conforming to the requirements of ASTM B209 and of a series suitable for enameling by continuous roller or other acceptable method. The aluminum sheets from which targets are fabricated shall have a nominal thickness of 0.050 inch subject to standard manufacturer's tolerances.

Target surfaces shall be cleaned and prepared for enameling in accordance with one of the appropriate methods conforming to the requirements of ASTM D1730.

Enamel shall be Class B baking enamel conforming to the requirements of Federal Specification TT-E-489C or acceptable equivalent.

Enameling shall consist of two coats of enamel, each coat being properly baked and with the final coat baked to a hard finish, or a coat of an inhibitive and compatible primer having a dry film thickness of about 0.3 mil, followed by one heavy coat of enamel baked to a hard finish. The baked enamel shall be uniform in color, smooth and free from flow lines, streaks, blisters or other surface imperfections.

The baked enamel finish shall be white or standard interstate yellow, as specified.

220.2.10C Reflectors: Reflectors shall consist of sealed, acrylic plastic, prismatic reflex units approximately three inches in diameter with centered mounting hole, conforming to the following requirements:

The reflective color or reflectors shall be either white or standard interstate yellow to correspond with the color of the target member on which they are mounted.

220.2.10C Reflectors, Continued

The reflector lens shall be of a methacrylate compound conforming to the requirements of ASTM D788, Grade 8.

Each reflector shall have a clear and transparent face, with a minimum of 6 square inches of reflective area (lens) sealed with either a metallic foil back or an opaque back of material identical to the face, fused to the lens around its perimeter and mounting hole to form a unit permanently sealed against dust, water and water vapor. When the back is a metal foil it shall be protected with an aluminum or tough plastic casing covering the back and edges of the lens. The mounting hole in the lens shall have an aluminum grommet expanded therein, or when the lens has a protective casing the grommet may be of aluminum or plastic molded integral with the casing.

The grommet shall have an inside diameter sufficient and proper to receive a 3/16 inch blind rivet.

The lens shall consist of a rear surface bearing a prismatic configuration such that it will effect total internal reflection of light and it shall have a smooth front surface free from projections or indentations other than for a central mounting hole and for identification. The manufacturer's trademark shall be molded legibly into the face of the lens.

220.3.00 Construction

220.3.01 Guardrail: Excavations through paved surfaces shall be made in such a way so as not to disturb the adjacent paved surface areas. Excavations through surfacing or base materials shall be backfilled with like materials and compacted to the density of the adjacent material. Excavations in other areas shall be backfilled with granular material.

All backfill shall be placed in layers not exceeding six inches and each layer shall be compacted to a firm, dense condition.

Adjoining areas which become misshapen or disturbed during excavating and backfilling operations shall be removed, replaced, repaired or restored, as directed. Excess materials shall be disposed of in an approved manner.

Materials which are damaged during installation shall be removed and replaced. The cut ends of galvanized bolts, rail elements and back-up plates and any holes drilled or punched after galvanizing shall be coated with an approved galvanizing substitute.

All bolts, except adjustment bolts, shall be drawn tight. Bolts shall be of sufficient length to extend slightly beyond the nuts.

220.3.02 Concrete Barrier: Portland cement concrete shall be Class 4500.

Concrete barrier may be either cast in place or precast.

Curing and finishing shall conform to the requirements of Section 503.

The top and faces of barriers shall be true and uniform and free of humps, sags or other irregularities. When a straightedge ten feet long is laid on the top or face of the barrier, the surface shall not vary more than 0.02 foot from the edge of the straightedge, except at grade changes or curves. To compensate for variations in grade, the Contractor shall adjust the height of cast-in-place barrier and adjust the depth of the grout leveling bed under precast sections.

220.3.03 Impact Attenuators: Impact attenuators shall be installed in conformance with the manufacturer's recommendations and as specified.

220.3.04 Guide Posts: Guide posts may be driven or set. Normally guide posts shall be installed to the lines, grades and spacings specified. To avoid unusually difficult installation at any individual post site, the spacing may be varied to 5 percent in either direction and deviation from line may be varied up to six inches in either direction, as approved by the Engineer. The post sites shall be made free and clear of vegetative growth, litter and debris.

Guide posts set in rock may be shortened and set to depths of not less than 18 inches in a drilled hole 1 inch greater in diameter than the large dimension of the post and backfilled with fine granular material, or grouted in place. In final position, the guide posts shall be vertical and firm. Damaged guide posts shall be replaced.

Excess excavated materials and all debris shall be removed and disposed of by the Contractor.

220.4.00 Measurement and Payment

220.4.01 Guardrail: Measurement and payment for guardrail will be on a linear foot basis for the type of guardrail specified and constructed.

220.4.02 Guardrail End Pieces: Measurement and payment for guardrail end pieces will be on a per each basis for the type of end pieces specified and constructed.

220.4.03 Guardrail Terminal Anchors: Measurement and payment for guardrail terminal anchors will be on a per each basis for the type of terminal anchors specified and constructed.

220.4.04 Median Barrier: Measurement and payment for median barrier will be on a linear foot basis for the type and kind of median barrier specified and constructed.

220.4.05 Shoulder Barrier: Measurement and payment for shoulder barrier will be on a linear foot basis for the type and kind of shoulder barrier specified and constructed.

220.4.06 Impact Attenuators: Measurement and payment for impact attenuators will be on a per each basis for the type of impact attenuators specified and constructed.

220.4.07 Guide Posts: Measurement and payment for guide posts will be on a per each basis for the type of guide posts specified and installed.

221 LANDSCAPING

221.1.00 Description

221.2.00 Materials
221.2.01 Seed
221.2.02 Mulch
221.2.02A Straw Mulch
221.2.02B Peat Moss Mulch
221.2.02C Sawdust Mulch
221.2.02D Bark Mulch
221.2.02E Wood Cellulose Fiber Mulch
221.2.02F Pulverized Corn Cobs
221.2.03 Matting
221.2.03A Jute Matting
221.2.03B Excelsior Matting
221.2.03C Burlap
221.2.04 Topsoil
221.2.05 Sod
221.2.06 Agricultural Limestone
221.2.07 Fertilizer
221.2.07A Organic
221.2.07B Inorganic
221.2.08 Plants
221.2.09 Pipe
221.2.09A Galvanized Steel
221.2.09B Copper
221.2.09C Polyvinylchloride
221.2.10 Valves
221.2.10A Gate Valves
221.2.10B Globe Valves
221.2.10C Pressure Reducing Valves
221.2.10D Swing-Check Valves
221.2.10E Quick-Coupling Valves
221.2.11 Backflow
221.2.12 Water Meters
221.2.13 Sprinkler Heads
221.2.13A Stationary Sprinkler Heads
221.2.13B Pop-up Non-Revolving Sprinkler Heads
221.2.13C Pop-up Rotary Sprinkler Heads
221.2.13D Agricultural Rotary Sprinkler Heads
221.2.14 Electrical Conductors and Conduit
221.2.15 Valve Boxes
221.2.16 Soil Sterilant

221.3.00 Construction
221.3.01 Seeded Lawn
221.3.02 Sod Lawn
221.3.03 Seeding and Mulching
221.3.04 Trees, Shrubs and Plants

221.4.00 Measurement and Payment
221.4.01 Lawn
221.4.02 Seeding and Mulching
221.4.03 Trees, Shrubs and Plants
221.4.04 Irrigation Pipe
221.4.05 Sprinklers
221.4.06 Valves
221.4.07 Meters
221.4.08 Fertilizer
221.4.09 Valve Boxes
221.4.10 Agricultural Limestone
221.4.11 Soil Sterilant
221.4.12 Matting
221.4.13 Topsoil
221.4.13A Native Topsoil
221.4.13B Imported Topsoil
221.4.14 Electrical Components

221 LANDSCAPE

221.1.00 Description: This section covers the work necessary to construct lawn, grass, shrub and tree areas.

221.2.00 Materials

221.2.01 Seed: Seed shall be from blue tag stock and from the latest crop available. Each variety shall be from tested seed and shall be delivered in standard sealed containers labeled in accordance with Kansas State laws and US Department of Agriculture rules and regulations under the Federal Seed Act in effect on the date of invitation of bids. The percentage of purity, germination and maximum weed content shall be as set forth in the state seed laws of Kansas and subsequent revisions. The label shall show the variety of seed, the percentage of germination, purity and weed content, and the date of test. The seed shall have been tested within nine months of the date of delivery and shall not be moldy, or show evidence of having been wet or otherwise damaged.

Each lot of seed shall be subject to inspection, sampling and testing on delivery to the project. Seed not meeting the requirements of these specifications or not labeled as specified, will be rejected and shall be replaced with seed conforming to the specifications.

Grass seed may be delivered to the project as a mixture providing each variety of grass seed in the mixture is identified and labeled as specified or a certification from the supplier is attached giving the percentage of each variety of grass seed in the mixture and the percentage of purity, germination, and weed content.

221.2.02 Mulch

221.2.02A Straw Mulch: Straw mulch shall consist of wheat straws, oat straws, other small stemmed straws meeting the approval of the Engineer; sweet clover hay, prairie hay, smooth bromegrass hay, cane and sorghum hay, soybean hay or sudan grass hay or excelsior mulch singly or in combination. Straw mulch shall not be musty, moldy, caked, decayed or of otherwise low quality, and shall be free of noxious weeds or noxious weed seeds.

221.2.02B Peat Moss Mulch: Peat moss mulch shall be horticultural grade natural peat moss furnished in bales or bags, in air-dry condition, and free from woody substances. The bales or bags shall carry identification of contents and volume.

221.2.02C Sawdust Mulch: Sawdust mulch shall be free of chips, strips and splinters. It shall have no toxic substances injurious to plants.

221.2.02D Bark Mulch: Bark mulch shall be ground, shredded or broken particles from the bark of fir, pine or hemlock trees and shall be free from weed seeds, harmful bacteria or disease spores and substances toxic to plant growth. The much shall be of the size commonly known in the trade as "medium bark mulch". A 15-pound sample shall be submitted to the Engineer for visual inspection and approval prior to delivery of the material to the project, and the approved sample will be used as a reference for acceptability of the material used in the work.

221.2.02E Wood Cellulose Fiber Mulch: Wood cellulose fiber mulch shall consist of a specially prepared wood fiber processed to contain no growth or germination inhibiting factors. The fiber mulch shall be manufactured and processed in such a manner that the wood cellulose fibers will remain in uniform suspension in water under agitation and will blend with grass seed, fertilizer and other additives to form a homogeneous slurry. The processed mulch material shall have characteristics to form a blotter-like ground cover on application, having moisture absorption and percolation properties and the ability to cover and hold grass seed in contact with soil. The wood cellulose fiber mulch material shall be shipped in packages of uniform weight (plus or minus 5 percent) and bearing the name of the manufacturer and the air-dry weight content.

221.2.02F Pulverized Corn Cobs: Pulverized corn cobs may be used by permission of the Engineer.

221.2.03 Matting

221.2.03A Jute Matting: Jute matting shall consist of a uniform open plain weave of single jute yarn. The yarn shall be of loosely twisted construction and shall not vary in thickness by more than one half of its normal diameter. The weave shall provide openings approximately 1-inch square. The matting shall be in widths of 45 inches or more and shall weigh not less than 0.9 pound per square yard. It shall be furnished in continuous lengths of not less than 150 feet. Staples for use with jute matting shall be of 12-gauge or heavier steel wire bent U-shaped approximately 1 ½ to 2 inches in width and shall be not less than 12 inches long unless hard pan soil conditions dictate the use of shorter lengths and this length is approved by the Engineer.

221.2.03B Excelsior Matting: Excelsior matting shall consist of a machine produced blanket of curled wood fibers, 80 percent of which shall be of consistent thickness with fiber evenly distributed over the entire area of the blanket. The top side of the matting shall be covered with a 3" x 1" weave of twisted kraft paper having a high wet strength, or a 2" x 1" biodegradable extended plastic mesh.

The excelsior matting shall have a minimum dry weight of 0.8 pound per square yard plus or minus 10 percent. The width of the matting shall be a minimum of 36 inches. Wire staples for excelsior matting shall be the same as specified for jute matting.

221.2.03C Burlap: Burlap shall be of standard weave with a weight of 3.5 to 5.0 ounces per square yard.

221.2.04 Topsoil: Topsoil shall be a fertile, loamy, natural surface soil consisting of sands, silts, clays and organic matter in combination and free of substances toxic to plant growth, noxious weeds, roots, refuse, sticks and lumps. The minimum and maximum pH value shall be 5 and 8, respectively.

Topsoil shall contain a minimum of 3 percent and a maximum of 20 percent organic matter as determined by loss on ignition of samples oven dried to constant weight at 212 degrees F.

Topsoil shall have a grading analysis as follows:

Sieve Designation	*Percentage by Weight Passing Square Mesh Sieve*	
1”	100	
¼”	97-100	
No. 10	80-100	
Material	*Particle Size*	
Sand	Passing #10 sieve	
Silt	Passing #10 sieve and retained on #200 sieve	
Clay	Passing #200 sieve	
	Minimum	*Maximum*
Sand	20%	75%
Silt	10%	60%
Clay	5%	30%

221.2.05 Sod: Sod shall be nursery grown on agricultural land cultivated specifically for sod purposes. Sod shall be weed free and free of diseases, nematodes and insects, and shall consist of bluegrass or other combinations of fine texture grasses. Sod shall be mature, not less than ten months old, and shall have the approval of the Engineer at the source prior to delivery to the project.

Sod shall be machine cut to a uniform thickness, depending on grass type, and a convenient length and width. Broken pads and torn or uneven ends will not be acceptable.

Sod shall be delivered and placed within a period of 36 hours after harvest.

221.2.06 Agricultural Limestone: Agricultural limestone shall be a calcic or dolomitic ground limestone containing not less than 85 percent of total (Calcium and Magnesium) carbonates. Limestone shall conform to the standards of the Association of Official Analytical Chemists and shall comply with all existing State and Federal regulations.

Limestone shall meet the following sieve analysis: At least 40 percent passing a No. 100 sieve, and at least 95 percent passing a No. 8 sieve.

Granulated slag or other approved natural sources of lime may be used, subject to approval by the Engineer of an adjusted application rate that will equal the total neutralizing power of the specified ground limestone.

221.2.07 Fertilizer: Fertilizer shall be furnished in moisture proof bags. Each bag shall be marked with the weight and with the manufacturer's analysis of the contents showing the percentage for each ingredient contained herein. Fertilizer shall be furnished in a dry condition free from lumps and caking, in granular, or pelletized form. Fertilizer shall be standard commercial grade and shall be manufactured by firms, registered by the Kansas State Board of Agriculture. Bagged or bulk fertilizers shall be delivered with the appropriate labels or certificates providing the information required by Section 2-1204 of the "Kansas Commercial Fertilizer Law" as amended.

221.2.07A Organic: Organic fertilizer, shall consist of cottonseed meal, blood meal, bone meal, fish meal, tankage or other similar organic substances. The chemical composition shall be as specified.

221.2.07B Inorganic: The requirement for each inorganic fertilizer shall be as shown on the plans or specified in the Special Provisions, and in the Proposal. In a fertilizer grade as shown, the first number shall represent the percentage of nitrogen required (expressed as available N), the second number shall represent the percentage of phosphorous required (expressed as the percent of available P_2O_5) and the third number shall represent the percentage of potassium required (expressed as the percent of available K_2O). A mixed fertilizer such as 12-24-12 should contain 12% N, 24% P_2O_5 and 12% K_2O.

A minus tolerance of 0.5 of one percent will be permitted for each of the designated ingredients in inorganic fertilizers.

221.2.08 Plants: Plants shall be first-class representatives of their normal species or varieties unless otherwise specified as "street-tree", "extra heavy", "clump", and other, or like import, according to the particular exception. Unless otherwise specified, all plants shall be nursery-grown stock that has been transplanted or root-trimmed two or more times, according to the kind and size of plants. The branch system shall be normal development and free from disfiguring knots, sun-scald, injuries, abrasions of the bark, dead or dry wood, broken terminal growth, or other objectionable disfigurements. Trees shall have reasonably straight stems and shall be well branched and symmetrical in accordance with their natural habits of growth.

221.2.08 Plants, Continued

Scientific and common plant names of the items specified shall conform to the edition of "Standardized Plant Names", as adopted by the American Joint Committee on Horticultural Nomenclature. All plants delivered shall be true to name and legibly tagged with the names and sizes of materials. Should it be necessary to substitute a plant or plants of a different variety than the plant material specified, it will be necessary for the Contractor to secure the approval of the Engineer for the proposed substitution prior to digging the plants. An approved substitute plant shall be of value at least equal to the specified plant for which the substitution is being made. Any substitutions necessary shall not be made until after the contract has been awarded.

Grading of plants shall conform to the "American Standard for Nursery Stock", as approved by the American National Standards Institute.

Plants shall be free from plant disease and insect pests. All shipments of plants shall comply with all nursery inspection and plant quarantine regulations of the State entomologist, and shall be free of bindweed or other noxious weeds.

Plants may be collected plants, provided such plants have been growing continuously in only one licensed nursery for the following minimum number of growing seasons:

Plant Material	*Time in Nursery*
Trees	2 Growing Seasons
Shrubs, Evergreens	2 Growing Seasons
Shrubs, Deciduous	1 Growing Season
Perennials	1 Growing Season

All evergreen, broadleaf evergreen or plants that may be planted partially in leaf, shall be treated with an anti-desiccant. The material shall be poly-vinyl chloride complex liquid and may be applied by dipping or as a spray, in accordance with the manufacturer's recommendations. All plants shall be treated at the nursery prior to shipment. The nursery shall supply a certification that the plants have been treated. Such treatment shall be incidental to the plant materials.

221.2.09 Pipe

221.2.09A Galvanized Steel: Galvanized steel pipe shall conform to the requirements of ASTM A120, standard weight, schedule 40, unless otherwise specified.

221.2.09B Copper: Copper pipe shall conform to the requirements of ASTM B88, Type K, unless otherwise specified. Joint fittings shall be of pure wrought copper. Solder shall be compound of 95 percent lead and 5 percent tin conforming to the requirements of ASTM B32, grade 95 TA.

221.2.09C Polyvinylchloride: Polyvinylchloride (PVC) pipe shall conform to the requirements of ASTM D2241. Fittings shall conform to the requirements of ASTM D2455. Polyvinylchloride pipe shall have a Standard Thermoplastic Pipe Dimension Radio (SDR) of 21. The pipe and fittings shall be made from PVC compounds conforming to the requirements of ASTM D1784, Class 12454-B or Class 12454-C. Plastic pipe shall be of the solvent-cement joint design.

Cements and primers shall be compatible with and of the kind recognized by the industry as proper for use with the kind of plastic pipe and fittings involved. Primer shall be colored.

Plastic pipe shall conform to the requirements of the National Sanitation Foundation Testing Laboratories, Inc., or other accredited laboratory and shall be marked with the "NSF" mark at intervals along the pipe, together with the manufacturer's trademark, PSI and PVC compound designation.

221.2.10 Valves

221.2.10A Gate Valves: Gate valves up to and including the three-inch size shall have bronze bodies. Valves of four inch size and larger may have either bronze or iron bodies. All valves shall have bronze stems, bronze seat rings and bronze disc faces. Material in bronze bodies shall conform to the requirements of ASTM B62 or approved equal. All valves shall be service rated (non-shock cold water) at not less than 200 psi. The valves shall be of the double disc, rising stem type, with union bonnets. Valves shall be of the screw type with wheel-handle.

221.2.10B Globe Valves: Globe calves shall be manufactured of bronze conforming to the requirements of ASTM B61. The valves shall be of the rising stem, metal disc, plug type with union bonnets, having wheel handles and be service rated (non-shock cold water) at not less than 200 psi.

221.2.10C Pressure Reducing Valves: Pressure reducing valves shall be manufactured of heavy-duty bronze with either an integral or independent stainless steel or monel strainer. The valve shall permit quick and easy cleaning or replacement of the strainer or its parts without dismantling or removing the valves from the line. The valves shall be adjustable as shown on the plans or Special Provisions. The valves shall have an integral or independent union.

221.2.10D Swing-Check Valves: Swing-check valves shall be manufactured of bronze conforming to the requirements of ASTM B62. The valves shall be of the screwed cap, removable disc type, have bronze or brass discs and be service rated (non-shock cold water) at not less than 200 psi.

221.2.10E Quick-Coupling Valves: Quick-coupling valves may be either one-piece or two-piece body type, with locking cap. The body shall be heavy-duty brass (ASTM B145, 81-3-7-9 type is acceptable), or of heavy-duty bronze. The cap may be of brass, bronze or other noncorrosive metal. Quick-coupling valves shall be watertight both before and after the coupler is inserted. The valve mechanism shall be so designed that the valve seat is closed before the coupler is removed. Each valve shall have the manufacturer's identification cast or stamped on the valve.

Couplers or keys for use with quick-coupling valves shall provide for attachment of portable sprinkler heads or hose swivels. The couplers or keys shall be of brass, bronze, stainless steel, other approved highly corrosion-resistant metal or combinations thereof, and shall be of a design expressly intended for use with quick-coupling valves. The couplers or keys shall be of bayonet type. Lugs shall be of a durable brass, bronze, stainless steel or other approved metal.

Hose swivels shall be of brass, bronze or other approved metal, of ¾ inch size, with 90 degrees swivel ell, and shall be free turning through a 360-degree swing. The swivel spindle shall be watertight in service.

Two couplers and two hose swivels for operation of the valves and two keys for the lock caps shall be furnished to the Engineer on each project requiring quick-coupling valves.

221.2.11 Backflow Prevention Devices: Backflow prevention devices shall conform to the requirements of AWWA C506.

221.2.12 Water Meters: Water meters shall conform to the applicable requirements of Subsection 403.2.08.

221.2.13 Sprinkler Heads: Sprinkler heads and the working parts shall be precision machined and free of burrs. They shall be brass, bronze, stainless steel, other durable and highly corrosion and wear resistant metal, or compatible combinations thereof. Sprinkler heads shall have service records of efficient performance over a period of at least two years. Sprinkler heads shall give uniform coverage when operating at the specified pressures.

221.2.13A Stationary Sprinkler Heads: Stationary sprinkler heads shall be of shrubbery two-piece type, consisting of body and adaptor, and shall be provided with volume control.

221.2.13B Pop-Up Nonrevolving Sprinkler Heads: Pop-up nonrevolving sprinkler heads shall be full or part circle.

The top flange or plate shall be not less than 2 3/8 inches in diameter. The pop-up portion of the head shall return freely to its closed position when the head, in dry condition, is inclined at an angle of 30 degrees from horizontal. The heads shall have adjustment for volume and area coverage and shall be accessible from the top without disturbance of the body of the head. Nozzles shall be removable and interchangeable from the top of the head.

221.2.13C Pop-Up Rotary Sprinkler Heads: Pop-up rotary heads shall be full or part circle. The heads shall be designed for heavy-duty, and all working parts shall be highly resistant to wear and shall operate smoothly without stalling of the rotary action while under specified operating pressure. The working assembly shall be removable from above the ground as a unit to permit adjustment and servicing. The orifices or nozzles shall be interchangeable and replaceable from the top of the head without disturbances of the assembly or body of the head. The heads shall be such that various sizes of orifices or nozzles may be used interchangeably.

Part circle heads shall be adjustable to any part of a circle from 45 degrees to 315 degrees, or greater range, while in operation.

Pop-up rotary sprinkler heads shall be rotated by means of a horizontal oscillating arm drive. The sprinkler shall make a positive closing of the plate when in off position. Part circle rotary heads shall have an anti-backsplash device.

The rotary sprinkler heads, both part circle and full circle, shall be adjustable for stream breakup and distance control.

221.2.13D Agricultural Rotary Sprinkler Heads: Agricultural rotary sprinkler heads shall be constructed basically of brass, bronze, stainless steel or combinations thereof. Nozzles shall be constructed of brass, bronze, stainless steel or other sturdy, durable material. All materials used must be highly resistant to corrosion. All working parts shall be precision machined and all bearings and other moving parts shall be highly resistant to wear. The sprinkler heads shall be of such design that at least three different sizes of nozzles may be used interchangeably. Part circle heads shall have an anti-backsplash device.

221.2.14 Electrical Conductors and Conduit: Electrical conductors from the power source to the controller, or timer, shall be copper, minimum size No. 10, type TW, consisting of two conductors and a bare copper ground wire of the same size conforming to the requirements of the National Electrical Code. These wires shall be encased in conduit from the source to the controller or timer.

Electrical conductors from the controllers or timers to the valves shall be standard copper “UF” irrigation control wire conforming to the size and other requirements of the National Electrical Code, current edition.

All aboveground conduit shall be galvanized rigid steel electrical type and all underground conduit shall be Schedule 40 PVC electrical type. All conduit shall conform to the requirements of the National Electrical Code, current edition.

221.2.15 Valve Boxes: Valve boxes shall be of precast concrete or other approved materials conforming to the requirements of Section 503. Concrete shall be Class 3000-CA-5 or Class 3000-MA-1, unless otherwise specified.

Valve boxes shall be furnished with a metal cover capable of being locked with a padlock. The metal cover shall be of galvanized steel, unless otherwise specified.

221.2.16 Soil Sterilant: Soil sterilant may be granular calcium cynamid, manufactured for use as a herbicide, or other approved sterilant.

221.3.00 Construction

221.3.01 Seeded Lawn: Seeded lawn construction shall be performed only at times when local weather and other conditions are favorable to the preparation of the soil and to the germination and growth of grass seed, generally between February 15 and April 20, or August 15 to September 30.

Areas on which seeded lawn is to be established shall be in a loose, friable condition for a minimum depth of six inches. The area shall be made substantially free of vegetative matter, stones, clods, roots, sticks, debris and other matter detrimental to the preparation of a good seed bed, or toxic to the growth of grass.

Each area shall be at the established grades and shall be finished to provide good drainage. The finished grade of lawn area shall be approximately ½" below the grades of adjacent walks, driveways and pavements.

Soil conditioners, soil amendments and fertilizers shall be spread evenly over the surface of the area to be seeded, at the rates specified, and shall be thoroughly and uniformly incorporated into the upper six inches of the soil. The surface shall then be fine-graded to specified grades and brought to a fine-textured, smooth and firm condition horticulturally recognized as providing a seed bed favorable to the germination and growth of lawn grasses.

At the end of the establishment period, all lawn areas will be inspected by the Engineer. The lawn shall be freshly cut and shall present the appearance of a healthy and well cared for lawn. It shall have uniform green color and texture, and shall be free of weeds. The judgement of the Engineer as to conformance to these requirements shall be final.

221.3.02 Sod Lawn: Sod lawn work shall be performed only at times when local weather and other conditions are favorable to the preparation of the soil and placing of sod. Placement of the sod shall not be done between November 15 and March 1, without written approval of the Engineer.

221.3.02 Sod Lawn, Continued

Soil conditioner, lime, gypsum and fertilizer shall be spread uniformly over the area and thoroughly cultivated into the soil to a depth of six inches. Rates of applications shall be as follows, unless otherwise specified:

Material	*Rate per 1,000 Sq. Ft.*
Soil Conditioner	6 CY (2" Depth)
Limestone	100 lbs.
Gypsum	5 lbs.
Fertilizer	10 lbs. (each Application)

After cultivation, the area shall be carefully fine graded and roller to provide a fine textured, smooth and firm surface, free of any undulations or irregularities. The finish grade of the sod bed shall be 1 inch below the finished grade of the walks and sod shall be placed to final grade ¼ inch below the finish grade of the walks.

Immediately prior to placing sod, the sod bed shall be thoroughly watered to prevent drying of grass roots. The first row of sod shall be laid in a straight line and subsequent rows placed parallel thereto and tightly against each other. Lateral joints shall be staggered. Care shall be exercised to insure that the sod is not stretched or overlapped, and that all joints are tightly butted. Sod segments containing less than two square feet of surface area shall not be incorporated in the work.

After placing sod, the lawn shall be adequately rolled diagonally and watered heavily. The second application of fertilizer shall be applied and watered in thoroughly.

The establishment period for the sod lawn shall end two weeks after completion and acceptance of all of the sod lawn on the project.

During the establishment period, all lawn areas shall be adequately watered and be kept mowed to a height of 1 ½ to 2 inches.

Areas which settle and collect water shall be regraded and resodded.

Protective fences and signs shall be used at the discretion of the Contractor, at his own expense, and if used shall be removed at such times as meets with the approval of the Engineer.

221.3.02 Sod Lawn, Continued

Grass clippings, weeds, noxious vegetation, litter, debris, clods, stones, surplus soil, and all extraneous matter shall be removed from the areas at appropriate times and shall be disposed of by the Contractor in a satisfactory manner.

The first mowing shall not be attempted until the sod is firmly rooted and secure in place. Not more than 1/3 of the grass leaf shall be removed during the initial or subsequent cuttings.

Acceptance of the sod lawn will be contingent upon the grass being uniform in color and height.

221.3.03 Seeding and Mulching: Unless otherwise specified, this work is to be performed during either the spring season, between February 15 and April 20, or the fall season, between August 15 and September 30. The work shall be performed only at times when local weather and other conditions affecting the work are favorable to proper prosecution within the specified seasons.

The work under this specification shall not be undertaken when wind velocities would prevent uniform application of the materials involved or when winds would drift the materials to areas on which they are not desired.

The work under this specification shall be done as soon as practicable after areas to be seeded and mulched are completed.

Those areas to be seeded shall be at established grades, cross sections and finish specified at the time of seeding.

Misshapen or eroded areas shall be restored to specified condition or to cross section, grade and slope as directed just prior to seeding.

All areas to be seeded shall be made substantially clear and free of weeds, briers, burrs, sticks, debris and other matter inimical, detrimental or toxic to growth of grass. If topsoil is specified, the existing ground surface shall be cultivated to a depth of four to six inches prior to placing the topsoil. On areas to be seeded which have slopes of 3:1 or flatter, all loose stones having any dimension greater than two inches shall be removed. The material so removed shall be disposed of by the Contractor is a satisfactory manner and at satisfactory locations.

Such trees, shrubs and ground covers which are designated by the Engineer or indicated on the Plans to be left in place on areas to be seeded or adjacent thereto shall be protected from damage, and the preparation work shall be performed around and between them as directed. Native grasses or turf may be left undisturbed at the discretion of the Engineer.

The surface soil on all areas to be seeded shall be in a condition favorable for the germination and growth of grass seed. A minimum of ½ inch of surface soil shall be in a loose condition.

221.3.03 Seeding and Mulching, Continued

Soil preparation operations shall be directional along the contours of the areas involved. On roadbed cut and fill slopes, the operations shall closely parallel the roadbed centerline to form minor ridges and irregularities thereon to retard erosion, retain seed and favor germination.

Fertilizer and seed shall be applied uniformly at the rates specified.

The several kinds of seed, when more than one kind is to be used, may be mixed together in the required proportions and used as a seed mixture. Fertilizer and seed may be combined in water for application by hydraulic means. When fertilizer and seed are to be applied separately and successively, they shall be applied in dry condition. If applied from separate compartments, the application may be done in one operation.

Fertilizer and seed normally shall be placed prior to the placing of mulch. However, fertilizer and seed may be applied after mulching under the following conditions: (1) when the mulch is punched into the soil by mechanized means such as modified sheepsfoot rollers or serrated flat blade discs, (2) when it is necessary to hold down the mulch with wire netting or like material, and (3) on slopes steeper than 1 ½ horizontal and 1 vertical where a slurry containing seed, fertilizer and water applied directly to the soil would tend to run down the slope.

Fertilizer and seed shall not be allowed to fall upon areas where they are not desired. Special care shall be exercised to prevent their falling or drifting upon areas occupied by stone base, stone shoulders, planting areas and other areas where, in the opinion of the Engineer, grass is considered detrimental.

On areas having slopes of 3:1 or flatter, the fertilizing and seeding shall be done with grass seed drills or seeders.

Regardless of the equipment and methods used, due care shall be exercised to prevent drift and displacement of fertilizer and seed. If the equipment used and the method of application result in waste of material, other equipment and method shall be substituted therefore and shall meet the approval of the Engineer.

The fertilizing and seeding operations shall be conducted to avoid disturbance and areas previously prepared, fertilized, seeded or mulched, and if any such areas do become disturbed they shall be again prepared, fertilized, seeded and mulched as the Engineer may direct, without additional compensation.

Mulch material shall be spread uniformly at the rates specified.

Mulch material on seeded areas shall be placed not later than two workdays after the seeding.

221.3.03 Seeding and Mulching, Continued

Mulch material shall be maintained in place by whatever means may be appropriate. The Contractor shall be responsible for the replacement of any material which becomes displaced (other than by earth slides) prior to acceptance of the work.

The placing of the several kinds of mulch materials shall be in conformance to the requirements set forth in the numbered paragraphs which follow, as applicable:

(1) Straw mulch material shall be placed to a reasonably uniform thickness, within the range of 1 ½ to 2 ½ inches, and averaging approximately 2 inches in loose condition. This rate requires approximately two tons of dry mulch per acre. The mulch shall be loose enough for sunlight to penetrate and air to circulate; but dense enough to shade the ground, reduce the rate of water evaporation, and prevent or materially reduce erosion of underlying soil. Straw mulch shall be retained in place by appropriate means which may include, but are not limited to the following: Light spraying with a nontoxic bituminous material at a rate of about 100 gallons per acre, discing or punching the straw partially into the soil, covering the straw lightly with soil, covering with open-mesh fabric or wire netting fastened to the soil, or by the prior "pegging" of the slopes with small stakes, pegs, arrow shaft material, etc., set in the ground at about two foot spacings and protruding about 3 inches. The method of placing and retaining grass straw mulch shall be at the option of the Contractor.

(2) Wood cellulose fiber shall be applied either as a waterborne material wherein the fibers are uniformly suspended in water and applied to seeded areas, or as a part of a homogeneous mixture containing fertilizer, seed and the fiber mulch in suspension in water and uniformly applied to prepared areas at the respective specified rates of application. Wood cellulose fiber shall be applied by hydraulic pressure equipment and methods which deliver the water-borne fiber, or homogeneous mixture containing the fiber.

    Unless otherwise specified, the rate at which the wood cellulose fiber is applied shall be a minimum of 2000 pounds per acre, which rate shall be based on the dry weight of the fiber.

(3) Jute or excelsior matting shall be laid out flat on the areas to be protected in single thickness strips paralleling the direction of probable flow of water. Multiple strips of jute matting shall lap in shingle fashion. Overlapping of adjacent excelsior matting will not be required. The jute or excelsior matting shall be in intimate contact with the soil at all points and shall be held in place with wire staples driven through the matting into the soil as necessary to provide a secure fastening under any adverse conditions normal to the location. The minimum width of laps for jute matting, the minimum spacing of wire staples, and other installation details shall be as shown on the Plans.

221.3.03 Seeding and Mulching, Continued

Care shall be exercised in the mulching operations to prevent displacement of soil, fertilizer and seed in place and to prevent disfigurement or damage to the areas on which the mulching is performed. Mulch material which comes upon adjacent trees and shrubs, roadways, in drain ditches, on structures, upon areas where mulching is not specified or which collects at the ends of culverts or accumulates to excessive depths on mulched areas shall be removed therefrom and shall be spread lightly on specified areas, restored to thinly mulched areas or wasted as conditions warrant and as the Engineer may approve or direct. Mulch materials which are deposited in a matted condition or in clumps shall be loosened and spread uniformly over the areas.

If liquid asphalt is used with grass straw mulch, protective covering shall be used on structures and objects where asphalt stains would be objectionable, as necessary to avoid such discoloration and stain; and care shall be taken to protect the traveling public and vehicles from damage by drifting spray.

Damage caused by earth slides shall be repaired as extra work. Seeded and mulched areas which become damaged from causes other than earth slides shall be repaired at the expense of the Contractor.

221.3.04 Trees, Shrubs and Plants: Planting shall be done either prior to April 15 or after November 15. Upon approval of the Engineer, plants established and growing in containers may be planted in other than the normal planting seasons.

The planting area shall be cultivated to a depth of six inches prior to placing topsoil.

Soil conditioners, if specified, shall be mixed completely and thoroughly with the topsoil. The kind, quality and quantity of the soil conditioner to be incorporated in the work shall be as specified.

Pits for trees shall be at least 24 inches greater in diameter than that of the earth ball, or the spread root system of bare root trees. Depths of pits for trees shall be not less than two feet and as much deeper as may be necessary to provide a depth of 12 inches below the bottom of the ball or the spread root system of the tree.

Pits for shrubs shall be at least 12 inches greater in diameter than that of the earth ball, or the spread root system of bare root shrubs. Depths of pits for shrubs shall be not less than one foot and as much deeper as may be necessary to provide a depth at least 6 inches below the bottom of ball or spread root system of the shrub.

Pits, pockets or trenches for vines, ground covers and similar types of plants shall be of such dimensions as will provide a space of not less than six inches around and beneath the bare root or ball.

221.3.04 Trees, Shrubs and Plants, Continued

All planting work, including backfilling, shall be in accordance with good horticultural practices. Plants of upright growth shall be set plumb and plants of prostrate type shall be set normal to the slope or ground surface. Plants shall be set at such a level or elevation that after settlement and placing of mulch materials they will bear the same relation to the level of the surrounding ground as they bore to the ground from which they were dug. The topsoil used in backfilling around the plants shall be firmly and carefully tamped around the roots or ball to eliminate air pockets.

Backfilling shall not be done when conditions are such that planting could not be done in accordance with good horticultural practices.

If balled and burlapped plants are furnished with a burlap wrapping which has been impregnated with plastic or other nondecomposable material, the wrapping shall be completely removed after plants are placed in the holes. Otherwise, balled and burlapped plants (except those of the Ericaceous family) shall be placed with the burlap wrapping intact, but with ties or strings cut.

Bare root plants shall have their roots spread out in a natural position equally distributed around the pit. Any roots which are broken or frayed shall be cut off.

The determination of the suitability of topsoil obtained from planting area preparation will be made by the Engineer.

Soil in excess of the amounts required for backfilling work in the planting area shall be disposed of by the Contractor is a satisfactory manner.

Watering shall be performed at such intervals as is required to maintain and promote growth.

Trees, shrubs and plants shall be "watered in" during the planting as required to eliminate air pockets, to insure the adherence of the soil to the roots or ball of the plants, and to remove voids and minimize settlement of the backfill.

In watering planter areas adjacent to lawn areas, the Contractor is warned to avoid excessive watering which would tend to leach any applied herbicide to the lawn areas. The Contractor shall repair any lawn area so damaged at the Contractor's own expense.

Pruning shall be done at or before the time of planting in accordance with good horticultural practice appropriate to the type of plant. Pruning shall be such as will remove all dead and damaged twigs and branches and compensate for loss of roots during planting operations. Crossed or rubbing branches may be removed providing the natural shape of the tree is preserved. Cuts shall be made as close to the parent stem so that healing may start readily. Cuts over ¾ inch in diameter shall be treated with an approved tree wound dressing.

The "Plant Establishment" shall be understood to be a part of the planting work to assure a satisfactory growth of the planted material by the end of a specified period of time.

221.3.04 Trees, Shrubs and Plants, Continued

Prior to the beginning of the establishment period, all plants which are dead, partially dead or which do not otherwise meet specifications, shall be removed and replaced with healthy plants. These plants will be classed as a part of the original planting and will be subject to establishment.

The plant establishment period will begin when the original planting and all construction items under the contract has been completed and approved.

The establishment period will end 10 days following the end of the planting season or any extension of the planting period approved by the Engineer. A final inspection will be held within 10 days after the end of the establishment period. All rejected plants shall be removed and replaced with healthy plants of the size and type required by the contract during the following planting season. All costs of replacement will be borne by the Contractor.

During the establishment period and until final acceptance, the Contractor shall be responsible for the care of the planting to maintain it in a vigorous growing condition.

Prior to the end of the establishment period, the planted areas and other facilities of the project will be inspected by the Engineer jointly with the Contractor. Any work which, in the opinion of the Engineer, does not comply with the specifications, shall be corrected prior to acceptance.

221.4.00 Measurement and Payment

221.4.01 Lawn: Measurement and payment for lawn will be made on a square foot, square yard or acre basis for the type of lawn specified and constructed.

221.4.02 Seeding and Mulching: Measurement and payment for seeding and mulching will be made on a square foot, square yard or acre basis for the type of seeding and mulching specified and constructed.

221.4.03 Trees, Shrubs and Plants: Measurement and payment for trees, shrubs and plants will be made on a per each basis for the number and type planted and accepted at the end of the establishment period.

221.4.04 Irrigation Pipe: Measurement and payment for irrigation pipe will be made on a linear foot basis for the size and type of irrigation pipe specified and installed.

221.4.05 Sprinklers: Measurement and payment for sprinklers will be made on a per each basis for the size and type of sprinklers specified and installed.

221.4.06 Valves: Measurement and payment for valves will be made on a per each basis for the size and type of valves specified and installed.

221.4.07 Meters: Measurement and payment for meters will be made on a per each basis for the size and type of meters specified and installed.

221.4.08 Fertilizer: Measurement and payment for fertilizer will be made on a pound or ton basis for the kind of fertilizer specified and placed.

221.4.09 Valve Boxes: Measurement and payment for valve boxes will be made on a per each basis for the size and type of valve boxes specified and installed.

221.4.10 Agricultural Limestone: Measurement and payment for agricultural limestone will be on a pound or ton basis for the area specified and placed.

221.4.11 Soil Sterilant: Measurement and payment for soil sterilant will be made on a square foot basis for the area specified and sterilized.

221.4.12 Matting: Measurement and payment for matting will be made on a square foot or acre basis for the type of matting specified and placed.

221.4.13 Topsoil

221.4.13A Native Topsoil: No measurement and payment will be made for native topsoil.

221.4.13B Imported Topsoil: Measurement and payment for imported topsoil will be made on a cubic yard basis for the amount of imported topsoil specified and placed.

221.4.14 Electrical Components: Measurement and payment for electrical components will be made in accordance with the applicable portions of Subsection 217.4.00.

222 UNASSIGNED

223 CLEANUP

223.1.00 Description

223.2.00 Materials

223.3.00 Construction
223.3.01 Surface Dressing
223.3.02 Disposal of Waste Material
223.3.03 Cleaning Drains
223.3.04 Cleaning Paved Surfaces and Appurtenances
223.3.05 Restoring Planted Areas
223.3.06 Restoring Mobilization, Borrow and Disposal Areas
223.3.07 Removal of Signs

223.4.00 Measurement and Payment
223.4.01 Lump Sum Basis
223.4.02 Incidental Basis

223 CLEANUP

223.1.00 Description: This section covers the work necessary to clean up and remove all refuse and unused materials of any kind resulting from the work.

223.2.00 Materials: Provide all materials required to accomplish the work as specified.

223.3.00 Construction: Perform all necessary work as described herein and in Subsection 105.19.00.

223.3.01 Surface Dressing: Slopes, sidewalk areas, planting areas and roadway shall be smoothed and dressed to the required cross section and grade by means of a grading machine insofar as it is possible to do so without damaging the work or existing improvements, trees and shrubs. Supplement machine dressing by hand work as necessary.

Upon completion of the cleanup, the project shall appear uniform in all respects. Grade all areas true to line and grade as shown and as directed. Where the existing planting is below sidewalk and curb, fill and dress the area to the sidewalk. Wherever fill material is required in a planting area, fill the area high enough to allow for final settlement.

223.3.02 Disposal of Waste Material: Remove all excess excavated or construction material and trash of all kinds resulting from the work and dispose of off the site as approved. Where brush and trees beyond the limits of the project have been disturbed, remove and dispose of or restore same as directed at no expense to the Owner.

223.3.03 Cleaning Drains: Clean all drainage facilities such as inlets, catch basins, culverts and open ditches of all excess material or debris which is the result of the work.

223.3.04 Cleaning Paved Surfaces and Appurtenances: Clean all pavement surfaces within the limits of the project as directed. Clean existing improvements such as curbs, curbs and gutters, walls, sidewalks, manhole covers, monuments, poles, vaults, signs and other items as directed.

223.3.05 Restoring Planted Areas: Hand rake and drag all former grassed and/or planted areas leaving disturbed areas free from rocks, gravel, clay or any other foreign material, and ready in all respects for seeding.

The finished surface shall conform to the original surface, be free draining and free from holes, rough spots, or other surface features detrimental to a seeded area.

223.3.06 Restoring Mobilization, Borrow and Disposal Areas: Dispose of all uprooted stumps, felled trees, brush, excess excavation, rock, discarded materials, rubbish and debris. Remove all equipment, tools and supplies and restore the areas to a neat and orderly condition.

223.3.07 Removal of Signs: Do not remove warning, regulatory, guide or project signs prior to formal acceptance, except as directed.

223.4.00 Measurement and Payment

223.4.01 Lump Sum Basis: When listed in the proposal as a pay item, payment for cleanup will be made on a lump sum basis.

223.4.02 Incidental Basis: When neither specified nor shown in the proposal for payment, all cleanup will be considered incidental work for which no separate payment will be made.

DIVISION THREE
SANITARY SEWERS AND STORM DRAINS

301 TRENCH EXCAVATION, BEDDING AND BACKFILL

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301.1.02 Trench Foundation
301.1.03 Pipe Bedding
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301.1.05 Trench Backfill
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301 TRENCH EXCAVATION, BEDDING AND BACKFILL

301.1.00 Description: This section covers trench excavation, trench foundation, pipe bedding, pipe zone, trench backfill, embankment and surface removal and replacement.

301.1.01 Trench Excavation: Trench excavation is defined as the removal of all material encountered in the trench to the depths as shown or as directed. Trench excavation shall be classified as either common or rock excavation.

Common excavation is defined as the removal of all material which is not classified as rock excavation.

Rock excavation is defined as boulders and pieces of concrete or masonry exceeding ½ cubic yard in size or solid ledge rock, which in the opinion of the Engineer, requires for its removal drilling and blasting, wedging, sledging, barring, or breaking up with a power operated tool. No soft or disintegrated rock, or hard pan or cemented gravel that can be removed with a hand pick or power operated excavator or shovel; no loose, shaken, or previously blasted rock or broken stone in rock fillings or elsewhere; and no rock exterior to the minimum limits of measurement allowed which may fall into the excavation will be measured or allowed.

301.1.02 Trench Foundation: Trench foundation is defined as the bottom of the trench on which the pipe bedding is to lay and is responsible for the support of the pipe.

301.1.03 Pipe Bedding: Pipe bedding is defined as the furnishing and placing of specified materials on the trench foundation so as to uniformly support the barrel of the pipe. The total bedding depth shall be as specified.

301.1.04 Pipe Zone: The pipe zone is defined as the full width of the trench from the top of the bedding to a point six inches above the top outside surface of the barrel of the pipe.

301.1.05 Trench Backfill: Trench backfill is defined as the furnishing, placing and compacting of material in the trench between the top of the pipe zone material and the bottom of the pavement base, ground surface, or surface material as directed.

301.1.06 Embankment: Embankment is defined as furnishing, placing and compacting of the embankment material to the depth and configuration as specified.

301.1.07 Surface Removal and Replacement: Surface removal and replacement is defined as the removal and/or replacement of surface material such as topsoil, sod, pavement, sidewalks, gravel, etc. which requires special consideration in order to accomplish and restore the trench excavation area as specified.

301.2.00 Material

301.2.01 Trench Foundation: The trench foundation shall be native material in all areas except where ground water or other conditions exist, and in the opinion of the Engineer, the native material is such that it cannot support the pipe. In those conditions, excavation shall be included to additional depths as required and backfilled with gravel, granular aggregate, or pipe bedding material as directed.

301.2.02 Pipe Bedding: Pipe bedding material as may be required in all instances shall be clean pea gravel or other approved granular material with a maximum size of ¾ inch, uniformly graded from coarse to fine. Clean, pit-run, or reject crusher run sand, or other materials may be substituted for gravel in trenches with no groundwater in the pipe zone. All pipe bedding materials shall be submitted for the Engineer's approval prior to utilization.

301.2.03 Pipe Zone: The pipe zone material shall consist of bedding material, as described in Subsection 301.2.02, or sand, gravel, rock or combination thereof, free of humus, organic matter, vegetative matter, frozen material, clods, sticks and debris and containing no stone having a dimension greater than 1 ½ inches. The materials shall predominate in the fine sizes and in place, shall present no isolated points or areas or larger stones which would cause fracture or denting of the structure or subject it to undue stress. All pipe zone materials shall be subject to the Engineer's approval.

301.2.04 Trench Backfill: Trench backfill shall consist of the following material:

301.2.04A Class A Backfill: Class A backfill shall be native or common material which, in the opinion of the Engineer, meets the desired characteristics required for the specific surface loading or other criteria of the backfill zone.

301.2.04B Class B Backfill: Class B backfill shall be granular material consisting of gravel or crushed rock meeting the requirements of Section 207. Designated size shall be ¾" – 0, unless otherwise specified.

301.2.04C Class C Backfill: Class C backfill shall be clean sand with no particle size larger than ¼ inch.

301.2.04D Class D Backfill: Special types (cinders, clinkers, pea gravel or other acceptable materials local to the area).

301.2.05 Embankment: All embankment materials shall be as shown on the plans.

301.2.06 Surface Removal and Replacement

301.2.06A Topsoil: Topsoil shall be fertile, loamy, natural surface soil consisting of sand, silts, clays and organic matter in combination and free from substances toxic to plant growth, noxious weeds, roots, refuse, sticks and lumps.

301.2.06B Other Material: All other materials to be used in this section shall be in accordance with their respective standard specifications herewithin contained. All special material required shall be designated in the contract documents.

301.3.00 Construction

301.3.01 Trench Excavation

301.3.01A General: All trench excavation and backfill shall conform to any and all specifications of any controlling regulatory agency under which the work is being performed.

301.3.01B Clearing the Right of Way: Where clearing of the right of way is necessary, it shall be completed prior to the start of the trenching. Brush shall be cut as near to the surface of the ground as practicable and removed to a disposal site approved by the Engineer.

The Contractor shall observe all federal and state laws relating to fire permits and local regulations relating to burning materials. Under no conditions shall excavated materials be permitted to cover brush prior to clearing and disposal of same.

301.3.01C Open Trench Limit: The length of the trench excavated shall always be kept to a minimum. The Engineer shall be the sole judge of the amount of open trench allowed based upon work conditions in the area. In normal cases, the open trench length shall not exceed 100 feet. Related trench construction such as pavement, road gravel, concrete restoration, etc. shall also be completed within 800 feet of the open trench limit unless otherwise authorized.

301.3.01D Trench Width: It is the intent of these specifications that the trench width at the surface of the ground be kept to a minimum necessary to install the pipe in a safe manner. In all cases, trenches must be of sufficient width to allow for shoring and permit proper jointing of the pipe and backfilling of material along the sides of the pipe. The minimum trench width, in the pipe zone, must provide a clear working space of six inches outside the maximum outside diameter of the pipe.

No maximum width of trench at the top of the pipe will be specified herein. When required by design, it will be shown on the plans. If the maximum width shown is exceeded by the Contractor without written authorization, the Contractor will be required, at no expense to the Owner, to provide pipe of a higher strength designation, a higher class of bedding, or both, as approved.

301.3.01D Trench Width, Continued

Excavation for manholes and other structures shall be wide enough to provide a minimum 12 inches between the structure surface and the sides of the excavation.

The Contractor shall confine the top width of the trench to right-of-ways or easements. Special written agreements to extend the width may be made with the affected property owner, provided such agreement is first approved by the Engineer.

301.3.01E Grade: The Contractor shall excavate the trench to the lines and grades shown or as established by the Engineer, with proper allowance for pipe thickness, pipe bedding and foundation stabilization as required. The subgrade upon which the bedding is to be placed shall be firm, undisturbed and true to grade. If the trench is over-excavated, the Contractor shall restore to grade with material of the type specified for pipe bedding at no expense to the Owner and place the material over the full width of the trench in compacted layers not exceeding six inches deep to the established grade with allowance of the pipe bedding.

301.3.01F Disposal of Excess Material: The Contractor shall dispose of all excess material not used or required elsewhere on the project, make arrangements for disposal and bear all cost related thereto.

301.3.01G Shoring: Unless otherwise provided in the Special Provisions, the Contractor shall provide all materials, labor and equipment necessary to adequately shore trenches to protect the work, existing property, utilities, pavement, etc. and to protect the working conditions in the trench. The method of shoring shall be according to the Contractor's design. The Contractor may elect to use a combination of shoring and overbreak, tunneling, boring, sliding trench shields or other methods of accomplishing the work, provided the method meets with the approval of all applicable local, state and federal safety codes.

Removal of any cribbing and sheeting from the trench shall be accomplished in such a manner as to fulfill the above requirements.

Damages resulting from the improper cribbing or from failure to crib shall be the sole responsibility of the Contractor. Cribbing will not be a pay item and the cost thereof shall be included in the unit contract price for "Trench Excavation" of the particular class of trench excavation required, unless otherwise provided in the Special Provisions.

That portion of cribbing or sheeting extending below the springline of rigid pipe or below the crown elevation of flexible pipe shall be left in place unless satisfactory means of reconsolidating bedding or side support, disturbed by cribbing or sheeting removal, can be demonstrated. If a moveable box is used in lieu of cribbing or sheeting and the bottom cannot be kept above the springline of rigid pipe or the crown elevation of flexible pipe, the bedding or side support shall be carefully reconsolidated behind the movable box prior to placing backfill.

301.3.01G Shoring, Continued

The use of horizontal strutting below the barrel of pipe or the use of the pipe as support for trench bracing will not be permitted.

301.3.01H Location of Excavated Material: Excavated material shall be placed at locations and in such a manner that it does not create a hazard to pedestrian or vehicular traffic, nor interfere with the function of existing drainage facilities.

301.3.01I Existing Facilities: The Contractor shall remove and dispose of existing abandoned sewer pipe, structures, and other facilities necessary to construct the sewer. The cost of such removal will be considered incidental to the item Trench Excavation and Backfill.

Other existing facilities which may be located during construction, and of which records are not available shall be restored to their original condition, if directed by the Engineer, at no additional cost to the Owner.

301.3.02 Rock Excavation: Where the bottom of the trench encounters ledge rock and/or boulders and large stones which meet the definition of "rock" as described in Subsection 301.1.01, said rock shall be removed to provide six inches of clearance to each side and below all pipe and accessories.

Excavations below subgrade in rock shall be backfilled to subgrade with approved bedding material and thoroughly compacted.

Where trench rock is anticipated or encountered, the Contractor will be required to excavate and remove the over-burden exposing the rock surface, thus allowing the Engineer to profile or cross section the excavated trench or area for rock measurement. The profiling or cross sectioning of the exposed rock surface shall be done prior to commencement of removal activities.

The Contractor shall comply with the requirements for the use and security of explosives as specified in Subsection 107.19.

The Contractor shall provide all necessary approved types of tools and devices required for loading and using explosives, blasting caps and accessories, and conform to and obey all federal, state and local laws that may be imposed by any public authority, or to directions that may be given from time to time by the Engineer relative to the handling, placing, and firing of explosives.

301.3.02 Rock Excavation, Continued

When blasting rock in trenches, cover the area to be shot with blasting mats or other approved type of protective material that will prevent the scattering of rock fragments outside the excavation. The Contractor shall give ample warning to all persons within the vicinity before blasting, station people and provide signals of danger in suitable places to warn people and vehicles before firing any blasts. Fire all blasts with an electric blasting machine which shall be connected to the circuit immediately prior to the time for firing and only then by the person who will operate the blasting machine.

The Contractor shall assume all liability and responsibility connected with or accruing from blasting, or the use of explosives or dangerous material of any kind whatsoever. Such liability shall extend to include, but not be limited to damage to work or adjacent property, injuries, lawsuits, complaints and all other adverse results, actual, alleged, inferred or implied.

301.3.03 Dewatering: The Contractor shall provide and maintain ample means and devices with which to promptly remove and dispose of all water entering the trench excavation during the time the trench is being prepared for the pipe laying, during the laying of the pipe and until the backfill at the pipe zone has been completed. The Contractor shall dispose of the water in a suitable manner without damage to adjacent property.

Groundwater shall be controlled such that softening of the bottom of excavations or formation of "quick" conditions or "boils" during excavation shall be prevented. Dewatering systems shall be designed and operated so as to prevent removal of the natural soils and so that the groundwater level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property.

Dewatering of the trench shall be considered as incidental to, and all costs included in, the various contract pay items in the Proposal.

301.3.04 Trench Foundation: When, in the judgement of the Engineer, the existing material in the bottom of the trench is unsuitable for supporting the pipe, the Contractor shall excavate below the pipe, as directed. The Contractor shall backfill the trench to subgrade of the pipe bedding, with trench foundation material over the full width of the trench and compact in layers not exceeding six inches deep to the required grade.

301.3.05 Pipe Bedding: Pipe bedding consists of leveling the bottom of the trench or the top of the foundation material and placing bedding material to the horizontal centerline of the pipe. Bedding material shall be as specified hereinabove and as shown on the plan and placed in at least two lifts. Place the first lift to provide the minimum six inch depth of bedding material as shown on the plan before the pipe is installed.

301.3.05 Pipe Bedding, Continued

The Contractor shall spread the bedding smooth to proper grade so that the pipe is uniformly supported along the barrel and excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. Bedding under the pipe shall provide a firm, unyielding support along the entire pipe length. The Contractor shall place subsequent lifts of not more than six inches in thickness up to the horizontal centerline of the pipe, bring lifts up together on both sides of the pipe and carefully work under the pipe haunches by slicing with a shovel, tamping or other approved procedure.

Particular attention must be given to the area from the flow line to the horizontal centerline of the pipe or top of bedding to insure that firm support is obtained to prevent any lateral movement of the pipe during the final backfilling of the pipe zone.

Pipe bedding shall be placed the full width of the trench.

301.3.06 Pipe Zone: The Contractor shall place the specified pipe zone material carefully around the pipe in six inch layers and thoroughly hand tamp with approved tamping sticks supplemented by "Walking In" and slicing with a shovel. The Contractor shall prevent pipe from movement either horizontally or vertically during placement and compaction of pipe zone material. Mechanical compactors shall not be utilized in placement of the pipe zone material.

301.3.07 Trench Backfill: The Engineer will sample excavated material to determine the suitability of the Class A material for backfill use. If the Class A backfill is found to be compatible and within the tolerance range of the moisture content, the Contractor will be required to use it for backfill. The Contractor shall take reasonable precautions to prevent excavated material from becoming saturated beyond the critical moisture limits and replace any saturated Class A material with Class B, C or D material, as specified and at no expense to the Owner.

Only when directed and when Class A material is not approved or available for backfill shall Class B, C or D material be used as backfill.

The Contractor shall backfill the trench above the pipe zone to within eight inches of the final surface grade, or as shown on the plans, in lifts not to exceed eight inch loose depth. The Contractor shall compact each lift to a minimum of 95 percent of the maximum density as determined by AASHTO T99, Method D, with mechanical vibrators or impact tampers. The Contractor shall then place the proper surface replacement as required.

Backfill shall not be placed in the trench in such a way as to permit free fall of the material until at least two feet of cover is provided over the top of the pipe. Under no circumstances shall the Contractor allow sharp, heavy materials to drop directly onto the pipe or pipe zone material around the pipe.

301.3.07 Trench Backfill, Continued

If the required compaction density has not been obtained, the Contractor shall remove the backfill from the trench and recompact. This process shall be repeated until the Contractor has established a procedure that will provide the required field density. The Contractor will then be permitted to proceed with backfilling and compacting the remainder of the pipeline under the approved compaction procedure.

If the routine field densities taken during the course of construction shown the specified compaction is not being obtained because of changes in soil types or for any other reason, the Contractor will be required to modify the compaction procedure. In no case will excavation and pipelaying operations be allowed to proceed until the specified compaction is attained. The Engineer shall have the right to change methods and limits to accommodate changes in soil conditions.

When in the judgement of the Engineer, either common material or granular material is approved as noncohesive soil, the Contractor may substitute water settling as an alternate compaction method. Water settling shall be done only with approved jetting equipment and methods. Water settlement will not relieve the Contractor of the responsibility for compaction of trench backfill as specified herein for standard compaction methods.

The location and extent of trench water settling will be determined by the Engineer. The Contractor shall backfill the trench as specified to a point level with or slightly above the required grade to allow for settlement. After all structures are completed and all subsurface utilities have been restored to their original condition, the Contractor shall place water in the trench section in such quantities and in such a manner that all portions of the backfill for the entire trench depth become saturated.

The Contractor shall determine the procedures and provide the quantity of water required in every case to affect complete water settlement of the backfilled materials. Under no circumstances will the jetting pipe be inserted closer than two feet above the top of the pipeline.

Any subsequent settlement of the trench during the warranty period shall be considered to be the result of improper water settlement or compaction and shall be promptly corrected as specified in Subsection 107.24.00.

Where topsoil conditions exist, the Contractor shall replace topsoil in the top 12 inches of the trench and remove all boulders and stones two inches in diameter and larger from material used for backfill in the upper 12 inches of the backfill.

The Contractor shall also compact and rake the soil to match the ground surface adjacent to the trench and maintain the surface of the backfilled trench level with the existing grade until the entire project is accepted by the Owner.

301.3.07 Trench Backfill, Continued

In paved or graveled areas, the Contractor shall maintain the surface of the backfill trench level with the existing grade with approved granular materials or asphalt concrete, if directed, until final pavement replacement is completed on the entire project, and is accepted by the Owner. The Contractor shall place asphalt concrete in conformance with the requirements of Section 211.

Maintenance of backfilled trenches is considered as incidental to this item of work, and payment for such maintenance will be considered included in payment for Trench Excavation and Backfill.

Water settling of backfilled trenches shall be included as part of the backfilling procedure, and payment will be considered to be incidental to the item for Trench Excavation and Backfill.

301.3.08 Embankments

301.3.08A Structural Embankments: The Contractor shall construct embankment to support the pipeline in accordance with the details shown on the Plans. The Contractor shall spread excess excavated trench material suitable for embankment, or approved imported material when directed, in maximum one foot lifts for the full width of the embankment cross section and compact to a minimum of 95 percent of maximum density for the full depth of the fill as determined by AASHTO T99.

The Contractor shall moisten or dry layers of fill as required to obtain the compaction specified and compact the embankment to its final cross section before the trench excavation for the pipe is made.

301.3.08B Additional Pipe Cover: In locations where insufficient pipe cover exists, the Contractor shall place excess excavated trench material suitable for embankment over the pipe as shown on the plan and compact as required.

301.3.09 Surface Removal and Replacement

301.3.09A Topsoil: Where trenches cross lawns, garden areas, pasturelands, cultivated fields, or other areas on which reasonable topsoil conditions exist, the Contractor shall remove the topsoil to a depth as specified for the full width of the trench to be excavated and stockpile the topsoil. The Contractor shall not mix the topsoil with other excavated material. Contractor shall replace the same in the top of the trench, as specified.

301.3.09A Topsoil, Continued

The Contractor shall maintain the finished grade of the topsoil level with the area adjacent to the trench until final acceptance by the Engineer and repair damage to adjacent topsoil caused by work operations. The Contractor shall remove all rock, gravel, clay and any other foreign materials from the surface; regrade, and add topsoil as required.

In lieu of stockpiling the topsoil, approved topsoil as defined herein, may be substituted to the depth as specified at no expense to the Owner.

301.3.09B Pavement, Curb and Sidewalk: All bituminous pavement, regardless of thickness, shall be cut by an approved method prior to excavation of trenches.

Portland cement concrete pavement, curbs and sidewalks, regardless of thickness, shall be cut with a pavement saw. Width of cut shall be the minimum width necessary for the excavation and shall follow lines parallel to the pipe centerline. The use of any machine or device that, during the course of operation, results in damage to adjacent pavement, existing utilities, adjacent structures or improvements, shall not be permitted.

Replacement of these items shall be as specified in Section 309.

301.4.00 Measurement and Payment

301.4.01 Trench Excavation

301.4.01A Measurement by Linear Foot: The length of the trench shall be measured horizontally from centerline to centerline of the manholes or to the end of the pipe, whichever is applicable. No consideration under this method will be given for the depth of the trench.

Measurement for the trench excavation will include all work specified herein, which is not specifically paid for in other pay items.

301.4.01B Measurement by Linear Foot (Depth Method): Quantities for trench excavation and backfill will be measured on a linear foot basis for the type of backfill installed and for the depth of the trench from the original ground surface to the invert of the pipe. The depth figures shown in the proposal are inclusive to the nearest 0.1 foot, that is, a trench depth measured as 11.9 feet will be paid for at the unit price for excavation 10 to 12 feet deep. A trench depth measured as 12.0 feet will be paid for at the unit price for excavation 12 to 14 feet deep. Depths measured at less than 6 feet will be included in the base depth range of 0 to 6 feet.

301.4.01B Measurement by Linear Foot (Depth Method), Continued

The length of trench will be measured horizontally from center to center of manholes or to the end of the pipe, whichever is applicable. The depth of trench will be measured at intervals of 25 feet or other intervals as necessary to adequately and accurately portray the ground profile, along the centerline of the trench, beginning at the center of the downstream manhole, and the average depth between measuring points will be the depth used for computing the depth of trench between measuring points.

Measurement for trench excavation and backfill shall include all work specified herein which is not specifically paid for in other pay items.

301.4.01C Measurement by the Cubic Yard: Work under this item for trench excavation and backfill will be measured on a cubic yard basis. The volume will be computed upon the following basis for length, width and depth of trench:

Length: The length will be the entire horizontal distance on a linear foot basis measured along the centerline of the trench, including measurement through manhole or structure locations, except that the measurement through such structure will be deducted if the proposal carries a separate pay item of structure excavation that is applicable to the manhole and terminate at the center of the most upstream manhole or end of pipe, whichever is applicable.

Width: The width upon which excavation will be calculated will be the maximum outside diameter of the pipe plus 12 inches.

Depth: The depth of the vertical measurement from the invert of the pipe to the original ground or paved surface. The depth of trench will be measured at intervals of 25 feet or other intervals as necessary to adequately and accurately portray the ground profile, along the centerline of the trench, beginning at the center of the downstream manhole, and the average depth between measuring points will be the depth used for computing the depth of trench between measuring points.

301.4.01D Incidental Work: Measurement for trench excavation may be considered incidental to other pay items.

301.4.02 Measurement of Rock Excavation: Rock excavation will be measured on a cubic yard basis as follows:

Length: The length will be the entire horizontal distance measured on a linear foot basis along the centerline of the trench, excluding manholes and other structures, which will be measured separately.

301.4.02 Measurement of Rock Excavation, Continued

Width: The width for measurement purposes shall be 12 inches greater than the maximum outside diameter of the pipe.

Depth: The measurement for depth will be the vertical distance from the top of the rock to the depth shown on the plan. The depth will be measured at intervals of 25 feet or other intervals as necessary to adequately and accurately portray the ground profile along the centerline of the trench and the average depth between measuring points will be the depth used for computing the depth of rock.

Measurement and payment for rock excavation will be in addition to the payment for trench excavation and backfill. Measurement for rock excavation shall include full compensation for all work necessary to excavate the rock material.

Rock excavation quantities for manholes and other structures shall be computed from the actual profile depth as above, times the area within a line parallel to and one foot outside of the actual dimensions of the manhole or structure base.

301.4.03 Measurement of Trench Foundation:

301.4.03A Measurement by the Ton: Measurement for this item will be made on a ton basis. Measurement will be the actual tons used and shall be based on weight tickets from state certified scales. Weight tickets shall be presented to the Engineer or his representative for signature on the day the material is delivered.

301.4.03B Measurement by the Cubic Yard: Measurement for this item will be made on a cubic yard basis. The volume will be computed upon the following basis for length, width and depth of trench:

Length: The length will be the entire horizontal distance on a linear foot basis along the centerline of the trench, including that measurement through manhole or structure locations, except that the measurement through such structures will be deducted if the proposal carries a separate item of structure excavation that is applicable to the structure.

Width: The width upon which trench foundation will be calculated shall be the maximum outside diameter of the pipe plus 12 inches.

Depth: The depth measured will be the actual depth placed as directed below the level of the bottom of bedding. The depth will be measured at intervals of 25 feet or other intervals as necessary to adequately and accurately portray the ground profile along the centerline of the trench, beginning at the downstream beginning of the trench foundation and the average depth between measuring points will be the depth used for computing the depth of trench foundation between the measuring points.

301.4.03B Measurement by the Cubic Yard, Continued

Payment for this item shall constitute full compensation for all work necessary to furnish materials at trench side; for placing and compacting it in the trench; and for the extra depth of trench excavation required below the pipe bedding grade to provide for a stable foundation for the pipe.

301.4.03C Incidental Work: Measurement for trench foundation may be considered incidental to other pay items.

301.4.04 Measurement for Pipe Bedding:

301.4.04A Measurement by Linear Foot: Quantities for bedding will be measured on a linear foot basis for the class of bedding and size of pipe installed at the depth shown on the plans. The length of bedding will be measured horizontally from center to center of manholes or to the end of pipe, whichever is applicable.

301.4.04B Measurement by the Cubic Yard: The work under this item of bedding for rigid conduits will be measured on a cubic yard basis. The volume will be computed upon the following basis for length, width and depth of bedding:

Length: The length will be the entire horizontal distance on a linear foot basis along the centerline of the trench, including measurement through manhole or structure locations, except if the proposal carries a separate item of structure base rock that is applicable to the structures. Measurement will commence at the center of the downstream manhole and terminate at the center of the most upstream manhole or end of pipe, whichever is applicable.

Width: The width upon which the bedding shall be calculated, shall be the maximum outside diameter of the pipe plus 12 inches.

Depth: The depth of bedding will be calculated on the depth shown on the plans.

Measurement of the volume calculated from the outside barrel of the pipe installed will be deducted from the calculated volume to determine the final pay quantity of cubic yards. Measurement and payment shall include full compensation for over-excavation to allow for placement of bedding material below the pipe invert and all work necessary to place and compact the bedding, complete as specified.

301.4.04C Incidental Work: Measurement for pipe bedding may be considered incidental to other pay items.

301.4.05 Measurement of Pipe Zone Backfill: Payment for pipe zone backfill is included in the bid item, Trench Excavation, and no further compensation will be made unless insufficient or unsuitable material for pipe zone backfill exists at the trench side as determined by the Engineer.

When approved, pipe zone backfill material shall be imported and measured and paid for under the bid item, Class B Backfill.

301.4.06 Measurement of Backfill Material: Measurement of backfill material shall be considered incidental unless otherwise specified.

301.4.06A Measurement by the Ton: Measurement for this item will be made on a ton basis. Measurement will be the actual tons used and shall be based on weight tickets from state certified scales. Weight tickets shall be presented to the Engineer for signature on the day the material is delivered. Measurement for this item shall constitute full compensation for all work necessary to furnish materials at trench side, for placing and compacting it in the trench, and for removal from the site and disposal of all unsuitable material.

301.4.06B Measurement by the Cubic Yard: The work under this item for backfill material will be measured on a cubic yard basis. The volume will be computed upon the following basis for length, width and depth of the backfill:

Length: The length will be the entire horizontal distance on a linear foot basis along the centerline of the trench, including measurement through manhole or structure locations, except if the proposal carries a separate item of structure backfill that is applicable to the structures.

Width: The width upon which the Class B, C or D backfill shall be calculated shall be the maximum outside diameter of the pipe plus 12 inches.

Depth: The depth of the backfill will be the actual vertical depth placed as directed.

Measurement of the volume calculated from the outside barrel of the pipe installed will be deducted from the calculated volume to determine the final pay quantity of cubic yards where applicable.

301.4.07 Measurement of Embankment: Measurement for embankment in place will be made on a cubic yard basis. Computation of the volume for payment will be based on field measurement of the actual number of cubic yards constructed and accepted, complete within the limits shown or directed.

Payment shall constitute full compensation for all work and all materials used, whether obtained from the site of work or imported, complete as specified.

302 TUNNELING, BORING, JACKING

302.1.00 Description
302.1.01 Tunneling
302.1.02 Boring
302.1.03 Jacking

302.2.00 Materials
302.2.01 Pipe Bedding and Pipe Zone Material
302.2.02 Pipe
302.2.03 Casing
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302.3.00 Construction
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302.3.02 Excavation
302.3.03 Tunneling Details Required
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302.4.00 Measurement and Payment
302.4.01 Tunneling, Boring and Jacking
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302.4.05 Tees and Wyes

301.4.07 Measurement of Embankment, Continued

Trench excavation, bedding, and backfill placed in the completed embankment will be paid for separately for the particular item and class of construction.

301.4.08 Measurement of Imported Topsoil: Measurement for imported topsoil will be made on a ton basis only when imported topsoil is listed in the proposal as a bid item, or when directed by the Engineer to be imported and placed in the trench. Measurements will be the actual tons used and shall be based on weight tickets from state certified scales. Weight tickets shall be presented to the Engineer or his representative for signature on the date the material is delivered. Payment for this item shall constitute full compensation for all work necessary to furnish materials at trench side and for placing and compacting it in the trench.

301.4.09 Payment: Payment will be made for the following items when listed as pay items:

Pay Item	*Unit of Measure*
Trench Excavation	L.F. or C.Y.
Rock Excavation	C.Y.
Trench Foundation	Ton or C.Y.
Pipe Bedding Material	L.F. or C.Y.
Pipe Zone Material	Ton or C.Y.
Backfill Material (Class B, C or D)	Ton or C.Y.
Embankment Material	C.Y.
Imported Topsoil	Ton

302 TUNNELING, BORING AND JACKING

302.1.00 Description

302.1.01 Tunneling: Tunneling shall include all methods by which the underground passageway is first excavated and by which the lining materials are brought in and placed.

302.1.02 Boring: Boring shall include all methods by which a conduit is pushed or pulled into place and by which the excavation method precludes the stationing of a worker within the conduit without stopping or removing the excavation equipment.

302.1.03 Jacking: Jacking shall include all methods by which a conduit is pushed or pulled into place with one or more workers inside to excavate and assist in keeping the conduit on the required grade and alignment.

302.2.00 Materials

302.2.01 Pipe Bedding and Pipe Zone Material: If required, pipe bedding and pipe zone material shall conform to the requirements of Section 301.

302.2.02 Pipe: Pipe materials shall conform to the strength, class and type as specified.

302.2.03 Casing: Corrugated metal pipe may be used in cased open-cut trenches and for casing in tunneled, bored or jacked applications where specified or approved. Coupling bands with galvanized or cadmium plated bolts and nuts shall be of material similar to the casing pipe and provided by the same manufacturer. Corrugated metal pipe shall conform to the requirements of Section 305.

The Contractor shall provide casing of a size to permit proper construction to the required lines and grades. Casing shall be the type shown in the table below.

The minimum gauge or wall thickness shall correspond to the size of casing selected from the following table. However, the Contractor shall be responsible for selecting the gauge consistent with his operation and the requirements of the permitter.

Diameter, Inches	*AASHTO M36 Corrugated Metal Pipe US Standard Gauge*	*Smooth Steel Pipe Minimum Thickness*
Up to 16	14	0.188” (3/16”)
18 to 22	12	0.250” (1/4”)
24 to 26	12	0.281” (9/32”)
28 to 34	10	0.321” (5/16”)
36 to 48	8	0.344” (11/32”)
Over 48	8	Not Allowable

302.2.03 Casing, Continued

Jacked casings shall be equipped with nipples at the spring line and crown at 10-foot centers when pressure grouting is specified.

Optionally, the casing may be constructed of galvanized standard, offset tunnel liner plate with gauge and section modulus as approved. Nipples for pressure grouting, when specified, shall be installed at the spring line and crown at 10-foot centers.

302.2.04 Portland Cement Concrete: Portland cement concrete shall conform to the requirements of ASTM C94, Alternate 2, Class 2,500, with slump between two and four inches.

302.2.05 Grout: Grout for filling the annular space between the carrier pipe and casing pipe shall be proportioned one part Portland cement, five parts sand, seven parts pea gravel (by volume), or as approved.

Grout for pressure grouting outside jacked carrier or casing pipe shall be one part Portland cement and three parts sand (by volume), or as approved.

302.3.00 Construction

302.3.01 General: The work shall conform to all federal, state and local laws and regulations pertaining to tunneling and specifically to the standards set forth in the Kansas Statutes Annotated or other applicable statutes.

302.3.02 Excavation: Excavation shall be classified and shall include whatever materials are encountered to the depths as shown or as required. The Contractor shall make an estimate of the kind and extent of the various materials which will be encountered in the excavation.

302.3.03 Tunneling Details Required: The Contractor shall submit details of the following to the Engineer for approval before beginning the tunnel construction:

1. Tunnel shaft bracing and dimensions.
2. Tunnel supports.
3. Method of backpacking tunnel supports.
4. Bracing to prevent lining from shifting and flotation.
5. Backfill material or pressure concrete mix design, placement method, and equipment.
6. Poling plate dimensions and details (if employed).

302.3.04 Jacking and Boring Details Required: The Contractor shall submit details of the following to the Engineer for approval before beginning the jacking or boring construction:

1. Jacking pit construction (including bracing and dimensions).
2. Jacking pit bracing.
3. Casing or conduit.
4. Jacking head.
5. Excavation method.
6. Tee or wye installation.
7. A substitute design for any part of the system that must be changed as a result of the jacking or boring operation (manhole, headwall, etc.).
8. Any structure that is required because of the particular method or procedure used by the Contractor.
9. If placed in a casing, bracing to prevent pipe shifting and flotation, backfilling material, method and equipment.
10. Backfill material or pressure grout mix, placement method and equipment.

302.3.05 Tunneling: Tunneling will be permitted only where shown, specified or approved.

Before the start of the work, the Contractor shall submit satisfactory evidence to the Engineer that all insurance coverage requirements called for by the permitter have been complied with. All proposed construction methods and materials shall be approved by the Engineer and permitter before the start of construction. Written approval to proceed from the permitter shall be submitted to the Engineer before the start of construction.

The subgrade upon which the pipe is to be constructed shall be firm, thoroughly compacted, true to grade and with at least six inches of approved bedding material under the pipe. If the material in the bottom of the tunnel is ledge rock, excavation of the tunnel shall extend to a depth below the bottom of the pipe and a bedding of crushed aggregate or concrete shall be provided as specified in Section 301. Excavation below grade, which is made inadvertently or without authority, shall be restored to grade by backfilling with approved bedding material at no expense to the Owner.

302.3.06 Alternate of Jacking or Boring: Jacking or boring may be allowed in lieu of the open trench method or tunneling. However, written approval by the Engineer must first be obtained. The Engineer retains the right to reject either the jacking or boring method without rejecting the other.

Approval by the Engineer shall in no way relieve the Contractor of the responsibility for making a satisfactory installation meeting the requirements set forth herein.

302.3.07 Jacking and Boring: The leading section of conduit shall be equipped with a jacking head securely anchored thereto to prevent any wobble or alignment variation during the jacking or boring operation. For jacking, all excavation shall be carried out entirely within the jacking head, and no excavation in advance thereof shall be permitted. For jacking, every effort shall be made to avoid any loss of earth outside the jacking head. Excavated material shall be removed from the conduit as excavation progresses and no accumulation of such material within the conduit will be permitted.

All conduit shall be jacked or bored to the required line and grade. The method shall be modified to correct any deviation therefrom. Should any deviation from line and grade be considered excessive in the Engineer's judgement, that portion of the conduit shall be taken up and repositioned at no expense to the Owner.

Should appreciable loss of surrounding material occur during the jacking or boring operation, the voids shall be backpacked or grouted promptly before the completion of the shift. On completion, all voids shall be filled. Filling or backpacking shall be with grout or granular material as approved.

It shall be understood that were any pipe is to be placed by jacking or boring in a tunnel or open trench, the design of such pipe is based upon the superimposed loads and not upon the loads resulting from the jacking or boring operations. Any increase in pipe strength to withstand jacking or boring loads shall be the responsibility of the Contractor.

302.3.08 Concrete Pipe and Box Sections: The Contractor shall protect the driving ends of concrete conduit against spalling and other damage. Intermediate joints shall be similarly protected by the installation of sufficient bearing shims to properly distribute the bearing stresses. Any section of conduit showing signs of failure shall be removed and replaced with a new section of conduit or with a cast-in-place section which, in the judgement of the Engineer, is adequate to carry the loads imposed upon it.

302.3.09 Smooth Steel Casing: Sections of smooth steel casing to be jacked or bored shall be joined by welding the joints with a continuous weld for full circumference or by other approved means. The Contractor shall provide joints which are capable of resisting the jacking or boring forces.

Pipe installed in a casing shall be braced to prevent shifting and flotation. Fill the void between the casing with grout or other material as specified or approved.

If not shown or specified, the casing diameter shall be the option of the Contractor. The Contractor shall provide casing of such strength as to withstand the jacking or boring loads and of such diameter as to allow filling the void between the pipe and casing with the approved material.

302.3.10 Grouting Voids Outside Casing: When grouting is specified, the void space between the tunnel and casing or liner plate shall be completely filled with approved grout. After the casing or carrier pipe has been jacked or tunneled into position, grout will be pressured through the grout holes provided to fill all voids outside the pipe. Grouting will be started at the spring line hole at one end and will be pumped in until it appears in the grout hole at the crown. Grout will them be started through the opposite spring line hole until it appears at the hole in the crown. The hole at the crown will then be grouted until grout appears in the next set of holes along the pipe. The holes at the starting point shall then be plugged. This process shall be repeated with the next set of holes and until the full length of jacked, bored or tunneled pipe has been grouted.

302.3.11 Cased or Tunneled Pipe: Where timber cradles are shown, the Contractor shall provide a strapped timber cradle under the barrel of the pipe, join pipe and slide into casing. Pipe barrel shall bear continuously on cradles. Pipe installation shall conform to the applicable requirements of hydrostatic or air testing and line and grade.

302.3.12 Placing Fill in Casing: Where shown, the Contractor shall completely fill the annular space between the casing, tunnel liner or tunnel wall and the pipe with approved grout or sand to prevent pipe flotation. The Contractor shall accomplish grout or sand filling by pouring or pumping the grout from the two ends and such intermediate points as may be necessary. Grouting, once commenced at any one point, shall be completed without stopping using approved low pressure grouting equipment. The Contractor shall accomplish sand filling by similar methods using a gunite machine or other approved equipment. The Contractor shall dispose of excess excavated material in a manner satisfactory to the Engineer.

302.3.13 Railroad Crossings: All work to be performed by the Contractor in construction on the railroad right-of-way shall be performed at such times and in such a manner as not to unnecessarily interfere with the movement of trains or traffic upon the track of the railway company. The Contractor shall use all care and precaution in order to avoid accidents, damage or unnecessary delay or interference with the railway company's trains or other property. When required by the railway company, the Contractor shall make arrangements for and pay the cost of all flagpersons required by the railway company. Such costs shall be considered incidental to other work and which no additional payment will be made.

Railroad liability insurance shall be obtained by the Contractor as provided in the contract documents. The cost of such insurance shall be considered as incidental to other work and no additional payment shall be made.

302.4.00 Measurement and Payment

302.4.01 Tunneling, Boring and Jacking: Measurement and payment for tunneled, bored and jacked conduit will be made on a linear foot basis. Payment will include compensation for all excavation, shafts, portals, jacking pits, backfill, lubricant, grouting and appurtenances.

302.4.01 Tunneling, Boring and Jacking, Continued

Where casing is shown or is used at the option of the Contractor, the casing and the backfill between the pipe and the casing shall be included in the pay item for the pipe installed within the casing and no separate payment will be made therefore.

302.4.02 Jacking and Boring: Measurement and payment for jacking and boring will be made on a linear foot basis along the centerline of the conduit between portals. Jacking and boring extension beyond the limits shown shall be considered to be for the Contractor's convenience, unless ordered in writing.

302.4.03 Jacking or Boring in Lieu of Tunneling: Where jacking or boring of a conduit is approved in lieu of tunneling, measurement and payment will be made as though the tunneling method has been used and will include the pay items for tunnel, for pipe in tunnel and for tunnel backfill complete, as specified. No additional payment will be made for stabilization and pipe bedding materials.

302.4.04 Tunneling, Jacking, or Boring in Lieu of Open Trench: Where tunneling, jacking or boring of a conduit is approved in lieu of open trench construction, measurement and payment will be made as though the open trench method had been used and will include the pay items for specified excavation and backfill, the required conduit in place and for curbs, sidewalk, pavement and pavement base courses whether cut or not. Payment will be made for bedding and backfill only if they are shown and specified.

302.4.05 Tees and Wyes: Measurement and payment for tees and wyes in a tunneled, jacked or bored conduit will be made at the unit bid price for tees and wyes installed in an open trench.

303 PIPE AND FITTINGS (SANITARY SEWER)

303.1.00 Description

303.2.00 Materials
303.2.01 General
303.2.02 Nonreinforced Concrete Pipe
303.2.03 Reinforced Concrete Pipe
303.2.04 Vitrified Clay Pipe
303.2.05 Cast Iron Pipe
303.2.06 Ductile Iron Pipe
303.2.07 Polyvinyl Chloride Pipe (PVC)
303.2.08 Jointing Materials
303.2.08A Concrete Pipe
303.2.08B Vitrified Clay Pipe
303.2.08C Cast Iron and Ductile Iron Pipe
303.2.08D Polyvinyl Chloride Pipe (PVC)
303.2.09 Proof Tests
303.2.09A General
303.2.09B Concrete Pipe
303.2.09C Clay Pipe
303.2.09D Cast Iron Pipe and Ductile Iron Pipe
303.2.09E PVC Pipe
303.2.10 Fittings
303.2.10A General
303.2.10B Concrete Pipe
303.2.10C Clay Pipe
303.2.10D Cast Iron and Ductile Pipe
303.2.10E PVC Pipe
303.2.11 Mechanical Couplings
303.2.12 Material Certification

303.3.00 Construction
303.3.01 Line and Grade
303.3.02 Pipe Distribution and Handling
303.3.03 Laying Pipe on Curves
303.3.04 Concrete Closure Collars
303.3.05 Installation of Service Tees and Wyes
303.3.06 Reinforced Concrete Pipe Core Tests
303.3.07 Concrete Pipe Field Permeability Tests
303.3.08 Concrete Pipe Plant Air Test
303.3.09 Pipe Placing and Jointing
303.3.09A Concrete and Clay Pipe
303.3.09B Cast Iron and Ductile Iron Pipe
303.3.09C PVC and ABS Pipe

303.3.09D Solvent Welded Joints
303.3.10 Deflection at Joints
303.3.11 Water and Equipment for Tests
303.3.12 Cleaning Prior to Test
303.3.13 Requirements Prior to Tests
303.3.13A General
303.3.13B Plugging of Tees, Wyes, Stubs and Service Connections
303.3.13C Testing of Equipment and Procedure
303.3.13D Time of Test
303.3.14 Repairs
303.3.15 Infiltration-Exfiltration Testing
303.3.16 Air Testing
303.3.16A General
303.3.16B Safety Precautions
303.3.16C Ground Water
303.3.16D Methods
303.3.16E Acceptance
303.3.17 Deflection Test for PVC and ABS Pipe
303.3.18 Television Inspection of Sanitary Sewers

303.4.00 Measurement and Payment
303.4.01 Sewer Pipe
303.4.02 Tee and Wye Fittings
303.4.03 Concrete Tee and Wye Encasement
303.4.04 Concrete Closure Collars
303.4.05 Television Inspection

303 PIPE AND FITTINGS (SANITARY SEWER)

303.1.00 Description: This section covers all work necessary for the installation of sanitary sewer pipe and fittings.

303.2.00 Materials

303.2.01 General: Sanitary sewer pipe shall have threaded, solvent welded or flexible elastomeric gasket joints. Materials and strength specifications shall be as hereinafter specified for the particular kind of pipe and fittings required.

Joints on all fittings shall be the same as the joints used on the pipe. Caps or plugs shall be furnished with each fitting, outlet or stub as required with the same type gasket and/or joint as the pipe.

303.2.02 Nonreinforced Concrete Pipe: Nonreinforced concrete pipe shall conform to the requirements of ASTM C14, Class 2.

303.2.03 Reinforced Concrete Pipe: Reinforced concrete nonpressure pipe shall conform to the requirements of ASTM C76 and shall be of the Class as specified. Unless otherwise specified, pipe shall meet the design requirements of wall B.

Reinforced concrete low head pressure pipe shall conform to the requirements of ASTM C361.

303.2.04 Vitrified Clay Pipe: Vitrified clay pipe shall conform to the requirements of ASTM C700, extra strength, unless otherwise specified.

303.2.05 Cast Iron Pipe: Cast iron pipe shall conform to the requirements of AWWA C106 or C108, or ANSI specification A21.6, with Type II Push-on joint or Type III Mechanical joints, conforming to federal specification WW-P-421c.

Cast iron pipe shall be lined with 3/32 inch cement mortar and seal coated in accordance with ANSI Standard A21.4 and AWWA C104, except thickness of lining and except as otherwise specified in WW-P-421c. The Contractor shall provide all foundry records of pipe as described in ANSI A21.6 when requested.

The minimum acceptable thickness class for cast iron pipe shall be Class 22 for 4 inch, Class 21 for 6 inch, and Class 20 for 8 inch and larger for 21/45 iron strength; and for 18/40 iron strength, the minimum acceptance thickness shall be Class 22 for pipes up to 12 inch diameter.

303.2.06 Ductile Iron Pipe: Ductile iron pipe shall conform to the requirements of ANSI A21.51 or AWWA C151, cement lined, push-on joint. The minimum thickness class shall be Class 2 through 12 inch diameter pipe and Class 1 for 14 inch diameter and larger pipe.

303.2.07 Polyvinyl Chloride Pipe (PVC): Type PSM polyvinyl chloride pipe and fittings shall conform to ASTM D3034.

Type PSP polyvinyl chloride pipe and fittings shall conform to ASTM D3033.

Polyvinyl chloride pipe Schedule 40 and 80 shall conform to ASTM D1785, and fittings shall conform to ASTM D2466 or D2467.

303.2.08 Jointing Materials

303.2.08A Concrete Pipe: Gaskets shall conform to the requirements of ASTM C443.

303.2.08B Vitrified Clay Pipe: Gaskets shall conform to the requirements of ASTM C425.

303.2.08C Cast Iron and Ductile Iron Pipe: Push-on joints shall conform to the requirements of federal specification WW-P-421c.

Mechanical joints shall conform to the requirements of ANSI A21.11.

303.2.08D Polyvinyl Chloride Pipe (PVC): Gaskets shall conform to the requirements of ASTM F477.

Threaded connections shall conform to the requirements of ASTM D2464 for Schedule 80 pipe.

Solvent welded joints shall conform to the applicable requirements of ASTM D2466 and ASTM D2467.

303.2.09 Proof Tests

303.2.09A General: The intent of this requirement is to prequalify a joint system, components of which meet the joint requirements, as to the water tightness capability of that joint system. These tests do not replace the acceptance testing required in Section 303.3.13 through 303.3.18. This proof test shall be understood to apply to sanitary sewers which are to be tested for water tightness prior to acceptance. Material and test equipment for proof testing shall be provided by the manufacturer. When approved, internal hydrostatic pressure may be applied by a suitable joint tested. In general, each pipe material and joint assembly shall be subject to the following three proof tests at the discretion of the Engineer.

1. Pipe in Straight Alignment. No less than three nor more than five pipes selected from stock by the Engineer shall be assembled according to the manufacture's installation instructions with the ends suitably plugged and restrained against

303.2.09A General, Continued

internal pressure. The pipe shall be subjected to 10 psi hydrostatic pressure for 10 minutes. Free movement of water through the pipe joint or pipe wall shall be grounds for rejection of the pipe.

2. Pipe in Maximum Deflected Position. A test section shall be deflected as described hereinafter for each pipe material. The pipe shall be subjected to 10 psi hydrostatic pressure for 10 minutes. Free movement of water through the pipe joint or pipe wall shall be grounds for rejection of the pipe.

3. Joints under Differential Load. The test section shall be supported on blocks or otherwise as described hereinafter for each pipe material. There shall be no visible leakage when the stressed joint is subjected to 10 psi internal hydrostatic pressure to 10 minutes.

303.2.09B Concrete Pipe: For deflected position, a position ½ inch wider than the fully compressed position, shall be created on one side of the outside perimeter.

For differential load, one pipe shall be supported so that it is suspended freely between adjacent pipe, bearing only on the joints. In addition to the weight of the suspended pipe, a test load shall be added as given in the following table:

TEST LOADS FOR PIPES UNDER DIFFERENTIAL LOAD		
Pipe Size	*Load Per Foot Laying Length up to 4 Feet*	*Total Load for Pipe 4 Feet and Over*
4 inches	650	2600
6 inches	1000	4000
8 inches	1300	5200
10 inches	1400	5600
12 inches	1500	6000
15 inches	1850	7400
18 inches	2200	8800
21 inches	2500	10000
24 inches and Over	2750	11000

303.2.09C Clay Pipe: For deflected position, one joint shall be deflected ½ inch per foot of pipe length for 12 inches or less in diameter, or 3/8 inch per foot of pipe length for pipe 15 inches to 24 inches in diameter.

A differential load shall be supported so that one pipe is suspended freely, bearing only on the joints. A force of 150 pounds per inch diameter shall be applied over an arc of not less than 120 degrees and along a longitudinal distance of 12 inches, immediately adjacent to one of the joints.

303.2.09D Cast Iron Pipe and Ductile Iron Pipe: For deflected position, a position ½ inch wider than the fully compressed section shall be created on one side of the outside perimeter.

For differential load, one of the pipes shall be supported so that it is suspended freely between adjacent pipe, bearing only on the joints. A force shall be applied per the following table along a longitudinal distance of 12 inches, immediately adjacent to one of the joints.

Pipe Size	*Force, Pounds*
4 inches	600
6 inches	900
8 inches	1200
10 inches	1500
12 inches	1800
15 inches	3700
18 inches	4400
21 inches	5000
24 inches and Over	5500

303.2.09E PVC Pipe: For deflected position, two 12 ½ foot lengths shall be joined, then deflected along an arc of 720 feet radius (0.11 feet offset at the end of length from a tangent at the joint).

For differential load, two lengths shall be joined and uniformly supported for at least 2 feet on both sides of the joint and adjacent pipe to 95 percent of its initial vertical diameter.

303.2.10 Fittings

303.2.10A General: Tee or wye fittings shall be provided in the sewer main for side sewer, catch basin or inlet connections. All fittings shall be of sufficient strength to withstand all handling and load stresses encountered. All fittings shall be of the same materials as the pipe unless otherwise specified. Material joining the fittings to the pipe shall be free from cracks and shall adhere tightly to each jointing surface.

All fittings shall be capped or plugged and gasketed with the same gasket material as the pipe joint, fitted with an approved mechanical stopper, or have an integrally cast knockout plug. The plug shall be able to withstand all test pressures without leaking, and when later removed, shall permit continuation of piping with jointing similar to joints in the installed line.

303.2.10B Concrete Pipe: Fittings on 18 inch and smaller concrete pipe shall be shop fabricated. Fittings on pipe 21 inches and larger may be field or shop fabricated. Fabrication details for fittings shall be submitted for and approval obtained prior to delivery of fittings to the jobsite.

303.2.10B Concrete Pipe, Continued

Fittings fabricated by inserting a stub into a hole cut in the pipe shall be grouted with a nonshrinking grout. Surfaces to receive grout shall be coated with an epoxy bonding agent prior to grouting. Fitting stubs shall not protrude inside the sewer pipe.

303.2.10C Clay Pipe: Fittings shall conform to the requirements of ASTM C425.

303.2.10D Cast Iron and Ductile Pipe: Fittings shall be mechanical or push-on of the class as specified. Mechanical joint cast iron fittings shall conform to AWWA C110 and shall be of a class at least equal to that of the adjacent pipe. Push-on joint fittings shall be gray iron with body thickness and radii of curvature conforming to ANSI A21.10.

303.2.10E PVC Pipe: Fittings shall conform to the applicable portions of the following specifications: ASTM D3033 and ASTM D3034. Fitting joint shall be the same as the pipe joints.

303.2.11 Mechanical Couplings: Mechanical couplings shall be wrought steel or cast iron. The diameter of the pipe shall be used to connect the pipeline to existing steel pipelines. Cast style mechanical couplings shall be used in the pipeline or to connect the pipeline to existing cast iron pipelines.

303.2.12 Material Certification: The manufacturer or fabricator shall furnish appropriate certification, based on manufacturer's routine quality control tests, that the materials in the pipe meet the requirements specified therein.

303.3.00 Construction

303.3.01 Line and Grade: Survey line and grade control hubs will be provided by the Engineer in a manner consistent with accepted practices.

Variance from established line and grade shall not be greater than one thirty-second (1/32) of an inch per inch of pipe diameter and not to exceed one-half (1/2) inch, provided that such variation does not result in a level or reverse sloping invert; provided also, that variation in the invert elevation between adjoining ends of pipe, due to nonconcentricity of joining surface and pipe interior surfaces, does not exceed one sixty-fourth (1/64) per inch of pipe in diameter, or one-half (1/2) inch maximum.

The Contractor shall established line and grade for pipe by the use of lasers or by transferring the cut from the offset stakes to the trench at whatever intervals necessary to maintain the line and grade.

303.3.01 Line and Grade, Continued

The Contractor shall constantly check line and grade in the event they do not meet the limits described, the work shall be immediately stopped, the Engineer notified, and the cause remedied before proceeding with the work.

303.3.02 Pipe Distribution and Handling: The Contractor shall not distribute material on the job faster than it can be used to good advantage. The Contractor shall unload pipe only by approved means. Pipe will not be unloaded by dropping to the ground. More than one week's supply of material in advance of laying will not be distributed unless approved.

The Contractor shall inspect all pipe and fittings prior to lowering into trench to ensure no cracked, broken, or otherwise defective materials are used. The Contractor shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep it clean during laying and joining.

The Contractor shall use approved implements, tools, and facilities for the safe and proper protection of the work. The Contractor shall lower pipe into trench in such a manner as to avoid any physical damage to the pipe. The Contractor shall remove all damaged pipe from the jobsite. Pipe will not be dropped or dumped into trenches.

303.3.03 Laying Pipe on Curves: The Contractor shall lay pipe on horizontal or vertical curves in accordance with the manufacturer's recommendations.

303.3.04 Concrete Closure Collars: The Contractor shall use concrete collars only when approved, and then only to make connections between dissimilar pipe or where standard rubber gasketed joints are impractical. The Contractor shall construct in conformance with the details shown. The Contractor shall wash pipe to remove all loose material and soil from the surface on which the concrete will be placed.

The Contractor shall moisten nonmetallic pipe thoroughly prior to pouring the collars. The Contractor shall wrap and securely fasten a light gauge of sheet metal or building felt around the pipe to insure that no concrete shall enter the line. The entire collar shall be constructed in one concrete pour. Collars will not be poured in water. After the collars are poured and have taken their initial set, the Contractor shall cure by an approved method.

303.3.05 Installation of Service Tees and Wyes: The Contractor shall provide a compacted approved granular base of pipe bedding material under all tees and wyes and branched fittings, extending to the springline of the fittings. The Contractor shall place bases on undisturbed native material or compacted foundation stabilization material.

303.3.05 Installation of Service Tees and Wyes, Continued

Maximum deflection permissible with any one fitting shall not exceed 45 degrees and shall be accomplished with long radius curves or bends, except when approved.

The Contractor shall connect service lines to manholes only when directed. The Contractor shall make the connection so that the standard pipe joint is located not more than 1.5 feet from the structure.

The Contractor shall provide ends of all service lines and fittings with approved watertight plugs, caps, or stoppers, suitably braced to prevent blowoff during internal hydrostatic or air testing. Such plugs or caps shall be removable and their removal shall provide a socket suitable for making a flexible joint lateral connection or extension.

303.3.06 Reinforced Concrete Pipe Core Tests: Acceptance for reinforced concrete pipe 60 inches in diameter and smaller shall conform to paragraph 4.1.1 of ASTM C76. Acceptance of pipe larger than 60 inches may, at the option of the Owner, conform to paragraph 4.1.2 of ASTM C76. Under this basis of acceptance, at least three 3 ½ inch minimum diameter core samples shall be taken from each pipe section tested. Pipe must have a 14 day or greater strength before core drilling. Cores will be taken and tested in conformance with ASTM C497. When cores meet the test requirements, the core holes shall be plugged and sealed in a manner such that the pipe section will meet all test requirements. Pipe sections so sealed shall be considered satisfactory for use.

Specimens for tests will be selected by the Engineer in accordance with the applicable ASTM specifications from pipe in the pipe manufacturer's yard or at the point of delivery to the job. The provisions of the applicable ASTM standards shall apply, except as modified herein. The tests for joint performed under ASTM C443 shall also be used as a basis for rejection of pipe.

303.3.07 Concrete Pipe Field Permeability Tests: In addition to the tests specified in the applicable ASTM specifications, the Owner will require permeability tests on a maximum of 5 percent of each lot, class or size of pipe in conformance with ASTM C497 on pipe 24 inch diameter and smaller.

The Contractor shall provide all the necessary labor, equipment, water and materials at the site where the pipe is to be unloaded for performing field permeability tests. Damp spots on the outside of the wall which appear during these tests shall not be cause of rejection unless actual movement of water through the pipe wall can be detected. Acceptance or rejection shall be in accordance with item 4.4 of ASTM C14, except that if over 20 percent of the group represented by the samples tested fails to pass, then the entire size, class and lot represented by the samples tested shall be rejected.

At the option of the pipe supplier, the individual field permeability tests as specified herein may be performed at the point of manufacture if the testing equipment, scheduling of tests and method of recording and documenting the test results are approved by the Engineer.

303.3.08 Concrete Pipe Plant Air Test: At the option of the Engineer, each length of concrete pipe 12 inch diameter and smaller shall be given an individual air test at the point of manufacture. Test equipment shall be approved by the Engineer and the test pressure shall be a minimum of 10 psi. Each length shall show no appreciable loss of air after 5 second.

When individual air testing is performed, no field or shop permeability tests will be required.

303.3.09 Pipe Placing and Jointing: Trench excavation, bedding and backfill shall be in accordance with Section 301, unless otherwise specified.

303.3.09A Concrete and Clay Pipe: Pipe laying shall proceed upgrade with spigot ends in the direction of flow. After a section of pipe has been lowered into the prepared trench, the end of the pipe to be joined will be cleaned as will the inside of the joint and the rubber ring, immediately before joining the pipe. The joint will be assembled in accordance with the recommendations of the manufacturer of the type of joint used. All special tools and appurtenances required for the jointing assembly will be provided by the Contractor.

After the joint has been made, pipe will be checked for alignment and grade. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints. Sufficient pressure will be applied in making the joint to assure that the joint is "home", as defined in the standard installation instruction provided by the pipe manufacturer. Sufficient bedding material will be placed to secure the pipe from movement before the next joint is installed to assure proper alignment and joint make-up.

Pipe 21 inches and smaller shall be laid so the inside joint space does not exceed 3/8 inch in width. If interior joints on 24 inch and larger pipe are greater than 3/8 inch, they shall be filled and sealed with premixed mortar conforming to ASTM C387 and troweled smooth on the inside surface.

When the pipe is laid within a movable trench shield, all necessary precautions will be taken to prevent pipe joints from pulling apart when the shield is moved ahead.

Elliptical reinforced pipe shall be laid so that the top or bottom marks are not more than 5 degrees from a vertical plane.

The Contractor shall take the necessary precautions required to prevent excavated or other foreign material from getting into the pipe during the laying operation. At all times, when laying operations are not in progress, at the close of the day's work, or whenever the workers are absent from the job, the open end of the last laid section of pipe will be closed and blocked to prevent entry of foreign material or creep of the gasketed joints.

The Contractor shall plug or close off pipes which are stubbed off for manhole construction or for connection by others, with temporary plugs as specified in Subsection 306.2.11.

303.3.09A Concrete and Clay Pipe, Continued

The Contractor shall take all precautions necessary to prevent the uplift or floating of the line prior to the completion of the backfilling operation.

Where nonreinforced pipe is connected to manholes or concrete structures, the connection will be constructed so that the standard pipe joint is located not more than 1.5 feet from the outside edge of the structure.

When cutting and/or machining of the pipe is necessary, the Contractor shall use only the tools and methods recommended by the pipe manufacturer.

303.3.09B Cast Iron and Ductile Iron Pipe: The Contractor shall conform to the applicable procedures described hereinbefore for concrete, and clay pipe. Foreign material will not be allowed to enter the pipe while it is being placed in the trench. After the first length of pipe is installed in the trench, pipe will be secured in place with approved bedding material tamped under and along sides to prevent movement. The Contractor shall keep ends clear of backfill. After each section is jointed, bedding or pipe zone material will be placed as specified to prevent movement.

303.3.09C PVC and ABS Pipe: The Contractor shall join the pipe in conformance with the manufacturer's recommendations. Joints or pipe will not be deflected more than recommended by the manufacturer.

The Contractor shall, when necessary, cut the pipe in a neat and professional manner without damaging the pipe. The Contractor shall cut the pipe so as to leave a smooth end at right angles to the axis of the pipe. The Contractor shall dress the cut end in conformance with the pipe manufacturer's recommendations.

303.3.09D Solvent Welded Joints: Solvent welded joints shall be made in accordance with manufacture's instruction, generally as follows:

1. Wipe the bell or inside of sleeve coupling and the spigot end clean.
2. Apply primer liberally to the inside of the sleeve coupling and the outside of the spigot end.
3. Immediately apply the cement over the primer to the inside of the sleeve coupling and the outside of the spigot end.
4. Immediately insert the spigot end into the sleeve coupling with a slight circumferential twist.

303.3.10 Deflection at Joints: When deflecting the pipe from a straight line, either in the vertical or horizontal plane, or when long radius curves are shown, the amount of deflection allowed shall not exceed that recommended by the pipe manufacturer.

303.3.11 Water and Equipment for Test: The Contractor shall make all arrangements for furnishing water for testing purposes. The Contractor shall perform the tests and provide all hoses, tank trucks, plugs and other necessary equipment to complete the tests.

303.3.12 Cleaning Prior to Test: Prior to the internal pressure testing and inspection of the system by the Engineer, the Contractor shall flush and clean all parts of the system. The Contractor shall remove all accumulated construction debris, rocks, gravel, sand, silt and other foreign material from the system at or near the closest downstream manhole. If necessary, the Contractor shall use high pressure water jet, ball flushing, or equipment approved by the Engineer.

Upon the Engineer's inspection of the system, if any foreign matter is still present, the sections and portions of the system will be re-flushed and cleaned as required.

303.3.13 Requirements Prior to Tests:

303.3.13A General: All gravity systems and appurtenances shall successfully pass a hydrostatic or air test prior to acceptance and shall be free of visible leakage, using either method of testing. Information regarding air testing may be obtained from the Engineer. Manholes shall be tested as specified in Subsection 306.3.01C.

On pipe 54 inch in diameter and larger, individual joints may be tested by an approved joint testing device. All details of testing procedure shall be subject to approval of the Engineer.

303.3.13B Plugging of Tees, Wyes, Stubs and Service Connections: The Contractor shall plug all wyes, tees, stubs and service connections with gasketed caps or plugs securely fastened or blocked to withstand the internal test pressure. Such plugs or caps shall be removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

303.3.13C Testing Equipment and Procedure: The Contractor shall furnish all necessary testing equipment and perform the tests in a manner satisfactory to the Engineer. Gauges shall be calibrated and certified at the direction of the Engineer. The certification shall be available with the gauge.

303.3.13D Time of Test: The Contractor shall test the system during the normal work day, scheduling the plugging, capping and other preparatory work so as to conduct the test during daylight hours.

303.3.14 Repairs: The Contractor shall repair or replace, in a manner approved by the Engineer, any portion of the system not passing the air or hydrostatic test.

Infiltration of ground water in an amount greater than specified, following a successful hydrostatic or air test, shall be considered as evidence that the original test was in error or that failure of the system has occurred. The Contractor shall correct such failures occurring within the warranty period in a manner approved by the Engineer and at no expense to the Owner.

303.3.15 Infiltration-Exfiltration Testing: Hydrostatic or air pressure tests shall be conducted on sewers before acceptance. For sewers with a diameter less than 24 inches, the infiltration-exfiltration shall not exceed 250 gallons per day per inch of nominal pipe diameter per mile of sewer line for any section of the system. For sewers with a diameter 24 inches or greater, infiltration-exfiltration shall not exceed 6000 gallons per day per mile of pipe.

303.3.15A For hydrostatic tests where sewers are laid above the groundwater table, exfiltration tests shall be conducted. Where sewers are laid within the groundwater table, infiltration testing shall be conducted. Exfiltration tests must be conducted with a minimum of four feet of static water head above the invert of the sewer at the upstream manhole. Manholes shall be tested using internal or intermal hydrostatic pressure. A minimum hydrostatic head of 4 feet is required for the test. Infiltration-exfiltration shall be less than 1.14 gallons per day per vertical foot of manhole (equals 6,000 gallons per day per vertical mile).

303.3.15B Low pressure air testing may be conducted on any pipe of 8 inch to 12 inch diameter pipe. Testing methods and air leakage rates shall conform with ASTM C828-76T or the latest revision thereof as a minimum.

303.3.16 Air Testing

303.3.16A General: The Contractor has the option after completion of the system, including service connections, and backfilling and compaction, of conducting a low pressure air test in lieu of the hydrostatic test required herein. The Owner may require testing of manhole sections as they are completed in order to expedite the acceptance of the system and allow connections before the entire system is complete.

The test shall be conducted at no expense to the Owner. The Contractor shall provide all equipment and personnel for the test.

The method, equipment and personnel shall be subject to the approval of the Engineer. The Engineer may, at any time, require a calibration check of the instrumentation used. The pressure gauge used shall have minimum divisions of 0.10 psi and have an accuracy of 0.0625 psi (one ounce per square inch). All air used shall pass through a single control panel.

303.3.16A General, Continued

Testing shall be conducted, at the direction of the Engineer, on the first section of sewer pipe installed by any pipe laying crew or change of personnel in the crew in order to establish that the pipeline meets the requirements under this section. Whenever possible, the section of pipeline to be tested shall be at least 300 feet in length.

303.3.16B Safety Precautions: All plugs used to close the sewer for the air test must be capable of resisting the internal pressures and must be securely braced, if necessary.

All air testing equipment must be placed above ground and no one shall be permitted to enter a manhole or trench where a plugged line is under pressure. All pressure must be released before the plugs are removed. The testing equipment used must include a pressure relief device designed to relieve pressure in the line under test at 10 psi or less and must allow continuous monitoring of the test pressures in order to avoid excessive pressure. The Contractor shall use care to avoid flooding of the air inlet by infiltrated groundwater. The Contractor shall inject the air at the upper plug, if possible. Only qualified personnel shall be permitted to conduct the test.

303.3.16C Ground Water: The presence of ground water will affect the results of the test. The average height of ground water over the lines must be determined immediately before starting the test. The method of checking the ground water height shall be as approved.

303.3.16D Method: All air testing shall be by the Time Pressure Drop Method. The test procedures are described as follows:

1. Clean the lines to be tested and remove all debris where noted.
2. The Contractor has the option of wetting the lines prior to testing.
3. Plug all open ends with suitable test plugs. Brace each plug securely.
4. Check the average height of the ground water over the line. The test pressures required below shall be increased 0.433 psi for each foot of average water depth over the line.
5. Add air slowly to the section of system being tested until the internal air pressure is raised to 4.0 psig greater than the average back pressure of any ground water that may submerge the pipe.
6. After the internal test pressure is reached, allow at least 2 minutes for the air temperature to stabilize adding only the amount of air required to maintain pressure.
7. After the temperature stabilization period, disconnect the air supply.
8. Determine and record the time in seconds that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig greater than the average back pressure of any ground water that may submerge the pipe.
9. Compare the time recorded in Step 8 with the time required as determined hereinafter.

303.3.16E Acceptance: The system shall be considered acceptable when tested as described hereinbefore, if the section under test does not lose air at a rate greater than (1) 0.003 cfm per square foot of internal pipeline surface, or (2) 2 cfm, whichever is greater.

If a line fails to meet these requirements, the Contractor shall determine at his own expense the reason for leakage and shall repair or replace all defective materials or workmanship. The repaired section shall meet the requirements of this test before being considered acceptable.

This specification shall also be considered as satisfied if the time as measured by the preceding described method is not less than the time as computed according to the following procedure.

1. Record the diameter in inches and the length in feet of all pipe in the section to be tested, including the service connections, in a table similar to the one shown below.

Diameter Inches	Length Feet	K= 0.011d L	C= 0.0003882dL
TOTAL			

Time Required by Specification =_____ seconds.
Actual Time as Determined by Test =_____ seconds.

2. Using the nomograph at the end of this section, place a straight edge from the "d" column (diameter in inches) to the "L" column (length in feet). Read the corresponding "K" and "C" values and record them in the table.

3. Add all values of "K" and all values of "C" for the section being tested.

4. If the total of all the "C" values is less than one, the time required by the specifications shall be the total of all the "K" values.

5. If the total of all the "C" values is more than one, the time required by the specifications shall be found by dividing the total of all the "K" values by the total of all the "C" values. The quotient is the time required by the specifications. To make this division with the nomograph, use the scales "C" and "K" and read the quotient (time) from the "t" scale.

6. In the event that the "d" and "L" values for a particular section of the system do not fall within the limits of the nomograph, the values of "K" and "C" may be computed from the following equations. "K" = 0.0011d L; "C" = 0.0003882dL.

303.3.17 Deflection Test for PVC and ABS Pipe: In addition to hydrostatic or air testing and when required, sanitary sewers constructed of PVC or ABS pipe shall be deflection tested not less that 30 days after the trench backfill and compaction has been completed. The test shall be conducted by pulling an approved solid pointed mandrel through the completed pipeline. The diameter of the mandrel shall be 95 percent of the pipe diameter unless otherwise specified by the Engineer. Testing shall be conducted on a manhole to manhole basis and shall be done after the line has been completely flushed out with water. The Contractor will be required, at the Contractor's expense, to locate and repair any sections failing to pass the test and to retest this section.

303.3.18 Television Inspection of Sanitary Sewers: Upon completion of all sewer construction, sewer repairs, required tests, and prior to any finish surfacing or final paving being done, the Engineer may direct the Contractor to have made a full TV inspection of all installed lines 24" and smaller. This inspection shall be conducted by an approved technical service which is equipped to make an audio-visual tape recording of the conducted television inspection. The audio-visual recording shall be compatible with the Owner's play back equipment.

A written report shall also be made at the time of the television inspection. This written report shall be made on the "Television Report Form" supplied by the Owner or on a form approved by the Engineer.

The Contractor shall insure that a clean and usable record shall be made of all possible defects and that the recording equipment is functioning properly. The equipment used for recording shall be equipped with a footage meter for visual record on the tape. A voice accounting of suspected deficiencies shall be made on the sound track.

The video tape and the written report shall be submitted to the Engineer for his examination. The Contractor will correct all deficiencies revealed by televiewing and will notify the Engineer at the time the corrective work is being done.

If, in the opinion of the Engineer, the extent of the deficiency is such to warrant it, he may require the section(s) in question to be televised as second time or until all work is acceptable. Sections ordered reinspected to insure that deficiencies have been corrected shall be at the expense of the Contractor.

The tapes, upon acceptance of the project by the Owner, shall become the property of the Owner.

303.4.00 Measurement and Payment

303.4.01 Sewer Pipe: Measurement and payment for pipe will be made on a linear foot basis for the various classes, types, and sizes of pipe listed and installed. The pipe will be measured horizontally from center to center of manholes or to the end of the pipe, whichever is applicable.

303.4.01 Sewer Pipe, Continued

The Contractor shall specify in the bid proposal what type of pipe is to be used on the project. No variance will be allowed in this designation unless unusual circumstances develop.

Payment shall constitute full compensation for the pipe in place, including excavation, backfilling and testing, and may also include bedding and pipe zone work.

Payment for pipe in place may be withheld until the pipe has successfully passed the air or hydrostatic test.

303.4.02 Tee and Wye Fittings: Measurement and payment for tee and wye fittings will be made at the unit price for each size and type as listed and installed.

Payment for tee and wye fittings will be in addition to payment for pipe from manhole to manhole.

303.4.03 Concrete Tee and Wye Encasement: Measurement and payment for concrete tee and wye encasement will be made at the unit price each for the various sizes of pipe as listed and installed.

303.4.04 Concrete Closure Collars: Measurement and payment for closure collars will be made at the unit price each as listed and constructed.

303.4.05 Television Inspection: Measurement and payment for television inspection shall be per lineal foot of sewer pipe inspected as directed, and accepted by the Engineer.

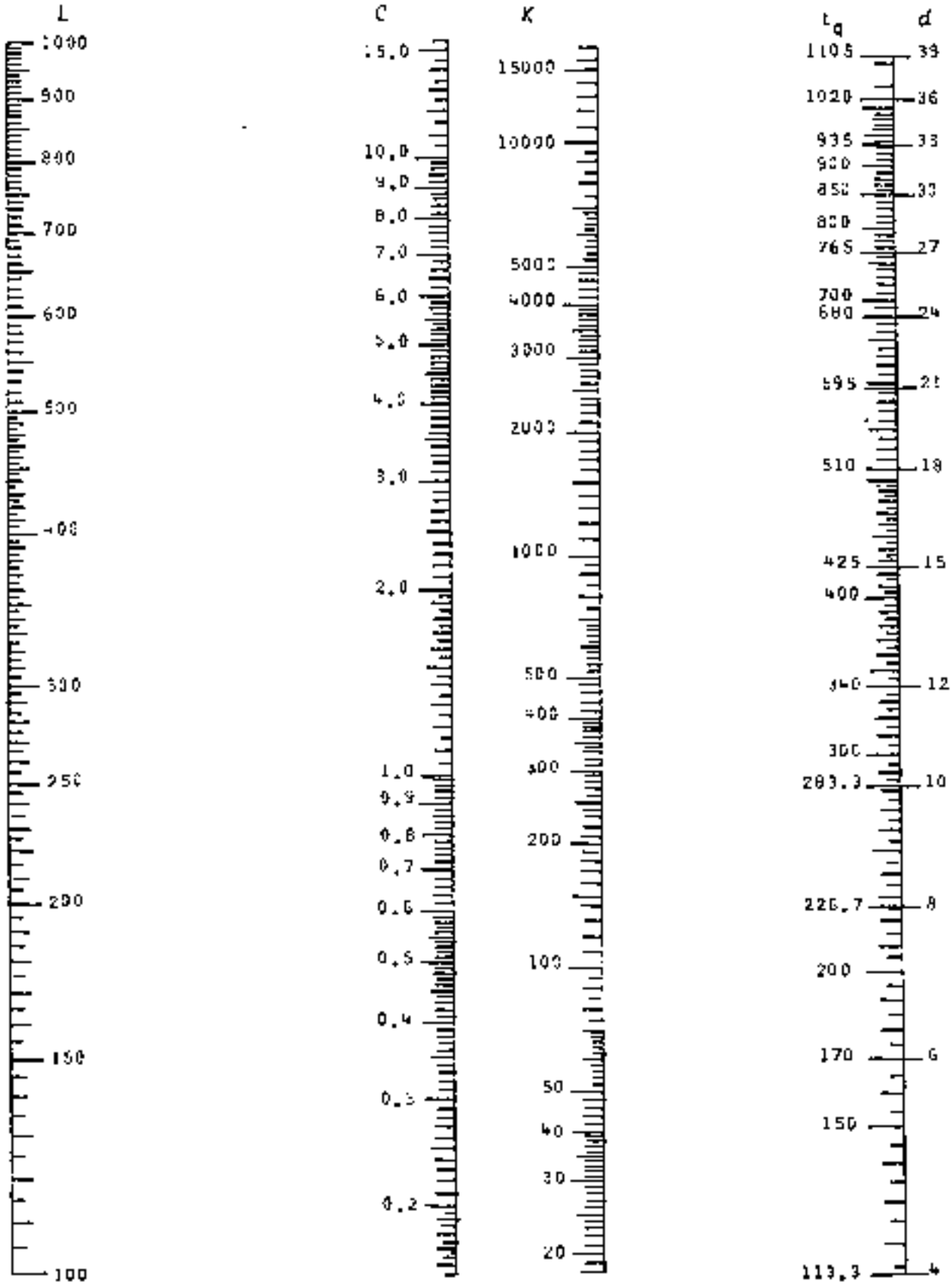

Fig 1

NOMOGRAPH FOR THE SOLUTION OF $K = .011d^2L$, $C = .0003982dL$, $t_q = K \div C$

304 SERVICE LINE SEWERS

304.1.00 Description

304.2.00 Materials
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304.2.03D Concrete Pipe
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304.2.03F Ductile Iron Pipe
304.2.03G Acrylonitrile Butadiene Styrene Pipe (ABS)
304.2.03H Polyvinyl Chloride Pipe (PVC)
304.2.04 Pipe Joints
304.2.05 Imported Pipe Zone and Pipe Bedding Material
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304.3.00 Construction
304.3.01 General
304.3.02 Imported Pipe Zone and Pipe Bedding
304.3.03 Trench Backfill
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304.4.00 Measurement and Payment
304.4.01 Service Lines
304.4.02 Deep Connections

304 SERVICE LINE SEWERS

304.1.00 Description: This section covers the work necessary for the installation of sewer service lines, connections and cleanouts. In general, service lines will extend from the sewer main to the street or alley right-of-way line.

304.2.00 Materials

304.2.01 Excavation and Backfill: The Contractor shall conform to the applicable requirements of Section 301.

304.2.02 Rock Excavation: The Contractor shall conform to the requirements of Section 301.

304.2.03 Pipe and Fittings for Service Lines and Cleanouts

304.2.03A General: Pipe and fittings for service lines shall be of one type of material throughout and no interchanging of pipe and fittings will be allowed except at cleanouts or as approved by the Engineer. Residential services shall normally be 4 inches in diameter. Larger service lines shall be a shown or specified.

304.2.03B Asbestos Cement Pipe: Asbestos cement pipe shall conform to the requirements of ASTM C644, Type II. The Contractor shall furnish pipe in the manufacture's standard lengths, half-lengths, and random lengths as required. The Contractor shall provide all tools for field cutting the pipe to the required lengths, and machine the ends as required. The pipe shall be Class 2400, unless otherwise specified.

304.2.03C Vitrified Clay Pipe: Vitrified clay pipe shall conform to the requirements of ASTM C700 and shall be extra strength, unless otherwise specified.

304.2.03D Concrete Pipe: Concrete pipe shall conform to the requirements of ASTM C14 and shall be Class 2, unless otherwise specified.

304.2.03E Cast Iron Pipe: Cast iron pipe shall conform to the requirements of ASTM A74 and shall be Class 150, unless otherwise specified.

304.2.03F Ductile Iron Pipe: Ductile iron pipe shall conform to the requirements of ANSI A21.51 or AWWA C151, with push-on joint or mechanical joints as specified, conforming to federal specification WWP421C and ANSI specifications A21.11. Ductile iron pipe shall be lined with cement mortar and seal coated in accordance with ANSI standard A21.4 and AWWA C104.

304.2.03G Acrylonitrile Butadiene Styrene Pipe (ABS): Acrylonitrile butadiene styrene pipe shall conform to the requirements of ASTM D2751.

304.2.03H Polyvinyl Chloride Pipe (PVC): Polyvinyl chloride pipe shall conform to the requirements of ASTM D1785, Schedule 40 pipe, as required by the plans and specifications.

304.2.04 Pipe Joints: Pipe joint materials shall conform to the requirements of Subsection 303.2.13.

304.2.05 Imported Pipe Zone and Pipe Bedding Material: Imported pipe zone and pipe bedding material shall conform to the requirements of Subsection 301.2.03.

304.2.06 Service Connection Markers: Service connection markers shall be new, one piece Douglas Fir, Southern Pine or cedar, 2 x 4, utility grade or better.

304.2.07 Portland Cement Concrete: Concrete shall conform to the requirements of Subsection 306.2.04 for cleanouts.

304.3.00 Construction

304.3.01 General: Construction shall conform to the applicable portions of Sections 301 and 303.

The Contractor shall install the sewer tee or wye so as to locate the service connection pipe within a horizontal distance of one foot either side of the plan location.

The Contractor shall install the pipe on a uniform grade between the tee and wye and the stake. Minimum slope shall be ¼ inch per foot, unless otherwise permitted by the Engineer.

304.3.02 Imported Pipe Zone and Pipe Bedding: Imported pipe zone and pipe bedding material will be furnished and placed in accordance with Subsection 301.3.02 and 301.2.03. Construction shall be in accordance with the requirements of Subsections 301.3.05 and 301.3.06.

304.3.03 Trench Backfill: Construction shall be in accordance with the requirements of Subsection 301.3.07.

304.3.04 Disposal of Excess Material: The Contractor shall dispose of excess material in accordance with the requirements of Subsection 301.3.01F.

304.3.05 Dewatering: Dewatering shall be in accordance with Subsection 301.3.03.

304.3.06 Installation of Pipe and Fittings: Install the service line pipe upgrade from its connection to the lateral or main with bell or coupling ends upgrade.

Where directed, the Contractor shall install a cleanout at the termination of the lines, as shown on the drawing(s). Cleanouts shall include, but not be limited to: Excavation and backfill, carrier pipe containing wye, 1/8 bends, riser pipe, mechanical plugs on carrier pipe, mechanical plugs on riser pipe, and cast iron ring and cover when specified. When specified, all pipe and pipe fittings shall be manufactured from Portland cement concrete C-14, Class 3.

Connect the service line to manholes only when directed. When such connection is permitted, make the connection so that the first pipe joint is located not more than 1.5 feet from the manhole.

Provide the ends of all service lines and fittings with approved watertight plugs, caps, and stopper, suitably braced to prevent blowoff during internal hydrostatic or air testing.

Maximum deflection permission with any one fitting shall not exceed 45 degrees and shall be accomplished with long radius curves or bends.

If foundation stabilization material is required, it shall be furnished, placed and paid for in accordance with Section 301.

304.3.07 Deep Connections: Where the slope of a service line is required by the Engineer to be greater than 45 degrees, a deep connection exists and shall be constructed in conformance with the details shown.

304.3.08 Culverts: If removed, the replacement of culvert pipe shall conform to the requirements of Section 305 at no additional cost to the Owner.

304.3.09 Existing Service Lines: The Contractor shall disconnect existing service lines from sewers to be abandoned and reconnect them to the new sewers. It shall be the Contractor's responsibility to locate the existing service lines prior to installing the tee or wye in the new sewer line.

304.3.10 Service Connection Markers: The Contractor shall install markers at the ends of those service lines not scheduled for user connection under the contract.

The markers shall be installed so as to extend from the end of the service line to 12 inches above the ground surface.

The Contractor shall determine the distance in feet and inches from the ground surface to the top of the service line and paint it on the marker. If the marker is broken or displaced prior to acceptance of the work, the Contractor shall reposition or replace the marker.

304.3.11 Testing: Testing of the service line shall be included in the test of the sewer lines and shall conform to the requirements of Section 303.

304.4.00 Measurement and Payment

304.4.01 Service Lines: Measurement and payment for pipe will be made on a linear foot basis for the various sizes, classes, types listed and installed. The measurement will be the horizontal distance along the pipe from center of manholes or center of main line to the end of the pipe, whichever is applicable, and to the nearest foot. All fittings, other than those used in cleanouts or mainline tees or wyes, shall be considered as being included in said horizontal measurement.

The Contractor shall specify in the bid proposal what type of pipe is to be used on the project. No variance will be allowed in this designation, unless unusual circumstances develop.

Payment shall constitute full compensation for the pipe in place, including excavations, bedding, pipe zone, backfill and testing.

Payment may be withheld for pipe in place until the pipe has successfully passed the air or hydrostatic test.

304.4.02 Deep Connections: Measurement and payment for deep connections shall be per linear foot as specified in Section 304.4.01.

304.4.03 Existing Service Lines: Measurement and payment for disconnecting and reconnecting existing services lines will be made on the unit price for each as shown.

304.4.04 Cleanouts: Measurement and payment for cleanouts will be made at the unit price for each.

305 PIPE AND FITTINGS (STORM DRAINS)

305.1.00 Description

305.2.00 Materials
305.2.01 Galvanized Corrugated Steel Pipe
305.2.01A Bituminous Coating
305.2.01B Asbestos Bonded
305.2.02 Corrugated Aluminum Alloy Pipe
305.2.03 Asbestos Cement Pipe
305.2.04 Nonreinforced Concrete Pipe
305.2.05 Reinforced Concrete Pipe
305.2.06 Vitrified Clay Pipe
305.2.07 Polyvinyl Chloride Pipe (PVC)
305.2.08 Acrylonitrile Butadiene Styrene Pipe (ABS)
305.2.09 Galvanized Corrugated Steel Pipe Arches
305.2.10 Corrugated Aluminum Alloy Pipe Arches
305.2.11 Galvanized Corrugated Structural Plate Pipe, Arches and Pipe Arches
305.2.12 Cast Iron Pipe
305.2.13 Ductile Iron Pipe
305.2.14 Clay Drain Tile
305.2.15 Concrete Drain Tile
305.2.16 Perforated Galvanized Corrugated Steel Pipe
305.2.17 Perforated Corrugated Aluminum Alloy Pipe
305.2.18 Perforated Asbestos Cement Pipe
305.2.19 Perforated Concrete Pipe
305.2.20 Perforated Vitrified Clay Pipe
305.2.21 Perforated Polyvinyl Chloride Pipe (PVC)
305.2.22 Perforated Acrylonitrile Butadiene Styrene Pipe (ABS)
305.2.23 Perforated Clay Drain Tile
305.2.24 Cement Mortar
305.2.25 Joints and Fittings
305.2.26 End Sections
305.2.26A Galvanized Corrugated Steel Pipe
305.2.26B Corrugated Aluminum Alloy Pipe
305.2.26C Reinforced Concrete Pipe
305.2.27 Tee and Wye Fittings
305.2.28 Foundation Stabilization
305.2.29 Filter Material

305.3.00 Construction
305.3.01 Trench Excavation, Bedding and Backfill
305.3.02 Foundation Stabilization
305.3.03 Installation
305.3.04 Pipe Zone Backfill

305.3.05 Trench Backfill
305.3.06 Filter Material
305.3.07 Television Inspection

305.4.00 Measurement and Payment
305.4.01 Storm Drain Pipe
305.4.02 Foundation Stabilization
305.4.03 End Sections
305.4.04 Tee and Wye Fittings
305.4.05 Existing Service Lines
305.4.06 Television Inspection

305 PIPE AND FITTINGS (STORM DRAINS)

305.1.00 Description: This section covers the work necessary for the construction of surface and underdrain facilities.

305.2.00 Materials

305.2.01 Galvanized Corrugated Steel Pipe: When specified, galvanized corrugated steel pipe shall conform to the requirements of AASHTO M36 or M167.

305.2.01A Bituminous Coating: When specified, the surfaces of corrugated steel pipe shall be completely coated with bituminous material conforming to AASHTO M190, with a minimum thickness of 0.05 inch at the crest of the corrugations.

305.2.01B Asbestos Bonded: When specified, corrugated steel pipe and connecting bands shall meet the following requirements: The asbestos fibers shall be applied in sheet form by pressing them into the molten zinc during the galvanizing process on each side of the culvert sheet. Immediately after the metallic bond has solidified, the asbestos fiber treated surfaces shall be thoroughly saturated with a bituminous material which shall stabilize the asbestos surface. The asbestos fibers shall adhere to the zinc layer without loss of bond between asbestos fibers and zinc when a culvert sheet with 2 2/3 x ½ corrugations is formed into a pipe as follows:

Gauge of Asbestos Protected Sheet	*Diameter to be Formed Without Loss of Bond*
16	15 inch
14	24 inch
12	30 inch
10	36 inch
8	48 inch

305.2.02 Corrugated Aluminum Alloy Pipe: When specified, corrugated aluminum alloy pipe shall conform to the requirements of AASHTO M196, M197, M211 and M219.

305.2.03 Asbestos Cement Pipe: Asbestos cement pipe shall conform to the requirements of ASTM C644 and ASTM C428. The class shall be as specified.

305.2.04 Nonreinforced Concrete Pipe: Nonreinforced concrete pipe shall conform to the requirements of ASTM C14 and ASTM C150, Type II cement.

305.2.05 Reinforced Concrete Pipe: Reinforced concrete pipe shall conform to the requirements of ASTM C76 and ASTM C150, Type I cement. The strength Class shall be as designated.

305.2.06 Vitrified Clay Pipe: Vitrified clay pipe shall conform to the requirements of ASTM C700.

305.2.07 Polyvinyl Chloride Pipe (PVC): Polyvinyl chloride pipe shall conform to the requirements of ASTM D3033 or ASTM D3034.

305.2.08 Acrylonitrile Butadiene Styrene Pipe (ABS): Acrylonitrile butadiene styrene pipe shall conform to the requirements of ASTM D2751.

305.2.09 Galvanized Corrugated Steel Pipe Arches: When specified, galvanized corrugated steel pipe arches shall conform to the requirements of AASHTO M36 and AASHTO M136.

305.2.10 Corrugated Aluminum Alloy Pipe Arches: When specified, corrugated aluminum alloy pipe arches shall conform to the requirements of AASHTO M196 and AASHTO M197.

305.2.11 Galvanized Corrugated Structural Plate Pipe, Arches, and Pipe Arches: When specified, galvanized corrugated structural plate pipe, arches and pipe arches shall conform to the requirements of AASHTO M167, except there shall be no limitation to the weight of a single plate. After galvanizing and corrugating, the base metal for structural plate shall also conform to the following mechanical requirements:

Tensile Strength	45,000 psi minimum
Yield Point	33,000 psi minimum
Elongation in 2 inches	20% minimum

Tension test specimens shall be prepared and tested in accordance with ASTM A446, except specimens shall be cut from the flat test portion of the roll with the specimen length parallel to the corrugation.

The gages of structural plates will be in accordance with the following:

Each installation will be designated by size and symbol indicating the number and gage of plates required. Thus, 412-18 will be used to designate an installation for one plate length composed of four 12 gage plates and one 8 gage plate, the heaviest gage to be placed in the invert.

305.2.12 Cast Iron Pipe: Cast iron pipe shall conform to the requirements of AWWA C106 or C108, or ANSI specification A21.6 with Type II push on joint or Type III mechanical joints, manufactured in accordance with federal specifications WW-P-421c.

The cast iron pipe shall be lined with 3/32 inch thin cement mortar and seal coated in accordance with ANSI standard A21.4 and AWWA C104, except thickness of lining and except as otherwise specified in WW-P-421c. The Contractor shall provide all foundry records of pipe as described in Section 6-6 of ANSI A21.6, when requested by the Engineer.

305.2.12 Cast Iron Pipe, Continued

Unless otherwise specified, the minimum thickness class for cast iron pipe shall be Class 22 for 4 inch pipe, Class 21 for 6 inch and Class 20 for 8 inch and larger for 21/45 iron strength. For 18/40 iron strength, the minimum acceptable thickness shall be Class 22 for pipes up to 12 inch diameter.

305.2.13 Ductile Iron Pipe: Ductile iron pipe shall conform to the requirements of ANSI A21.51, or AWWA C151 and shall be cement lined, push on joint, unless otherwise specified. The minimum thickness class shall be Class 2 up through 12 inch diameter pipe and Class 1 for 14 inch diameter and larger pipe unless specified otherwise by the Engineer.

305.2.14 Clay Drain Tile: Clay drain tile shall conform to the requirements of ASTM C4.

305.2.15 Concrete Drain Tile: Concrete drain tile shall conform to the requirements of ASTM C412.

305.2.16 Perforated Galvanized Corrugated Steel Pipe: Perforated galvanized corrugated steel pipe shall conform to the requirements of AASHTO M36 or AASHTO M197.

305.2.17 Perforated Corrugated Aluminum Alloy Pipe: Perforated corrugated aluminum alloy pipe shall conform to the requirements of AASHTO M197.

305.2.18 Perforated Asbestos Cement Pipe: Perforated asbestos cement pipe shall conform to the requirements of ASTM C508.

305.2.19 Perforated Concrete Pipe: Perforated concrete pipe shall conform to the requirements of ASTM C444.

305.2.20 Perforated Vitrified Clay Pipe: Perforated vitrified clay pipe shall conform to the requirements of ASTM C700.

305.2.21 Perforated Polyvinyl Chloride Pipe (PVC): Perforated polyvinyl chloride pipe shall conform to the requirements of ASTM D3033 and ASTM D3034. The perforations shall consist of two rows of 3/8 inch holes along each side approximately 90 degrees apart.

305.2.22 Perforated Acrylonitrile Butadiene Styrene Pipe (ABS): Perforated acrylonitrile butadiene styrene pipe shall conform to the requirements of ASTM D2751. The perforations shall consist of the following: Pipes less than 4 inches in diameter shall have one row of 3/8 inch holes in a straight line, 3 inches on centers along the axis of the pipe; four inch diameter pipe shall have one row of 3/8 inch holes along each side approximately 90 degrees apart; pipes larger than 4 inches in diameter shall have two rows along each side approximately 90 degrees apart.

305.2.23 Perforated Clay Drain Tile: Perforated clay drain tile shall conform to the requirements of ASTM C498.

305.2.24 Cement Mortar: Cement mortar shall conform to the requirements of ASTM C387, or be proportioned 1 part Portland cement to 2 parts clean, well-graded sand which will pass a 1/8 inch sieve. Admixtures may be used not exceeding the following percentages by weight of cement: hydrated lime, 10 percent; diatomaceous earth or other inert material, 5 percent. Consistency of mortar shall be such that it will adhere readily to the pipe. Mortar mixed for longer than 30 minutes shall not be used.

305.2.25 Joints and Fittings: Joint materials and fittings shall conform to the applicable requirements of Section 303.

305.2.26 End Sections

305.2.26A Galvanized Corrugated Steel Pipe: When specified, end sections shall conform to the requirements of AASHTO M36.

305.2.26B Corrugated Aluminum Alloy Pipe: When specified, end sections shall conform to the requirements of AASHTO M196 and AASHTO M211.

305.2.26C Reinforced Concrete Pipe: End sections shall conform to the requirements of AASHTO M170.

305.2.27 Tee and Wye Fittings: Where required by the plans or specifications, the Contractor shall furnish tee and wye fittings of the same or compatible materials for the pipe proposed or specified for use.

305.2.28 Foundation Stabilization: Foundation stabilization materials shall conform to the requirements of Subsection 301.2.01.

305.2.29 Filter Material: Filter material shall be coarse sand, crushed or uncrushed gravel, rock or combinations thereof, and shall meet the following requirements:

SIEVE ANALYSIS	
Sieve Size Retained (Type UD-1)	*Percent by Weight*
¾ inch	0
3/8 inch	0-15
No. 8 sieve	40-60
No. 30 sieve	70-95
No. 100 sieve, not less than	98

Filter materials shall be crushed or natural granular material and shall contain not more than 3% by weight of clay lumps, nor more than 1% of sticks (wet).

305.3.00 Construction

305.3.01 Trench Excavation, Bedding and Backfill: Trench excavation, pipe bedding and backfill shall conform to the applicable requirements of Section 301.

305.3.02 Foundation Stabilization: Foundation stabilization work shall be in accordance with the requirements of Section 301.

305.3.03 Installation: Pipe installation shall be in accordance with the manufacture's recommendations.

Normally pipe laying shall begin at the downstream end of the pipe line. The lower segment of the pipe shall be in contact with the shaped bedding throughout its full length. Bell or groove ends of rigid pipe and outside circumferential laps of flexible pipe shall be placed facing upstream. Flexible pipe shall be placed with longitudinal laps or seams at the sides.

Paved invert or partially lined pipe shall be laid so that the longitudinal center line of the paved segment coincides with the flow line. Elliptical and elliptically reinforced pipe shall be placed with the major axis within 5 degrees of a vertical plane through the longitudinal axis of the pipe.

All field joints made in the joining of sections of pipe to form culverts and sewers and to connect to structures and special sections shall be closely fitted and tight, shall provide a smooth and uniform interior surface, shall secure and hold adjoining sections to each other and shall fasten securely to adjoining structures and special sections.

Perforated pipe shall be securely fastened together with couplings, fittings or bands as specified by the manufacturer for the type of pipe used. Upgrade ends of all subsurface drain pipe shall be closed with approved plugs.

All perforated pipe shall be placed with the perforations facing down, unless otherwise specified or directed. Cement mortar joints will be required when using reinforced or nonreinforced concrete pipe, unless otherwise specified.

Tees, wyes or other fittings shall be placed accurately and positioned so that lateral pipes may be installed without unnecessary deflection or stress.

All pipe shall be inspected prior to lowering into the trench and, if necessary, cleaned of any material tending to plug the perforations of the pipe.

The Contractor shall have available the proper tools, labor and equipment for efficient execution of the work. All pipe and fittings shall be carefully lowered into the trench to avoid any contamination of the filter material.

305.3.04 Pipe Zone Backfill: Pipe zone backfill material shall be placed in accordance with the requirements of Subsection 301.3.06.

305.3.05 Trench Backfill: Trench backfill shall be placed in accordance with the requirements of Subsection 301.3.07.

305.3.06 Filter Material: The Contractor shall place a minimum of 4 inches of filter material under perforated pipes. The placed material shall provide a firm unyielding support along the entire pipe length. Additional filter material will then be placed as specified in the plans or other contract documents.

305.3.07 Television Inspection: Should the plans or specifications require television inspection of the system, such inspection shall comply with the provisions of Section 303.3.18.

305.4.00 Measurement and Payment

305.4.01 Storm Drain Pipe: Measurement and payment for storm drain pipe will be made on a linear foot basis for the various classes, types and sizes of pipe listed and installed. Measurement will be the horizontal pipe length along the centerline from center to center of manholes or to the end of the pipe, whichever is applicable, and to the nearest foot.

The Contractor shall specify in the bid proposal what type of pipe is to be used on the project. No variance will be allowed in this designation, unless unusual circumstances develop.

Payment for trench excavation and backfill will be in conformance with Section 301, if so specified.

If so specified, payment shall constitute full compensation for the pipe in place, including excavation, bedding, pipe zone material, backfill and testing.

305.4.02 Foundation Stabilization: Measurement and payment for foundation stabilization will be in accordance with Section 301.

305.4.03 End Sections: Measurement and payment for end sections will be made on a unit price basis for each type and size installed as shown. The limits of payment for end sections shall be as shown.

305.4.04 Tee and Wye Fittings: Measurement and payment for tee and wye fittings will be made at the unit price for each size and type as listed and installed. Payment for tee and wye fittings will be in addition to payment for pipe from manhole to manhole or to the end of the pipe.

305.4.05 Existing Service Lines: Measurement and payment for disconnecting and reconnecting existing service lines will be made on the unit price for each as shown.

305.4.06 Television Inspection: Measurement and payment for TV inspection shall be per lineal foot of drain line inspected as directed and accepted by the Engineer.

306 MANHOLES

306.1.00 Description

306.2.00 Materials
306.2.01 Aggregates
306.2.02 Portland Cement
306.2.03 Metal Reinforcement
306.2.04 Concrete
306.2.05 Brick
306.2.06 Forms
306.2.07 Metal Castings
306.2.07A Ferric Castings
306.2.07B Aluminum Castings
306.2.07C Machined Surfaces and Fit
306.2.07D Identification
306.2.08 Cap Screws
306.2.09 Manholes
306.2.09A Precast Concrete Manholes
306.2.09B Precast Bases
306.2.09C Brick Manholes
306.2.09D Mortar
306.2.10 Pipe and Fittings
306.2.11 Pipe Stubouts for Service Connections
306.2.12 Pipe Stubouts for Future Sewer Connections

306.3.00 Construction
306.3.01 General
306.3.01A Foundation Stabilization
306.3.01B Pipe Connections
306.3.02 Precast Concrete Manholes
306.3.02A Bases
306.3.02B Risers
306.3.02C Grates, Frames and Covers
306.3.03 Manhole Testing
306.3.03A Hydrostatic Testing
306.3.03B Vacuum Testing

306.4.00 Measurement and Payment
306.4.01 Manholes

306 MANHOLES

306.1.00 Description: This section covers the work necessary for the construction of manholes.

306.2.00 Materials

306.2.01 Aggregates: Aggregates shall conform to the requirements of Subsection 503.2.02.

306.2.02 Portland Cement: Portland cement shall conform to the requirements of Subsection 503.2.01.

306.2.03 Metal Reinforcement: Metal reinforcement shall conform to the requirements of ASTM A615, Grade 40, deformed bars.

306.2.04 Concrete: Concrete shall conform to the requirements of ASTM C94, Alternate 2. Compressive field strength for manhole bases and miscellaneous concrete structures shall be not less than 3,000 psi at 28 days. Maximum size of aggregate shall be 1 inch. Slump shall be between 2 and 4 inches.

306.2.05 Brick: Brick for construction of manholes shall conform to the requirements of ASTM C-32, latest revision, Grade M.A. for sewer brick, and ASTM C-126.

306.2.06 Forms: Exterior surfaces shall be formed with steel or plywood. Other surfaces shall be formed with matched boards, plywood, or other approved materials. Trench walls, rock, or earth will not be acceptable form material, unless approved by the Engineer.

306.2.07 Metal Castings

306.2.07A Ferric Castings: Metal casting materials shall conform to the requirements of ASTM A48, Class 30B, with the following revisions:

Tensile Strength	30,000 psi
Transverse Strength:	(1.2” diameter bar – 18” centers)
Load – pounds	2,600 – 3,000
Deflection – inches	0.22 – 0.34
Brinell Hardness (as cast)	173 – 200

The foundry shall certify as to the tensile and transverse properties and the Brinell Hardness. The Owner reserves the right to require a rough transverse bar (size of bar 1.2” diameter by 20” long) and/or a tensile bar as per ASTM A48 for each 20 castings or heat when less than 20 castings are made.

306.2.07B Aluminum Castings: All manhole frames and covers shall be of the size and shape detailed in the standard drawings.

Aluminum manhole frames and covers shall be cast of an aluminum alloy of sufficient physical properties to meet the Federal Specifications RR-F-621B, dated September 14, 1967, for 20,000 lb. loading. Dimensions shall be that specified by the standard drawings or as approved by the Engineer.

All castings shall be free of any porosity, shrinks, cracks or other defects characteristic of aluminum castings.

Covers shall have the necessary appurtenance to secure them to the frame, so that removal cannot be made without a special tool.

A fixed locking lug shall be cast as an integral part of the cover and of a design that will allow the lock to be positioned at any location on the circumference of the frame flange.

The lock shall be of cam design with the cam being of the same aluminum alloy as frame and cover and of such a design to secure the cover to the frame by turning one-half to full turn.

The cam shall be operated by a bolt, securely screwed through the cam, with an ESNA stop nut locking it in place. The cam shall have sufficient applied tension so it will not vibrate loose under traffic. The bolt shall be a ¾ inch socket head cap screw with a hexagon socket and shall be made of ASTM 18-8 stainless steel.

306.2.07C Machined Surfaces and Fit: All covers, both ferric or aluminum, shall have matching surfaces that are flat to prevent any rocking when covers are installed in the frame.

Covers and frames shall be inter-changeable within type.

306.2.07D Identification: When specified, covers shall have “SEWER” or “STORM” stamped on it, as appropriate.

306.2.08 Cap Screws: Cap screws and washers for watertight manhole covers shall be stainless steel with 60,000 psi minimum tensile strength conforming to the requirements of ASTM A453.

306.2.09 Manholes

306.2.09A Precast Concrete Manholes: Materials shall conform to the requirements of ASTM C478. Minimum wall thickness shall be 4 inches for 0-16 feet and 5 inches for greater than 16’ depth. Cones shall have the same wall thickness and reinforcement as riser sections. Joints shall be tongue-and-groove or keylock type. Cones shall be eccentric unless otherwise specified.

306.2.09A Precast Concrete Manholes, Continued

Prior to the delivery of any size of precast manhole section to the job site, the Engineer may require yard permeability tests to be conducted at the point of manufacture. The precast sections to be tested will be selected at random from the stockpile material which is to be supplied to the project. All test specimens will be mat tested, and shall meet the permeability test requirements of ASTM C14.

Joints between precast reinforced concrete sections shall be of such design that leakage and infiltration can satisfactorily be reduced to a minimum. The use of rubber gaskets or mastics will be required per the Contractor's choice. If mastic is utilized, the joint must be protected on the exterior of the manhole from the degradating action of the soil.

306.2.09B Precast Bases: At the option of the Contractor, precast base sections or manhole bases may be used provided all the details of construction are approved prior to construction. Pouring three to four inches of concrete up along the inside of the riser will is required for sealing purposes.

306.2.09C Brick Manholes: When so indicated on the plans or if approved by the Engineer, brick masonry may be used for the walls of manholes. The designer and Contractor are cautioned that this type of manhole must meet the same type of watertightness requirements as other manholes. Such masonry walls shall be 8 inches in thickness for depths up to and including 16 feet, and 12 inches for depths over 16 feet. Masonry manholes shall be circular with a clear inside diameter of 48 inches, unless the plans call for alternate shapes or dimensions.

Bricks shall be clean and thoroughly wetted shortly before they are laid. The brick shall be laid in a full bed of mortar with best end exposed on the inside and with sufficient header courses to tie the masonry together. Inside vertical face-joints shall be not more than ¼ inch wide, horizontal joints shall be not more than ½ inch wide. All voids between bricks and holes in cored bricks shall be filled with mortar. Exposed mortar joints shall be pointed with mortar and struck flush. The outside of brick manholes shall be plastered with a minimum of ½ inch or mortar and trowelled smooth. The plastering of manholes shall be placed progressively as the manhole is constructed. One coating of a bituminous or other similar waterproofing compound will be applied prior to backfilling.

Manhole steps shall be embedded half their length and spaces as shown on the drawings.

306.2.09D Mortar: Mortar for use with brick manholes shall conform to the requirements of ASTM C387, or be proportioned 1 part Portland cement to 2 parts clean, well-graded sand which will pass a 1/8 inch screen. Admixtures may be used not exceeding the following percentages of weight of cement: hydrated lime, 10 percent; diatomaceous earth or other inert materials, 5 percent. Consistency of mortar shall be such that it will readily adhere to the precast concrete if using the standard tongue-and-groove type joint. Mortar mixed for longer than 30 minutes shall not be used.

306.2.10 Pipe Fittings: Pipe and fittings shall conform to the applicable portions of Sections 303 and 305.

Tees, wyes, ells and other fittings for drop manholes shall be of the same material as the pipe in the adjacent trench unless specified otherwise.

306.2.11 Pipe Stubouts for Service Connections: Pipe stubouts for service connections shall conform to the applicable portions of Section 304 and are to be of the same size and kind of material as the service connection pipes.

306.2.12 Pipe Stubouts for Future Sewer Connections: Pipe stubouts shall be the same type as approved for use in the lateral, main or trunk sewer construction. Strength classifications shall be the same class as in adjacent trenches. Where there are two different classes of pipe at a manhole, the higher strength pipe will govern strength classification. Rubber-gasketed watertight plugs shall be furnished with each stubout adequately braced against hydrostatic or air test pressures.

306.3.00 Construction

306.3.01 General

306.3.01A Foundation Stabilization: If, in the opinion of the Engineer, unstable material exists that will not support the manhole or other structure, the Contractor shall excavate below grade and backfill with foundation stabilization material in accordance with Subsection 301.3.04.

306.3.01B Pipe Connections: All pipes entering or leaving the manhole shall be provided with flexible joints within 1 ½ feet of the manhole structure and shall be placed on firmly compacted bedding. Special care shall be taken to see that the openings through which pipes enter the structure are completely watertight. All pipe shall be connected to manholes according to the manufacturer's recommendations. The Contractor shall furnish shop drawings showing the method of connections for the Engineer's approval.

306.3.02 Precast Concrete Manholes: Precast manhole components may be used to construct standard, drop or carry-through manholes. All manholes shall be constructed in conformance with the drawings.

306.3.02A Bases: If bases are cast in place, the concrete shall be consolidated by mechanical vibration. The concrete shall be screeded off in a manner such that the first manhole section to be placed has a level, uniform bearing for the full circumference.

If bases are precast, the base section shall be carefully placed on the prepared bedding so as to be fully and uniformly supported in true alignment, and making sure that all entering pipes can be inserted on proper grade.

306.3.02A Bases, Continued

In all cases, the first riser pipe section shall be imbedded in the base so that 3" – 4" of concrete extends above the bottom of the riser pipe wall.

The invert shall be constructed to a section identical with that of the sewer pipe. Where size of sewer pipe is changed at the manhole, the invert shall be constructed in the form of a smooth transition without abrupt breaks or unevenness of the invert surfaces. Where a full section of sewer pipe is laid through the manhole, the top shall be broken or cut out to the spring line of the pipe for the full width of the manhole and the exposed edge of the pipe made smooth by mortaring or other approved methods. During construction of the invert section and for a period of not less than 24 hours following placing of concrete or mortar in the invert sections, the Contractor shall temporarily divert existing flows of ground water or sewage from new concrete or mortar surfaces to prevent damage within the manhole until initial set has been achieved.

306.3.02B Risers: Risers and cone sections shall be 48 inches inside diameter. Other sections shall be 24-inch diameter riser and flattop sections.

In precast manhole sections where steel loops are provided in lieu of lift holes, the loops shall be removed flush with the inside wall surface after the manhole has been completed. No sharp cutoff protrusions will be permitted. If concrete spalling occurs as a result of the loop removal, the spalled area shall be restored in a neat, professional manner with mortar to a uniform smooth surface.

All lift holes and all joints between precast elements shall be thoroughly wetted and then completely filled with mortar, smoothed and pointed both inside and out, to ensure watertightness, except that rubber-gasketed or those manholes using preformed plastic gaskets need not be mortared.

Preformed plastic gaskets shall be used on all sanitary manholes. Mortar will be allowed on storm manholes, and on 24-inch extension rings above the cone. On unimproved or proposed street grades, a minimum of one 4 inch x 24 inch precast riser will be required between the cone and iron ring.

Where the sewer line crosses open fields, the top of the cone section of manholes shall be held a minimum of 2 feet below existing ground surface, except as designated on the plans or by the Engineer. The remaining 2 feet of manhole shall be constructed with 24 inch diameter riser sections so that the top of the manhole cover will be approximately 6 inches above the finished backfilled surface.

When sanitary sewer manholes are constructed within the wetted section of any ditch or drainage way, the manhole shall be so constructed that the top of the cover is at least 6 inches above any possible water elevation within the ditch or drainage way, as determined by the Engineer.

306.3.02B Risers, Continued

Manhole frames, grates and covers shall be placed at the top of the manhole as shown on the drawings and set to the elevation required, and in such a manner as to prevent infiltration of any surface or groundwater into the manhole between the frame and the concrete of the manhole section. Mortar placed to provide this seal shall be placed in the form of a smooth, uniform fillet.

306.3.03 Manhole Testing: The Contractor shall be responsible for process testing of manholes and may conduct such tests as necessary during the construction process. The tests required in this subsection are for the information of the Engineer. The results of the tests shall not indemnify the Contractor of responsibility for defects in the construction.

The first three sanitary sewer manholes built by each manhole construction crew on the project shall immediately be proof tested. No additional manholes shall be constructed until three successful proof tests have demonstrated satisfactory workmanship and materials.

Acceptance tests shall be conducted on all manholes constructed. The manholes shall be tested after completion of backfilling, compaction and surface restoration.

306.3.03A Hydrostatic Testing: The hydrostatic test shall consist of plugging all inlets and outlets and filling the manhole to the top with water. Each manhole shall be filled to the rim at the start of the test.

Leakage in each manhole shall not exceed 1.14 gallons per vertical foot per day. Leakage shall be determined by refilling to the rim using a calibrated known-volume container.

Manholes may be filled 24 hours prior to the time of testing to permit normal absorption into the manhole walls.

306.3.03B Vacuum Testing: The vacuum test shall consist of plugging all lift holes with an approved non-shrink grout, plugging all inlets and outlets, taking care that the plugs are securely braced to prevent the plug from being drawn into the manhole.

The vacuum test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time for the vacuum to drop to 9 inches of mercury shall be accurately measured.

The manhole shall be deemed to have passed the test if the time to drop 1.0 inch of mercury is greater than 60 seconds, 75 seconds and 90 seconds for 48 inch, 72 inch, and 80 inch manholes, respectively.

306.3.03B Vacuum Testing, Continued

If the manhole fails the initial test, the necessary repairs shall be made with non-shrink grout while the vacuum is still being drawn. Re-testing shall proceed until a satisfactory test is obtained.

The Contractor may wish to have his/her field personnel seal the exterior of the joints with a hydraulic cement in addition to using the standard joint mastic during installation.

306.4.00 Measurement and Payment

306.4.01 Manholes: Measurement and payment for manholes will be made on a per each basis for each type and size shown.

Payment shall include all materials and work necessary to construct all service connections shown.

307 CATCH BASINS AND INLETS

307.1.00 Description

307.2.00 Materials
307.2.01 Concrete
307.2.02 Forms
307.2.03 Metal Reinforcement
307.2.04 Mortar
307.2.05 Cast Iron Frames and Grades
307.2.06 Welded Frame and Grates
307.2.07 Precast Concrete Units

307.3.00 Construction
307.3.01 Excavation and Backfill
307.3.02 Forming, Pouring and Curing
307.3.03 Precast Concrete Units
307.3.04 Frames and Grates

307.4.00 Measurement and Payment
307.1.01 Catch Basins and Inlets

307 CATCH BASINS AND INLETS

307.1.00 Description: This section covers the work necessary for the construction of catch basins and inlets of the types and sizes shown.

307.2.00 Materials

307.2.01 Concrete: Concrete shall conform to the requirements of Section 503.

307.2.02 Forms: Forms shall conform to the requirements of Subsection 306.2.06.

307.2.03 Metal Reinforcement: Metal reinforcement shall conform to the requirements of Section 306.2.03.

307.2.04 Mortar: Mortar shall conform to the requirements of Subsection 306.2.09D.

307.2.05 Cast Iron Frames and Grates: Cast iron frames and grates shall conform to the requirements of Subsection 306.2.07.

307.2.06 Welded Frames and Grates: Welded frames and grates shall be fabricated of steel conforming to ASTM A7, A36, or A373 in accordance with the details shown.

307.2.07 Precast Concrete Units: At the option of the Contractor, approved precast units may be substituted for cast-in-place units. Precast units shall conform to the requirements of ASTM C478.

307.3.00 Construction

307.3.01 Excavation and Backfill: Excavation and backfill shall conform to the applicable requirements of Section 301.

307.3.02 Forming, Pouring and Curing: Forms shall be tight and well braced. Chamfer corners of forms. Prior to placing the concrete, remove all water and debris from the forms. Moisten forms just prior to placing the concrete. Handle concrete to prevent segregation or loss of ingredients. Immediately after placing, consolidate concrete with an approved vibrator. Limit vibration to the time necessary to produce satisfactory consolidation without causing segregation. Screed the top surface of exposed surfaces and trowel to a smooth finish free from marks or irregularities. Finish exposed edges with a steel edging tool. Cure concrete for a period of seven days with an approved curing compound. Apply the curing compound immediately after

307.3.02 Forming, Pouring and Curing, Continued

removal of forms or finishing. Protect concrete from damage during the seven day curing period. Remove forms and patch any defects in the concrete with mortar mixed in the same proportions as the original concrete mix.

307.3.03 Precast Concrete Units: At the option of the Contractor, precast catch basins and inlets may be used provided all the details of construction are approved prior to construction.

307.3.04 Frames and Grates: Frames and grates shall be of the type and placed as shown on the plans.

307.4.00 Measurement and Payment

307.4.01 Catch Basin and Inlets: Measurement and payment for catch basins and inlets will be made on a per each basis for the number and type shown.

308 WORK ON EXISTING SEWERS AND STRUCTURES

308.1.00 Description

308.2.00 Materials

308.3.00 Construction
308.3.01 Excavation, Bedding and Backfill
308.3.02 Manholes Over Existing Sewers
308.3.03 Manhole Connections
308.3.04 Pipe, Manhole and Catch Basin Removal
308.3.05 Filling Abandoned Manholes and Catch Basins
308.3.06 Salvaging Manhole Frames and Covers
308.3.07 Capping Abandoned Pipes
308.3.08 Manhole Adjustments
308.3.08A Masonry Manholes
308.3.08B Metal Manholes
308.3.08C Fiberglass Reinforced Polyester Resin Manholes
308.3.08D Reinforced Plastic Mortar Manholes
308.3.09 Catch Basin and Inlet Adjustment
308.3.10 Manhole Base Reconstruction
308.3.11 Catch Basin Connections

308.4.00 Measurement and Payment
308.4.01 Manholes Over Existing Sewers
308.4.02 Manhole Connections
308.4.03 Filling Abandoned Manholes
308.4.04 Capping Abandoned Pipes
308.4.05 Catch Basin and Inlet Adjustment
308.4.06 Manhole Base Reconstruction
308.4.07 Catch Basin Connections
308.4.08 Manhole Adjustment

308 WORK ON EXISTING SEWERS AND STRUCTURES

308.1.00 Description: This section covers the work necessary for joining new work to existing, the abandoning of sewerlines and structures, and the adjustment of existing utility structures.

308.2.00 Materials: Materials shall conform to the requirements for the related work referred to herein.

308.3.00 Construction

308.3.01 Excavation, Bedding and Backfill: Excavation, bedding and backfill shall conform to the requirements of Section 301.

308.3.02 Manholes Over Existing Sewers: Construction shall be in accordance with the applicable portions of Section 306.

After completion of the manhole, the Contractor shall sever the existing pipe with the manhole, smooth the edges with mortar or otherwise finish the edges of the cut pipe to provide smooth, finished edges in the manhole.

The Contractor shall prevent broken material or debris from entering the line.

Flow shall be maintained at all times. Prior approval by the Engineer will be required prior to diverting flows.

308.3.03 Manhole Connections: The Contractor shall construct openings in the existing manhole base or barrel as required and construct connections that are watertight and that will provide a smooth flow into and through the manhole.

The Contractor shall provide all diversion facilities and perform all work necessary to maintain flow in existing lines during the connection to the manhole.

308.3.04 Pipe, Manhole and Catch Basin Removal: Pipes, manholes and catch basins scheduled for removal shall be removed and disposed of in accordance with Section 204.3.02.

308.3.05 Filling Abandoned Manholes and Catch Basins: Manholes and catch basins scheduled to be abandoned shall have all connecting pipes capped or plugged and the manhole barrel filled with granular material meeting the requirements of Subsection 301.2.02.

308.3.06 Salvaging Manhole Frames and Covers: Manhole frames and covers scheduled for salvage shall be removed by the Contractor and stored for pickup by the Owner.

308.3.07 Capping Abandoned Pipes: Abandoned pipes shall be capped or plugged in accordance with the pipe manufacturer's recommendations or as specified. All ends shall be watertight.

308.3.08 Manhole Adjustment: Manhole adjustment can be found in Section 216.3.06.

308.3.08A Masonry Manholes: Masonry manholes shall be raised or lowered by removing the existing frames, grates and covers and adjusting the height as necessary to correspond to grade. Manholes may be raised or lowered by any of the following or combination of methods when no particular method is specified.

The manhole neck may be extended by the use of precast extension rings or by reconstructing the neck except that the total distance from the top of metal cover at its new adjusted grade to the bottom of the neck shall not exceed 2 feet.

Manhole necks are defined as that upper portion of a manhole having vertical walls and a uniform diameter or dimensions just sufficient to receive and support the metal frame.

The dome or cone portions of manholes may be cut down and rebuilt provided the batter or slope of the cone does not exceed 6 inches horizontal per 12 inches vertical.

Manhole barrels of brick, block, or concrete shall be extended in kind unless otherwise specified.

Precast sections and rings removed in the adjusting work may be reused in other adjusting work or in new construction if in good condition, and such precast items which are not reused in the work will become the property of the Contractor.

Metal rings may be used in the adjustment work, provided: (1) the metal and its fabrication design shall be such that it will at least equal the pertinent characteristics of strength and support required of the covers or grates to be placed thereon; (2) that uniform bearing or bearing surfaces is assured; and (3) that positive provision is afforded against displacement when in service.

Mortar for building up existing masonry shall not be placed to a depth of more than 2 inches. Concrete shall not be placed to a depth of less than 3 ½ inches. To conform to these requirements, the existing shells or wall of structures to be raised shall be cut down as necessary to provide space for the new construction.

The exposed top surface of monolithic concrete on which new mortar or concrete is to be placed shall be chipped away to a depth of at least ¼ inch to expose firm concrete, and the new surface shall be cleaned by brushing and shall be moistened with water at the time of placing new concrete thereon. The new concrete shall then be placed to required grade and cured at least three days, after which the frame shall be seated in fresh mortar and brought to proper grade.

308.3.08B Metal Manholes: Metal manholes shall be adjusted to grade by resetting the entire structure on a firm foundation, by adding extensions of like design and material or by severing the barrel in an acceptable manner. Salvaged structures not reused on the project shall become the property of the Contractor.

308.3.08C Fiberglass Reinforced Polyester Resin Manholes: Fiberglass reinforced polyester resin manholes shall be adjusted to grade in accordance with the requirements of Subsection 308.3.08B.

308.3.08D Reinforced Plastic Mortar Manholes: Reinforced plastic mortar manholes shall be adjusted to grade in accordance with the requirements of Subsection 308.3.08B.

308.3.09 Catch Basin and Inlet Adjustment: Catch basins and inlets will be adjusted in accordance with the applicable portions of Section 307 and Subsection 308.3.08B.

308.3.10 Manhole Base Reconstruction: Manhole base reconstruction shall be in accordance with the applicable portions of Section 306.

308.3.11 Catch Basin Connections: Catch basin connections, unless otherwise specified, shall be constructed in conformance with the pipe manufacturer's recommended practice for the type of piping and catch basin combination under consideration.

308.4.00 Measurement and Payment

308.4.01 Manholes Over Existing Sewers: Measurement and payment for manholes over existing sewers will be made on a lump sum per each basis. No differentiation will be made for manhole depth.

308.4.02 Manhole Connections: Measurement and payment for connections to existing manholes will be made on a per each basis.

308.4.03 Filling Abandoned Manholes and Catch Basins: No separate or additional payment will be made for filling manholes and catch basins. This work shall be considered as incidental.

308.4.04 Capping Abandoned Pipes: No separate or additional payment will be made for capping abandoned pipes. Payment for this work will be made under one or more of the other bid items.

308.4.05 Catch Basin and Inlet Adjustment: Measurement and payment for adjusting catch basins and inlets will be made on a per each basis for each type and size shown.

308.4.06 Manhole Base Reconstruction: Measurement and payment for reconstructing manhole bases will be made on a per each basis.

308.4.07 Catch Basin Connections: Measurement and payment for catch basin connections will be made on a per each basis.

308.4.08 Manhole Adjustment: Measurement and payment will be made in accordance with Section 216.4.02.

309 RESURFACING

309.1.00 Description

309.2.00 Materials
309.2.01 Asphalt Concrete Pavement
309.2.02 Portland Cement Concrete Pavement
309.2.03 Brick Pavement
309.2.04 Aggregate Base
309.2.05 Curbs
309.2.06 Driveways and Sidewalks
309.2.07 Metal Reinforcement
309.2.08 Epoxy Cement

309.3.00 Construction
309.3.01 Work Area Maintenance
309.3.02 Trench Excavation
309.3.03 Asphalt Concrete Pavement
309.3.04 Portland Cement Concrete Paving
309.3.05 Brick Pavement
309.3.06 Aggregate Base
309.3.07 Curbs
309.3.08 Driveways and Sidewalks
309.3.09 Metal Reinforcement

309.4.00 Measurement and Payment
309.4.01 Trench Excavation
309.4.02 Asphalt Concrete Pavement
309.4.03 Portland Cement Concrete Pavement
309.4.04 Brick Pavement
309.4.05 Aggregate Base
309.4.06 Curbs
309.4.07 Driveways and Sidewalks
309.4.08 Jacking, Boring and Tunneling
309.4.09 Payment

309 RESURFACING

309.1.00 Description: This section covers the work necessary to replace pavement, curbs, sidewalks, rock surfacing and other features damaged either directly or indirectly by the operations related to the construction of all facilities.

309.2.00 Materials

309.2.01 Asphalt Concrete Pavement: Asphalt concrete pavement materials shall conform to the applicable requirements of Subsection 211.2.00. Asphalt concrete shall be Class BM-2, unless otherwise specified.

309.2.02 Portland Cement Concrete Pavement: Portland cement concrete materials shall conform to the requirements of Subsection 212.2.00.

309.2.03 Brick Pavement: Brick paving materials shall be paving brick salvaged from the job site or brick furnished by the City of Dodge City from stock and a Portland cement concrete base, conforming to Subsection 212.2.00.

309.2.04 Aggregate Base: Aggregate base materials shall conform to the requirements of Subsection 207.2.00.

309.2.05 Curbs: Curb materials shall conform to the requirements of Subsection 213.2.00.

309.2.06 Driveways and Sidewalks: Driveway and sidewalk materials shall conform to the requirements of Subsections 214.2.00 and 215.2.00.

309.2.07 Metal Reinforcement: Metal reinforcement materials shall conform to the requirements of Subsections 212.2.00, 213.2.00, and 214.2.00.

309.2.08 Epoxy Cement: Epoxy cement shall be a two-compound epoxy resin adhesive conforming to the requirements of AASHTO M235.

309.3.00 Construction

309.3.01 Work Area Maintenance: The Contractor shall maintain the work area in conformance with the applicable requirements of Subsection 301.3.00.

309.3.02 Trench Excavation: The trench edges in paved areas shall be sawed or cut by methods satisfactory to the Engineer to a depth sufficient to permit removal of pavement without damage to pavement to be left in place. Pavement within the cutting limits together with all other excavated material shall be removed and disposed of.

309.3.02 Trench Excavation, Continued

The trench edges in rock surfaced areas shall be made vertical where soil and depth conditions permit, and if that is not possible, sloped outwardly from the trench.

In trenching across the roads or streets, no more than one-half of the traveled way is to be opened at one time without authorization from the Engineer. The opened half shall be completely backfilled before opening the other half.

Closure of intersecting streets, road approaches, or other access points will not be permitted unless authorized by the Engineer. Upon trenching across such facilities, steel running plates, planks, or other satisfactory methods shall be used to provide for traffic to enter or leave the road, streets, or adjacent property.

Pavement patching shall be scheduled to accommodate the demands of traffic and shall be performed as rapidly as possible to provide maximum safety and convenience to public travel.

Isolated trenches which cross vehicular, pedestrian or bicycle lanes shall be resurfaced immediately.

309.3.03 Asphalt Concrete Pavement: The Contractor shall apply a tack coat to the vertical faces of the existing pavement prior to placing asphalt concrete pavement.

The edges shall be clean and dry prior to applying the tack coat.

The asphalt concrete shall be placed to a compacted thickness of four inches or the thickness of the removed pavement, whichever is greater.

The finished surface of the placed asphalt concrete shall match the surface of the existing pavement. The surface shall not be subjected to traffic until the material has been properly compacted and cured. Construction shall conform to the applicable requirements of Section 211.3.00.

309.3.04 Portland Cement Concrete Paving: Trench edges shall be saw-cut unless otherwise specified. The Contractor shall apply either an approved bonding agent or neat cement grout to the saw-cut faces of the existing pavement prior to placing the fresh concrete.

The edges shall be clean prior to applying the bonding agent or neat cement.

The Portland cement concrete shall be placed to a thickness of six inches or the thickness of the removed pavement, whichever is greater.

309.3.04 Portland Cement Concrete Paving, Continued

The finished surface of the placed Portland cement concrete paving shall match the surface of the existing pavement.

The surface shall not be subjected to traffic until the material has been properly cured.

309.3.05 Brick Pavement: Paving brick shall be removed in such a manner that will permit maximum salvage and reuse of the brick. All brick and parts of brick having full thickness shall be considered reusable. Paving brick which are to be removed shall be reused for construction of the new pavement.

Brick to be reused shall be thoroughly cleaned before being placed in the new pavement. Should it be necessary to add to the brick from a City stockpile, those bricks shall also be thoroughly cleaned before reused.

No usable brick shall be wasted. Paving brick removed and not used in the new work shall be stockpiled for the City.

Brick pavement shall be constructed on a base course consisting of 6 inches of Portland cement concrete placed on a compacted granular subgrade. The concrete shall be Class 3000, as specified in Subsection 503.3.01A.

After construction of the concrete base, a one inch sand cushion or leveling course shall be placed and compacted.

The paving brick shall then be laid using the same pattern as the existing pavement. Joints between bricks shall be as tight as possible.

After the brick has been placed, all joints or interstices shall be filled completely with an approved asphaltic filler. Filler material shall contain no pitch and after curing shall be impervious to street liquids. Filler material shall remain pliable at all climatic conditions to which it will be subjected. The brick shall be dry when the filler material is forced into the joints by using a squeegee to distribute the material evenly. After the filler has set, excess material shall be removed from the brick surface.

309.3.06 Aggregate or Granular Base: Base materials shall be placed in lifts not to exceed six inches. Compaction shall conform to the requirements of Subsection 207.3.04B. The aggregate size shall be 1” – 0, or ¾” – 0 unless otherwise specified.

The compacted thickness shall be 12 inches or the thickness of the removed base, whichever is greater.

309.3.07 Curbs: Curbs shall be saw-cut unless otherwise specified. Construction shall conform to the applicable requirements of Subsection 213.3.00.

The Contractor shall apply either an approved bonding agent or neat cement grout to the saw-cut faces of existing Portland cement concrete curbs prior to placing the fresh concrete.

The materials, dimensions, and geometry of the constructed curb shall match that of the existing curb.

309.3.08 Driveways and Sidewalks: Driveways and sidewalks shall be removed to lines conforming to the transverse scoring lines or joint lines of the existing sidewalk, unless otherwise specified.

Construction shall conform to the applicable requirements of Subsection 215.3.00 and 309.3.04.

309.3.09 Metal Reinforcement: Metal reinforcement will be placed in the material being replaced in the same amounts and location as was in the removed material, unless otherwise specified.

Lapped splices shall be 20 diameters, unless otherwise specified.

Placing of metal reinforcement shall conform to the applicable requirements of Subsection 504.3.03.

309.4.00 Measurement and Payment: Measurement and payment for the following items will be considered incidental, unless specified otherwise.

309.4.01 Trench Excavation: There will be no separate or additional payment for trench excavation unless specified. When specified, measurement and payment shall conform to the requirements of Subsection 301.4.00, as specified.

309.4.02 Asphalt Concrete Pavement: Measurement and payment for asphalt concrete pavement, when specified, shall be on a square yard basis for the amount of surface area replaced within the limits shown. No additional payment will be made for replacement outside the limits shown.

309.4.03 Portland Cement Concrete Pavement: Measurements and payment, when specified, shall conform to the requirements of Subsection 309.4.02.

309.4.04 Brick Pavement: Measurement and payment, when specified, shall be on a square yard basis for the amount of surface replaced within the limits shown, and shall include all costs for construction of the Portland cement concrete base, sand cushion, placing brick, filling joints and cleaning.

309.4.05 Aggregate Base: Measurement and payment, when specified, shall conform to the requirements of Subsection 309.4.02.

309.4.06 Curbs: Measurement and payment, when specified, shall conform to the requirements of Section 213.4.01A.

309.4.07 Driveways and Sidewalks: Measurement and payment, when specified, shall conform to the requirements of Subsection 309.4.02.

309.4.08 Jacking, Boring and Tunneling: If the Contractor elects to jack, bore or tunnel in lieu of removal and replacement, measurement and payment will be made as though the items were removed and replaced, as specified.

309.4.09 Payment: Payment will be made for the following items listed as pay items:

Pay Item	*Unit of Measure*
Trench Excavation	LF
Asphalt Concrete Pavement	SY
Portland Cement Concrete Pavement	SY
Brick Pavement	SY
Aggregate Base	SY
Curbs	LF
Driveways and Sidewalks	SY

DIVISION FOUR
WATER DISTRIBUTION

401 WATER SYSTEM TRENCH EXCAVATION, BEDDING AND BACKFILL

401.1.00 Description

401.2.00 Materials

401.3.00 Construction

401.4.00 Measurement and Payment

401 WATER SYSTEM TRENCH EXCAVATION, BEDDING AND BACKFILL

401.1.00 Description: The work necessary to excavate, bed and backfill water pipelines shall conform to the requirements of Section 301.

401.2.00 Materials: Materials shall conform to the requirements of Subsection 301.2.00.

401.3.00 Construction: Construction shall conform to the requirements of Subsection 301.3.00.

401.4.00 Measurement and Payment: Measurement and payment shall conform to the requirements of Subsection 301.4.00.

402 WATER PIPE AND FITTINGS

402.1.00 Description
402.1.01 General
402.1.02 Certification
402.1.03 Corrosion Protection

402.2.00 Materials
402.2.01 Ductile Iron Pipe
402.2.02 Polyvinyl Chloride (PVC) Class Pressure Pipe
402.2.03 Reinforced Concrete Steel Cylinder Pipe
402.2.04 Prestressed Concrete Steel Cylinder Pipe
402.2.05 Reinforced Concrete Pipe
402.2.06 Pretensioned Reinforced Concrete Steel Cylinder Pipe
402.2.07 Steel Pipe
402.2.08 Galvanized Steel Pipe
402.2.09 Service Line Pipe
402.2.10 Pipe Fittings
402.2.10A Polyvinyl Chloride (PVC) Class Pressure Pipe
402.2.11 Joint Lubricant
402.2.12 Nuts, Bolts and Washers
402.2.13 Thrust Blocks
402.2.14 Pipe Locating Material
402.2.15 Valve Boxes and Vaults
402.2.15A Cast Iron
402.2.15B Portland Cement Concrete Blocks
402.2.15C Portland Cement Concrete
402.2.15D Mortar
402.2.15E Concrete Block

402.3.00 Construction
402.3.01 Handling and Storage
402.3.02 Alignment and Grade
402.3.03 Installation
402.3.03A Cast and Ductile Iron Pipe
402.3.03B Polyvinyl Chloride Pipe
402.3.03C Concrete Steel Cylinder Pipe
402.3.03D Reinforced Concrete Pipe
402.3.03E Steel Pipe
402.3.03F Valves, Fittings, Plugs and Caps
402.3.03G Valve Boxes and Vaults
402.3.04 Pressure Testing
402.3.04A Polyvinyl Chloride Pipe

402.4.00 Service Taps and Lines
402.4.01 Tapping
402.4.02 Corporation Stops
402.4.03 Copper Service Lines
402.4.04 Curb Stops

402.5.00 Measurement and Payment
402.5.01 Pipe
402.5.02 Fittings
402.5.03 Thrust Blocks
402.5.04 Testing
402.5.05 Service Taps

402 WATER PIPE AND FITTINGS

402.1.00 Description

402.1.01 General: This section covers the work necessary for furnishing and installing water pipe and fittings normally used for water distribution systems.

402.1.02 Certification: The Contractor shall furnish materials certifications in accordance with the requirements of Subsection 106.04.

402.1.03 Corrosion Protection: The method of corrosion protection shall be as specified in the contract documents.

402.2.00 Materials

402.2.01 Ductile Iron Pipe: Ductile iron pipe shall be cement-mortar lined and seal coated and shall conform to the requirements of ASTM 536, ANSI A21.51 (AWWA C151) ANSI A21.4 (AWWA C104) and ANSI A2.1.11 (AWWA C111).

402.2.02 Polyvinyl Chloride (PVC) Class Pressure Pipe: Polyvinyl chloride class pressure pipe with diameters of 4 inches through 12 inches shall conform to the requirements of AWWA C900. Joints shall be either elastomeric gasketed or solvent cement welded and shall conform to the requirements of ASTM D3139. Gaskets shall conform to the requirements of ASTM F477 and ASTM D1869. The pressure class shall be as specified.

402.2.03 Reinforced Concrete Steel Cylinder Pipe: Reinforced concrete steel cylinder pipe shall conform to the requirements of AWWA C300.

Before starting fabrication, the Contractor shall furnish the Engineer with two sets of shop drawings. The drawings shall include a laying plan and details of a standard pipe section, special fittings, and bends. Dimensions, coating and lining, and other pertinent information shall be shown. The laying plan shall show the location of each pipe section and each special length with each piece numbered or otherwise designated in sequence.

402.2.04 Prestressed Concrete Steel Cylinder Pipe: Prestressed concrete steel cylinder pipe shall conform to the requirements of AWWA C301.

402.2.05 Reinforced Concrete Pipe: Reinforced concrete pipe shall conform to the requirements of AWWA C 302.

402.2.06 Pretensioned Reinforced Concrete Steel Cylinder Pipe: Pretensioned reinforced concrete steel cylinder pipe shall conform to the requirements of AWWA C303.

Shop drawings shall be furnished in accordance with Subsection 402.2.03.

402.2.07 Steel Pipe: Steel pipe six inches and larger in diameter shall conform to the requirements of AWWA C200.

Protective coatings and linings shall be as specified and shall conform to the applicable portions of AWWA C203, AWWA C205, and AWWA C210.

Field welding shall be in conformance with the requirements of AWWA C206.

402.2.08 Galvanized Steel Pipe: Galvanized steel pipe shall conform to the requirements of AWWA A53.

402.2.09 Service Line Pipe: Service line pipe shall be as specified and shall conform to the applicable requirements of AWWA C800.

402.2.10 Pipe Fittings: Pipe fittings shall be of a class and rating at least equal to the adjacent pipe, unless specified otherwise. Joint materials shall be compatible with the adjacent pipe.

402.2.10A Polyvinyl Chloride (PVC) Class Pressure Pipe: Fittings for polyvinyl chloride class pressure pipe shall be cast or ductile iron and shall be elastomeric gasketed (rubber ring) push-on type specifically made for cast and ductile iron. Polyvinyl chloride class pressure pipe fittings shall conform to the requirements of AWWA C110 and AWWA C111.

Cement mortar lining and seal coating, when required, shall conform to the requirements of ANSI A21.4 and AWWA C104.

Joint materials for jointing valves to polyvinyl chloride pipe shall conform to the applicable requirements of ASTM F477, ASTM D1869, and AWWA C111.

402.2.11 Joint Lubricant: Joint lubricant, when required, shall be in accordance with the pipe or joint manufacturer's recommendations and shall be water-soluble and non-toxic.

402.2.12 Nuts, Bolts and Washers: Nuts, bolts and washers, unless otherwise specified, shall be of ductile iron or zinc coated steel. If of zinc coated steel, the zinc coating shall be by the hot-dip process and shall conform to the requirements of ASTM B6.

402.2.13 Thrust Blocks: Portland cement concrete shall conform to the requirements of Subsection 306.2.04.

Metal reinforcement shall conform to the requirements of Subsection 306.2.03.

402.2.14 Pipe Locating Material: Pipe locating material shall be provided and installed when specified and shown.

402.2.15 Valve Boxes and Vaults

402.2.15A Cast Iron: Cast iron boxes and box components shall conform to the requirements of ASTM A48.

402.2.15B Portland Cement Concrete Blocks: Portland cement concrete blocks shall conform to the requirements of ASTM C149. Overall thickness of blocks shall be six inches with optional lengths and widths. Curved manhole blocks shall be used for round valve chambers.

402.2.15C Portland Cement Concrete: Portland cement concrete shall conform to the requirements of Subsection 306.2.04.

402.2.15D Mortar: Mortar shall conform to the requirements of Subsection 305.2.08C.

402.2.15E Concrete Brick: Concrete brick shall conform to the requirements of ASTM C55, Grade A.

402.3.00 Construction

402.3.01 Handling and Storage: All material shall be handled with care to avoid damage. Whether moved by hand, skidways or hoists, material shall not be dropped, bumped or allowed to impact.

The Contractor shall provide safe storage for material until it has been incorporated into the completed project. The interior of all pipe, couplings, rings, fittings and other accessories shall be kept free from dirt and other foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing. Material that is supplied by the Contractor and is rejected at the point of delivery because of defects or damage shall be replaced by the Contractor. Material damaged subsequent to acceptance by the Engineer shall be replaced by the Contractor.

402.3.02 Alignment and Grade: All pipe shall be laid to and maintained at the lines and grades required by the Engineer. Fittings, valves, air vents and hydrants shall be installed at the required locations with joints centered, spigots home and valve and hydrant stems plumb. No deviation shall be made from the required line or grade without approval from the Engineer or his representative.

402.3.03 Installation

402.3.03A Cast and Ductile Iron Pipe: Installation shall conform to the requirements of AWWA C600.

402.3.03B Polyvinyl Chloride Pipe: Installation shall be in accordance with the manufacturer's recommendations unless otherwise specified.

402.3.03C Concrete Steel Cylinder Pipe: Installation shall be in accordance with the manufacturer's recommendations unless otherwise specified.

402.3.03D Reinforced Concrete Pipe: Installation shall be in accordance with the manufacturer's recommendations unless otherwise specified.

402.3.03E Steel Pipe: Installation shall be in accordance with the manufacturer's recommendations unless otherwise specified.

402.3.03F Valves, Fittings, Plugs and Caps: Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified. Valves 12 inches and larger shall be provided with special support, such as crushed stone, concrete pads or sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve. All dead ends on new mains shall be closed with plugs or caps that are suitably restrained to prevent blowing off under test pressure. If a blowoff valve precedes the plug or cap, it too shall be restrained against blowing off. All dead ends shall be equipped with suitable blowoff facilities.

402.3.03G Valve Boxes and Vaults: Valve boxes and vaults shall be installed so as not to transmit shock or stress to the valve with the box cover flush with the surface of the finished area or such other level as may be specified. The valve operating nut shall be readily accessible for operation through the opening in the box or vault.

402.3.04 Pressure Testing: Testing shall be by the hydrostatic method and shall conform to the requirements of Section 4, AWWA C600, unless otherwise specified herein or in the contract documents.

402.3.04A Polyvinyl Chloride Pipe: Contrary to the first sentence of Section 4.1, AWWA C600, the test pressure shall be as specified and shall not exceed the rated operating pressure of the lowest rated component in the system by more than 1 ½ times. The testing of polyvinyl chloride pipe may, at the option of the Contractor, consist of two tests, an initial optional low pressure test and a mandatory high pressure test. The low pressure test shall be conducted before the pipe is completely backfilled. This test shall be conducted at a pressure of 25 to 50 psi gauge, no testing shall commence for at least 24 hours after the last joint is welded.

402.3.04A Polyvinyl Chloride Pipe, Continued

Upon completion of the low pressure test and repair of any leaks, the pipeline shall be high pressure tested for a duration of two (2) hours.

Prior to testing, the pipeline shall be partially backfilled or otherwise sufficiently anchored to prevent any movement during the test.

402.4.00 Service Taps and Lines

402.4.01 Tapping: Corporation stops may be installed either before or after pipe installation. Generally, they may be located at ten or two o'clock on the circumference of the pipe and may be screwed directly into the tapped and threaded main without any additional appurtenances. When more than one tap in an existing gray cast-iron pipe is necessary to deliver the required flow, they shall be staggered around the circumference at least 12 inches (30 cm) apart (not in a straight line). Ductile iron pipe in all classes may be directly tapped with standard corporation stops; however, torque requirement for the installation may be effectively reduced by the application of two layers of 3-mil (0.1 mm) TFE tape to the male threads of the corporation stop.

402.4.02 Corporation Stops: Corporation stops shall be Mueller Ground key or Ford Ground key corporation stops or approved equal.

402.4.03 Copper Service Lines: Copper service lines from the main to the curb stop shall be Type K copper of the size and length specified on the plans or in the Special Provisions.

402.4.04 Curb Stops: Curb stops shall be Mueller or Ford ball valve curb stops, or approved equal.

402.5.00 Measurement and Payment

402.5.01 Pipe: Measurement and payment for pipe will be made on a linear foot basis for the type and size of pipe installed. No reduction in length will be made for valves and fittings unless specified.

402.5.02 Fittings: Measurement and payment for fittings will be made on a per each basis for the type, kind and size specified and installed. No separate or additional payment will be made for couplings, joint lubricant, nuts, bolts, washers and other fitting related hardware or supplies.

402.5.03 Thrust Blocks

402.5.03A If specified or shown as a bid item in the proposal forms, measurement and payment for thrust blocks will be made on a per each basis for each thrust block installed.

402.5.03B If not specified or shown as a bid item, thrust blocks shall be considered as incidental work for which no additional payment will be made.

402.5.04 Pressure Testing: Unless specified otherwise, pressure testing shall be considered as incidental work for which no additional payment will be made.

402.5.05 Service Taps and Lines: Service taps and lines will be measured and payment made on the basis of each service actually constructed.

403 VALVES AND METERS

403.1.00 Description
403.1.01 General
403.1.02 Certification

403.2.00 Materials
403.2.01 Gate Valves, 3 Through 48 Inch Diameter
403.2.02 Butterfly Valves
403.2.03 Ball Valves
403.2.04 Check Valves
403.2.04A Swing Check Type
403.2.04B Spring Load Plug or Disc Type
403.2.04C Hydraulic Cushion Type
403.2.05 Hydraulically-Operated Valves
403.2.06 Combination Air and Vacuum Release Valves
403.2.07 Backflow Prevention Devices
403.2.08 Meters
403.2.08A Displacement Type
403.2.08B Turbine Type
403.2.08C Compound Type
403.2.08D Fire Service Type
403.2.08E Propeller Type
403.2.08F Multi-Jet Type
403.2.09 Remote Registration Systems
403.2.09A Direct Reading Type
403.2.09B Encoder Type
403.2.10 Sluice Gates
403.2.11 Valve Shaft Enclosures

403 VALVES AND METERS

403.1.00 Description

403.1.01 General: This section covers the work necessary for furnishing and installing valves and meters.

403.1.02 Certification: The Contractor shall furnish materials certifications in accordance with the requirements of Subsection 106.04.

403.2.00 Materials

403.2.01 Gate Valves, 3 Inches Through 48 Inch Diameter: Gate valves, 3 inches through 48 inches in diameter shall be Mueller Centurion, unless specified otherwise, conforming to the requirements of AWWA C500, unless otherwise specified. Valves shall open when the stem is rotated counterclockwise.

403.2.02 Butterfly Valves: Butterfly valves shall be Mueller or approved equal, and shall conform to the requirements of AWWA C504. Valves shall be Class 150B, unless otherwise specified.

403.2.03 Ball Valves: Ball valves shall be Mueller or approved equal, and shall conform to the requirements of AWWA C507. The Class and kind of body material shall be as specified.

403.2.04 Check Valves

403.2.04A Swing Check Type: Swing check valves shall be Mueller or approved equal and shall be bronze mounted with cast or ductile iron body with outside lever and spring unless otherwise specified.

403.2.04B Spring Loaded Plug or Disc Type: Spring loaded plug or disc type check valves shall be bronze mounted with bronze, cast or ductile iron body, bronze plug or disc, stainless steel spring and resilient seating suitable for clear cold water service. The plug or disc of the check valves shall be easily removable and replaceable.

403.2.04C Hydraulic Cushion Type: Hydraulic cushion type check valves shall be of bronze, cast or ductile iron, with bronze disc and disc faces, seat rings and pivot pins. The valve shall provide drop-tight sealing. The valve shall be provided with an adjustable speed, integrally mounted, oil dashpot mechanical snubber system.

403.2.05 Hydraulically-Operated Valves: Hydraulically-operated valves shall be pilot controlled and diaphragm-operated. Valves shall be suitable for 175 psi operation and shall be globe or angle valves. Closing speed shall be adjustable on all valves. Self-cleaning strainers for pilot water supply and valve position indicators shall be provided.

403.2.06 Combination Air and Vacuum Release Valves: Combination air and vacuum release valves shall be constructed to permit the escape of large volumes of air when the pipeline is being filled with water, so that smaller amounts of accumulated air will be released under normal operating conditions, and so that air may re-enter the line to break any vacuum caused by the water leaving the pipeline rapidly. Valves shall have cast iron bodies and covers and stainless steel floats. Float guides, bushings and lever pins shall be stainless steel or bronze. Valves shall be designed for operating service to 300 psi.

403.2.07 Backflow Prevention Devices: Backflow prevention devices shall conform to the requirements of AWWA C506.

403.2.08 Meters: Meters shall be Neptune, unless specified otherwise. The units of measure shall be shown in US gallons, unless otherwise specified.

403.2.08A Displacement Type: Displacement type meters shall conform to the requirements of AWWA C700.

403.2.08B Turbine Type: Turbine type meters shall conform to the requirements of AWWA C701.

403.2.08C Compound Type: Compound type meters shall conform to the requirements of AWWA C702.

403.2.08D Fire Service Type: Fire service type meters shall conform to the requirements of AWWA C703.

403.2.08E Propeller Type: Propeller type meters shall conform to the requirements of AWWA C708.

403.2.08F Multi-Jet Type: Multi-Jet type meters shall conform to the requirements of AWWA C708.

403.2.09 Remote Registration Systems

403.2.09A Direct Reading Type: Direct reading remote registration systems for meters shall conform to the requirements of AWWA C706.

403.2.09B Encoder Type: Encoder type remote registration systems for meters shall conform to the requirements of AWWA C707.

403.2.10 Sluice Gates: Sluice gates shall conform to the requirements of AWWA C501, or the manufacturer's specifications.

403.2.11 Valve Shaft Enclosures: Valve shaft enclosures shall be Road Way No. 564-F with screw tops or approved equal, and shall consist of a top section, cover and extension section. The cover shall have the word "water" cast in its top. The length shall be that necessary to properly enclose the valve shaft at each particular location or as shown in the Special Provisions or shown on the plans.

403.3.00 Construction

403.3.01 Valves: Valves shall be installed so that the shafts are vertical, unless otherwise directed. Jointing procedures shall conform to the applicable AWWA specifications or as specified.

403.3.02 Meters: Meters shall be installed in conformance with the manufacturer's recommendations.

403.3.03 Remote Registration System: Remote registration systems shall be installed in conformance with the manufacturer's recommendations.

403.3.04 Sluice Gates: Sluice gates shall be installed in conformance with the requirements of AWWA C501 or the manufacturer's recommendations.

403.3.05 Back Flow Prevention Devices: Backflow prevention devices shall be installed in conformance with the manufacture's recommendations.

403.3.06 Valve Shaft Enclosures: Valve shaft enclosures shall be centered on the valve shaft. Construction shall conform to the requirements of Subsection 402.3.03I.

403.4.00 Measurement and Payment

403.4.01 Valves: Measurement and payment for valves will be made on a per each basis for the type, kind and size specified and installed.

403.4.02 Backflow Prevention Devices: Measurement and payment for backflow prevention devices will be made on a per each basis for the type, kind and size specified and installed.

403.4.03 Meters: Measurement and payment for meters will be made on a per each basis for the type, kind and size specified and installed.

403.4.04 Remote Registration Systems: Measurement and payment for remote registration systems will be made on a per each basis for the type, kind and size specified and installed.

403.4.05 Sluice Gates: Measurement and payment for sluice gates will be made on a per each basis for the type, kind and size specified and installed.

403.4.06 Valve Shaft Enclosures: Measurement and payment for valve shaft enclosures will be made on one of the methods specified hereinbelow.

403.4.06A Where so indicated in the Special Provisions or shown as a bid item on the proposal, measurement and payment for valve shaft enclosures will be made on a per each basis as specified and installed.

403.4.06B If not indicated in the Special Provisions or in the Proposal, valve shaft enclosures shall be considered incidental work for which no extra payment will be made.

404 FIRE HYDRANTS

404.1.00 Description
404.1.01 General
404.1.02 Certification

404.2.00 Materials
404.2.01 Hydrants
404.2.01A Dry-Barrel Type
404.2.01B Wet-Barrel Type

404.3.00 Construction
404.3.01 Hydrants

404.4.00 Measurement and Payment

404 FIRE HYDRANTS

404.1.00 Description

404.1.01 General: This section covers the work necessary for furnishing and installing fire hydrants.

404.1.02 Certification: The Contractor shall furnish materials certifications in accordance with the requirements of Subsection 106.04.

404.2.00 Materials

404.2.01 Hydrants: Hydrants shall be of the dry-barrel type unless otherwise specified. The bury length shall be a minimum of 3 ½ feet, unless otherwise specified. Outlet nozzle threads shall conform to the requirements of NFPA 194. (Appendix A)

Hydrants shall be furnished with two 2 ½ inch hose outlet nozzles and one 4 ½ inch pumper nozzle, unless otherwise specified. The nominal diameter of the main valve opening shall be 5 ¼ inches, unless otherwise specified.

The base of the hydrant shall be provided with a mechanical joint connection unless otherwise specified. Gaskets, nuts and bolts for this connection shall be furnished by the Contractor.

The drain outlet shall be tapped to receive a drain pipe.

404.2.01A Dry-Barrel Type: Dry-barrel hydrants shall be Mueller Centurion, unless specified otherwise.

404.2.01B Hydrant Barrel Extensions: Hydrant barrel extension shall be standard for the hydrants furnished.

404.3.00 Construction

404.3.01 Hydrants: Installation shall conform to the requirements of AWWA Manual M17 and AWWA C600. Hydrants shall be set at the elevations shown on the plans or with the sidewalk flange approximately 2 inches above an elevation which is ¼ inch per foot above the curb or curb grade opposite the point of installation.

404.3.02 Hydrant Barrel Extensions: Hydrant barrel extensions shall be installed in strict conformance with the manufacture's specifications. Unless specified otherwise by the Engineer, the barrel extension shall permit the hydrant to be installed at the elevation specified in Subsection 404.3.01.

404.4.00 Measurement and Payment

404.4.01 Hydrants: Measurement and payment for hydrants will be made on a per each basis for the type of hydrant specified and installed.

404.4.02 Hydrant Barrel Extensions: Measurement and payment for hydrant barrel extensions will be made on a linear foot basis for extensions specified and installed.

405 DISINFECTION

405.1.00 Disinfection

405.2.00 Chlorine
405.2.01 Forms of Chlorine and Disinfection
405.2.02 Liquid Chlorine
405.2.03 Sodium Hypochlorite
405.2.04 Calcium Hypochlorite

405.3.00 Preventative and Corrective Measures During Construction
405.3.01 General
405.3.02 Keeping Pipe Clean and Dry
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405.3.06 Wet-Trench Construction
405.3.07 Flooding During Construction

405.4.00 Methods of Chlorination
405.4.01 General
405.4.02 Tablet Method
405.4.02A Placing of Calcium Hypochlorite Granules
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405.4.02C Filling and Contact
405.4.03 Continuous Feed Method
405.4.03A Placing of Calcium Hypochlorite Granules
405.4.03B Preliminary Flushing
405.4.03C Chlorinating the Main
405.4.04 Slug Method
405.4.04A Placing Calcium Hypochlorite Granules
405.4.04B Preliminary Flushing
405.4.04C Chlorinating the Main

405.5.00 Final Flushing
405.5.01 Cleaning Main of Heavily Chlorinated Water
405.5.02 Disposing of Heavily Chlorinated Water

405.6.00 Bacteriological Tests
405.6.01 Standard Conditions
405.6.02 Special Conditions
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405 DISINFECTION

405.7.00 Redisinfection
405.7.01 Disinfection When Cutting Into or Replacing Existing Mains
405.7.02 Trench Treatment
405.7.03 Swabbing with Hypochlorite Solution
405.7.04 Flushing
405.7.05 Slug Chlorination
405.7.06 Sampling and Bacteriological Testing

405.8.00 Measurement and Payment
405.8.01 Disinfection
405.8.02 Sampling and Bacteriological Testing

405 DISINFECTION

405.1.00 Description: This standard presents essential procedures for disinfecting new and repaired water mains. All new water mains shall be disinfected before they are placed in service. All water mains taken out of service for inspecting, repairing or other activity which light lead to contamination of water shall be disinfected before they are returned to service.

405.2.00 Chlorine

405.2.01 Forms of Chlorine for Disinfection: The forms of chlorine that may be used in the disinfection operations are liquid chlorine, sodium hypochlorite solution, and calcium hypochlorite granules or tablets.

405.2.02 Liquid Chlorine: Liquid chlorine contains 100 percent available chlorine and is packaged in steel containers usually of 100 lb., 150 lb., or 1 ton net chlorine weight. Liquid chlorine shall be used only (1) in combination with appropriate gas-flow chlorinators and ejectors to provide a controlled high-concentration solution feed to the water to be chlorinated; (2) under the direct supervision of a person who is familiar with the physiological, chemical and physical properties of liquid chlorine, and who is trained and equipped to handle any emergency that may arise; and (3) when appropriate safety practices are observed to protect working personnel and the public.

405.2.03 Sodium Hypochlorite: Sodium hypochlorite is available in liquid form in glass, rubber-lined or plastic containers typically ranging in size from 1 qt. to 4 gal.; containers of 30 gal. or larger sizes may be available in some areas. Sodium hypochlorite contains approximately 5 percent to 15 percent available chlorine, but care must be used in control of conditions and length of storage to minimize its deterioration. (Note: Available chlorine is expressed as a percent of weight when the concentration is 5 percent or less, and usually as a percent of the volume for higher concentrations. Percent x 10 = grams of available chlorine per liter of hypochlorite.)

405.2.04 Calcium Hypochlorite: Calcium hypochlorite is available in granular form or in 5-g tablets, and contains approximately 65 percent available chlorine by weight. The material should be stored in a cool, dry and dark environment to minimize its deterioration.

405.3.00 Preventative and Corrective Measures During Construction

405.3.01 General: Heavy particulates generally will contain bacteria, and will prevent even very high concentrations of chlorine from contacting and killing such organisms. It is therefore essential that the procedures of this section be observed to assure that a water main and its appurtenances are thoroughly clean for the final disinfection by chlorination.

405.3.02 Keeping Pipe Clean and Dry: Precautions shall be taken to protect the interiors of pipes, fittings and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. All openings in the pipeline shall be closed with watertight plugs when pipelaying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used where it is determined that watertight plugs are not practicable and where thorough cleaning will be performed by flushing or other means.

> NOTE: Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipelaying, the less likelihood of contamination.

405.3.03 Joints: Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

405.3.04 Sealing Materials: No contaminated material or any material capable of supporting prolific growth of microorganisms shall be used for sealing joints. Sealing material or gaskets shall be handled in a manner which avoids contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in closed containers and shall be kept clean.

405.3.05 Cleaning and Swabbing: If dirt enters the pipe that, in the opinion of the Owner's Engineer or Job Superintendent, will not be removed by the flushing operation, the interior of the pipe shall be cleaned by mechanical means and then shall be swabbed with a 10 percent hypochlorite disinfecting solution. Cleaning with the use of a pig, swab or "go devil" should be undertaken only when the Engineer has determined that such operation will not force mud or debris into pipe joint spaces.

405.3.06 Wet-Trench Construction: If it is not possible to keep the pipe and fittings dry during installation, every effort shall be made to assure that any of the water that may enter the pipe joint spaces contains an available chlorine concentration of approximately 25 mg/L. This may be accomplished by adding calcium hypochlorite granules or tablets to each length of pipe before it is lowered into a wet trench, or by treating the trench water with hypochlorite tablets.

405.3.07 Flooding by Storm or Accident During Construction: If the main is flooded during construction, it shall be cleared of the flood water by draining and by flushing with potable water until clean. The section exposed to the flood water shall then be filled with a chlorinated potable water which at the end of a holding period will have a free chlorine residual of not less than 10 mg/L. The chlorinated water may then be drained or flushed from the main. After construction is completed, the main shall be disinfected using the continuous feed or slug method.

405.4.00 Methods of Chlorination

405.4.01 General: Three methods of chlorination are given.

The tablet method, which gives an average chlorine dose of approximately 25 mg/L, may only be used if specified by the Special Provisions or if permitted by the Engineer for special circumstances.

The continuous feed method gives a 24-hour chlorine residual of not less than 10 mg/L.

The slug method gives 3 hour exposure of not less than 50 mg/L free chlorine.

405.4.02 Tablet Method: The tablet method consists of placing calcium hypochlorite granules and tables in the water main as it is being installed and then filling the main with potable water when installation is completed.

405.4.02A Placing of Calcium Hypochlorite Granules: During construction, calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-ft intervals. The quantity of granules shall be as shown in Table 1.

> WARNING: THIS PROCEDURE MUST NOT BE USED ON SOLVENT WELDED PLASTIC OR ON SCREWED JOINT STEEL PIPE BECAUSE OF THE DANGER OF FIRE OR EXPLOSION FROM THE REACTION OF THE JOINT COMPOUNDS WITH THE CALCIUM HYPOCHLORITE.

TABLE 1	
Ounces of Calcium Hypochlorite Granules To Be Placed at Beginning of Main and At Each 500-ft Interval	
Pipe Diameter (inches)	*Granules (ounces)*
4	0.5
6	1.0
8	2.0
12	4.0
16 and larger	8.0

405.4.02B Placing of Calcium Hypochlorite Tablets: During construction, 5-g calcium hypochlorite tablets shall be placed in each section of pipe and also one such tablet shall be placed in each hydrant, hydrant branch, and other appurtenance. The number of 5-g tablets

405.4.02B Placing of Calcium Hypochlorite Tablets, Continued

required for each pipe section shall be 0.0012 d^2L rounded to the next higher integer, where d is the inside pipe diameter in inches and L is the length of the pipe section in feet. Table 2 shows the number of tablets required for commonly used sizes of pipe. They shall be attached by an adhesive such as Permatex No. 1 or equal as manufactured by Loctite Corp., Automotive and Consumer Group. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all the tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can be readily determined that the pipe is installed with the tablets at the top.

TABLE 2

*Number of 5-g Hypochlorite Tablets Required for Dose of 25 mg/L**

Pipe Diameter (inches)	*Length of Pipe Section, ft.*				
	13 or less	*18*	*20*	*30*	*40*
4	1	1	1	1	1
6	1	1	1	2	2
8	1	2	2	3	4
10	2	3	3	4	5
12	3	4	4	6	7
16	4	6	7	10	13

*Based on 3.25g available chlorine per tablet, any portion of tablet rounded to next higher number.

405.4.02C Filling and Contact: When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 fps. Precautions shall be taken to assure that air pockets are eliminated. This water shall remain in the pipe for at least 24 hours. If the water temperature is less than 5 degrees C (41 degrees F), the water shall remain in the pipe for at least 48 hours. Valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service.

405.2.03 Continuous Feed Method: The continuous feed method consists of placing calcium hypochlorite granules in the main during construction (optional), completely filling the main to remove all air pockets, flushing the completed main to remove particulates, and filling the main with potable water chlorinated so that after a 24-hour holding period in the main there will be a free chlorine residual of not less than 10 mg/L.

405.4.03A Placing Calcium Hypochlorite Granules: At the option of the Engineer, calcium hypochlorite granules shall be placed in pipe sections as specified in Section 402.4.03A. The purpose of this procedure is to provide a strong chlorine concentration in the first flow of flushing water that flows down the main. This procedure is recommended particularly where the type of pipe is such that this first flow of water will flow into annular spaces at pipe joints.

405.4.03B Preliminary Flushing: Prior to being chlorinated, the main shall be filled to eliminate air pockets and shall be flushed to remove particulates. The flushing velocity in the main shall be not less than 2.5 fps unless the Engineer determines that conditions do not permit the required flow to be discharged to waste. Table 3 shows the rates of flow required to produce a velocity of 2.5 fps in pipes of various sizes.

> Flushing is no substitute for preventative measures during construction. Certain contaminants such as caked deposits resist flushing at any feasible velocity.

In mains of 24 inches or larger diameter, an acceptable alternative to flushing is to broom-sweep the main, carefully removing all sweepings prior to chlorinating the main.

TABLE 3

*Required Flow and Openings to Flush Pipelines**
(40-psi Residual Pressure in Water Main)

Pipe Diameter (inches)	*Flow Required to Produce 2.5 fps Velocity in Main (gpm)*	*Size of Tap on Main** (inches)*	*Hydrant Number*	*Outlets Size (inches)*
4	100	15/16	1	2 ½
6	220	1 3/8	1	2 ½
8	390	1 7/8	1	2 ½
10	610	2 5/16	1	2 ½
12	880	2 13/16	1	2 ½
16	1565	3 5/8	2	2 ½

* With a 40-psi pressure in the main with the hydrant flowing to atmosphere, a 2 ½ inch hydrant outlet will discharge approximately 1,000 gpm and a 4 ½ inch hydrant nozzle will discharge approximately 2,500 gpm.

** Size of tap on main, with no significant length of discharge piping.

405.4.03C Chlorinating the Main: Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate into the newly laid water main. In the absence of a meter, the rate may be approximated by methods such as placing the pivot gauge in the discharge, measuring the time to fill a container of known volume, or other acceptable methods.

At a point not more than 10 ft downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 50 mg/L free chlorine. To assure that this concentration is provided, measure the chlorine concentration at regular intervals using appropriate chlorine test kits.

Table 4 gives the amount of chlorine required for each 100 ft of pipe of various diameters. Solutions of chlorine may be prepared with sodium hypochlorite or calcium hypochlorite.

During the application of chlorine, valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service. Chlorine application shall not cease until the entire main is filled with heavily chlorinated water. The chlorinated water shall be retained in the main for at least 8 hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 8 hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L free chlorine.

TABLE 4

Chlorine Required to Produce 25 mg/L Concentration in 100 ft of Pipe (by Diameter)

Pipe Diameter (inches)	*Sodium Hypochlorite 10% Solution (ounces)*	*Calcium Hypochlorite 65% Powder (ounces)*
2	1.8	0.27
3	3.5	0.54
4	5.25	0.81
6	10.5	1.62
8	17.5	2.69
10	27.4	4.20
12	38.5	5.92
16	69.0	10.60

The preferred equipment for applying liquid chlorine is a solution feed vacuum-operated chlorinator to mix the chlorine gas in solution water, in combination with a booster pump for injecting the chlorine gas solution water into the main to be disinfected. It is recommended that direct feed chlorinators not be used. (A direct feed chlorinator is one which operates solely from

405.4.03C Chlorinating the Main, Continued

the pressure in the chlorine cylinder.) Hypochlorite solutions may be applied to the water main with a gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. Feed lines shall be of such material and strength as to withstand safely the corrosion caused by the concentrated chlorine solutions and the maximum pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main.

405.4.04 Slug Method: The slug method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main to eliminate all air pockets, flushing the main to remove particulates, and slowly flowing through the main a slug of water dosed with chlorine to a concentration of 300 mg/L in order that all parts of the main and its appurtenances will be exposed to the highly chlorinated water for a period of not less than 3 hours.

405.4.04A Placing Calcium Hypochlorite Granules: Same as 405.4.02A.

405.4.04B Preliminary Flushing: Same as 405.4.02B.

405.4.04C Chlorinating the Main: At a point not more than 10 feet downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 300 mg/L free chlorine. To assure that this concentration is provided, the chlorine concentration should be measured at regular intervals. The chlorine shall be applied continuously and for a sufficient period to develop a solid column of "slug" of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 300 mg/L for at least 3 hours.

The free chlorine residual shall be measured in the slug as it moves through the main. If at any time it drops below 50 mg/L, the flow shall be stopped, chlorination equipment shall be relocated at the head of the slug, and as flow is resumed, chlorine shall be applied to restore the free chlorine in the slug to not less than 300 mg/L.

As the chlorinated water flows past fittings in valves, related valves and hydrants shall be operated so as to disinfect appurtenances and pipe branches.

405.5.00 Final Flushing

405.5.01 Clearing the Main of Heavily Chlorinated Water: After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use.

405.5.02 Disposing of Heavily Chlorinated Water: The environment to which the chlorinated water is to be discharged shall be inspected and if there is any question that the chlorinated discharge will cause damage to the environment, then a reducing agent shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water. Where necessary, federal, state, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

405.6.00 Bacteriological Tests

405.6.01 Standard Conditions: After final flushing and before the water main is replaced in service, a sample or samples shall be collected from the end of the line, shall be tested for bacteriological quality in accordance with Standard Methods, and shall show the absence of coliform organisms. A standard plate count may be required at the option of the Engineer. At least one sample shall be collected from the new main and one from each branch. In the case of extremely long mains, it is desirable that samples be collected along the length of the line as well as its end.

405.6.02 Special Conditions: If, during construction, trench water has entered the main, or if in the opinion of the Engineer, excessive quantities of dirt or debris have entered the main, bacteriological samples shall be taken at intervals of approximately 200 ft and shall be identified as to location. Samples shall be taken of water that has stood in the main for at least 16 hours after final flushing has been completed.

405.6.03 Sampling Procedure: Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate as required by Standard Methods. No hose or fire hydrant shall be used in collection of samples. A corporation cock shall be installed in the main with copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly shall be removed.

405.7.00 Redisinfection: If the initial disinfection fails to produce satisfactory bacteriological samples, the main may be reflushed and shall be resampled. If check samples show the presence of coliform organisms, then the main shall be rechlorinated by the continuous feed or slug method of chlorination until satisfactory results are obtained.

405.7.01 Disinfection When Cutting Into or Repairing Existing Mains: The following procedures apply primarily when mains are wholly or partially dewatered. After the appropriate procedures have been completed, the main may be returned to service prior to completion of bacteriological testing in order to minimize the time customers are out of water. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

405.7.02 Trench Treatment: When an old main is opened, either by accident or by design, the excavation will likely be wet and may be badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

405.7.03 Swabbing with Hypochlorite Solution: The interior of all pipe and fittings used in making the repair (particularly couplings and sleeves) shall be swabbed or sprayed with a one percent hypochlorite solution before they are installed.

405.7.04 Flushing: Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant locations permit, flushing toward the work location from both directions is recommended. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

405.7.05 Slug Chlorination: Where practical in addition to the procedures above, a section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described in Section 402.4.03C, except that the contact time may be reduced to as little as 15 minutes. After chlorination, flushing shall be resumed and continued until discolored water is eliminated and the water is free of noticeable chlorine odor.

405.7.06 Sampling and Bacteriological Testing: Bacteriological samples shall be taken after repairs to provide a record by which the effectiveness of the procedures used can be determined. If the direction of the flow is unknown, samples shall be taken on each side of the main break.

If positive samples are recorded, daily sampling shall be continued until two consecutive negative samples are recorded. Positive samples shall be evaluated by the Engineer for corrective action.

405.8.00 Measurement and Payment

405.8.01 Disinfection: Unless specified otherwise, disinfection shall be considered as incidental work for which no additional payment will be made.

405.8.02 Sampling and Bacteriological Testing: Unless specified otherwise, sampling and bacteriological testing will be considered as incidental work for which no additional payment will be made.

406 PROTECTION OF WATER SUPPLIES

406.1.00 Description

406.2.00 Separation of mains from Pollution Sources
406.2.01 Types of Pollution Sources
406.2.01A Septic Tanks, Waste Stabilization Ponds, and Open Sewage Discharge Locations
406.2.02 Absorption Fields and Feedlots
406.2.03 Sewer Drain Crossings
406.2.04 Encasement

406.3.00 Separation of Potable Water Mains and Sanitary Sewers
406.3.01 Parallel Water and Sewer Lines
406.3.02 Water Services and Building Sewers

406.4.00 Sewer Connections

406 PROTECTION OF WATER SUPPLIES

406.1.00 Description

406.4.01 General: This section describes the requirements for protecting water supplies from pollution sources.

406.2.00 Separation of Water Mains from Pollution Sources

406.2.01 Types of Pollution Sources: It is of utmost importance that potable water lines be protected from any source of pollution. The following shall pertain to instances where individual or industrial septic tanks and tile absorption fields, waste stabilization ponds, waste water lines discharging into roadside ditches, feedlots or other sources of pollution are encountered.

406.2.01A Septic Tanks, Waste Stabilization Ponds and Open Sewage Discharge Locations: A minimum distance of 25 feet shall be maintained between all potable water lines and all septic tanks, waste stabilization ponds or open sewage discharge locations.

406.2.02 Absorption Fields and Feedlots: Under no circumstances shall a water line extend through a septic tank tile absorption field or feedlot. All water lines shall be located a minimum of 25 feet from the farthest known extent of any sewage absorption.

406.2.03 Sewer Drain Crossing: When it is necessary for any water line to cross a sewer drain, including an open drain ditch, the sewage flow shall be encased in a cast iron or approved plastic pipe for at least 10 feet of each side of the water main.

406.2.04 Encasement: Under no condition will it be considered that encasement of the water main through an area of real or potential pollution would provide the protection needed to the water supply.

406.3.00 Separation of Potable Water Mains and Sanitary Sewers

406.3.01 Parallel Water and Sewer Lines: When potable water pipes and sanitary sewers are laid parallel to each other, the horizontal distance between them shall be not less than 10 feet. The laying of water pipes and sanitary sewers shall be in separate trenches with undisturbed earth between them.

When a water pipe and a sanitary sewer cross and the sewer is 2 feet or more (clear space) below the water pipe, no extra protection to the latter is needed. At <u>all other</u> crossings, the sewer is to be constructed of either cast iron pipe with leaded joints or approved plastic pipe with bonded joints for a distance of 10 feet in either direction from the crossing. Joints are not to be in the

406.3.01 Parallel Water and Sewer Lines, Continued

immediately vicinity of the water main and as far from it as practicable. Where water mains are laid across or through an area where there are existing sewers and the extra protection is needed, the existing sewers may be encased in concrete with a minimum of 7 inches thickness for the required distance on each side of the crossing.

406.3.02 Water Services and Building Sewers: The same horizontal separation requirements as listed above apply to water service lines and building sewers. The same vertical distance separations and the extra protections as required above for potable water mains and sanitary sewers apply in the same manner to water service pipes and building sewers.

406.4.00 Sewer Connections: There shall be no physical connection between any part of the potable water supply with any building sewer, building lateral or house lateral, or with any sanitary sewer or waste water treatment facility by means of which it would be possible for sewage, even under exceptional circumstances, to reach the wells, storage reservoirs or distribution system and thus contaminate the water supply.

DIVISION FIVE
STRUCTURES

501 EARTHWORK

501.1.00 Description

501.2.00 Materials
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501.4.07 Topsoil
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501.4.09 Payment

501 EARTHWORK

501.1.00 Description: This section covers the work necessary for excavation, backfilling, embankment construction and disposal of materials in connection with the construction of structures.

501.2.00 Materials

501.2.01 Material Approval: Samples of all fabricated materials shall be submitted to the Engineer for approval prior to placing orders. Samples shall be representative and clearly marked to indicate the source of the material and its intended use on the project.

501.2.02 Structure Excavation: Structure excavation shall include the removal of all materials, of whatever nature, necessary for the construction of foundations and substructures in accordance with the plans or as directed by the Engineer. It shall include the furnishing of all necessary equipment and the construction of all cribs, cofferdams, caissons and all dewatering, etc., which may be necessary for the execution of the work. It shall also include the subsequent removal of cofferdams and cribs and the placement of all backfill. It shall also include the wasting of excavated material which is not required for backfill.

501.2.03 General Backfill: General backfill shall be excavated material free from roots, debris and other deleterious materials.

501.2.04 Special Backfill

501.2.04A Granular Backfill: Granular backfill shall conform to the requirements of Sections 301.2.04B and 301.3.07 as specified.

501.2.04B Sand Backfill: Sand backfill shall conform to the requirements of Subsection 301.2.04C.

501.2.04C Impervious Backfill: Impervious backfill material shall be composed of particles at least 95 percent of which will pass the No. 200 sieve, and with a plasticity index not less than 20.

501.2.05 Foundation Stabilization: When a firm foundation is not encountered due to soft, spongy or other unsuitable soil, all such unsuitable soil under the structure shall be removed and replaced with a suitable granular material. If a suitable granular material is not available on the job site for this backfill, the Contractor shall, after approval from the Engineer, furnish granular material which shall be paid for as foundation stabilization. The granular material shall be deposited in lifts not exceeding eight inches loose thickness. Each lift shall be compacted to at least 95 percent of its maximum density at optimum moisture content as determined by the applicable method of ASTN D698, before placing the next lift. Jetting or puddling will not be permitted.

501.2.06 Topsoil: Topsoil shall conform to the requirements of Subsection 221.2.04.

501.2.07 Water: Water shall conform to the requirements of Subsection 205.2.01.

501.3.00 Construction

501.3.01 Excavation: Excavation shall consist of the excavation, removal, and disposal of all formations and materials, natural or man made, irrespective of nature or condition, encountered within the limits hereinafter defined, necessary for the construction of footings, foundations, slabs, retaining walls, cribbing, culverts or other similar structures.

501.3.02 Limits of Excavation: The limits of excavation for pay quantities shall be as shown.

When the limits are not shown, the limits for pay quantities will be lines parallel to and one foot outside the neat lines of the footings or bases of the structure.

The lower limit shall be the elevation shown on the plans for the bottoms of footings or bases for the structure.

The upper limit shall be the ground surface at the site of the work immediately prior to the beginning of the work; except that where the excavation for the structure comes within the limits of roadway or channel change excavation areas, the upper limits shall be the planes of the bottoms and side slopes of those areas, and where the excavation for the structure comes within the limits of embankment to be constructed as a part of the contract, such embankment shall be constructed prior to construction or installation of the structure and the upper limit shall be the planes of the new embankment at the elevation specified or established by the Engineer for the embankment construction.

Excavation outside or below the limits for purposes of forming, shoring, or other activities, will not be considered for payment.

In the event of excavation occurring below the elevations shown, the area will be backfilled to the proper grade as the Engineer may direct, at no cost to the Owner.

No measurement or payment will be considered for material forced up between foundation piles during driving nor of material used in backfilling around piles should compaction occur during driving.

501.3.03 Shoring and Cribbing: Shoring and cribbing of excavations will not be required when open excavation would not be detrimental to adjacent structures, roadways, etc.; otherwise excavation shall be shored, braced or protected by cofferdams in accordance with approved methods. When footings can be placed in the dry without the use of cribs or cofferdams, backforms may be omitted with the approval of the Engineer and the entire excavation filled with concrete to the required elevation of the top of the footing.

501.3.03 Shoring and Cribbing, Continued

Cofferdams or cribs shall be constructed so as to protect green concrete against damage from a sudden rising of the stream and to prevent damage to the foundation by erosion. No timber or bracing shall be left in cofferdams or cribs in such a way as to extend into the substructure concrete, without written permission from the Engineer.

Unless otherwise provided, cofferdams or cribs including all sheeting and bracing shall be removed after the completion of the substructure, care being taken not to disturb or otherwise injure the finished concrete.

Shoring and cribbing shall be designed and constructed as necessary for the proper performance of the work which must be done inside them. The interior dimensions of cofferdams and cribs shall be such as to give sufficient clearance for the inspection of forms.

501.3.04 Dewatering: The Contractor shall provide and maintain ample means and devices with which to promptly remove and dispose of all water entering the excavation during the excavation, forming, placing of metal reinforcement and concrete and backfilling activities. The Contractor shall dispose of the water in a suitable manner without damage to adjacent property.

Ground water shall be controlled such that softening of the bottom of excavations or formation of "quick" conditions or "boils" during excavation shall be prevented. Dewatering systems shall be designed and operated so as to prevent removal of the natural soils and so that the ground water level outside the excavation is not reduced to the extent that would damage or endanger adjacent structures or property.

501.3.05 Disposal of Excavated Materials: Disposal of excavated material shall conform to the requirements of Subsection 204.3.03.

501.3.06 Backfill: All spaces excavated and not occupied by structures or other permanent work shall be backfilled with excavated native material unless otherwise specified. The top surface shall be neatly graded.

Backfill which becomes a part of the roadway embankment or which is to support a roadway, rock slope protection or slope paving shall be in conformance to the requirements of Subsection 204.3.02.

501.3.06A Backfill Around Structures: Backfill around concrete structures shall be placed only after the concrete has attained two-thirds of its specified compressive strength. All form materials and trash shall be removed from the excavation before placing any backfill.

501.3.06A Backfill Around Structures, Continued

Backfill placed around piers and columns shall be deposited on all sides to approximately the same elevation at the same time. The backfill in front of abutments and walls shall be placed first to prevent the possibility of forward movement. Special precautions shall be taken to prevent any wedging action against the concrete, and slopes bounding the excavation shall be destroyed by stepping or roughening to prevent wedge action. Material from the excavation shall be deposited in lifts not exceeding eight inches loose thickness. Each lift shall be compacted to at least 95 percent of its maximum density at optimum moisture content, as determined by the applicable method of ASTM D698, before placing the next lift. Jetting or puddling will not be permitted. Adequate provision shall be made for thorough drainage of all backfill. Selected granular and free-draining material shall be placed at weep holes.

No separate payment will be made for special material placed at weep holes, it being understood that such work is incidental to and a part of the backfilling work.

Where excavations are made in paved areas, all or part of which are to be preserved, required pavement replacement shall be made in conformity to the applicable requirements of Section 309. No separate payment will be made for pavement replacement, it being understood that such work is incidental to and a part of the backfilling work.

501.3.06B Granular Backfill Around Structures: When specified, granular backfill around structures shall be placed in lifts not exceeding a six inch loose thickness. Each lift shall be compacted to 95 percent of its maximum density at optimum moisture content, as determined by ASTM D698, Method D.

501.3.06C Granular Backfill Under Footings and Slabs: When specified, granular backfill under footings and slabs shall be placed in lifts not exceeding a six inch loose thickness. Each lift shall be compacted to 100 percent of its maximum density at optimum moisture content, as determined by ASTM D698, Method C.

501.3.06D Granular Backfill Under Facilities: When specified, granular backfill shall be placed in excavated areas under piping, sidewalks, curbs and similar structures and facilities. The material shall be placed in lifts not exceeding six inch loose thickness. Each lift shall be compacted to 95 percent of its maximum density at optimum moisture content, as determined by ASTM D698, Method D.

501.3.06E Sand Backfill: Sand backfill shall be placed in lifts not exceeding six inches in loose thickness. Each lift shall be compacted to the percentage of maximum density at not less than 2 percent above optimum moisture content specified, as determined by ASTM D698, Method A.

501.3.06F Impervious Backfill: Impervious backfill shall be placed in lifts not exceeding 12 inches in loose thickness. Each lift shall be compacted to at least 95 percent of its maximum density at not less than 2 percent above optimum moisture content, as determined by ASTM D698, Method A.

501.3.07 Compaction Equipment: The Contractor shall furnish and operate compaction equipment best suited for the particular conditions and materials.

501.3.08 Foundation Stabilization: If, in the judgement of the Engineer, the material in the bottom of the excavation is unsuitable for supporting foundations, piers, retaining walls, cribbing, culverts or similar structures, the Contractor shall over-excavate as directed and backfill to the required grade with foundation stabilization material. The foundation stabilization material shall be placed in lifts of a thickness as directed by the Engineer.

501.3.09 Embankment Construction: Embankment construction shall conform to the requirements of Subsection 204.3.07.

501.4.00 Measurement and Payment

501.4.01 Shoring and Cribbing: Shoring and cribbing, including all work and materials expended in furnishing, placing, and removing such shoring and cribbing necessary to complete the excavation shall be considered incidental to the pay item for excavation. No separate or additional measurement and payment will be made for shoring and cribbing.

501.4.02 Structure Excavation: Structure excavation will be measured on a cubic yard basis in original position prior to excavation. The quantity measured for payment will include only the material excavated from within the limits defined, regardless of whether the excavation is made within an enclosure or in an open trench or pit.

501.4.03 Excavation Below Elevations Shown: If ordered by the Engineer, in writing, excavation below elevations shown will be measured the same as set forth under structure excavation above, except that the upper pay limit will be the elevation shown for the bottoms of footings or bases of the structure, and the lower pay limit will be the elevation established by the Engineer for the bottoms of the footings or bases of the structure.

501.4.04 Backfill: Unless otherwise specified, all backfill shall be considered as incidental to and included in the pay item for the appurtenant structure or facility.

501.4.05 Foundation Stabilization: Measurement for this item will be made on a cubic yard basis. Measurement will be based upon individual trip tickets of material furnished and placed and validated by the Engineer.

501.4.06 Dewatering: Dewatering shall be considered as incidental and no separate measurement and payment will be made.

501.4.07 Topsoil: Measurement and payment for topsoil shall be made in accordance with the requirements of Subsection 221.4.00.

501.4.08 Embankment: Embankment will be measured on a cubic yard basis. Computation of the volume for payment will be based on field measurements of the actual volume placed and accepted within the neat lines. No allowance will be made for subsidence or settlement.

501.4.09 Payment: Payment will be made for the following items when listed as pay items.

Pay Item	*Unit of Measure*
Structure Excavation	CY
Backfill (specify type)	CY
Foundation Stabilization	CY
Topsoil	CY
Excavation Below Elevation Shown	CY
Embankment	CY

502 PILING

STANDARDS NOT COMPLETE AT THIS TIME

503 CONCRETE STRUCTURES

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503.4.00 Measurement and Payment
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503.4.01A Lump Sum Basis
503.4.01B Cubic Yard Basis
503.4.02 Pneumatically Applied Mortar
503.4.03 Payment

503 CONCRETE STRUCTURES

503.1.00 Description: This section covers the work necessary for concrete, reinforced or nonreinforced, precast or cast-in-place, in bridges, box culverts, retaining walls and other concrete structures.

503.2.00 Materials

503.2.01 Portland Cement: Portland cement shall conform to the following types as specified:

Type I – For use when the special properties of other cements are not required.

Type IA – Air-entraining cement for the same uses as Type I, where air entrainment is desired.

Type II – For general use, especially when moderate sulfate resistance or moderate hear of hydration is desired.

Type IIA – Air-entraining cement for the same uses as Type II, where air entrainment is desired.

Type III – For use when high early strength is desired.

Type IIIA – Air-entraining cement for the same use as Type II, where air-entrainment is desired.

Portland cement shall conform to the requirements of AASHTO M 85 for low alkali cement except as follows:

1. Cement shall have a total alkali content (sodium and potassium oxide calculated as $Na_20 + 0.658\ K_20$) not exceeding 0.6 percent.

2. Types I, IA, III or IIIA shall contain a maximum of 10 percent tricalcium aluminate.

3. For Types II and IIA, tricalcium silicate and tricalcium aluminate shall have a maximum total percentage of 58.

When not otherwise specified, Type I shall be used. When approved in writing, Type III Portland cement may be used in lieu of Type I in the identical quantity specified for Type I.

Differing brands or types of cement, or the same brand or type of cement from different mills shall not be mixed during use nor shall they be used alternately without prior written approval.

503.2.02 Aggregates

503.2.02A Fine Aggregates: Fine aggregate shall consist of one of the two types listed below:

1. FA-A. This type of aggregate shall consist of natural sand resulting from the disintegration of siliceous and/or calcareous rocks or manufactured sand produced by crushing predominantly siliceous materials or a combination of natural and manufactured sand.

2. FA-B. This type of aggregate shall consist of fine granular particles resulting from the crushing of lead and zinc ores.

3. FA-M, mortar sand. This material shall be of natural sand for use as fine aggregate for grout or mortar for laying brick or concrete blocks, grouted stone wash checks or grouted stone ditch lining.

Fine aggregates shall be free of injurious amounts of organic impurities, alkali, sulfates or carbonates. Other deleterious substances shall not exceed the following percentages by weight:

Material Passing 200 Sieve	2.0
FA-A & FA-M	4.0
FA-B	
Shale, Shalelike Material, Coal, Soft or Friable Particles	1.0
Sticks (wet)	0.1
Clay Lumps or Sludge Lumps	0.25

Mortar Strength: When combined with Type III (High Early Strength) cement the resulting mortar shall develop the following strength:

Aggregate Type	*Age of Specimens*	*Minimum Strength**	*Type of Test*
FA-A & FA-B	24 & 72 hrs	100%	Compression
FA-M	3 days	90%	Compression

* Compared to the strengths of specimens of the same proportions and consistency made of the same cement and standard 20-30 Ottawa Sand.

Hardening Characteristics: A mixture composed of three parts of FA-B, one part of Portland cement and sufficient water for proper molding shall, when molded into specimens, harden completely in 24 hours.

503.2.02A Fine Aggregates, Continued

Size Requirements: Fine aggregates shall meet the size requirements specified in the table below:

GRADING REQUIREMENTS *Fine Aggregate – Portland Cement Concrete*							
	Percent Retained – Square Mesh Sieves						
Aggregate Designation	3/8”	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100
FA-A & FA-B	0	0-5	0-24	15-50	40-75	70-90	90-98
FA-M		0	0-2	0-30	20-50	50-75	90-98

If the Contractor desires to furnish aggregate in more than one designated size as specified, written approval shall be obtained from the Engineer prior to incorporation of any of these materials in any part of the work.

Sampling and testing fine aggregate shall conform to the following methods:

Sampling	AASHTO T 2
Material Passing the No. 200 Sieve	AASHTO T 11
Organic Impurities	AASHTO T 21
Sieve Analysis	AASHTO T 27
Mortar Strength	
Soundness	AASHTO T 104
Friable Particles	AASHTO T 112
Lightweight Pieces	AASHTO T 113
Clay Lumps in Aggregate	KDOT KT-7
Shale or Shalelike Particles	KDOT KT-8
Plasticity	KDOT KT-10

503.2.02B Coarse Aggregate and Mixed Aggregate: Coarse aggregate shall consist of rock, gravel, or other approved inert material of similar characteristics or combinations thereof, having hard, strong, durable pieces free from adherent coatings.

The amount of deleterious substances shall not exceed the following percentages by weight:

Material Passing No. 200 Sieve	2.0
Shale or Shale-Like Material	0.5
Soft or Friable Particles	2.5
Sticks (wet)	0.1
Coal	0.5
Clay Lumps	0.5

No one of the above percentages shall be exceeded when taken separately. In addition, any combination of shale, soft or friable particles, sticks, coal, clay or clay lumps shall not exceed 3.0 percent.

Quality:

Soundness, minimum	0.90
Wear, Maximum	50%

The material shall also be reasonably free from all other deleterious substance.

The grading of each of the specified sizes of coarse aggregate shall be in accordance with the following table.

Grading Requirements

Coarse Aggregate - Portland Concrete

Aggregate Designation	Usage	Composition	Percent Retained 1½"	1"	3/4"	1/2"	3/8"	No.4	No.8	No.16	No.30	No.50	No.100
COARSE AGGREGATES													
CA-1	Pavement or Base	Gravel or Crushed Calcite Cemented Sandstone	0	0-10	....	....	70-95	....	95-100	....	....	....	....
CA-2	Pavement or Base	Chat	0	0-5	....	....	....	55-75	90-100	....	....	....	....
CA-3	Pavement, Base or Structures	Chat	0	0-5	....	....	....	....	85-95	....	95-100	....	....
CA-4	Same as CA-3	Gravel or Crushed Stone	....	....	0	0-30	30-60	75-100	95-100	....	....	....	....
CA-5	Structures	Crushed Stone, Crushed Siliceous Gravel	....	0	0-5	....	40-60	....	95-100	....	....	....	....
CA-6	Use with Sands MA Below	Gravel or Crushed Stone	....	....	....	....	....	....	95+	....	....	....	....
MIXED AGGREGATES													
MA-1	6" Pavement or Structures	Sand-Gravel, or Sand-Gravel and Crushed Stone	....	0	0-5	....	....	20-60	....	....	76-84	90-96	....
MA-2	Pavement, Base or Structures	Sand-Gravel, or Sand-Gravel and Crushed Stone	....	....	0	0-10	10-25	26-53	34-66	48-75	65-87	85-95	95-100

503.2.02B Coarse Aggregate and Mixed Aggregate, Continued

When a tolerance range is set forth in the above grading requirements, it shall be understood that the midpoint of the tolerance range is the target value and the product shall conform as closely as realistically possible to this target value. The purpose of the tolerance range is only to permit occasional minor variations from the target value that are, for practical reasons, unavoidable.

If gravel is used in the manufacture of aggregate for Portland cement concrete pavement, the material shall contain in each designated separated size not less than 60 percent by weight of fragments which have at least one fractured face produced by mechanical crushing.

Sampling and testing of coarse aggregate shall conform to the following:

Sampling	AASHTO T 2
Materials Passing the No. 200 Sieve	AASHTO T 11
Organic Impurities	AASHTO T 21
Sieve Analysis	AASHTO T 27
Abrasion	AASHTO T 96
Soundness	AASHTO T 104
Friable Particles	AASHTO T 112
Lightweight Pieces	AASHTO T 113
Fracture	KDOT KT-21

The sampling and testing of Portland cement concrete shall conform to the following:

Sampling	AASHTO T 141
Cement Content	AASHTO T 121
Consistency	AASHTO T 183
Slump	AASHTO T 119
Air Content	AASHTO T 152
Bulk Specific Gravity and Absorption	AASHTO T 84 & T 85
Molding Test Cylinders	AASHTO T 23
Compressive Strength of Cylinders	AASHTO T 22

503.2.02C Commercial Grade Concrete: Commercial grade concrete may be used on items designated on the Plans or if approved in writing by the Engineer. When commercial grade concrete is used, Subsection 502.2.02A and 502.2.02B of these specifications shall be disregarded and the following stipulations shall govern:

1. Materials: The commercial grade concrete mix shall be approved by the Engineer. This approval will in general be based on the following conditions:

503.2.02C Commercial Grade Concrete, Continued

All materials shall be those normally used for the production and sale of concrete in the vicinity of the project.

The mixture produced shall have a minimum cement content of six sacks of cement per cubic yard of concrete and shall be Class 3000 as hereinafter defined in Subsection 503.3.01A. The water-cement ratio will be designated by the Engineer but in no case be less than 5 ½ (gallons of water per 94 lb sack of cement).

Type I, II or III cement may be used unless otherwise designated.

No additives other than air-entraining agent will be allowed.

503.2.03 Water: Water used in mixing Portland cement concrete shall be clean and free of soil, salt, acid, alkali, sugar, vegetable matter, or other deleterious substances, and shall conform to the requirements of AASHTO T 26. Water of approved potable quality may be used without test.

503.2.04 Admixtures

503.2.04A Air-Entraining Admixtures: Air-entraining admixtures shall conform to the requirements of ASTM C260 using one or another of the several tests as directed by the Engineer. Chloride content of the admixture shall not exceed 0.5 percent by weight.

503.2.04B Water-Reducing, Retarding and Accelerating Admixtures: Water-reducing, retarding and accelerating admixtures shall conform to the requirements of ASTM C 494, using one or other of the several tests as the Engineer may direct. Chloride content of the admixture shall not exceed 0.5 percent by weight.

503.2.05 Curing Materials: Curing materials shall conform to the following requirements as specified:

White Burlap-Polyethylene Sheets for Curing Concrete	AASHTO M 171
Waterproof Paper for Curing Concrete	AASHTO M 171
Liquid Membrane-Forming Compounds for Curing Concrete* (white pigmented)	AASHTO M 148
White Polyethylene (Film) for Curing Concrete	AASHTO M 171
Burlap Cloth (Jute or Kenaf)	AASHTO M 182
Linseed Oil-Mineral Spirits Mixture for Curing Concrete	AASHTO M 233

* Not permitted on bridges and box culverts

503.2.06 Joint Materials

503.2.06A Preformed Expansion Joint Fillers: Preformed expansion joint fillers for concrete shall conform to the requirements of AASHTO M 153 or AASHTO M 213 except that those furnished under AASHTO M 213 shall be tested in conformance to ASTM D 1751. Fillers conforming to AASHTO M 213, except the binder if other than bituminous material, may also be used provided that they otherwise meet this specification and provided further that they have been demonstrated to be rot and vermin proof for a period of at least 5 years.

503.2.06B Preformed Elastomeric Joint Seals: Preformed elastomeric joint seals shall conform to the requirements of AASHTO M 220.

503.2.06C Poured Filler: Poured filler for concrete joints shall conform to the requirements of ASTM D 1190.

503.2.07 Water Stop

503.2.07A Plastic: Plastic water stops shall be fabricated with a uniform cross section, free from porosity or other defects, to the nominal dimensions shown on the Plans. An equivalent standard shape may be furnished, if approved by the Engineer.

The material from which the water stop is fabricated shall be a homogeneous, elastomeric, plastic compound of basic polyvinyl chloride and other material which, after fabrication, will meet the requirements tabulated herein. No reclaimed material shall be used. The Contractor shall furnish a certificate from the producer, showing values for the designated properties. The Contractor shall furnish samples, in lengths adequate for making designated tests, as ordered by the Engineer.

503.2.07A Plastic, Continued

REQUIRED PROPERTIES AND TEST METHODS PLASTIC WATER STOP			
Property	*No. 406 Method Standard Federal Test*	*ASTM Equivalent*	*Requirement*
Tensile Strength	1011	D 638	Minimum 1,400 psi (965 MPa)
Elongation at Breaking	1011	D 638	Minimum 250%
Hardness (shore durometer)	1082	D 2240	60 to 75
Specific gravity	5011		Maximum + or – 0.02 from manufacturer's value
Resistance to alkali	7011	D 543	Maximum weight change 0.10% to + 0.25%
7 days using 10% NaOH			Maximum hardness change + or – (shore); maximum tensile strength decrease: 15%
Water Absorption (48 hours)	7031	D 570	Maximum 0.5%
Cold bending	(1)	(1)	No cracking
Volatile loss	6081	D 1203	Not more than manufacturer's value

(1) The cold bend test will be made by subjecting a 1 inch by 6 inch by 1/8 inch strip of plastic water stop to a temperature of minus 20 degrees Fahrenheit for two hours. The strip will immediately thereafter be bent 180 degrees around a rod of ¼ inch diameter by applying sufficient force to hold the sample in very close contact with the rod. The sample will then be examined for evidence of cracking. At least three individual samples from each lot will be tested and the result reported.

503.2.07B Rubber: Rubber water stops may be molded or extruded and shall have a uniform cross section, free from porosity or other defects, conforming to the nominal dimensions shown on the Plans. An equivalent standard shape may be furnished, if approved by the Engineer.

The water stop may be compounded from natural rubber, synthetic rubber, or a blend of the two, together with other compatible materials which will produce a finished water stop meeting the requirements tabulated herein. No reclaimed material shall be used. The Contractor shall furnish a certificate from the producer to show the general composition of the material and values for the designated properties. The Contractor shall furnish samples, in lengths adequate for making designated tests, as ordered by the Engineer.

REQUIRED PROPERTIES AND TEST METHODS RUBBER WATER STOP		
Property	*Federal Test Method Standard No. 601*	*Requirement*
Hardness (by shore durometer)	3021	60 to 70
Compression Set	3311	Maximum 30 percent
Tensile Strength	4111	Minimum 2,500 psi (17.24 MPa)
Elongation at Breaking	4121	Minimum 450 percent
Tensile Stress at 300 Percent Elongation	4131	Minimum 900 psi (6.21 MPa)
Water Absorption by Weight	6631	Maximum 5 percent
Tensile Strength after Aging	7111	Minimum 80% original

503.2.07C Copper: Sheet copper for water stops or flashings shall meet the requirements of ASTM B 152 for type ETP light cold-rolled, soft anneal, unless otherwise specified.

503.3.00 Construction

503.3.01 Mix Design

503.3.01A Classes of Concrete: The classes of concrete shall designate the compressive strength (f'c) of the concrete in 28 days (psi); i.e., Class 3000 shall indicate a compressive strength of 300 psi in 28 days for that concrete. The class of concrete required for the component parts of the structure shall be as shown. Unless otherwise specified or shown, the Contractor shall use Class 3000 concrete, subject to the following:

503.3.01B Classification and Proportioning of Concrete Mixtures: If required by the plans or specifications, the Contractor shall have the concrete mix designed by an approved independent testing laboratory, at no expense to the Owner before beginning any concrete work. Certified copies of all laboratory trial mix reports shall be sent to the Engineer from the testing laboratory. The Contractor shall not place concrete prior to approval of the concrete mixes and laboratory test results.

During the progress of the work, if concrete strength and quality as determined by cylinders and tests taken by the Engineer fail to attain the requirements specified, the Contractor shall suspend all concrete work and redesign the mixes as outlined above.

The Contractor may request, in writing, permission to use a mix using different proportions of aggregate sizes of any of the concrete materials in the mix to satisfy a particular production schedule or for other reasons. Any requested and authorized alteration to proportions of any of the concrete materials in the mix shall be made at no expense to the Owner.

The Contractor shall design the mix in accordance with the following requirements, unless otherwise specified:

1. Entrained air, when specified, shall range between 3 and 6 percent (by volume).

2. Slump shall range between two and four inches.

3. Water reducing admixture, when specified, shall be in accordance with the manufacturer's recommendations.

4. Maximum water cement ratio (gallons of water per 94 pound sack of cement) shall be 5 ½ unless otherwise specified.

Class (Compressive Strength, f'c)	*Minimum Cement Content*
2500	518 pounds (5.5 sack)
3000	564 pounds (6.0 sack)
3500	610 pounds (6.5 sack)
4000	658 pounds (7.0 sack)
4500	677 pounds (7.2 sack)
5000	705 pounds (7.5 sack)
5500	733 pounds (7.8 sack)
6000	752 pounds (8.0 sack)

503.3.01B Classification and Proportioning of Concrete Mixtures, Continued

Tests for strength shall be made in accordance with the following:

Molding Concrete Specimens in the Field	AASHTO T 23
Compressive Strength of Molded Cylinders	AASHTO T 22

The curing of cylinders shall conform to the requirements of AASHTO T 23, except as modified herein.

503.3.02 Consistency: The quality of mixing water to be used shall be determined from the laboratory tests and fixed with the proportions of other materials, and no changes shall be made without approval. In general, a mixture shall be used which contains the minimum amount of water consistent with the required workability. The consistency of concrete shall be gauged by the ability of the equipment to properly place it and not by the difficulty in mixing or transporting.

503.3.03 Measurement of Materials: All of the materials, except water, in the batches of concrete shall be measured by weight. Facilities for accurately weighing the cement for each batch shall be provided. Fine and coarse aggregates shall be weighed separately. Representative samples shall be taken and the moisture content determined for each kind of aggregate. The aggregates shall be stored and handled so that their water content remains reasonably constant during any day's run. The equipment for weighing materials shall provide convenient and positive means for the addition or removal of shall quantities of materials to obtain the exact weight per batch. The device for measuring water shall show accurately the quantity in gallons and be so designated that the water supply will be automatically cut off while water is being discharged into the mixer. Water shall be assumed to weigh 8.34 pounds per gallon.

503.3.04 Mixing

503.3.04A General: Concrete shall be machine mixed.

503.3.04B Mixing at Site: Concrete shall be mixed in a batch mixer of an approved size and type which will ensure a uniform distribution of the materials throughout the mass.

The mixer shall be equipped with adequate water storage and a device for accurately measuring and automatically controlling the amount of water used in each batch. Preferably, mechanical means shall be provided for recording the number of revolutions of each batch and automatically preventing the discharge of the mixer until the materials have been mixed in the specified minimum time.

503.3.04B Mixing at Site, Continued

The entire contents of the mixer shall be removed from the drum before materials for a succeeding batch are placed therein. The materials composing a batch shall be deposited simultaneously in the mixer. No mixer having a rated capacity of less than a one-sack batch shall be used nor shall a mixer be charged in excess of its rated capacity.

All concrete shall be mixed for a period of not less than 1 ½ minutes after all materials, including eater, are in the mixer. During the period of mixing, the mixer shall operate at a design speed of not less than 14 nor more than 20 revolutions per minute.

The first batch of concrete materials placed in the mixer shall contain a sufficient excess of cement, sand and water to coat the inside of the drum without reducing the required mortar content of the mix. Upon the cessation of mixing for a considerable period, the mixer shall be thoroughly cleaned.

The above specification contemplates the use of conventional revolving drum type mixers. Other types may be used with the written permission of the Engineer.

503.3.04C Truck Mixing: Truck mixers, unless otherwise authorized by the Engineer, shall be of the revolving drum type, watertight and so constructed that the concrete can be mixed to ensure a uniform distribution of materials throughout the mass. All solid materials for the concrete shall be accurately measured in accordance with Subsection 503.3.04 and charged into the drum at the proportioning plant. Except as subsequently provided, the truck mixer shall be equipped with a tank for carrying mixing water. Only the prescribed amount of water shall be placed in the tank unless the tank is equipped with a device by which the quantity of water added can be readily verified. The mixing water may be added directly to the batch in which case a tank will not be required. Truck mixers may be required to be provided with means by which the mixing time can be readily verified by the Engineer.

The maximum size of batch in truck mixers shall not exceed the maximum rated capacity of the mixer as stated by the manufacturer and stamped in metal on the mixer. Truck mixing shall be continued for not less than 70 revolutions nor more than 100 revolutions of the drum at the rate of rotation designated by the manufacturer. Mixing shall commence after all ingredients, including water, are in the drum. Additional mixing, if any, shall be at the rate of rotation as designated by the manufacturer at agitating speed. Mixing shall begin within 30 minutes after the cement has been added to either the water or aggregate. When cement is charged into a mixer drum containing water or surface-wet aggregate and when the temperature is above 90 degrees F, or when high-early strength Portland cement is used, this limit shall be reduced to 15 minutes.

503.3.04C Truck Mixing, Continued

The limitation on time between the introduction of the cement to the aggregates and the beginning of the mixing may be waived when, in the judgement of the Engineer, the aggregates are sufficiently free from moisture so that there will be no harmful effects on the cement.

503.3.04D Partial Mixing at the Central Plant: When a stationary mixer is used for partial mixing of concrete (shrink-mixing), the mixing time in the stationary mixer may be more than is required to intermingle the ingredients. After transfer to a truck mixer, further mixing at a designated mixing speed will be required only as necessary to meet the requirements for uniformity of concrete as specified for truck mixing.

503.3.04E Plant Mix: Mixing at a central plant shall conform to the requirements for mixing at the site.

503.3.05 Time of Hauling and Placing: Concrete transported in a truck mixer, agitator or other transportation device shall be discharged at the job and placed in its final position in the forms within 1 ½ hours after the introduction of the mixing water to the cement and aggregate or the cement to the aggregate, except that in hot weather or under other conditions contributing to quick stiffening of the concrete, the maximum allowable time may be reduced. The maximum volume of mixed concrete transported in an agitator shall be in accordance with the specified rating.

503.3.06 Delivery: The plant capacity and transporting apparatus shall be adequate to insure continuous delivery of concrete during concreting operations and shall be such as to provide for the proper handling, placing and finishing of the concrete. The rate of delivery shall be such that the interval between batches shall not exceed 20 minutes. The methods of delivering and handling the concrete shall be such as will facilitate placing with a minimum of rehandling and without damage to the structure or the concrete. The time interval may be reduced when deck concrete is being placed. Concrete for decks shall be delivered so that the deck pour will progress at a rate of not less than 20 feet per hour unless some other rate of pour is approved.

503.3.07 Retempering: The concrete shall be mixed only in such quantities as are required for immediate use and any which has developed initial set shall not be used. Concrete which has partially hardened shall not be retempered or remixed.

503.3.08 Slump Test: The slump of concrete shall be determined in accordance with the requirements of AASHTO T 119.

503.3.09 Falsework: For bridge structures requiring poured-in-place superstructures, working drawings and calculations for falsework prepared by an Engineer registered to practice in the State of Kansas may be required to be submitted for approval.

503.3.09 Falsework, Continued

For designing falsework a weight of 150 pounds per cubic foot shall be assumed for green concrete. All falsework shall be designed and constructed to support the total applied loads with a deflection not to exceed 1/500 in any falsework span. The Contractor shall employ screw jacks or hardwood wedges to take up any settlement in the formwork either before or during the placing of concrete when directed. Falsework shall be set to give the finished structure the camber specified or shown. Falsework for post-tensioned structures shall be designed to carry the full dead load of any additional vertical or horizontal loads caused by the prestressing operation.

The Contractor's attention is directed to the fact that the design of post-tensioned structures is such that the structure is not self-supporting until post-tensioning is complete and it shall be understood that the Contractor has considered this fact in the design, maintenance and protection of falsework.

503.3.10 Forms: All forms shall be mortar-tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other loads incidental to the construction operations. Forms shall be constructed and maintained to prevent warping and the opening of joints.

The forms shall be substantial and unyielding and shall be so designed that the finished concrete will conform to the proper dimensions and contours. Forms shall be designed and constructed so as to withstand the effect of vibration of concrete as it is placed. All forms used for curbs, sidewalks, alleys, etc. shall be placed within ½ inch of the thickness of the concrete section being placed.

Deck forms for concrete box girder spans shall be supported by the girder stems. Posts or other supports for deck forms will not be permitted to come in contact with the bottom slab of the box girder.

Wood forms for concrete surfaces not subject to backfill shall be made of dressed lumber of uniform thickness with a form liner of an approved type and mortar-tight. Wood forms for the interior of cells of box girders may be made with or without a form liner. Shiplap or S45 boards are acceptable, provided the forms are mortar-tight.

Plywood will be acceptable as a form liner if supported in an approved manner. Metal ties or anchorages within the forms shall be so constructed as to permit their removal to a depth of at least 1 inch from the face without injury to the concrete. In case ordinary wire tires are permitted, all wires, upon removal of the forms, shall be cut back at least ¼ inch from the face of the concrete with chisels or nippers; for green concrete, nippers are necessary. All fittings for metal ties shall be of such design that, upon their removal, the cavities which are left will be the smallest possible size. The cavities shall be filled with cement mortar and the surface left sound, smooth, even and uniform in color.

503.3.10 Forms, Continued

All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. Forms shall remain in place for periods which shall be determined as hereinafter specified. When forms appear to be unsatisfactory in any way, either before or during the placing of concrete, the work may be ordered stopped until the defects have been corrected.

The shape, strength, rigidity, watertightness and surface smoothness of reused forms shall be maintained at all times. Any warped or bulged lumber shall be resized before being reused. The Contractor shall not reuse forms which are unsatisfactory in any respect.

For narrow walls and columns, where the bottom of the form is inaccessible, openings near the bottom shall be provided for cleaning out extraneous material immediately before placing the concrete.

All forms shall be treated with an approved form oil immediately before placing the concrete. Material which will adhere to or discolor the concrete shall not be used.

503.3.11 Removal of Falsework and Forms: The Contractor shall be responsible for all damage resulting from premature removal of forms.

If field operations are controlled by cylinder tests, forms and shoring for structural slabs or beams shall remain in place until the concrete has reached a compressive strength equal to 75 percent of the specified 28-day compressive strength as determined by test cylinders. The Contractor shall not place earth backfill against walls below grade until the concrete has obtained a compressive strength equal to 75 percent of the specified 28-day compressive strength. Field cured cylinders shall be cured under conditions which are equivalent to the most unfavorable conditions for the portions of the concrete which the cylinders represent.

If field operations are not controlled by cylinder tests, the following intervals, exclusive of days when the temperature is below 40 degrees F, may be used as a guide for removal of forms and supports.

Part of Structure	*Interval*
Supports under Beams	14 days
Floor Slabs	7-14 days
Walls	12-24 hours
Columns	1-7 days
Sides of Beams and All Other Parts	12-24 hours

503.3.11 Removal of Falsework and Forms, Continued

Methods of form removal likely to cause over-stressing of the concrete shall not be used. In general, the forms shall be removed from the bottom upwards. Do not remove forms and their supports without approval. Supports shall be removed in such a manner as to permit the concrete to uniformly and gradually take the stresses due to its own weight.

All formwork shall be removed from the cells of concrete box girders to which access is provided, and all formwork except that necessary to support the deck slab shall be removed from the remaining cells of the box girder.

All wood formwork and all form supports and braces shall be removed from the interior of structural steel box girders.

503.3.12 Adverse Weather

503.3.12A Hot Weather: Concreting during hot weather shall conform to the requirements of ACI 305.

The temperature of the concrete shall not be allowed to exceed 75 degrees F prior to being placed.

Crushed ice in lieu of water will be acceptable to maintain the temperature of the concrete.

503.3.12B Cold Weather: Concreting during cold weather shall conform to the requirements of ACI 306.

No concrete shall be placed when the ambient temperature is below 35 degrees F without written permission of the Engineer. When directed by the Engineer, the Contractor shall enclose the structure in such a way that the concrete and air within the enclosure can be kept above 60 degrees F for a period of seven days after placing concrete. When enclosures are used to maintain specified temperatures, the Contractor shall furnish a 24-hour temperature recording thermometer to record air temperature within the enclosure.

The Contractor shall supply heating equipment and the necessary fuel. When dry heat is used, means of maintaining atmospheric moisture shall be provided.

All aggregates and mixing water shall be heated to a temperature of at least 60 degrees but not more than 150 degrees F; the aggregates may be heated by either steam or dry heat. The temperature of the concrete shall be not less than 50 degrees F at the time of placing in the forms. In case extremely low temperatures the minimum limiting temperatures for water, aggregates and mixed concrete may be raised at the discretion of the Engineer.

503.3.12B Cold Weather, Continued

Where practical, insulated forms capable of maintaining the surface of the concrete at no less than 50 degrees F may be used in lieu of other protection of concrete involving housing and heating. When forms are insulated, exposed horizontal surfaces shall be protected. If the insulated forms do not maintain the proper temperature at the surface of the concrete, auxiliary protection and heat shall be used.

503.3.13 Measuring, Mixing, Hauling and Placing

503.3.13A General: Measuring, mixing, hauling and placing shall conform to the requirements of ACI 304.

Consolidation of concrete shall conform to the requirements of ACI 309.

In preparation for the placing of concrete, all sawdust, chips, and other construction debris and extraneous matter shall be removed from the interior of forms. Struts, stays and braces, serving temporarily to hold the forms in correct shape and alignment prior to the placing of concrete, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary.

Concrete shall be placed in horizontal layers not more than 12 inches thick except as hereinafter provided. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and consolidated as heretofore described before the preceding layer has taken initial set to avoid surfaces of separation between the layers. Each layer shall be consolidated so as to avoid the formation of a surface of separation with a preceding layer.

When the placing of concrete is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete. The top surface of the concrete adjacent to the forms shall be smoothed with a trowel. Where a “feather edge” might be produced at a construction joint, as in the sloped top surface of a wing wall, inset formwork shall be used to produce a blocked out portion in the preceding layer which shall produce an edge thickness of not less than 6 inches in the succeeding layer. Work shall not be discontinued within 18 inches of the top of any face, unless provision has been made for a coping, in which case, a construction joint shall be made at the underside of the coping.

503.3.13B Culverts: In general, the base slab or footings of box culverts shall be placed and allowed to set before the remainder of the culvert is constructed. In this case, suitable provision shall be made for bonding the sidewalls to the culvert base, preferably by means of raised longitudinal keys so constructed as to prevent, as far as possible, the percolation of water through the construction joint.

Before concrete is placed in the sidewalls, the culvert footings shall be thoroughly cleaned of all shavings, sticks, sawdust or other extraneous material and the surface carefully chipped and roughened in accordance with the method of bonding construction joints as specified herein.

In the construction of box culverts 4 feet or less in height, the sidewalls and top slab may be constructed as a monolith. When this method of construction is used, any necessary construction joints shall be vertical and at right angles to the axis of the culvert.

In the construction of box culverts more than 4 feet in height, the concrete in the walls shall be placed and allowed to set before the top slab is placed. In this case, appropriate keys shall be left in the sidewalls for anchoring the cover slab.

Each wing wall shall be constructed, if possible, as a monolith. Construction joints, where unavoidable, shall be horizontal and so located that no joint will be visible in the exposed face of the wing wall above the ground line.

503.3.13C Girders, Slabs and Columns: Concrete shall be deposited by beginning at the center of the span and working from the center toward the ends unless otherwise permitted. Concrete in girders shall be deposited uniformly for the full length of the girder and brought up evenly in horizontal layers.

Concrete pours in columns and abutments or walls shall be stopped at the bottom of caps, cross-beams, girders or any widened portion of the column or wall, and the concrete allowed to obtain its full shrinkage and settlement before the pour is continued. For pours over four feet in height, this delay shall not be less than 12 hours. Mechanical shear keys shall be formed in all construction joints in columns. Shear keys shall be approximately two inches in depth, and shall be approximately one-third the width of the column in both directions, centered in the column.

Concrete pours in T-beams and box girders shall be stopped at the bottom of the deck or deck fillet and the concrete allowed to obtain its full shrinkage and settlement before the pour is continued. If the beams or girders are over four feet in height, the delay shall be not less than 12 hours. Similar delays shall be incorporated into concrete pours at the intersection of any structural members where concrete settlement could cause cracking at the intersection. Mechanical shear keys shall be formed between girder stems and slabs, and in vertical construction joints where permitted. In general, suitable keys may be formed by the use of timber blocks approximately two inches by four inches in cross-section and having a length of

503.3.13C Girders, Slabs and Columns, Continued

four inches less than the width of the girder stem. The keys shall be spaced along the girder stem as required, but the spacing shall not exceed one foot center to center. These key blocks shall be beveled and oiled as to insure their ready removal and they shall be removed as soon as the concrete has set sufficiently to retain its shape.

Concrete in the bottom slab of box girder structures shall be poured to the bottoms of beam stems or stem fillets. Before the stems are poured, the bottom slab concrete shall be allowed to cure a minimum of three days at ambient temperatures of 40 degrees F or above, or for at least five days at ambient temperatures below 40 degrees F.

In box girder spans, construction joints shall be placed at locations called for on the Plans.

Concrete in columns shall be allowed to set at least 12 hours before the caps are placed.

No concrete shall be placed in the superstructure until the column forms have been stripped sufficiently to determine the character of the concrete in columns. The load of the superstructure shall not be allowed to come upon the bends until they have been in place at least 14 days, unless otherwise permitted by the Engineer.

503.3.13D Pumping: Placement of concrete by pumping will be permitted provided the Contractor finishes and uses clean equipment of sufficient size and capacity to satisfactorily handle the concrete mix specified for the project or adjusted by the Engineer. The discharge line of the pump shall be steel or rubber pipe. Any extra costs involved for additional cement or additives required to obtain a pumpable mix shall be at the expense of the Contractor.

Where concrete is placed by pumping, the operation of the pump shall produce a continuous stream of concrete without air pockets. When pumping is completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in a manner that will not cause contamination or the concrete or separation of the ingredients.

503.3.13E Depositing Concrete Under Water: Concrete shall be deposited in water only with the approval of the Engineer and under the Engineer's immediate inspection. The method of placing shall be as hereinafter designated.

Concrete deposited in water shall be carefully placed in a compact mass, in its final position, by means of a tremie and shall not be disturbed after being deposited. Still water shall be maintained at the point of deposit.

Concrete seals shall be placed continuously from start to finish; the surface of the concrete shall be kept as nearly horizontal as practicable at all times. To insure thorough bonding, each succeeding layer of a seal shall be placed before the preceding layer has taken initial set.

503.3.13E Depositing Concrete Under Water, Continued

A tremie shall consist of a tube having a minimum diameter of 10 inches, of sufficient length to reach from the bottom of the excavation up to concrete placing elevation above water line with an attached receptacle or hopper for receiving concrete. A jointed tremie will be permitted, provided joints are of the flanged and gasketed type and waterproof. The tremies shall be supported to permit free movement of the discharge end over the entire top surface of the work and to permit rapid lowering when necessary to retard or stop the flow of concrete. At the start of the work and on any withdrawal of the pipe for moving to a new location, the discharge end shall be closed to prevent water from entering the pipe. During the progress of the work the pipe shall be entirely sealed at all times and kept full of concrete to the bottom of the hopper. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it in the deposited concrete. The placing of concrete shall be continuous until the work is completed.

Unwatering may proceed when the concrete seal is sufficiently hard and strong. All laitance or other unsatisfactory material shall be removed from the exposed surface by scraping, chipping or other means which will not injure the surface of the concrete.

503.3.14 Construction Joints

503.3.14A General: Construction joints shall be made only where located on the Plans or shown in the pouring schedule, unless otherwise approved by the Engineer.

If not detailed on the Plans, or in the case of emergency, construction joints shall be placed as directed by the Engineer. Shear keys or inclined reinforcement shall be used where necessary to transmit shear or bond the two sections together.

503.3.14B Bonding: Before depositing new concrete on or against concrete which has hardened, the forms shall be retightened. The surface of the hardened concrete shall be roughened as required by the Engineer, 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. At the juncture of the hardened and the newly deposited concrete, the cleaned and saturated surfaces (including vertical and inclined surfaces) shall first be thoroughly covered with a coating of mortar or neat cement grout against which the new concrete shall be placed before the grout has attained its initial set.

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

503.3.15 Expansion and Fixed Joints and Bearings

503.3.15A Open Joints: Construction shall be by the insertion and subsequent removal of a template or approved material without chipping or breaking the corners of the concrete. Reinforcement shall not extend across an open joint unless so shown.

503.3.15B Poured Joints: Poured expansion joints shall be constructed similar to open joints. When premolded types are specified, the filler 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.

503.3.15C Steel Joints: The plates, angles or other structural shapes shall be accurately shaped at the shop, to conform to the section of the concrete deck. The fabrication and painting shall conform to the requirements of these specifications. Care shall be taken to insure that the surface in the finished plane is true and free of warping. Positive methods shall be employed in placing the joints to keep them in correct position during the placing of the concrete. The opening at expansion joints at normal temperature shall be as shown, and care shall be taken to avoid impairment of the clearance in any manner.

503.3.15D Water Stops: Water stops shall be placed as shown on the Plans. Where movement at the joint is provided for, the water stops shall be of a type permitting such movement without injury. They shall be spliced, welded or soldered to form continuous watertight joints, except plastic, rubber or neoprene stops which shall be full roadway width without shop or field splices.

503.3.15E Bearing Devices: Bearing plates, rockers and other expansion devices shall be constructed according to details shown on the Plans. Unless set in the plastic concrete otherwise specified, they shall be set in grout to insure uniform bearing. The rockers or other expansion devices shall be set to conform to the temperature at the time of erection. No separate payment will be made for rocker assemblies. Payment therefore shall be understood to be included in the contract price for the item "Reinforcement".

503.3.15F Preformed Elastomeric Joint Seals: Preformed elastomeric joint seals shall be in the longest practicable lengths for longitudinal joints. In transverse joints, one factory splice will be permitted in joint seals where the required length of material in any one joint exceeds manufacturer's standard stock lengths. Such splices shall be true and smooth on the outside surfaces with no offsets of abutting sections and with the complete bond on all abutting surfaces. Joints shall be clean and dry and shall be made free of spalls and irregularities which would impair a tight seal in service. Seals shall be placed in the joint under compression, as recommended by the manufacturer, using a lubricant-adhesive as a covering film applied to both sides of the seal just prior to its installation.

503.3.15F Preformed Elastomeric Joint Seals, Continued

Lubricant-adhesive material shall be a compound consisting of the same base polymer as the joint seal with which it is used, blended with a suitable volatile solvent. The lubricant-adhesive shall be compatible with the joint seal and concrete, and shall be relatively unaffected by the normal moisture in the concrete. It shall maintain a suitable consistency at the temperature at which the joint seal is installed.

The seal shall be set as shown and shall contact the walls of the joint throughout its length. Longitudinal elongation of an installed seal by three percent or more of its original length will be cause for its removal and reinstallation.

All lubricant-adhesive which comes upon the top of an installed seal shall be removed before it dries, and all seals which show twist, curl, nicks or other malformation, as installed, shall be removed and discarded. All ends or preformed elastomeric joint seals shall be sealed with a watertight plug prior to installation of the joint seal. The plug shall be foam rubber or other acceptable closed cell cellular material which is compressible to 15 percent of its uncompressed thickness. The plug shall be a minimum of two inches in length and shall be secured in the elastomeric joint seal with an adhesive which will insure a watertight plug.

503.3.16 Surface Finishing

503.3.16A Formed Surfaces: Unless otherwise authorized, the surface of the concrete shall be finished immediately after form removal.

All formed concrete surfaces shall be given a Class 1 finish. If further finishing is required, exposed surfaces shall be given a Class 2 finish. Other finish classes may be specified on the plans for designated surfaces. All roadway surfaces shall be given a float finish in accordance with the requirements of Subsection 503.3.16B.

<u>Class 1, Ordinary Surface Finish:</u> As soon as the forms are removed, the projecting wire or metal devices that have been used for holding the forms in place and which pass through the body of the concrete, shall be removed or cut back at least one inch beneath the surface of the concrete. Lips of mortar and all irregularities caused by form joints shall be removed.

All small holes, depressions and voids that show upon the removal of forms shall be filled with cement mortar mixed in the same proportions as that used in the body of the work. In patching larger holes and honeycombs, all coarse or broken materials shall be chipped away until a dense uniform surface of concrete exposing solid coarse aggregate is obtained. Feathered edges shall be cut away to form faces perpendicular to the surface. All surfaces of the cavity shall be saturated thoroughly with water, after which a thin layer of neat cement mortar shall be applied.

503.3.16A Formed Surfaces, Continued

The cavity shall then be filled with stiff mortar composed of one part of Portland cement and two parts sand, which shall be thoroughly tamped into placed. The mortar shall be preshrunk by mixing it approximately 30 minutes before using. The length of time may be varies in accordance with brand of cement used, temperature, humidity, and other local conditions. The surface of this mortar shall be floated with a wooden float before initial set takes place and shall be neat in appearance.

For patching large or deep areas, coarse aggregate shall be added to the patching material and special precautions shall be taken to insure a dense, well-bonded and properly cured patch.

Areas of excessive honeycomb, as determined by the Engineer, may be considered sufficient cause for rejection of a structure. Upon written notice from the Engineer that a given structure has been rejected, the Contractor shall remove and rebuild the structure, in part or wholly as specified, at the Contractor's own expense.

The mortar patches shall be cured as specified in subsection 503.3.17. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges.

All surfaces which cannot be repaired to the satisfaction of the Engineer shall be "rubbed" as specified for a Class 2 finish.

<u>Class 2, Rubbed Finish:</u> After removal of forms, the rubbing of concrete shall be started as soon as its condition will permit. Immediately before starting this work, the concrete shall be kept thoroughly saturated with water. Sufficient time shall have elapsed to allow the mortar used in the pointing to thoroughly set. Surfaces to be finished shall be rubbed with a medium coarse carborundum stone, using a small amount of mortar on its face. The mortar shall be composed of cement and fine sand mixed in proportions 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 has been obtained. The paste produced by this rubbing shall be left in place.

After all concrete above the surface being treated as been case, 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 has 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.

503.3.16B Unformed Surfaces: Bridge Decks: On bridge decks, a smooth riding surface of uniform texture, true to the required grade and cross section, shall be obtained. The Contractor may use hand tools, finishing machines or a combination of both, conforming to the requirements specified herein for finishing bridge roadway deck concrete.

Finishing of concrete placed in bridge decks shall consist essentially of striking off the surface of the concrete as placed and floating the surface so struck off.

The placing of concrete in bridge roadway decks will not be permitted until the Engineer is satisfied that the rate of producing and placing concrete will be sufficient to complete the proposed placing and finishing operations within the scheduled time, that experienced finishing machine operators and concrete finishers are employed to finish the deck, that fogging equipment and all necessary finishing tools and equipment are on hand at the site of the work and in satisfactory condition for use. A finishing machine shall be set up sufficiently in advance of use to permit inspection by the Engineer during the daylight hours before each pour.

Rails for the support and operation of finishing machines and headers for hand-operated strike off devices shall be completely in place and firmly secured for the schedule length for concrete placement before placing of concrete will be permitted. Rails for finishing machines shall extend beyond both ends of the scheduled length for concrete placement a distance that will permit the float of the finishing machine to fully clear the concrete to be placed unless otherwise approved by the Engineer. Rails or headers shall be adjustable for elevation and shall be set to elevations, with allowance for anticipated settlement, camber and deflection of falsework, as required to obtain a bridge roadway deck true to the required grade and cross section. Rails or headers shall be of a type and shall be so installed that no springing or deflection will occur under the weight of the finishing equipment and shall be so located that finishing equipment may operate without interruption over the entire bridge roadway deck being finished. Rails or headers shall be adjusted as necessary to correct for unanticipated settlement or deflection which may occur during finishing operations.

Immediately prior to placing bridge deck concrete, the Contractor shall check all falsework and wedges and shall make all necessary adjustments. Care shall be exercised to insure that settlement and deflection due to the added weight of the bridge deck concrete will be a minimum. Suitable means such as telltales shall be provided by the Contractor to readily permit measurement by the Engineer of settlement and deflection as it occurs.

Should settlement of other unanticipated events occur which in the opinion of the Engineer would prevent obtaining a bridge deck conforming to the requirements of these special provisions, placing of deck concrete shall be discontinued until corrective measures satisfactory to the Engineer are provided. In the event satisfactory measures are not provided prior to initial set of the concrete in the affected area, the placing of concrete shall be discontinued and a bulkhead installed at a location determined by the Engineer. All concrete in place beyond the bulkhead shall be removed.

503.3.16B Unformed Surfaces, Continued

Concrete for bridge decks shall be placed in a uniform heading approximately normal to the structure centerline or, in the case of screeds, supported on transverse headers, parallel to the centerline as directed by the Engineer. The rate of placing concrete shall be limited to that which can be finished before the beginning of initial set.

Immediately after the concrete has been placed and consolidated, the surface shall be struck off with the finishing machine or hand-operated screed until the required surface is obtained.

The strike off method and equipment shall be subject to approval by the Engineer. Approval shall be withdrawn if performance is not satisfactory. The equipment shall be capable of finishing roadway decks within the surface tolerances set forth in these specifications. Improper adjustment and operation which results in unsatisfactory consolidation and smoothness shall be corrected immediately. Unsatisfactory performance may be cause for rejection of the equipment and removal of the in-place concrete.

Following the completion of the strike off by hand methods, the roadway slab surface shall be floated to a smooth uniform surface by means of floats 10 feet or more in length. When a finishing machine is used, the finished surface shall be floated in a similar manner unless otherwise directed by the Engineer. Adequate floats shall be used to remove roughness and minor irregularities left by the strike board or finishing machine and to seal the concrete surface. Excessive working of the concrete surface is not desired. All floats shall be used in such a manner that each transverse pass overlaps the previous pass by a distance equal to or at least one-half the length of the float.

When hand-operated float boards are used, they shall be from 12 feet to 16 feet long, ribbed and trussed as necessary to provide a rigid float and shall be equipped with adjustable handles at each end. The float shall be wood, not less than 1 inch thick and a minimum of 8 inches wide. Adjusting screws spaced at not to exceed 24 inches on centers shall be provided between the float and the rib. The float board shall be maintained free of twist and true at all times.

Hand-operated float boards shall be operated from transverse finishing bridges. The finishing bridges shall span completely the roadway area being floated and a sufficient number of finishing bridges shall be provided when hand-operated float boards are used. When a finishing machine is used for longitudinal floating, one finishing bridge equivalent to the transverse finishing bridge specified herein shall be furnished for use by the Engineer.

All finishing bridges shall be of rigid construction and shall be free of wobble and springing when used by the operators of longitudinal floats and shall be easily moved.

In advance of curing operations, the surface of the concrete shall be textured by brooming with a stiff bristled broom or by other suitable devices which will result in uniform scoring. Brooming shall be performed transversely from the finishing bridge. The operation shall be performed at a time and in a manner to produce a hardened surface having a uniform texture.

503.3.16B Unformed Surfaces, Continued

Fogging equipment to be furnished shall be capable of applying water to the concrete in the form of a fine fog mist in sufficient quantity to curb the effects of rapid evaporation of the mixing water from the concrete on the deck, resulting from wind, high temperature or low humidity, or a combination of these factors. The fog mist shall be applied at the times and in the manner directed by the Engineer.

After floating has been completed and the excess water removed, but while the concrete is still plastic, the surface of the concrete shall be tested for trueness with a 10 foot straightedge.

As soon as the concrete has hardened sufficiently, the surface shall be given a further test for trueness using a 10 foot straightedge or other specified device. Areas showing high spots of more than 1/8 inch shall be marked and ground down with a diamond-faced saw-type cutting machine, capable of cutting through mortar and aggregate without breaking or dislodging the aggregate or causing spalls, to an elevation where the area or spot will not show surface deviations in excess of 1/8 inch when tested with a 10 foot straightedge.

The 10 foot straightedge shall be provided by the Contractor and the straightedge testing shall be performed by the Contractor's personnel under the supervision of the Engineer.

Floors and Slabs: Floors and slabs shall be finished in accordance with the applicable requirements of ACI 302, for the type of floor or slab being constructed.

Bridge Sidewalks: The surface of bridge sidewalks shall have a granular texture which will not be slippery when wet. An edging tool shall be used on all edges and at all expansion joints.

503.3.19 Curing: All newly-placed concrete shall be cured and curing shall be begun immediately after finishing and continued for at least seven days. Curing shall be done so that the moisture is always present and shall be an integral part of the concreting operation. Improperly cured concrete will be considered defective and the Engineer will stop all of the Contractor's placing operation until proper procedures are put into effect.

When the air temperature is expected to fall below 35 degrees F, the Contractor shall provide suitable measures to maintain the concrete surface temperature between 50 degrees F and 90 degrees F.

One of the following methods of curing, or a combination thereof, shall be used.

Supplying Additional Moisture: This method shall include supplying additional moisture by ponding, sprinkling or fogging. Coverings such as burlap shall be used to retain water so supplied. The use of sawdust will not be allowed and coverings which cause unsightly

503.3.19 Curing, Continued

discoloration of concrete shall not be used. Any method which results on the concrete being alternately wet and dry will be considered an improper curing procedure. Coverings shall be placed as soon as possible after finishing operations have been completed and there is no danger of surface damage. They shall be kept continuously moist.

Preventing Moisture Loss: This method shall consist of preventing moisture loss from the concrete by the use of approved waterproof paper, plastic sheets or liquid membrane curing compounds except where other requirements prohibit the use of the compounds. If a formed surface is to be rubbed, the concrete shall be kept moist before and during the rubbing, and the curing shall be initiated immediately following the first rub while the concrete surface is still moist. Bridge decks, approach slabs, sidewalks and curbs shall be covered with burlap or sand blankets as soon as the concrete is sufficiently set to support this material without damage to the finish. This moisture-retaining material shall then be saturated with water and the entire area covered with waterproof paper or plastic sheeting.

Waterproof Paper: The paper shall be the widest practicable width and adjacent sheets shall overlap a minimum of 6 inches and shall be tightly sealed with pressure sensitive tape, mastic, glue or other approved methods to form a complete waterproof cover of the entire concrete surface. The paper shall be secured so that wind will not displace it. Should any portion of the sheets be broken or damaged before expiration of the curing period, the broken or damaged portions shall be immediately repaired. Sections which have list their waterproof qualities shall not be used.

Plastic Sheets: The sheets shall be used in the same manner as required above for waterproof paper.

Curing Compounds: Type 1 or Type 2 liquid membrane curing compounds, as specified in AASHTO M 148, may be used as the initial and final curing agents on structural concrete subject to the following limitations:

If the membrane film is broken or damaged at any time during the curing period, the area or areas shall be re-coated to the original requirements.

Curing compounds shall be applied to unformed areas as soon as the water sheen has practically disappeared from the concrete, or as soon as the forms have been removed from surfaces not to be rubbed.

Areas receiving a rubbed finish shall be cured with Type 1 curing compound only as specified in AASHTO M 148.

If there is to be any delay in applying curing compound, the surface can receive moist curing until the compound can be applied.

503.3.19 Curing, Continued

Curing compound shall be applied with equipment which will produce a fine spray, and all compounds shall be thoroughly agitated just prior to use. The surface shall be sprayed again immediately at right angles to the first application. The rate of each application shall be not less than one gallon for each 150 square feet of surface. Care shall be taken to prevent application to joints where concrete bond is required to reinforcement steel and to joints where joint sealer is to be placed.

Curing shall conform to the applicable requirements of ACI 302, 305, 306, and 308.

503.3.20 Pneumatically Applied Mortar: Pneumatically applied mortar is an intimate mixture of Portland cement, sand and water, shot into place by means of compressed air.

The proportion of cement to sand shall be based on dry and loose volumes and shall not be less than 1 to 4 for encasement of steel members, 1 to 3 for concrete repair, and 1 to 4 ½ for special linings. The water-cement ratio of the fresh mortar in place shall not exceed 0.57.

The sand shall contain not less than three no more than six percent moisture by weight.

When coatings 1 inch or more in thickness are to be applied to vertical or overhand surfaces, the mortar shall be applied in layers of not more than three-quarters inch in thickness. For level or slightly sloping surfaces, the thickness of a single layer shall not exceed 3 ½ inches. There will be a minimum time interval of 30 minutes between layers.

Surfaces to which pneumatically applied mortar is to be bonded shall be thoroughly cleaned of dirt, paint, grease, organic matter and loose particles. Absorptive surfaces shall be wetted before the application of the mortar.

Pneumatically applied mortar shall be applied only with the approval of the Engineer if the ambient temperature is 50 degrees F or less.

503.4.00 Measurement and Payment

503.4.01 Concrete

503.4.01A Lump Sum Basis: Measurement and payment for Portland cement concrete will be made on a lump sum basis for the class of concrete specified and will include all labor and materials, including metal reinforcement, bearing assemblies and other metal items.

503.4.01B Cubic Yard Basis: Measurement and payment for Portland cement concrete will be made on a cubic yard basis for the class of concrete specified and will include all labor and materials, including metal reinforcement, bearing assemblies and other metal items

503.4.02 Pneumatically Applied Mortar: Measurement and payment for pneumatically applied mortar will be made on a square foot basis for the actual number of square feet of mortar placed and accepted and will include all metal reinforcement and other metal items.

503.4.03 Payment: Payment will be made for the following items when listed as pay items:

Payment Item	*Unit of Measure*
Portland cement concrete, class	Lump Sum
Portland cement concrete, class	C.Y.
Pneumatically applied mortar	S.F.

504 REINFORCEMENT

504.1.00 Description

504.2.00 Materials
504.2.01 Bars
504.2.02 Mats
504.2.03 Welded Wire Fabric
504.2.04 Dowels
504.2.05 Wire
504.2.06 Supports
504.2.07 Certification
504.2.08 Identification

504.3.00 Construction
504.3.01 Shop Drawings
504.3.02 Fabrication
504.3.03 Placing
504.3.03A Splicing

504.4.00 Measurement and Payment
504.4.01 Incidental Basis
504.4.02 Lump Sum Basis
504.4.03 Unit Price Basis

504 REINFORCEMENT

504.1.00 Description: This section covers the work necessary for the furnishing and placing of metal reinforcement and accessories.

504.2.00 Materials

504.2.01 Bars: Bars shall be deformed and shall be of billet-steel conforming to the requirements of ASTM A615 or rail-steel conforming to the requirements of ASTM A616, or of axle-steel conforming to the requirements of ASTM A617. Longitudinal bars in continuously reinforced concrete pavement shall be Grade 60.

All other bars shall be Grade 40, unless otherwise specified.

504.2.02 Mats: Steel for bar or rod mats shall conform to the requirements of ASTM A184.

504.2.03 Welded Wire Fabric: Welded wire fabric shall conform to the requirements of ASTM A185.

504.2.04 Dowels: Dowels shall conform to the requirements of ASTM A306. Dowels shall be Grade 70, unless otherwise specified.

504.2.05 Wire: Wire shall conform to the requirements of AASHTO M32.

504.2.06 Supports: Bar supports and their placement shall conform to Chapter 3 of the Manual of Standard Practice, Concrete Reinforcing Steel Institute. Bar supports in areas exposed to view after stripping shall be of galvanized or plastic coated steel, or of concrete, as directed by the Engineer.

504.2.07 Certification: Certification of bar reinforcement will identify the reinforcement as that composed of the heat numbers indicated and is represented by the samples tested.

The certification shall also contain the weight, number of pieces, and dimensions of each size of material of each heat number shipped, the project identification and the date of shipment. If a color code is used for identification, the heat number and color combinations are also to be shown.

504.2.08 Identification: Each piece of bar reinforcement shall be identified in a manner such that the heat number can be determined by the Engineer prior to its placement. Reinforcement shall be tagged and marked in accordance with the Manual of Standard Practice of the Concrete Reinforcing Steel Institute.

504.3.00 Construction

504.3.01 Shop Drawings: Shop drawings shall be submitted in accordance with the requirements of Subsection 104.4.00. Two sets of drawings will be required, unless otherwise specified. Shop drawing details for bar reinforcement shall conform to Chapter Six of the Manual of Standard Practice, Concrete Reinforcing Steel Institute. Shop drawing details for welded wire fabric shall conform to Chapter Two of the same manual.

504.3.02 Fabrication: Fabrication shall conform to Chapter Seven of the Manual of Standard Practice, Concrete Reinforcing Steel Institute.

504.3.03 Placing: Reinforcement shall be accurately placed in positions shown on the Plans and firmly held during the placing of concrete. Bars in top mats of footings and deck slabs shall be tied at all intersections, all other bars shall be tied at all intersections except where spacing is less than one foot in each direction where alternate intersections shall be tied.

Distance from the forms shall be maintained by means of stays, blocks, ties, hangers or other approved supports. Blocks for holding reinforcement from contract with the forms shall be precast blocks of approved shape and dimensions and shall have the same compressive strength as the concrete in which they are placed. Layers of bars shall be separated by precast mortar blocks or by equally suitable devices. The use of pebbles, pieces of broken stone or brick, metal pipe and wooden blocks will not be permitted. Reinforcement in any member shall be placed and then inspected and approved by the Engineer before the placing of concrete begins. Concrete placed in violation of this provision may be rejected and removal required.

The placing of bar reinforcement shall conform to the requirements of Chapter Eight of the Manual of Standard Practice, Concrete Reinforcing Steel Institute.

504.3.03A Splicing: Bar reinforcement shall be furnished in the lengths indicated on the Plans. Splicing of bars, except when shown on the Plans, will not be permitted without written approval of the Engineer.

504.4.00 Measurement and Payment

504.4.01 Incidental Basis: When not shown as a pay item, reinforcement shall be considered to be incidental to the work and no separate payment will be made.

504.4.02 Lump Sum Basis: Measurement and payment for reinforcement will be made on a lump sum basis.

504.4.03 Unit Price Basis: Measurement and payment for reinforcement will be made on a unit price per pound basis.

Reinforcement will be measured based on the total computed weight for the sizes and lengths of bars as shown on the plans or authorized.

The weight of mesh will be computed from the theoretical weight of plain wire. If the weight per square foot is given on the Plan, that weight will be used.

For the purpose of computing weights of bar reinforcement, the following table shall be used:

BAR REINFORCEMENT		
Formed Bar Designation Number	*Nominal Diameter (Inches)*	*Unit Weight (Pounds per Foot)*
3	0.375	0.376
4	0.500	0.668
5	0.625	1.043
6	0.750	1.502
7	0.875	2.044
8	1.000	2.670
9	1.128	3.400
10	1.270	4.303
11	1.410	5.313
14	1.690	7.650
18	2.260	13.600

The weight of reinforcement in prestressed beams, slabs, piles and other items where the reinforcement is included in the contract price for the item will not be included in the pay quantities.

No allowance will be made for the clips, wire, separators, supports and other material used in fastening the reinforcing in place. If bars are substituted upon the Contractor's request and as a result, more steel is used than specified, only the amount specified will be included in the pay quantities.

When laps are made for splices for the convenience of the Contractor, the additional reinforcement will not be included in the pay quantities.

505 PRESTRESSED CONCRETE MEMBERS

STANDARDS NOT COMPLETE AT THIS TIME

506 STEEL STRUCTURES

STANDARDS NOT COMPLETE AT THIS TIME

507 TIMBER STRUCTURES

STANDARDS NOT COMPLETE AT THIS TIME

508 METAL RETAINING WALLS

STANDARDS NOT COMPLETE AT THIS TIME

509 UNASSIGNED

510 MISCELLANEOUS METALS

STANDARDS NOT COMPLETE AT THIS TIME

511 BEARING AND EXPANSION DEVICES

STANDARDS NOT COMPLETE AT THIS TIME

512 RAILING, FENCING, GATES AND CATTLE GUARDS

STANDARDS NOT COMPLETE AT THIS TIME

513 PAINTING, GALVANIZING AND ANODIZING

STANDARDS NOT COMPLETE AT THIS TIME

514 SLOPE PROTECTION

514.1.00 Description
514.1.01 Slope Paving
514.1.02 Riprap
514.1.03 Gabions
514.1.04 Filter Blanket

514.2.00 Materials
514.2.01 Slope Paving Blocks
514.2.02 Grout
514.2.03 Portland Cement Concrete
514.2.04 Metal Reinforcement
514.2.05 Asphalt Concrete
514.2.06 Broken Stone
514.2.07 Broken Concrete
514.2.08 Wire Enclosed Stone
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514.2.10 Sacked Concrete
514.2.11 Wire Enclosures
514.2.11A Chain-Link Fence Fabric
514.2.11B Welded Wire Fabric
514.2.11C Lacing and Tie Wire

514.3.00 Construction
514.3.01 Preparation
514.3.02 Slope Paving Blocks
514.3.03 Portland Cement Concrete
514.3.04 Pneumatically Placed Mortar
514.3.05 Loose Riprap
514.3.06 Grouted Riprap
514.3.07 Filter Blanket
514.3.08 Wire Enclosed Stone Riprap

514.4.00 Measurement and Payment
514.4.01 Measurement by the Cubic Yard
514.4.02 Measurement by the Ton
514.4.03 Lump Sum

514 SLOPE PROTECTION

514.1.00 Description: This section covers the work necessary for slope paving, riprap, or other slope protection as specified.

514.1.01 Slope Paving: Slope paving shall consist of cement concrete blocks, poured cement concrete, pneumatically placed cement concrete or asphalt concrete paving.

514.1.02 Riprap: Riprap shall consist of broken stone, wire enclosed stone, broken Portland cement concrete or sacked concrete.

514.1.03 Gabions: Gabions shall consist of rectangular compartments of wire mesh material filled with stones or broken Portland cement concrete.

514.1.04 Filter Blankets: Filter blankets shall consist of one or more layers of graded material placed on a prepared slope prior to placing the riprap thereon to prevent underlying material from passing through the riprap.

514.2.00 Materials

514.2.01 Slope Paving Blocks: Slope paving blocks shall conform to the requirements of Section 503.

514.2.02 Grout: Grout shall consist of one part Portland cement and three parts sand, thoroughly mixed with water to produce thick, creamy consistency.

514.2.03 Portland Cement Concrete: Portland cement concrete shall conform to the requirements of Section 503, and shall be Class 3000, unless otherwise specified. The maximum aggregate size shall be as specified on the Plans, in the Special Provisions or on the Proposal.

514.2.04 Metal Reinforcement: Metal reinforcement shall be welded wire fabric conforming to the requirements of ASTM A185, unless otherwise specified.

514.2.05 Asphalt Concrete: Asphalt concrete shall conform to the requirements of Section 211.

514.2.06 Broken Stone: Broken stone shall be hard, durable, angular in shape, resistant to weathering and shall meet the gradation requirements of the class specified. Neither breadth nor thickness of a single stone should be less than one-third its length. The acceptability of the stone will be determined by the previous use records or by tests as the Engineer determines to be appropriate. If testing is required, suitable samples of stone shall be furnished by the Contractor and taken in the presence of the Engineer at least 25 days in advance of the time when the

514.2.06 Broken Stone, Continued

placing of riprap is expected to begin. The approval of some riprap from a particular source shall not be construed the approval of all riprap taken from that source.

In the absence of satisfactory previous use records, the stone shall conform to the following requirements:

Apparent Specific Gravity (AASHTO T 85)	2.5 minimum
Percent Absorption (AASHTO T 85)	6 maximum
Soundness (AASHTO T 104)	
Average Loss for 2 ½" – 1 ½" and 1 ½" – ¾" fraction	16%

The riprap shall be free from overburden, spoil, shale and organic material.

The grading of riprap by class and size of stone shall conform to the following:

Class 50	*Class 100*	*Class 700*	*Class 2000*	*Percent (by Weight)*
Size of Stone (lbs.)				
50-30	100-60	700-500	2000-1400	20
30-15	60-25	500-200	1400-700	30
15-2	25-2	200-20	700-40	40
Less than 2	Less than 2	Less than 20	Less than 40	10

Each load of riprap shall be reasonably well graded from the smallest to the maximum size specified.

Control of gradation will be by visual inspection. The Contractor shall provide, at a location satisfactory to the Engineer and in close proximity to the project, a mass of rock sample of at least five tons meeting the gradation for the class specified. This sample will be used as a frequent reference for judging the gradation of the riprap supplied. Any difference of opinion between the Engineer and the Contractor shall be resolved by dumping and checking the gradation of two random truckloads of stone. Mechanical equipment, a sorting site and labor needed to assist in checking gradation shall be provided by the Contractor.

514.2.07 Broken Concrete: Broken concrete shall conform to the breadth, thickness and length relationship described in Subsection 514.2.06. All projecting metal reinforcement shall be trimmed flush with the surface of the concrete, unless otherwise specified. The acceptability of broken concrete will be determined by the Engineer or an individual basis for each source.

514.2.08 Wire Enclosed Stone: Wire enclosed stone shall be hard, durable, crushed, quarried, or natural stone, or broken concrete having an apparent specific gravity of not less than 2.4. The absorption shall not exceed four percent, unless otherwise specified. It shall be free of weak laminations and cleavages and shall be of a quality that will not disintegrate on exposure to water or weathering. The size shall be as specified.

514.2.09 Filter Blanket: Filter blanket material shall be composed of tough, durable particles, reasonably free from thin, flat and elongated pieces and shall contain no organic matter nor soft, friable particles in quantities in excess of those specified.

514.2.10 Sacked Concrete: Sacked concrete shall consist of Portland cement concrete placed in loosely woven burlap sacks.

514.2.11 Wire Enclosures: Wire enclosure material shall consist of one of the following:

514.2.11A Chain-Link Fence Fabric: Chain-link fence fabric shall conform to the requirements of AASHTO M181. The fabric shall be 11 gauge, two inch mesh with Class I coating meeting the requirements of ASTM A392.

514.2.11B Welded Wire Fabric: Welded wire fabric shall conform to the requirements of AASHTO M55. The fabric shall be 11 gauge, two inch mesh with Class I coating meeting the requirements of ASTM A116.

514.2.11C Lacing and Tie Wire: Lacing and tire wire shall be galvanized, 12 ½ gauge smooth steel wire. In lieu of lacing, 9-gauge, galvanized hog rings at four inch spacings may be used for fastening ends, sides and top panels.

514.3.00 Construction

514.3.01 Preparation: Slope and foundation areas shall be cleared of all organic material and shaped to a smooth surface. All soft or spongy material shall be removed to the depth shown or as directed and replaced with approved material and compacted to the specified density.

514.3.02 Slope Paving Blocks: Slope paving blocks shall be placed in such a manner that they rest firmly and evenly against the slope. The blocks shall be placed in horizontal parallel courses and successive course shall break joints with the preceding course to form a running bond. Joints between blocks shall be grouted.

514.3.03 Portland Cement Concrete: Portland cement concrete shall be placed in such a manner so as to form a dense, impervious and uniform surface. The thickness shall be a minimum of four inches, unless otherwise specified. Portland cement concrete shall have formed or sawed joints constructed as shown on the Plans.

514.3.04 Pneumatically Placed Mortar: Pneumatically placed mortar shall be placed in accordance with the requirements of Section 503.

514.3.05 Loose Riprap: Loose riprap shall be placed in such a manner so as to produce a reasonably well graded uniform mass.

514.3.06 Grouted Riprap: Grouted riprap shall be thoroughly moistened prior to grouting. The grout shall completely fill the voids. The surface texture shall be as specified.

514.3.07 Filter Blanket: Filter blanket material shall be placed such that segregation of particle sizes shall not occur. The finished surface of the blanket shall be free of irregularities.

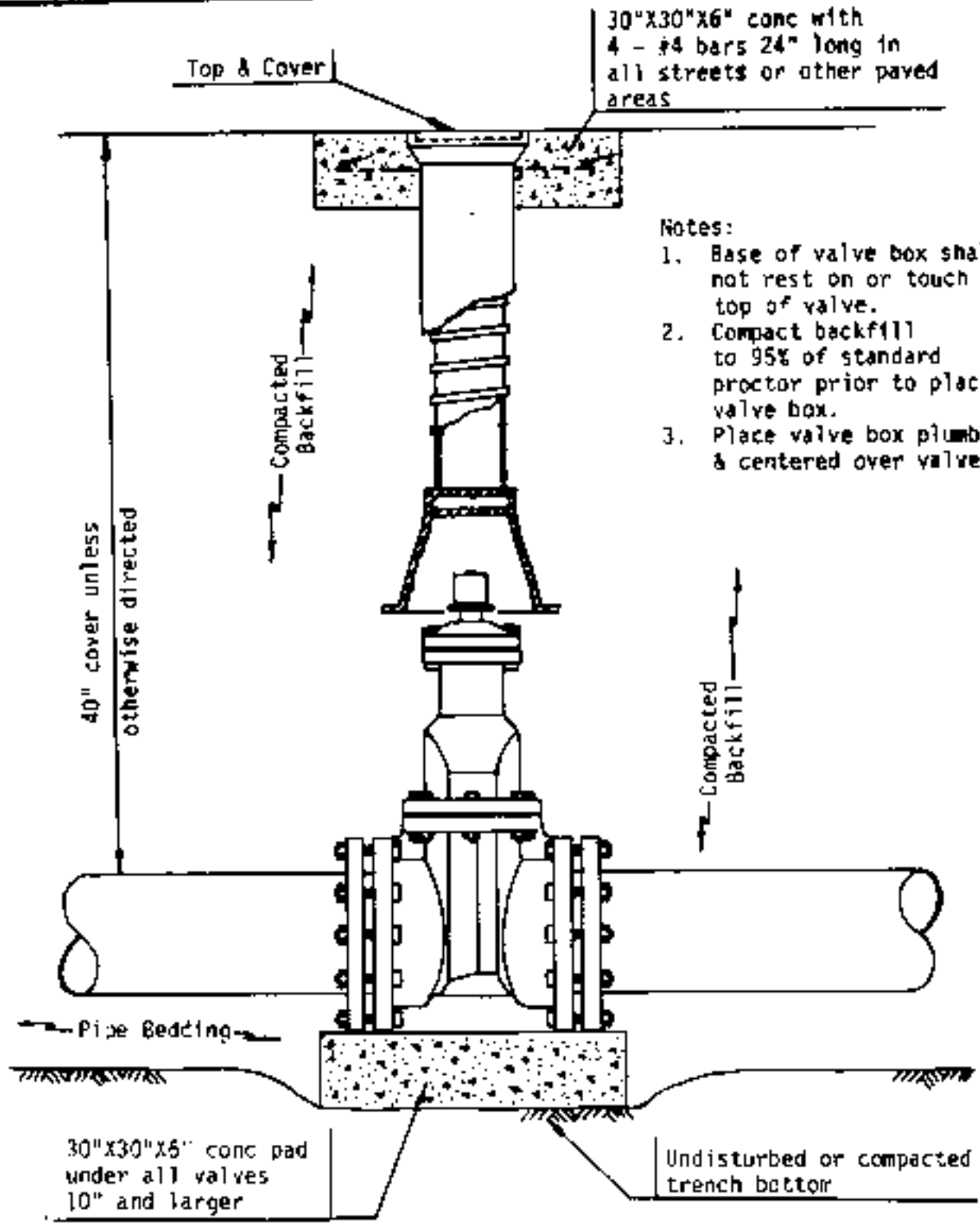
514.3.08 Wire Enclosed Stone Riprap: Wire enclosures shall be connected together at all contacting edges at six inch intervals.

514.4.00 Measurement and Payment

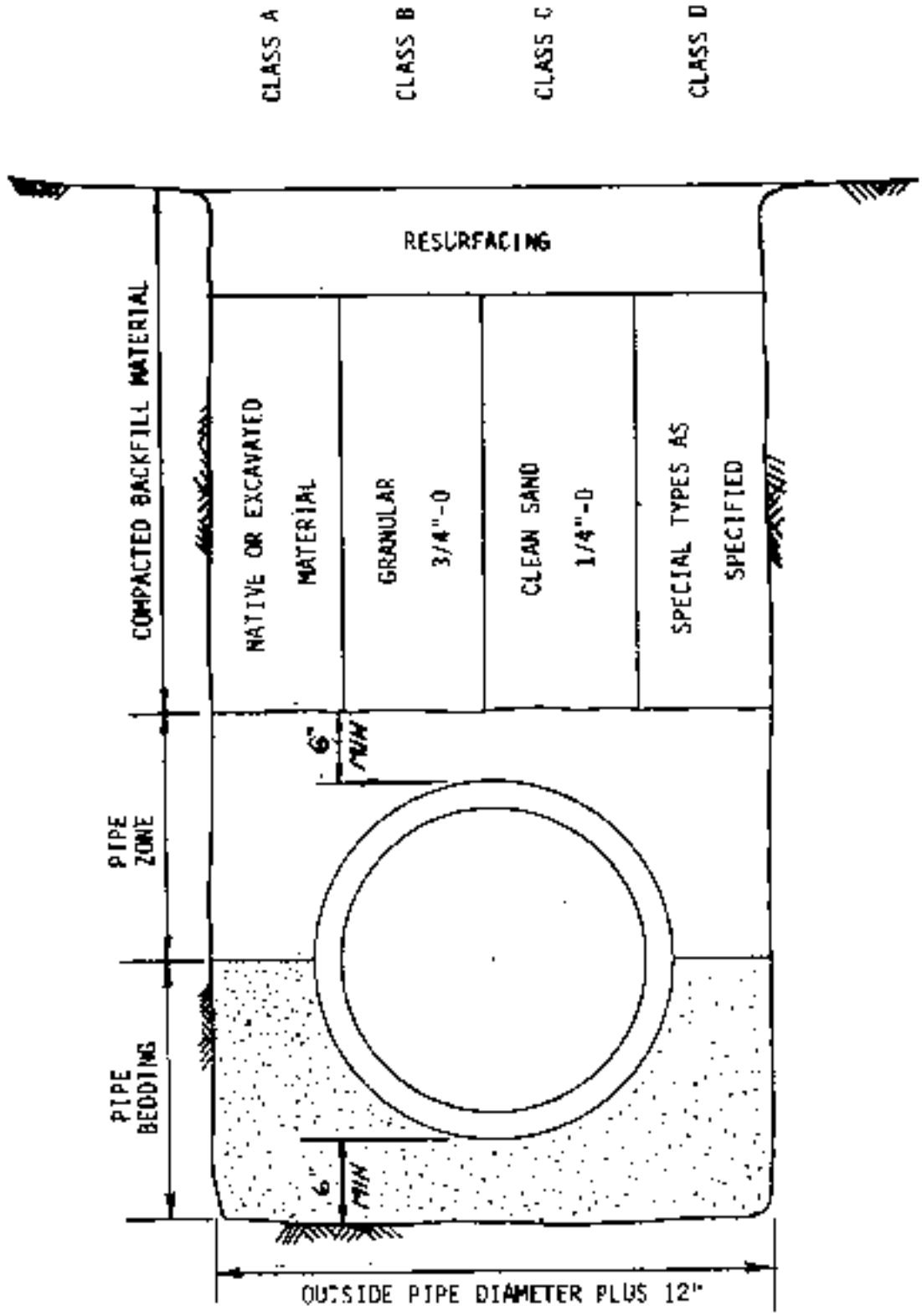
514.4.01 Measurement by the Cubic Yard: Measurement will be based on the number of cubic yards of slope protection material constructed and accepted.

514.4.02 Measurement by the Ton: Measurement will be based on the number of tons of slope protection material constructed and accepted.

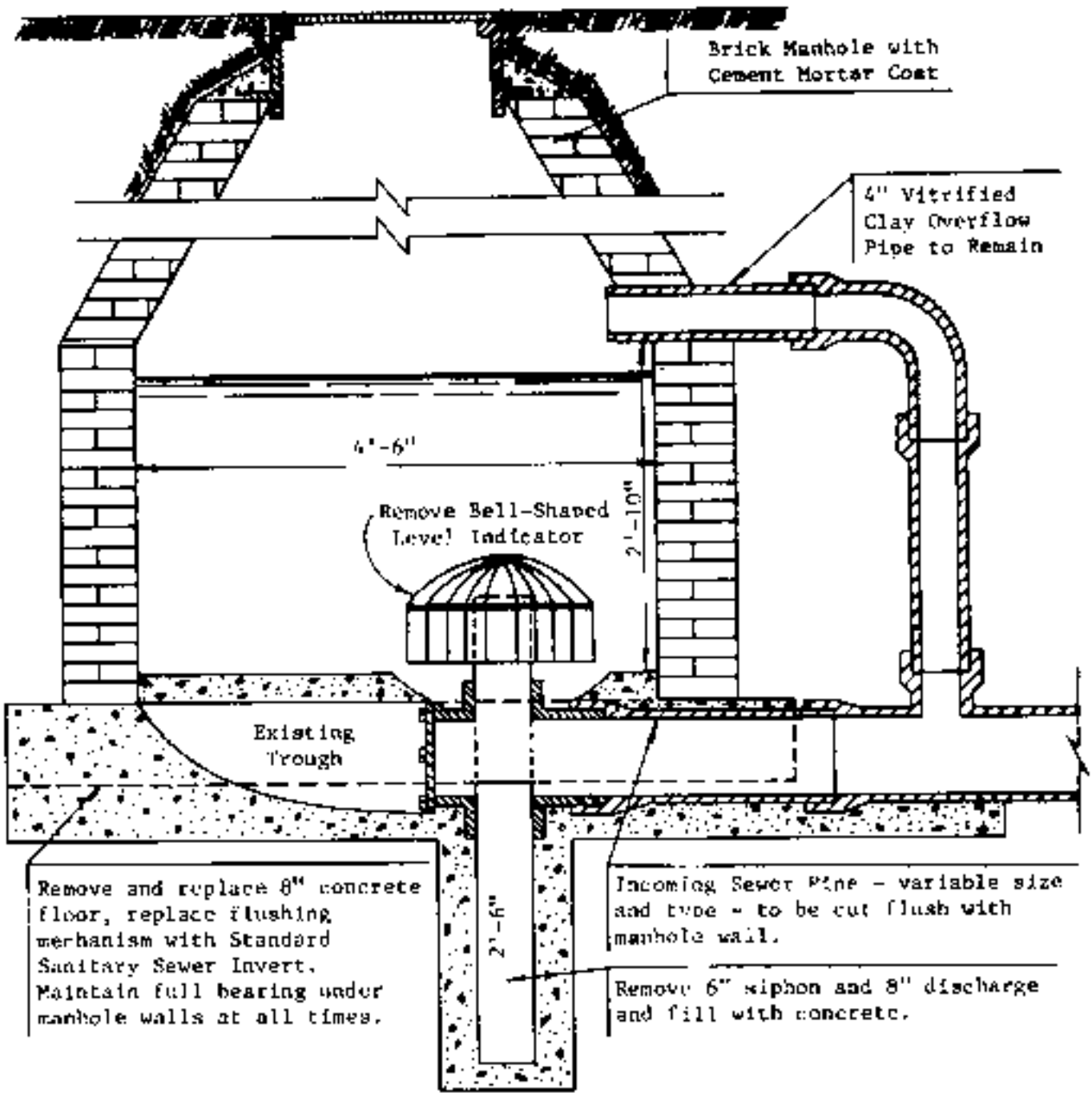
514.4.03 Lump Sum: Measurement and payment will be based on a lump sum basis for the type and size of slope protection constructed and accepted.



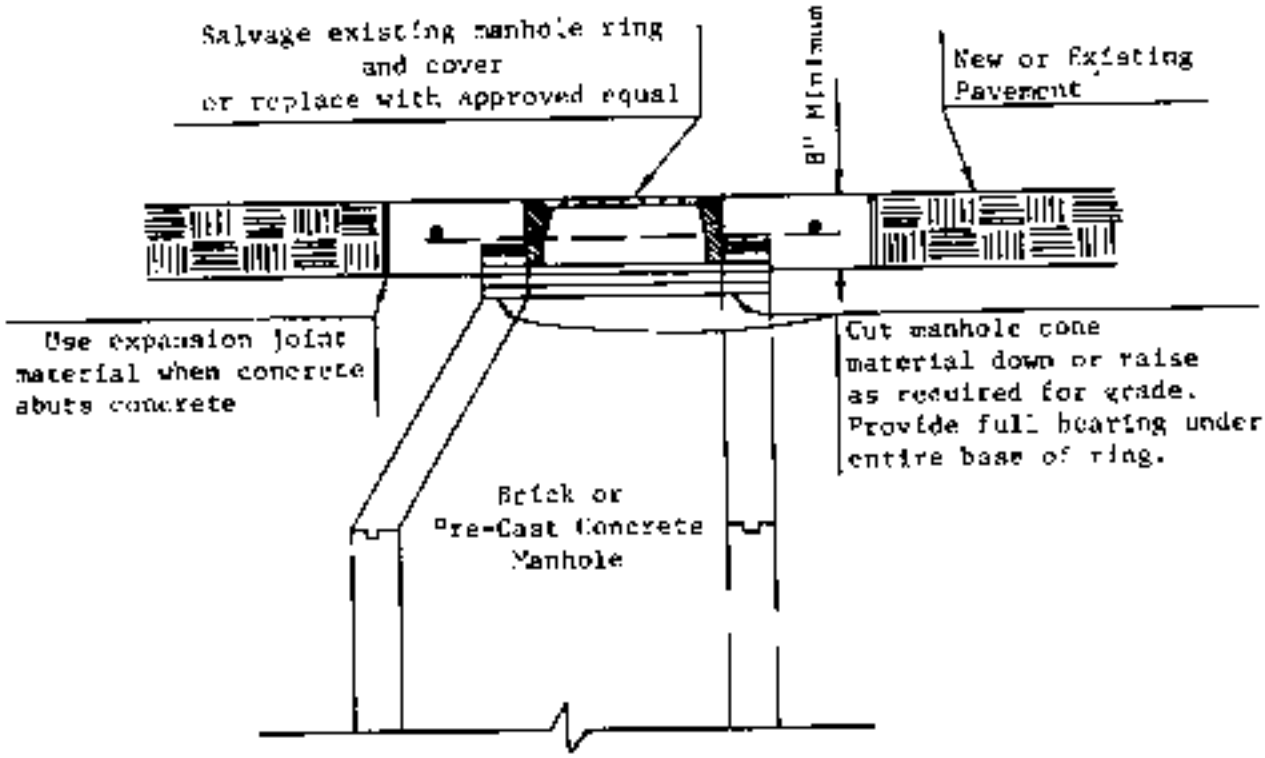
NOV '84 REVISIONS	CITY OF DODGE CITY DEPARTMENT OF PUBLIC WORKS	STANDARD DRAWING NO.
	TYPICAL VALVE BOX INSTALLATION	



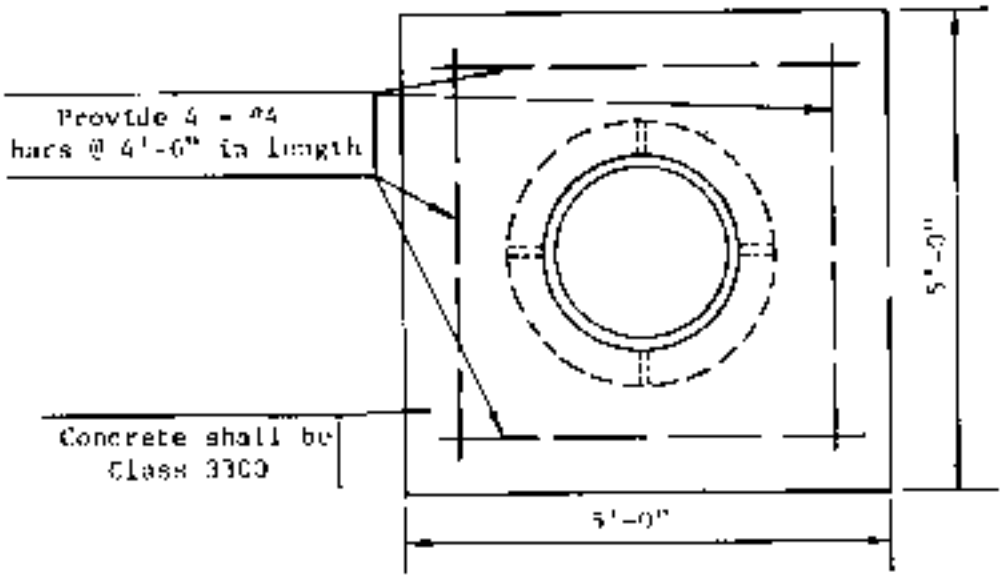
Oct 84 REVISIONS	CITY OF DODGE CITY DEPARTMENT OF PUBLIC WORKS	STANDARD DRAWING NO.
	SANITARY SEWER, WATER AND STORM DRAIN EXCAVATION AND BACKFILL	



JUNE 85 REVISIONS	CITY OF DODGE CITY DEPARTMENT OF PUBLIC WORKS	STANDARD DRAWING NO.
	SANITARY SEWER FLUSH TANK RENOVATION DETAIL	



Concrete Manhole Pad: In asphaltic pavement, saw cut and remove 5'x5' square after new pavement is constructed. In PC concrete pavement, block out and construct manhole pad separate from pavement slab.

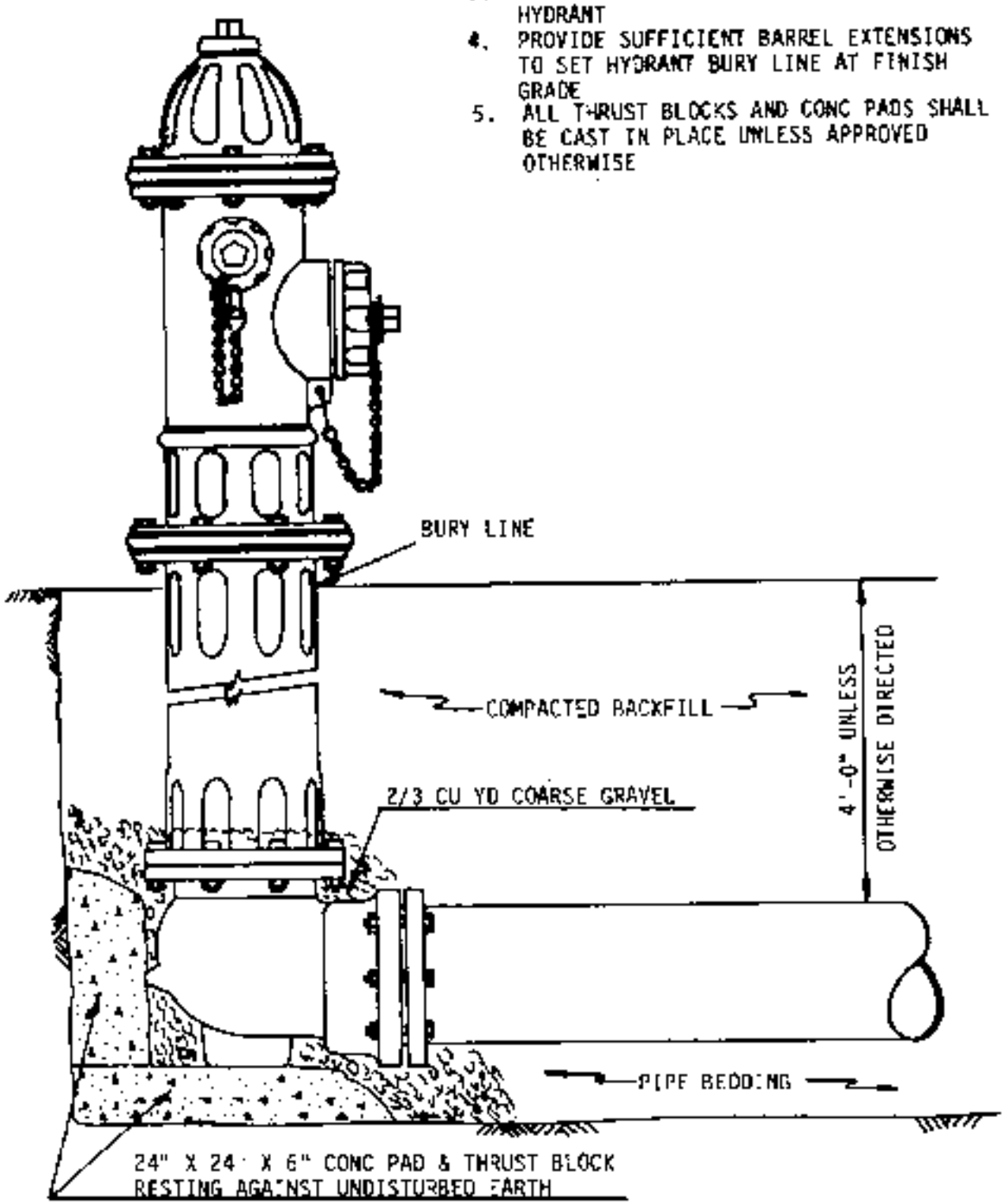


Note: Centerline of manhole pad shall be parallel to the centerline of the street.

JUNE 85 REVISIONS	CITY OF DODGE CITY DEPARTMENT OF PUBLIC WORKS	STANDARD DRAWING NO.
	SANITARY SEWER AND STORM DRAINAGE MANHOLE DETAIL	

NOTES:

1. ALL HYDRANTS TO BE MUELLER CENTURION OR APPROVED EQUAL
2. SET ALL HYDRANTS PLUMB
3. SET HYDRANT VALVE 36" FROM HYDRANT
4. PROVIDE SUFFICIENT BARREL EXTENSIONS TO SET HYDRANT BURY LINE AT FINISH GRADE
5. ALL THRUST BLOCKS AND CONC PADS SHALL BE CAST IN PLACE UNLESS APPROVED OTHERWISE



NOV '84 REVISIONS	CITY OF DODGE CITY DEPARTMENT OF PUBLIC WORKS	STANDARD DRAWING NO.
	TYPICAL FIRE HYDRANT INSTALLATION	

SUPPLEMENTAL
STANDARD SPECIFICATIONS

1.0 GENERAL REQUIREMENTS:

1.1 INTENT: The purpose of the Supplemental Standard Specifications is to make alterations to the STANDARD SPECIFICATIONS as may be necessary from time to time, as construction methods change or as certain projects may require special considerations. Anything that is required in these Supplemental Standard Specifications will supersede what is required in the City's STANDARD SPECIFICATIONS.

1.2 STANDARD SPECIFICATIONS: All Bidders shall have a copy of the City of Dodge City STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, 1995 Edition. Failure to obtain said STANDARD SPECIFICATIONS shall disqualify any firm from bidding until these specifications are in their possession.

Copies of the STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, 1995 Edition, may be obtained from the Engineering Division, City of Dodge City, 806 Second Avenue, P.O. Box 880, Dodge City, Kansas 67801-0880. The cost is $25.00 per copy.

1.3 INSURANCE REQUIREMENTS: The Contractor shall provide proof of insurance coverage complying with Section 107.7.00 of the STANDARD SPECIFICATIONS. Attention is called specifically to the requirement for liability limits and umbrella limits of not less than $1,000,000. Proof of coverage shall be in the form of a standard insurance certificate provided by the insurance carrier or the carrier's agent, and shall specifically show the project name and number.

1.4 SCHEDULING OF WORK: The Contractor, upon notification of award of the contract, shall prepare a construction schedule in accordance with Section 108.1.00 of the STANDARD SPECIFICATIONS. Said schedule shall be approved by the Engineer prior to the issuance of the Notice to Proceed.

If the Contractor plans on doing any work after normal daytime working hours or on weekends, it shall be noted in the schedule or phasing plan and approved by the Engineer.

The Contractor shall submit a revised construction schedule along with each monthly partial pay request. The City reserves the right to withhold partial payments if said schedule is not submitted.

1.5 PROTECTION OF WORK: Until acceptance of the project, the Contractor shall, at all times, protect from damage all public and private property which may be affected by the work and preserve all materials, supplies, equipment of any description, and all work already performed from his work activities, the action of the elements, and damage by any person or persons, or from any other cause whatsoever.

1.6 COORDINATION WITH EXISTING UTILITIES: The Contractor shall coordinate his activities with those of the power, telephone, gas, cable televisions, water, and sanitary sewer utilities. In addition, the location of the electric, telephone, natural gas, water, sewer, and cable TV lines shall be verified by the Contractor prior to construction.

1.7 NOTIFICATION OF EMERGENCY SERVICES: It shall be the responsibility of the Contractor to provide 48-hour advance notice to all emergency services, including police, fire, and ambulance, of the status of the work or of any street closure so that they are fully informed at all times. If the project is located on a school bus route, the Contractor shall also notify the USD #443 Transportation Division. When work has been completed, the Contractor shall inform emergency services of work completion.

1.8 ACCESS TO PRIVATE PROPERTY: In general, access to private property shall be provided by the Contractor during evenings and weekends or other times as long as such access does not jeopardize portions of the work. The Contractor shall give occupants and businesses, which will be affected by the project, not less than 48 hours written notice before beginning work which will in any way limit access to private property.

1.9 INSPECTION/TESTING: The City of Dodge City will provide the construction inspection and materials testing services on this project. However, due to manpower limitations, the City of Dodge City expressly reserves the right to hire consultants to perform the construction inspection services and consultants or testing laboratories to provide the required testing services.

The Contractor will be responsible for providing asphalt or concrete cores as required in these Supplemental Standard Specifications or in the project Special Provisions.

The Contractor will be charged $50.00 for each failing subgrade compaction tests. The charge will be $75.00 if taken before 8:00 a.m. or after 5:00 p.m.

The Contractor will reimburse the City of Dodge City for the total cost of any compaction tests taken that do not pass. The City will not charge the Contractor for tests that do pass. All testing will be done in accordance with these Specifications.

1.10 PRE-BID CONFERENCE: All bidders are required to attend a Pre-Bid Conference at the designated date, time, and location as indicated in the Advertisement/Notice to Bidders, if specified. The purpose of the pre-bid conference is to familiarize prospective bidders with the site and scope of the work. Additionally, this conference affords prospective bidders an opportunity to get answers to their questions and seek clarifications, which, if not provided could have a significant effect on the difficulty and cost of the work.

Failure to have a representative attend said Pre-Bid Conference shall be considered nonresponsive and may be grounds for rejection of Proposal.

SUPPLEMENTAL STANDARD SPECIFICATIONS
GENERAL REQUIREMENTS

1.11 PRE-CONSTRUCTION CONFERENCE: The successful bidders will be required to attend a pre-construction conference which is to be held at least one week prior to the start of work. At that time, the Contractor will submit the following for the City's review:

A. Construction Schedule
B. Applicable mix design information/material tests.
C. Names of Contractors job site representative that is authorized to receive instruction and make decisions on the Contractor's behalf.
D. After hours telephone numbers for a Contractor's representative that can handle emergency situations or repair warning signs.

1.12 WARRANTY AND MAINTENANCE: The Contractor shall note the requirements of Section 107.24.00 of the STANDARD SPECIFICATIONS concerning the one year warranty and maintenance period. All performance bonds shall cover this one year period.

2.0 GENERAL CONSTRUCTION:

2.1 TEMPORARY TRAFFIC CONTROL: Temporary traffic control shall be planned and provided by the Contractor and shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) and in accordance with Section 202 of the STANDARD SPECIFICATIONS. Yellow warning lights will be provided when required by the MUTCD.

Traffic control plans shall be provided in writing to the Engineer for approval at least seven (7) days prior to starting work. Said plan will include the name and telephone number of a person that can be contacted after hours should the need arise.

The plan shall provide details and locations of barricades, construction and warning signs, and detours. Included in the plan shall be a description of the progression of the work, how notice to abutting properties is to be given, and person(s) responsible for notices and communications.

All signs and barricades shall be maintained in a clean, well maintained, attractive condition. Failure to properly maintain barricades/signs will be grounds for no payment for this item. The Contractor shall provide and be responsible at all times for flagpersons, signs, and other devices not otherwise specified by the Owner. The Contractor shall erect and maintain all barricades, guards, standard construction signs, warning signs as are necessary to warn and protect the public at all times from injury or damage as a result of the work operations.

Upon failure to immediately provide the necessary flagpersons or to provide, erect, maintain and remove barricades, lights and signs when so ordered, the Engineer shall have the right, without further notice to the Contractor or the Contractor's Surety, to cause the condition to be remedied and deducted from all costs thereof from any payments due, or coming due to the Contractor.

2.2 SURVEYING AND CONSTRUCTION STAKING: The Contractor shall be responsible for providing all required surveying and construction staking for this project. When required, the City will provide the horizontal and vertical control reference points. Sufficient staking will be provided to ensure the Engineer that line and grade are proper.

2.3 PROJECT SIGNS: The Contractor shall be responsible for furnishing, installing, and maintaining project signs. Each sign shall be placed at the ends of each project limits, or as designated by the Engineer. Specifications governing the sign are shown on the Details Sheets of these SUPPLEMENTAL STANDARD SPECIFICATIONS.

Deviation from information specified and shown shall not be allowed. It shall be responsibility of the Contractor to clarify and coordinate information to be contained on the sign with the Engineer prior to its placement. The City will not pay for these signs if they are not installed prior to 25% of the work being completed.

2.4 SUBGRADE PREPARATION: After removal of the existing pavement, the Contractor shall prepare the subgrade for the new pavement in compliance with Section 206 of the STANDARD SPECIFICATIONS.

2.4.1 COMPACTION AND GRADING: After the subgrade has been brought to grade, the Contractor shall compact the top six (6) inches to 95% standard proctor density.

The subgrade shall be accurately shaped by blading, and the finished surface compacted to a tight, smooth surface, suitable for construction of the pavement. This shall be completed prior to final density testing.

When the Contractor has completed a portion of the subgrade and is ready to begin construction of the new pavement, he shall give the Engineer at least 4 hours notice so the subgrade can be checked and approved. Any areas found to be not to grade in accordance with Section 206.3.05 shall be reworked until the required grades and/or densities are achieved. Sand will not be used to fine grade the subgrade if the subgrade is ½" or more out of tolerance. Should density tests not pass, the Contractor will be billed for the cost of the test. The City will not bill for passing tests.

2.5 SUBGRADE REPAIR: Subgrade repair shall provide a means to accommodate unsuitable subgrade material encountered after the removal of existing pavement. Unsuitable subgrade refers to soil quality only, not to moisture content. A wet soil, properly worked and dried, is not necessarily unsuitable. Quantities of unsuitable subgrade material shall be calculated by measuring the limits of excavations necessary to remove unsuitable subgrade. Payment for subgrade repair shall be based on measured quantities and shall include all costs of over-excavation, backfill, and
compaction of the imported material necessary to complete the subgrade. Material proposed for use as backfill shall be submitted to the Engineer and written approval received before use in the project.

The quantity of subgrade repair in the Proposal is an estimated quantity intended to establish a unit cost for repair of unsuitable subgrade material. Any attempt by the Contractor to unbalance this, or any other bid item, may result in rejection of the bid proposal. Prior to beginning any subgrade repair work, the Contractor shall obtain written approval from the Engineer.

2.6 RESEAL JOINTS: The Contractor shall be responsible for cleaning
and resealing joints and cracks in the existing street or adjacent curb and gutter, as indicated on the plans or in the project Special Provisions.

Joint sealing material shall be Dow Corning 888, or approved equal.

2.7 MANHOLE AND WATER VALVE ADJUSTMENTS: Manhole and valve box tops shall be adjusted to the new pavement grade, as necessary. The Contractor shall call for an inspection of each individual manhole or valve box prior to placing the surfacing around them to enable the Engineer to check conformance to both transverse and lateral grade.

The provisions of Section 216 of the STANDARD SPECIFICATIONS not withstanding, concrete aprons separate from new concrete pavements will not be required, however, the Contractor shall install the 1/2 inch reinforcing around each manhole or valve box as required by Section 216 of the STANDARD SPECIFICATIONS. This 1/2 inch reinforcing shall be in addition to the normal pavement reinforcing.

On asphalt streets, concrete aprons with reinforcing will be required around all such castings. Concrete shall be 3500 psi high-early strength, capable of supporting normal traffic loads within six (6) hours of installation.

Excavations necessary to adjust manholes or valve boxes to grade shall be backfilled with flowable fill to the top of the subgrade. This shall be incidental to the bid item of both manhole and/or water valve adjustments.

All manholes, valve covers, and similar utility covers shall be protected during the paving in order to keep from coating them with asphalt cement or asphaltic concrete. Should any of these covers need cleaning, the Contractor shall clean them without damage to adjacent property or street surface and without permitting his solvents to run into any sanitary sewer or storm drain. Any cover castings or valve stems damaged by the Contractor during his operations will be replaced by the Contractor at no cost to the City. Any such items already broken shall be replaced by the City. Contact the City Water Department.

The Contractor shall not allow foreign material to fall into sewers and stone, broken asphalt or concrete pieces which fall into manholes or into valve boxes or similar structures shall be removed by the Contractor.

The City of Dodge City considers the completion of adjustment of manholes and water valves of such importance that should these adjustments not be completed within fourteen (14) calendar days after paving operations on each street are completed, then the City shall withhold $35.00 per day per incomplete adjustment, as liquidated damages.

Further, should the City have a water or sewer problem that requires it to open a manhole or valve box prior to the adjustment being made, the Contractor shall reimburse the City for its cost to open the manhole and barricade it.

2.8 REMOVAL AND REPLACEMENT OF CONCRETE CURB AND GUTTER: Curb and gutter work shall comply with Section 213 of the STANDARD SPECIFICATIONS. Concrete shall be Class 3500. Removal of curb and gutter shall be done in such a manner so as to minimize damage to adjacent curb and gutter, pavement, sidewalks, or other facilities.

When existing curb and gutter is adjacent to brick pavement, a minimum of two rows of bricks shall be removed in order to form the new curb and gutter. The underlying concrete base may remain and used as a form for the new curb and gutter. The Contractor shall replace the sand bedding and brick adjacent to the new curb and gutter, matching the gutter grade, After the bricks have been placed, a light application of sand and cement slurry shall be squeegeed or broomed into the spaces between the bricks to seal the pavement surface. Care shall be taken to use only the amount of slurry necessary to accomplish a seal. Excess material on the horizontal surface shall be removed prior to opening the work to traffic. Removal and replacement of the brick along the curb toe shall be considered as incidental to the curb and gutter bid for which no additional payment shall be made.

When existing curb and gutter is adjacent to asphaltic or concrete pavement, the existing pavement may be used as a form for the new curb and gutter. If the pavement is damaged during construction, it shall be saw cut to form a smooth vertical edge and then replaced at no expense to the City.

The Contractor is also responsible for replacing in-kind any material removed or disturbed back of curb during removal and replacement of curb and gutter. There shall be no direct pay for this replacement.

New curb and gutter shall be doweled and grouted to the existing curb and gutter by using #4 x 18" rebar (See Detail).

The cost of any excavation or subgrade preparation required for the removal and/or replacement of curb and gutter will be considered incidental to the bid item for which no additional payment will be made.

2.9 REMOVAL AND REPLACEMENT OF SIDEWALKS, DRIVEWAYS AND APPROACHES: Driveway and sidewalk approach work shall comply with Section 214 and 215 of the STANDARD SPECIFICATIONS. Concrete shall be Class 3500.

2.10 4" CONCRETE ADA CURB RAMPS: Sidewalk work shall comply with Section 215 of the STANDARD SPECIFICATIONS. Concrete shall be Class 3500. Curb ramps shall meet the 1990 American with Disabilities Act (ADA) uniform Federal accessibility standards (See Detail). The limits of pay for the ADA curb ramps is as shown of the Detail.

2.11 PLASTIC PAVEMENT MARKINGS: Pavement marking shall be a cold plastic material manufactured by 3M Company, or approved equal.

2.11.1 METHODS OF TEST: Unless otherwise stated, tests will be conducted using methods established by the Research-Materials Laboratory, Kansas Department of Transportation.

2.11.2 BASIS OF ACCEPTANCE: Acceptance of this material may be based on satisfactory results of tests conducted on representative samples submitted to a laboratory selected by the City of Dodge City.

2.11.3 MATERIAL SPECIFICATIONS: The Contractor shall furnish a specification showing the physical properties and detailed installation instructions for the materials which are proposed.

2.11.4 CONFORMANCE TO MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES: When specified, pavement arrows and legends shall conform closely in shape and size to those specified in the Manual on Uniform Traffic Control Devices. Exceptions to sizes and shapes shall be clearly specified at the time of bidding. Failure to meet the manual size and shape specifications without giving exceptions may be grounds for rejecting the work.

2.11.5 DESCRIPTION: Cold plastic marking materials shall be a conformable ribbon or other flat shape as specified, and shall be fabricated of a plastic material, suitable pigments, plasticizers and reflective glass beads distributed evenly throughout, suitable for application to asphalt, concrete, and brick. The marking material shall be so formulated that the applied lines and shapes will show a high visibility which will remain during the effective life of the material. A material which permits or promotes adherence of excessive amounts of road film so as to decrease markedly visual impact shall not be acceptable, regardless of compliance with other provisions of this specification.

The marking shall be supplied complete with a precoated, factory applied adhesive, to make possible immediate application to pavement. When the adhesive backing is supplemented by a solvent, or other type of adhesive, the material used and application shall be in accordance with the manufacturer's recommendation. Items recommended for special handling may be applied utilizing an adhesive recommended and supplied by the manufacturer of the pavement marking material.

2.11.5.1 CLASS AND TYPE: The marking material shall be furnished in two classes as follows:

Class W - White
Class Y - Yellow

It shall further be furnish in one type as follows:

Type I - 60 mils thick (Nominal)

2.11.5.2 ADHESIVE ACTIVATOR OR SOLVENT: The Contractor shall furnish and use an adhesive activator or solvent as recommended by the manufacturer of the plastic marking material suitable for portland cement concrete, asphaltic concrete, or brick depending upon which pavement it is to be applied on.

The Contractor shall take special care to remove any materials from the surface to which the pavement markings are to be applied which might inhibit the adhesive or the activator.

2.11.6 REQUIREMENTS: Length, width, shape, and type shall be as designated on the plans, or as specified in the Special Provisions.

2.11.6.1 DIMENSIONAL REQUIREMENTS AND COMPOSITION: Type I – Thickness shall be not less than 0.055 inch or more than 0.070 inch exclusive of the adhesive. Composition shall conform to the following by weight:

Glass spheres retained on a No. 325 sieve……..30% Min.
Plastic material and pigments.....……...Remainder

2.11.6.2 COLOR AND DAYLIGHT REFLECTANCE: Daylight reflectance (ASTM E97) of Class W (White) shall be not less than 50%. The color of Class Y (Yellow) shall be within the red and green tolerance limits of the Highway Yellow Color Tolerance Chart, issued by the U.S. Department of Transportation.

2.11.6.3 FLEXIBILITY: Flexibility of the material shall be such that it can be applied at a temperature of 75 degrees F, or more, without cracking or breaking.

2.11.6.4 REFLECTIVITY: The white and yellow material shall be retroreflective, reflecting white and yellow respectively, and shall be readily visible when viewed with automobile headlamps at night from a distance of at least 300 feet.

2.11.6.5 INSTALLATION: Prior to installing any pavement markings, the surface of the pavement shall be thoroughly cleaned to remove grit, grease, and other substances that would prevent the markings from adhering to the pavement. The Contractor shall comply with the recommended manufacturer's specifications. Once installed, all plastic pavement markings will be cut at all joints.

2.12 PAVEMENT SMOOTHNESS: The smoothness of the surface will be measured by the profilograph method, in accordance with KDOT Special Provision 90P-111-R1 (rigid pavements) and Special Provision 90P-39-R4 (flexible pavements). Copies of the KDOT Special Provisions are attached to these Supplemental Standard Specifications.

2.12 PAVEMENT SMOOTHNESS, Continued

In reducing the profilograph tracings, all Contractors should note that a zero blanking band will be used, so as to include the effects of chatter in the profile index.

Prior to determining the final punch list on any given street, the Contractor will furnish the Engineer one (1) tracing per traveled lane, to be taken at the lane centerline. The Engineer and the Contractor will jointly review the tracings to determine bump or excessive chatter locations. The Contractor will take corrective actions to remove bumps and chatter. A profile index will be calculated, however, no penalty or bonus will be assessed based on this index. This index is for the City's information only on this project.

2.13 MEASUREMENT AND PAYMENT:

2.13.1 METHOD OF MEASUREMENT: Quantities shall be measured as provided for under the various unit items which constitute the completed and accepted work according to the plans and specifications for each bid item. Any attempt by the Contractor to unbalance any bid item may result in the rejection of the bid proposal.

A submittal form shall be completed by the Contractor in order to process a project payment. All pay requests shall be submitted by the Contractor not less than 13 days prior to the first Monday of the month to allow adequate time for processing.

Payment shall be based on work completed at 5:00 p.m. on the Friday prior to submittals. The Engineer will review the Contractor's submittals for accuracy with the City's measurements. The Contractor will be notified of any changes. Should the Contractor disagree with the City's measurements, the Contractor will be required to submit scaled drawings, complete with his measurements and calculations for review by the City's Inspector.

2.13.2 BASIS OF PAYMENT: Quantities shall be paid for at the contract unit price for each bid item. Payment will be full compensation for furnishing and placing all materials, and for all labor,
equipment, tools, and incidentals necessary to complete the work in accordance with these Supplemental Standard Specifications and the STANDARD SPECIFICATIONS for the City of Dodge City.

2.13.3 PAYMENT FOR ADDITIONAL WORK: Payment for additional work shall be in accordance with Section 109.5.00 of the STANDARD SPECIFICATIONS. Extra work, when required, shall be approved in writing prior to beginning the work.

2.13.4 PAYMENT FOR MATERIALS ON HAND: Payment for materials on hand shall be issued upon receipt of paid invoices and inspection of materials delivered to the Project site. Payment for materials on hand will be a one-time payment and will not be carried forward in subsequent partial payments. Should the Contractor fail or be prevented from incorporating sufficient materials into the work prior to the next partial payment and such failure results in a zero or a negative balance, in the pay requests, no payments will be made until the work has progressed to the point where a positive balance results.

3.0 ASPHALT CONSTRUCTION:

3.1 TYPES OF CONSTRUCTION:

3.1.1 TYPE A-1: 3" ASPHALT SURFACE: This type of construction essentially places a 3" asphalt mat on a prepared subgrade with soil support fabric between the subgrade and the bottom of the asphalt mat. This type of construction will be done on those streets where so indicated on the Proposal form.

The existing surface of the street will be removed by milling and windrowing the asphalt material adjacent to one curb for use in the base course. After the surfacing is windrowed, the existing base will be excavated to the depth necessary to allow for the construction of a 3" asphalt pavement of BM-2 asphaltic concrete.

After excavation, the milled asphalt material shall be uniformly spread across the entire street and thoroughly mixed or scarified with the top 6" of subgrade material. When the mixing process is
complete, the subgrade shall be compacted to not less than 95% of Standard Proctor Density. Once this process is completed, the elevation of the subgrade shall be at the proper line and grade,
with crown.

After the paving fabric, if called for, has been placed and secured, the street will be paved with 3" of BM-2 asphaltic concrete. This asphalt mix shall meet the specifications indicated below.

3.1.2 TYPE A-2: ASPHALT SURFACE: The general intent of this construction is to provide for a specified asphalt mat over a prepared subgrade with a soil support fabric between the subgrade and the bottom of the asphalt mat.

On this type of construction, the existing asphalt pavement will be removed by the process that is indicated in the Special Provisions. If milling is specified as the method of removal, the Contractor will haul the milled material to the City Animal Shelter, which is located in South Dodge, east of S. US Hwy 283. If milling is not specified, then the Contractor may use the method of his choice to remove the existing asphalt mat. In this situation, unless specified otherwise in the Special Provisions, this material will become the Contractor's property and will be disposed of by him by some legal means.

After the asphalt surfacing has been removed, the remainder of the existing subgrade shall be excavated to provide for a full 6" of paving. The top 6" of the subgrade shall be thoroughly worked and remixed by means of disks, tilling, or other suitable methods, shaped, and compacted to a minimum of 95% of Standard Proctor Density. After mixing, the street shall be regraded, crowned, and compacted to meet these requirements. After this work is completed, the soil support fabric will be installed and the streets shall be paved with the specified thicknesses of BM-4 base and BM-1B surface course material. Said specified thicknesses will be stated in the Special Provisions.

3.1.2 TYPE A-2: ASPHALT SURFACE, Continued

In determining the calculated asphalt quantity for yield determinations, the actual square yards reconstructed and the actual asphalt unit weights will be used. Adjustments will be made, if necessary, for unusual irregularities in either the subgrade or within the pavement mat.

The thickness of the BM-4 and BM-1B surfaces are just as important as the total mat thickness. The surface course will be 2 inches minimum in thickness and will be continuously checked by the Engineer. Corrections will be made immediately in the field. No cores will be required on the BM-1B surface.

Cores will be required on the BM-4 base course. See Supplemental Standard Specifications Section 3.15 modifications below. Cores will be furnished to the Engineer at least two (2) working days prior to the placement of the surface course.

3.1.3 TYPE A-3: MILL AND ASPHALT OVERLAY: This type of work will be performed on those streets where so indicated by the Proposal. The general intent of this type of construction is to mill asphalt off an existing asphalt street and replace it with a new asphalt overlay. The thickness of this construction will be indicated in the Special Provisions. Prior to placing the asphalt overlay, cracks in the existing street surface will be repaired as indicated in these Supplemental Standard Specifications or the Special Provisions.

Once the cracks are repaired as specified, the street surface will be thoroughly broomed to remove all loose and foreign materials. A tack coat shall then be applied as specified in Section 3.10 of the Supplemental Standard Specifications. The overlay will consist of either BM-1B asphalt or BM-2 asphalt, as may be specified in the Special Provisions for the project.

3.2 ASPHALT CONCRETE PAVEMENT: Asphalt concrete pavement shall comply with Section 211 of the STANDARD SPECIFICATIONS. Specific mix composition requirements shall comply with Section 1103.02 (1) BM-1B, Section 1103.02 (2) BM-2, and Section 1103.02 (4) BM-4 of the Kansas Department of Transportation (KDOT) Standard Specifications, 1990 Edition.

3.3 MIX DESIGNS: The Contractor shall submit the complete mix designs and materials for each type of asphaltic concrete he proposes to use for review and approval by the City's laboratories at least two weeks prior to the planned production date.

3.4 BM-1B ASPHALT: BM-1B shall meet the following specifications:

3.4.1 MASTER GRADING LIMITS:

BM-1B	¾"	½"	3/8"	4	8	16	30	50	100	200
	0	0-10	12-26	39-56	60-76	72-87	79-92	84-95	88-96	92-98
Tolerance, +/-				5	4	4	3	3	3	2

Asphaltic cement shall be viscosity graded AC-10 mixed with the specified aggregate at an approximate rate of 4.5 - 4.75%. The percentage of asphalt cement shall be based on the results of density and stability tests as determined by Kansas Test Method KT-14, latest version.

The BM-1B mix may be composed of any combination of aggregates and mineral filler supplements meeting the requirements of the Master Grading Limits specified hereinabove and the following composition limits:

- A minimum of 75% crushed aggregates
- A minimum of 15% natural sand from an alluvial deposit
- No MFS-6 (fly ash)

3.4.2 Quality: The quality of individual aggregates shall meet the following:

Soundness, minimum	0.90
Wear, maximum	40.0%
Absorption, maximum	4.0%

Aggregates for bituminous hot mix shall be tested for absorption as follows:

Crushed stone (KDOT CS-1)	Test Method kT-6, Proc I
Screenings (KDOT CS-2)	Test Method kT-2, Proc II
Sand-Gravel (KDOT SS6) or Crushed Gravel (KDOT C6)	Test Method kT-6, Proc I & II

Deleterious Substances: The combined aggregates shall be free of alkali, acids, organic matter, or injurious quantities of other foreign substances. Other deleterious substances shall not exceed the following percentages by weight:

Sticks (wet)	0.1
Shale, shalelike, soft or friable particles either singly or in combination	0.1
Coal	0.5

3.4.3 Crushed Material: A minimum of 98% of the particles retained on the No. 30 sieve after crushing shall have one or more crushed faces as determined microscopically at the testing laboratory.

Failure to comply with the above requirement shall result in the reduction in contract payment as shown below:

Percent with Crushed Face	Contract Price Reduction*
97.0 to 97.9	$1.00/ton
96.0 to 96.9	$2.25/ton
95.0 to 95.9	$3.50/ton
94.0 to 94.9	$5.00/ton
Less than 94.0	The material may be used at a $7.00/ton contract reduction or rejected at the Engineer's option.

* The above contract price reduction values shall be applied at the same percentage rate that the non-complying crushed gravel is used in the mix. For example, in a mix having 50% KDOT CG-5 with 97.0 to 97.9% crushed faces, the contract price reduction to be applied shall be $1.00 x 0.5 = $0.50. The dollar value derived for the appropriate category of percent crushed faces shall be assessed for each ton of asphaltic mixture in which the material was used.

3.4.4 General Mix Composition Requirements: Not more than 30% of the material passing the No. 200 sieve shall be present in the uncrushed aggregate. The remaining mineral filler shall be present in crushed aggregate or shall be obtained by the addition of materials meeting the requirements for KDOT defined wet bottom slag or any mineral filler supplement except KDOT MFS-3.

The gradation, plasticity index (P.I.) and moisture content shall comply with the applicable requirements of KDOT specifications, page 1103, Table 6, except that the Master Grading Limits provided hereinabove shall apply.

At least 15% of the crushed aggregate passing the 3/8" sieve shall consist of crushed limestone. The Contractor may choose to use 1% KDOT MFS-4 (hydrated lime) in lieu of the above requirement. If MFS-4 is selected, then it shall be added to the combined aggregate as dry hydrated lime and shall be mixed in a pug mill or other approved device to ensure adequate coating of the combined aggregates. The combined aggregate shall be moistened to at least 3% above the saturated surface dry condition prior to or during the addition of the hydrated lime. This requirement shall not apply to a mix containing 50% or more calcite cemented sandstone.

3.4.5 Process Control: During production, the Engineer shall conduct tests for gradation. A minimum of two samples of materials for a 1,000 ton lot shall be tested to verify compliance with the approved mix design. Non-compliance shall be subject to rejection or a price adjustment for the entire lot or portion of the lot represented by the test results.

The process shall be considered in non-compliance when one or both test results on any sieve(s) fall outside the Master Grading Limits for BM-1B. When this occurs, the lot shall be terminated, accepted at a reduced pay or rejected by the Engineer. Production shall be suspended pending the satisfactory results of a new pre-production sample.

The combined cold feed samples shall be taken at times designated by the Engineer and analyzed in the Contractor's laboratory.

3.4.6 Basis of Acceptance: Calculated values for acceptance test results for gradations shall be shown to the nearest 0.01%

3.5 BM-2 ASPHALT: Asphaltic concrete mixes meeting KDOT specifications, edition of 1990, for BM-2 shall be furnished as called for by the plans and specifications.

Asphaltic cement content, density, and stability tests shall be based on the results of Kansas Test Method KT-14, the latest version.

3.6 BM-4 ASPHALT: Asphaltic concrete mixes meeting KDOT specifications, edition of 1990, for BM-4 shall be furnished as called for by the plans and specifications.

Asphaltic cement content, density, and stability tests shall be based on the results of Kansas Test Method KT-14, the latest version.

3.7 SOIL SUPPORT FABRIC: If a paving fabric is called for, it shall be spread on the base course after the crown is approved for grade.

The paving fabric shall be Amoco 4546, or an approved equal. The Contractor shall be Responsible for installing the fabric and restraining it with staples, large headed spikes or other suitable methods to keep the fabric in close contact with the base during paving operations. Should the fabric become displaced in any way, whether by the Contractor's equipment or wind or other causes, paving shall be discontinued until the fabric is properly re-spread and secured. No more fabric than can be covered by the surface course shall be placed ahead of the paving machine. Placing of the fabric shall be by means of a piece of equipment specifically designed to lay or spread the fabric and capable of handling full rolls. Such equipment shall lay the material smoothly, without excess wrinkles or folds. All wrinkles severe enough to allow a fold shall be slit, layed flat, and secured with staples or large headed nails.

3.7 SOIL SUPPORT FABRIC, Continued

Hand placing of fabric will not be approved except for special need and for small, irregular areas.

The fabric shall be overlapped a minimum of 3 inch and a maximum of 6 inches. All transverse joints shall be "shingled" in the direction of paving machine travel.

3.8 CONTACT SURFACES: Contact surfaces of curbing, gutters, manholes, and similar structures shall be painted with a thin, uniform coating of asphaltic cement material. Any asphalt material in excess of this shall be removed without damage to the new pavement. The Contractor may use any means he chooses to apply the asphalt material, but coverage shall be complete and uniform. A "bead" of asphalt from a spray nozzle shall not be acceptable.

The asphaltic concrete shall be placed uniformly high at the contact surfaces so that after compaction, the finished surface will be approximately 1/4 inch above the edge of such structures.

3.9 PAVEMENT MEMBRANE FABRIC: A pavement membrane fabric shall be installed between or below the various layers of asphalt mat, as may be indicated in the Special Provisions for the particular project. This fabric shall be "Petromat", as manufactured by Phillips Fibers, or an approved equal. The Petromat will be installed in place with mechanical lay down equipment, capable of handling the rolls of fabric and shall be capable of laying the fabric smoothly, without excessive wrinkles and/or folds. When manual laydown is required, a length of standard 1" pipe, together with suitable roll tension devices, is required for proper roll handling.

The surface upon which the fabric is placed shall be free of dirt, water, and vegetation. Cracks shall be repaired as indicated in the crack repair or filling specifications.

Prior to the installation of the Petromat, a tack coat on the roadway surface will be required. The correct tack coat application rate should be based on the quantity of residual asphalt in the tack material specified and the porosity of the surface to the covered. Generally, this will approximate 0.25 gallons per square yard residual asphalt; but depending on pavement conditions, the rate may vary between 0.20 to 0.30 gallons per square yard (See Special Provisions for individual project). If asphalt emulsion is used, a greater amount of the emulsion must be applied to result in a cured 0.25 gallons per square yards of residual asphalt.

In general, the Contractor shall comply with any manufacture recommendations concerning the proper installation of this pavement membrane fabric.

3.10 TACK COAT: This work shall conform to Section 211.3.04 of the STANDARD SPECIFICATIONS. The tack coat shall be applied at a rate of 0.04 gallons per square yard. Sufficient time shall be provided to allow the tack coat to cure before laying the surface coarse.

If the Engineer determines that the tack coat is unnecessary, the Engineer reserves the right to waive this item of work from the project.

3.11 PRIME COAT: A prime coat shall be required whenever an asphalt mat is placed over any soil or rock base. The prime coat shall meet the requirements as specified in Section 211.3.03 of the STANDARD SPECIFICATIONS. The type of asphalt to be used, along with the required application rate, will be as indicated in the Special Provisions for the particular project in question.

3.12 MILLING OPERATIONS: When the method of removal of all or a portion of an asphalt mat is by milling, the Contractor is expected to use a milling machine that is manufactured for that
purpose to accomplish this removal. Unless otherwise specified in the Special Provisions, the milled materials will be loaded on trucks supplied by the Contractor and hauled to a site within the
City of Dodge City, as specified in the Special Provisions for the project. During milling operations, care will be taken not to damage any passing motor vehicles.

The site of the milling operations will be signed in accordance with the requirements of the Manual on Uniform Traffic Control Devices (MUTCD). Flagmen will be provided where required. In addition, all temporary drop offs resulting from the milling operations will be adequately signed. Upon completion of the milling operations, the street shall be swept to remove any remaining loose materials and temporary pavement markings applied to indicated the lanes as they existed prior to the milling operations. Should an asphalt overlay follow closely to the milling operations, the need for temporary pavement markings may be waived by the Engineer. See any Special Provisions for a discussion on required temporary pavement markings.

3.13 TEMPERATURE LIMITATION: Base course asphalt (BM-4) will not be placed if the ambient air temperature is below 40° F. Surface course asphalt (BM-1B) will not be placed if the ambient air temperature is below 50° F. Asphalt paving operations will be suspended when the temperature falls below minimum. No asphalt will be laid on wet pavements or subgrade nor on frozen subgrades or bases. Otherwise, comply with Section 211.3.05B of the STANDARD SPECIFICATIONS.

3.14 COMPACTION: Final compaction record testing will be done on the BM-4 base using the core densities. The Contractor shall be solely responsible for meeting the compaction specified in Section 211.3.05 C of the STANDARD SPECIFICATIONS. The use of nuclear gauges or rolling patterns will be acceptable for the surface course.

3.15 THICKNESS: The Contractor shall furnish a minimum of two cores per 500 ton lot or two cores per block, whichever is less, of asphalt base course (BM-4) to be used to assess compliance with thickness requirements. Core locations shall be chosen by the Engineer or his representative. Cores will not be required in the surface course.

Should the average core thickness for the two cores be found to be less than the specified thickness by less than 1/4 inch, the pavement lot will be paid for as being full thickness.

Should the average core thickness for the two cores be found to be less than the specified thickness by more than 1/4 inch, the Contractor shall provide three additional cores from locations
within the same lot or block at locations chosen by the Engineer.

Should the average of the 5 cores be found to be under specification by 1/4 inch or less, the specified thickness of the pavement lot will be paid for as being full thickness.

If, however, the average of the 5 cores is less than the specified thickness by more than 1/4 inch, a deduction in unit cost shall be made. Such adjustment shall be as specified in the following table:

Deviation from Specified Thickness	% Price Adjustment
> 1/4" to 1/2"	6.25
> 1/2" to 3/4"	12.5
> 3/4" to 1"	18.75
> 1"	Reject

3.16 MINOR CRACK FILLING: The work covered by this specification consists of furnishing all labor, equipment, materials and performing all operations necessary for the application of crack sealant in accordance with the following specifications.

3.16.1 DESCRIPTION: This work shall consist of the application of a hot-pumped crack sealant in accordance with these specifications which consists of the cleaning and sealing of joints and cracks 1/8" in width or greater. Sealant shall be Koch 9001 or Crafco Roadsaver 211.

3.16.2 PREPARATION OF SURFACE: All cracks to be sealed shall be cleaned of all foreign material with oil-free compressed air. Compressed air shall be 90 psi minimum at the nozzle. Contaminants on the surface adjacent to the joint and cracks shall also be removed, along with all contaminants on the sides of the cracks. At the time of placement of the sealant, surfaces to be sealed shall be dry and the ambient temperature shall be above 40 degrees Fahrenheit.

3.16.3 EQUIPMENT: All equipment, tools, and machines used in the performance of this work shall be maintained in a satisfactory working order at all times. The equipment used to apply the crack filler shall conform with that recommended by the manufacturer of the crack filler material. The Contractor shall furnish literature on the crack filler for review by the Engineer prior to using it.

3.16.4 MIXING AND APPLYING MATERIALS: This mixing and application of the crack filling material shall comply with the manufacturers specifications.

Traffic shall not be allowed under normal conditions on the sealant until it is cured and the possibility of tracking does not exist. Blotting with fine aggregate may be permitted, if necessary, to prevent tracking of the sealant. The Engineer will determine, in conjunction with the Contractor, when this condition exists. Material necessary for blotting purposes shall be incidental to the joint sealing process for which no additional payment will be made.

3.16.5 WEATHER LIMITATIONS: No material shall be applied unless the atmospheric temperature is 40 degrees F and rising, nor when the temperature has been below 35 degrees F in the preceding 24 hours. No material shall be applied while the surface is wet, nor when the impending weather conditions are such that proper curing may not be obtained.

3.17 MAJOR CRACK REPAIR:

3.17.1 DESCRIPTION: The work covered by this shall consist of repairing cracks located within the project limits which are wide and/or show evidence of settlement or heaving, which impacts the ride quality of the pavement. The Engineer will, in conjunction with the Contractor, establish which cracks shall receive the following repair treatment. The work included under this specification shall consist of removing the pavement surrounding the crack to a width of 24" and full depth.

The preferred method of removal is to saw cut the existing asphalt and removing the old asphalt between the cuts. Milling the asphalt will be allowed if preceded by saw cutting at the removal lines for a depth of at least two (2) inches. The removal operation shall be centered as nearly as possible over the crack being repaired.

Following the completion of the removal operation, the trough shall be cleaned, prepared, and tacked with SS-1H emulsified asphalt at the rate of 0.10 gallons per square yard. Care shall be taken to tack both the bottom and vertical surfaces for the trough.

3.17.1 DESCRIPTION, Continued

Following completion of the tacking operation, the trough shall be filled with BM-2 asphalt, or approved equal. Paving work shall comply with Section 211 of the STANDARD SPECIFICATIONS. Specific mix composition requirements shall comply with Section 1103.02(b)(1.1) of the Kansas Department of Transportation (KDOT) Standard Specifications, 1990 Edition. The Contractor shall submit the complete mix design and materials for each type of asphaltic concrete he proposes to use for review and approval by the City Engineer at least two weeks prior to the planned production date. Care shall be taken to complete the installation procedure and provide sufficient material to eliminate the possibility of depressions in the finished surface. Rolling of the patch material shall be accomplished perpendicular to the street curb and shall be compacted to 95% of marshall density of the mix material, in a maximum of 2 inch lifts.

Compaction of the asphalt will be critical to prevent the top of the patches from sinking later under traffic. To provide the best ride possible, the finished surface will be checked with a straight edge. A maximum of 1/8 inch will be allowed for settlement.

3.18 MEASUREMENT AND PAYMENT:

3.18.1 METHOD OF MEASUREMENT: Quantities shall be measured as provided for under the various unit items which constitute the completed and accepted work according to the plans and specifications for each bid item. Any attempt by the Contractor to unbalance any bid item may result in the rejection of the bid proposal.

A submittal form shall be completed by the Contractor in order to process a project payment. All pay requests shall be submitted by the Contractor not less than 13 days prior to the first Monday of the month to allow adequate time for processing.

Payment shall be based on work completed at 5:00 p.m. on the Friday prior to submittals. The Engineer will review the Contractor's submittals for accuracy with the City's measurements. The Contractor will be notified of any changes. Should the Contractor disagree with the City's measurements, the Contractor will be required to submit scaled drawings, complete with his measurements and calculations for review by the City's Inspector.

3.18.2 BASIS OF PAYMENT: Quantities shall be paid for at the contract unit price for each bid item. Payment will be full compensation for furnishing and placing all materials, and for all labor, equipment, tools, and incidentals necessary to complete the work in accordance with these Supplemental Standard Specifications and the STANDARD SPECIFICATIONS for the City of Dodge City.

3.18.3 PAYMENT FOR ADDITIONAL WORK: Payment for additional work shall be in accordance with Section 109.5.00 of the STANDARD SPECIFICATIONS. Extra work, when required, shall be approved in writing prior to beginning the work.

3.18.4 PAYMENT FOR MATERIALS ON HAND: Payment for materials on hand shall be issued upon receipt of paid invoices and inspection of materials delivered to the Project site. Payment for materials on hand will be a one-time payment and will not be carried forward in subsequent partial payments. Should the Contractor fail or be prevented from incorporating sufficient materials into the work prior to the next partial payment and such failure results in a zero or a negative balance, in the pay requests, no payments will be made until the work has progressed to the point where a positive balance results.

4.0 CONCRETE CONSTRUCTION:

4.1 TYPES OF CONSTRUCTION: Work shall comply with Section 212 of the STANDARD SPECIFICATIONS. Concrete shall be Class 3500. The type of construction shall be as indicated on the bid form and as described below.

4.1.1 Type C-1: Reinforced P.C.C. Pavements: This type of construction includes placing reinforced portland cement concrete slab on a prepared subgrade. The thickness of the concrete paving shall be as indicated in the project Special Provisions. On reinforced concrete pavements, transverse joints shall contain dowel bars on baskets as indicated in the paving details. Longitudinal joints will contain tie-bars with or without a keyway. The pavement will be continuously reinforced with wire mesh as specified in the details and in the STANDARD SPECIFICATIONS. This pavement will not contain any fiber reinforcement. See Joint Detail sheet.

4.1.2 Type C-2: Plain P.C.C. Pavement: This type of construction will place a plain portland cement concrete pavement on a prepared subgrade. In plain concrete pavements, the transverse joints will contain dowel bars on baskets and the longitudinal joints will contain tie bars, all as shown in the Joint Details Sheets. No continuous mesh reinforcement will be required. This pavement will not contain fiber reinforcement.

4.1.3 Type C-3: Fiber Reinforced P.C.C. Pavements: This type of construction will result in the placement of a fiber reinforced portland cement concrete pavement on a prepared subgrade. The thickness of the concrete pavement will be as indicated in the Special Provisions. The fiber reinforced concrete itself shall be as specified below. Transverse joints will contain dowel bars and longitudinal joints will contain tie-bars, all as shown on the Joint Detail Sheet.

Fibers shall be fibrillated polypropylene fibers as manufactured by W.R. Grace & Company, or an approved equal. Manufacturer's specifications and certifications shall be made available on request. Standard ACI 302 procedures for placing, finishing, and curing shall be followed when using fibers. The amount of fiber reinforcing to be used shall be one and one-half pounds (1½ lbs) per cubic yard of concrete or the amount shall comply with the manufacturer's recommendations.

4.2 CONCRETE: Concrete shall be 30% coarse aggregate, 6.5 sack and 6% entrained air. The minimum 28 day compressive strength shall be 3500 psi complying with the provisions of Section 503 of the STANDARD SPECIFICATIONS. Slump of the ready mixed concrete shall not exceed 3" when tested in accordance with AASHTO T-119 designation. For Type C-1 pavement, reinforcing steel shall be 6" x 6" x 4 gauge wire mesh. Joints shall conform to the details shown on the Detail Sheet.

4.3 THICKNESS TOLERANCE: The thickness tolerance of concrete pavements will be determined by Caliper measurements of cores, unless otherwise directed by the Engineer. Cores for thickness determination shall be provided by the Contractor at random locations chosen by the Engineer. The Contractor shall fill core holes with an approved non-shrink grout. Cores shall be taken prior to opening the street to public traffic.

4.3 THICKNESS TOLERANCE, Continued

One core shall be obtained from each sample unit. Sample units shall be defined as any pavement or placements which equal 500 square yards of total surface area.

Pavement cores will not be taken from any intersection curb return, any entrance, any irregular areas consisting of less than 500 square yards unless coring of these areas is specifically requested by the Engineer. The constructed thickness will be determined by the average height measurement of the cores representing each pavement unit.

When the measurement of the first core from any unit is not deficient more than 0.2 inch from the Plan thickness, full payment will be made. When the measurement of the first core from any unit is deficient more than 0.2 inch from the Plan thickness, two additional cores within the 500 square yard unit will be taken such that the pavement will be well represented and shall be at the discretion of the Engineer. The average thickness of the unit will be determined by using the measurements of the three cores taken in that unit.

In calculating the average thickness of the pavement, measurements which are in excess of the specified thickness by more than 0.2 inch will be considered as the specified thickness plus 0.2 inch and measurements which are less than the specified thickness by more than 1.0 inch will be considered as the specified thickness minus 1.0 inch. If the average thickness of the three cores is not deficient more than 0.2 inch from Plan thickness, full payment will be made. If the average thickness of the three cores is deficient more than 0.2 inch from the Plan thickness, an adjusted unit price, as provided in these Specifications, will be paid for the unit represented.

When the measurement of any core is deficient by more than 1.0 inch from Plan thickness, exploratory cores will be taken at intervals not less than ten feet parallel to the centerline in each direction from the deficient core until in each direction an exploratory core is taken which is not deficient by more than 1.0 inch. Exploratory cores are to be used only to determine the length of the pavement in a unit that is to be removed and replaced without pay.

4.3.1 PRICE ADJUSTMENTS: Where the average thickness of pavement is deficient in thickness by more than 0.2 inch, but not more than 1.0 inch, payment will be made at an adjusted price as specified in the following table:

CONCRETE PAVEMENT DEFICIENCY	
Deficiency in thickness as determined by cores, inches	Proportioned part of Contract price allowed
0.00 to 0.20	100%
0.21 to 0.30	80%
0.31 to 0.40	72%
0.41 to 0.50	68%
0.51 to 0.75	57%
0.76 to 1.00	50%

4.3.1 PRICE ADJUSTMENTS, Continued

When the pavement is more than one inch deficient in thickness, the Contractor will be required to remove such deficient areas and to replace them with pavement of satisfactory quality and thickness.

When it is necessary to remove and replace a length of pavement and one end of the deficient pavement is less than ten feet from an expansion, contraction or construction joint, the entire pavement up to the joint shall be removed and replaced at the Contractor's expense.

4.4 REPAIR OF DEFECTIVE PAVEMENT SLABS: It shall be the responsibility of the Contractor, regardless of reason, to repair or replace any broken panels, as specified hereinafter at no cost to the City. The work shall be accomplished prior to completion of the joint sealing. Slabs that crack during the one year guarantee period shall also be replaced at the Contractor's expense.

When a single full depth transverse crack falls within the middle one-third of the panel, the crack shall be routed and sealed. The top of the crack shall be routed to a minimum depth of ¾ inch and to a width not less than 3/8 inch nor more than 5/8 inch by means of an approved routing machine. The routing machine shall be of the vertical rotary-cutting type and shall be capable of following closely the path of the crack and of widening the top of the crack to the required section without spauling or otherwise damaging the concrete. Loose and fractured concrete shall be removed, and the routed crack shall be thoroughly cleaned and sealed as specified in Section 2.6 of these Supplemental Standard Specifications.

When any portion of a full depth crack falls outside the middle one third of the panel, the portion of panel between the planned joints and middle or center of the cracked panel shall be sawed full depth, removed and replaced. Joints created by such replacement shall be dowelled and sealed as specified hereinabove.

Pavement panels (area between planned joints) containing multiple cracks through the full depth of the slab separating the panel into three or more parts, shall be entirely removed and replaced at the Contractor's expense.

4.5 JOINTS: Joints shall be constructed as specified and in the approximate locations shown or as described on the Detail Sheets. The joints shall be thoroughly cleaned by approved methods prior to the placing of the joint material. All sawn joints shall be filled with approved joint sealant compounds as shown on the Detail Sheets. Joint sealant shall be DOW Corning 888, or an approved equal, meeting ASTM D3405-78.

4.5 JOINTS, Continued

Where called for, backer rods shall be inserted in the joint prior to applying the sealing compound. The Contractor shall provide the specifications for the sealant and backer rods and methods of application of both to the Engineer for approval at least ten (10) days prior to its use to allow time for review and written approval. The manufacturer's recommended specifications will be followed in sealing joints.

4.6 CONCRETE HEADER: At the project limits, when matching any existing pavement, the Contractor shall construct a concrete header by trenching an 18" deep by 8" wide trough. Trench depth shall be measured from the top of the new concrete pavement. Concrete for this header shall be placed monolithically with the pavement.

At all locations where new construction parallels and abuts existing gutter or pavement, a saw cut shall be made to provide a smooth interface and form the new construction. After constructing the new pavement, this joint shall be routed, cleaned, and sealed with an approved joint sealant. All saw cuts and sealing work shall be considered incidental to the project for which no additional payment shall be made.

When the new pavement matches an existing asphalt pavement, the Contractor shall construct a full depth asphalt transition strip between the new header and the existing asphalt pavement. The width of the transition strip will be as shown on the Plans or indicated in the Special Provisions.

All headers shall be measured and paid for on a per square yard basis, at the contract unit price for the new concrete pavement being placed. All asphalt transitions will be paid for on a per ton basis (in-place) at the contract unit price for asphaltic concrete.

4.7 HOT/COLD WEATHER CONCRETING: The Contractor shall comply with ACI Specifications 305R-89 (hot weather concreting) and 306R-88 (cold weather concreting).

4.8 OPENING TO TRAFFIC: No traffic of any kind will be allowed on any new slab until the concrete has cured for four (4) days and has reached a flexural strength of 375 psi. Construction traffic shall not be allowed on the new pavement until all joints are sealed or until a temporary backer-rod is installed in the joints, at the Contractor's expense. Public traffic shall not be allowed on the slabs until joints are fully sealed.

4.9 FORMS: Forms shall be metal forms manufactured for the purpose of concrete paving. At least two pins shall be put in each form. Forms shall be placed on solid base and not on a built-up mound. Forms shall be set true to line and grade. Forms that are bent or dirty will be rejected by the Engineer. Wooden forms will be allowed only when the standard metal forms cannot be used.

4.10 CONCRETE DELIVERY RATE: Prior to pouring any main line concrete paving (excluding small side pours, returns, driveways, tie-ins, etc.), the Contractor shall specify his minimum concrete delivery rate for each pour. This rate must be approved by the City prior to pouring. A pour will not be made when an acceptable delivery rate cannot be maintained to minimize the starting/stopping of the paving machine.

4.11 MEASUREMENT AND PAYMENT:

4.11.1 METHOD OF MEASUREMENT: Quantities shall be measured as provided for under the various unit items which constitute the completed and accepted work according to the plans and specifications for each bid item. Any attempt by the Contractor to unbalance any bid item may result in the rejection of the bid proposal.

A submittal form shall be completed by the Contractor in order to process a project payment. All pay requests shall be submitted by the Contractor not less than 13 days prior to the first Monday of the month to allow adequate time for processing.

Payment shall be based on work completed at 5:00 p.m. on the Friday prior to submittals. The Engineer will review the Contractor's submittals for accuracy with the City's measurements. The Contractor will be notified of any changes. Should the Contractor disagree with the City's measurements, the Contractor will be required to submit scaled drawings, complete with his measurements and calculations for review by the City's Inspector.

4.11.2 BASIS OF PAYMENT: Quantities shall be paid for at the contract unit price for each bid item. Payment will be full compensation for furnishing and placing all materials, and for all labor, equipment, tools, and incidentals necessary to complete the work in accordance with these Supplemental Standard Specifications and the STANDARD SPECIFICATIONS for the City of Dodge City.

4.11.3 PAYMENT FOR ADDITIONAL WORK: Payment for additional work shall be in accordance with Section 109.5.00 of the STANDARD SPECIFICATIONS. Extra work, when required, shall be approved in writing prior to beginning the work.

4.11.4 PAYMENT FOR MATERIALS ON HAND: Payment for materials on hand shall be issued upon receipt of paid invoices and inspection of materials delivered to the Project site. Payment for materials on hand will be a one-time payment and will not be carried forward in subsequent partial payments. Should the Contractor fail or be prevented from incorporating sufficient materials into the work prior to the next partial payment and such failure results in a zero or a negative balance, in the pay requests, no payments will be made until the work has progressed to the point where a positive balance results.

5.0 DETAILS:

Standard Concrete Joints

Standard Pavement Sections

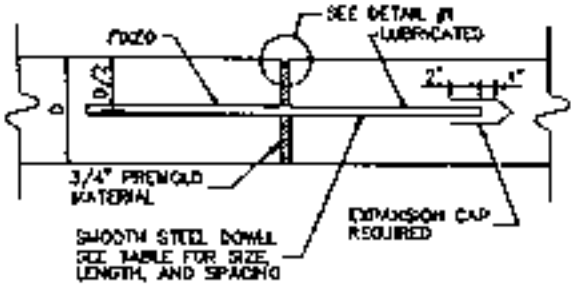
Standard Curb & Gutter

Standard Handicap Ramp

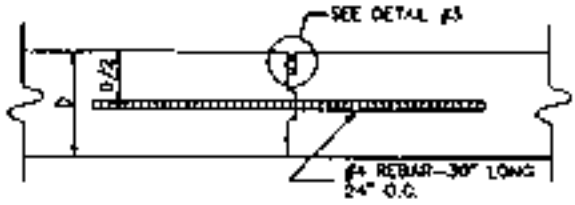
Standard Alley and Driveway Approach

Standard Manhole Cover

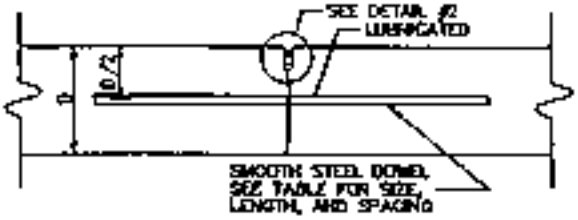
Standard Water Valve and Box



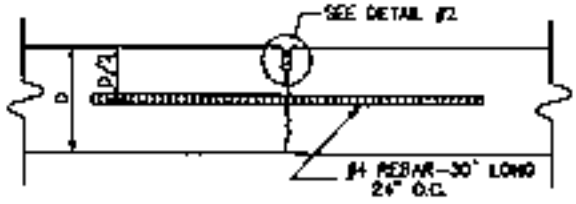
EXPANSION JOINT (E)



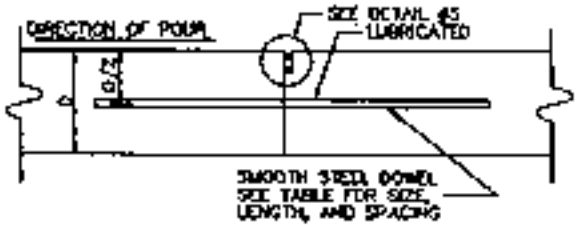
LONG. CONSTRUCTION JOINT (LC)



TRANSV. JOINT (T)



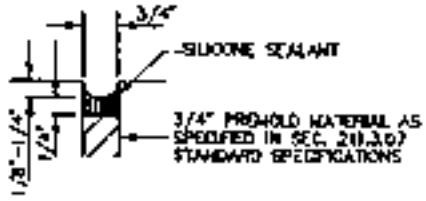
LONG. TIED JOINT (LT)



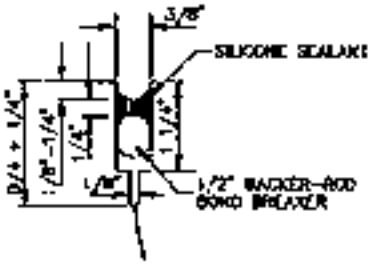
TRANSV. CONSTRUCTION JOINT (TC)

NOTE: ALL TRANSVERSE DOWELS SHALL BE SET ON BASKETS MADE FOR THAT PURPOSE. DOWELS SHALL BE WELDED TO BASKETS AT ALTERNATING ENDS. GREASE THE NON-WELDED ENDS. ALL DOWELS SHALL BE EPOXY COATED.

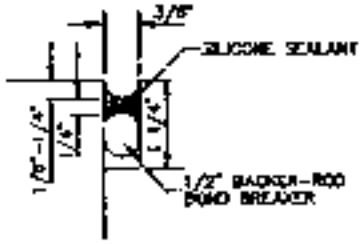
PAVEMENT THICKNESS (in.)	DOWEL DIAMETER (in.)	DOWEL LENGTH (in.)	DOWEL SPACING (in.)
6	3/4	14	12
7	7/8	14	12
8	1	14	12
9	1 1/8	16	12
10	1 1/4	18	12
11	1 3/8	18	12
12	1 1/2	20	12



DETAIL 1

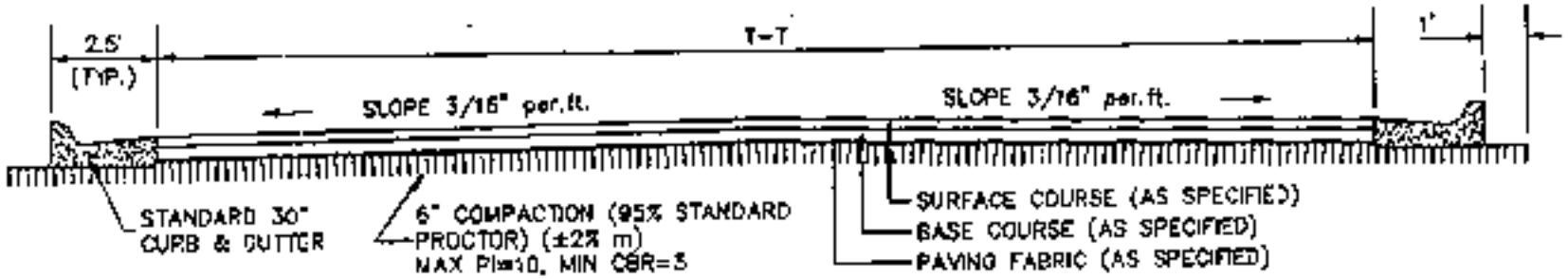


DETAIL 2

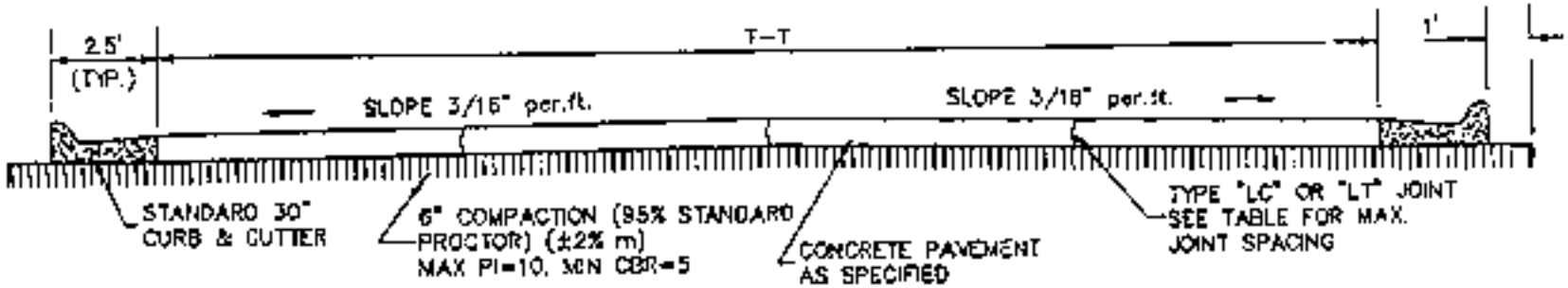


DETAIL 3

DRAWN BY DDR	CITY OF DODGE CITY, KANSAS CITY HALL ENGINEERING DEPARTMENT (316) 225-8106	PROJECT NO.
CHECKED BY CMC	STANDARD CONCRETE JOINTS	SHEET 1 OF 1
DATE FEB.94		REVISIONS



ASPHALT SECTION



CONCRETE SECTION

PVMT. WIDTH (T-T)	MAX. LONGITUDINAL JOINT SPACING (ft.)
28	14.0
31	15.5
32	16
36	12
39	13
40	13.3
44	14.7
46	11.5
48	12
49	12.25

NOTES:

1– ACTUAL LONGITUDINAL JOINT SPACING ON CONCRETE STREETS WILL BE DETERMINED, IN PART, BY CONTRACTORS PROPOSED PAVING PLAN. FOR 6" TO 8" PAVEMENTS, THE GOAL IS TO MAINTAIN CLOSE TO A 15ft TRANSVERSE AND LONGITUDINAL SPACING. FOR THICKER PAVEMENTS A SOMEWHAT WIDER SPACING WOULD BE PERMITTED.

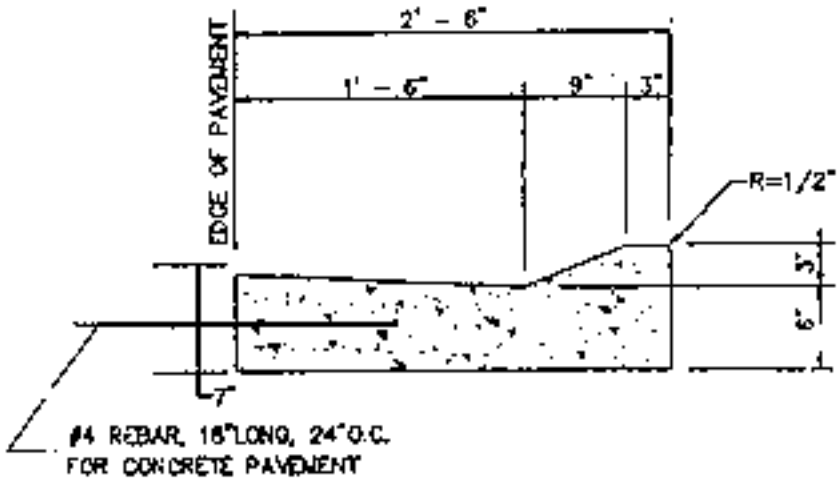
2– CROSS SLOPE SHOWN IS TYPICAL FOR NEW STREETS. ON EXISTING STREETS TO BE RECONSTRUCTED, SLOPE WILL MATCH EXISTING UNLESS CALLED FOR IN THE PROJECT SPECIAL PROVISIONS.

DRAWN BY DDR
CHECKED BY CMC
DATE MAR.94

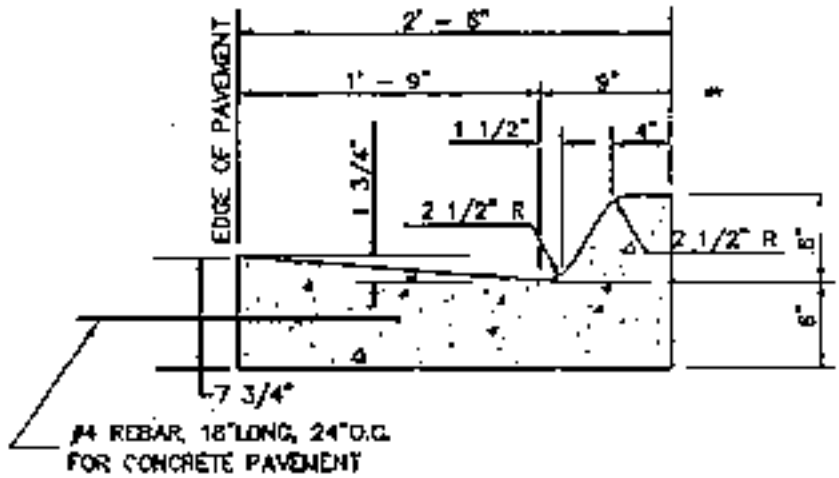
CITY OF DODGE CITY, KANSAS
CITY HALL ENGINEERING DEPARTMENT (316) 225-8106

STANDARD PAVEMENT SECTIONS

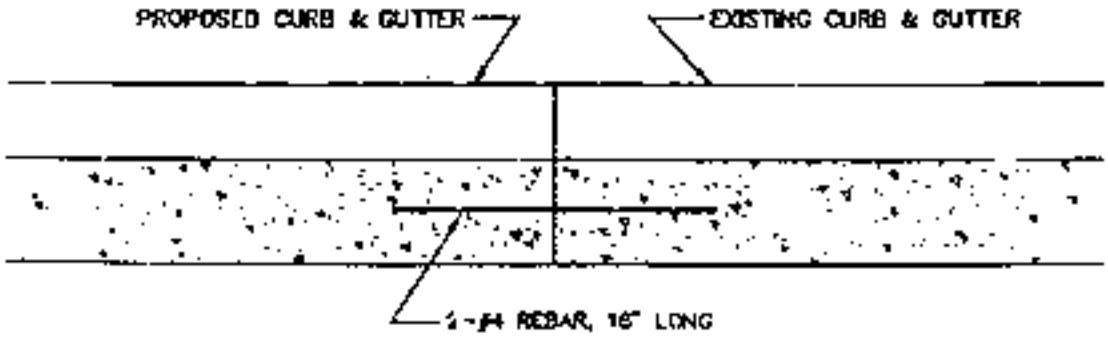
REVISIONS
SHEET 1 OF 1
PROJECT NO.



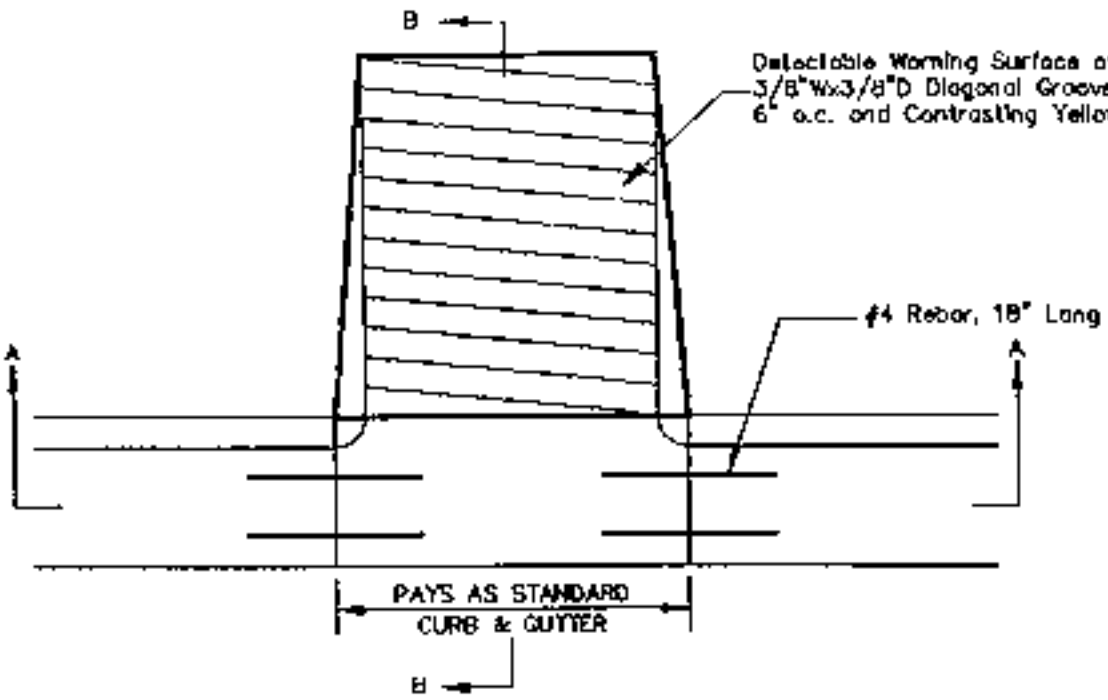
30" LAYBACK



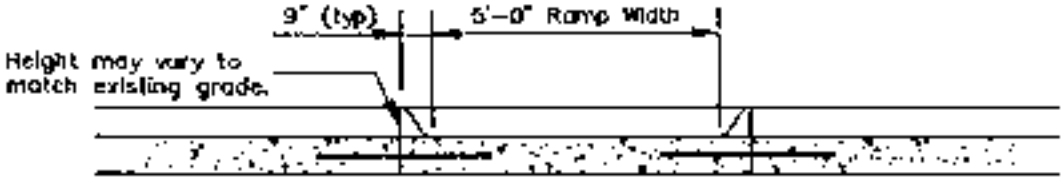
30" COMBINATION



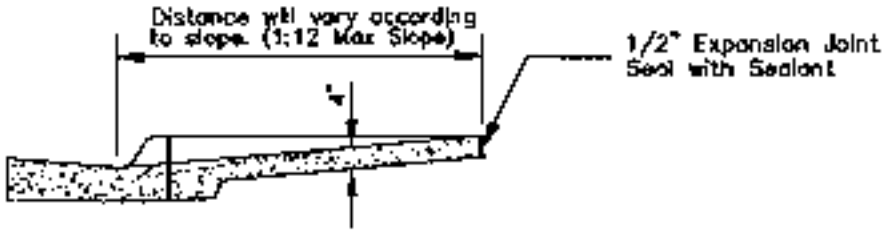
DRAWN BY DDR	CITY OF DODGE CITY, KANSAS CITY HALL ENGINEERING DEPARTMENT (316) 225-8106	PROJECT NO.
CHECKED BY CMC	STANDARD CURB AND GUTTER	SHEET 1 OF 1
DATE FEB.94		REVISIONS MAY 94



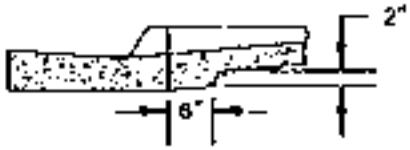
PLAN



SEC. A-A

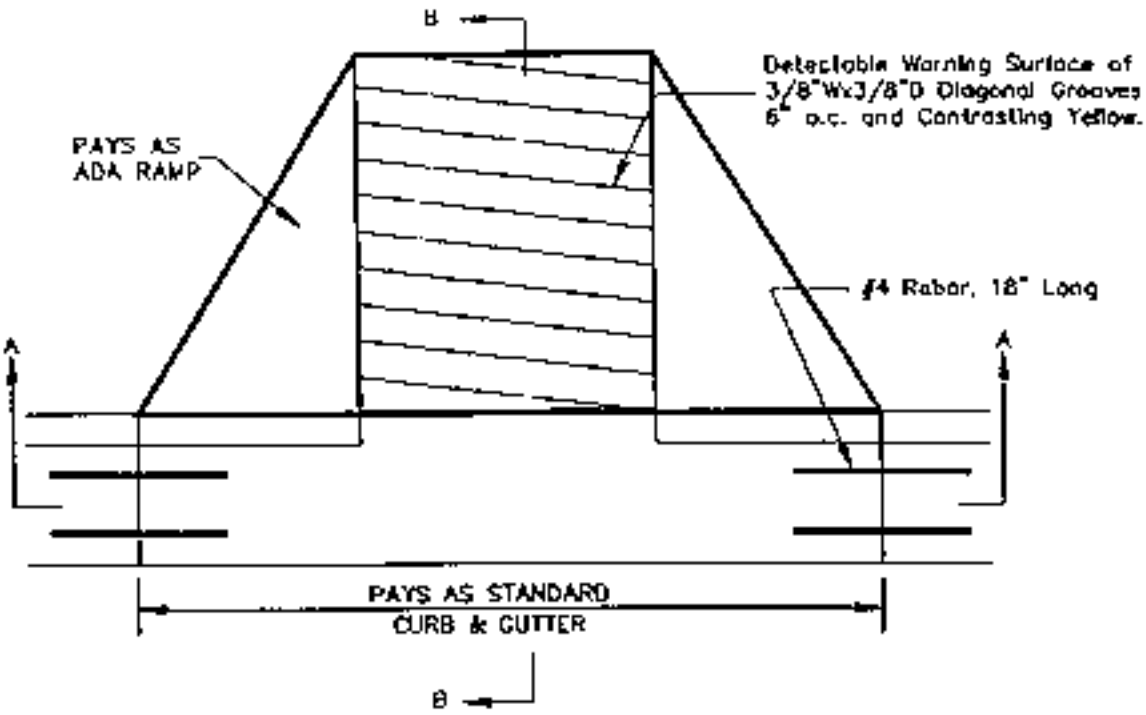


SEC. B-B

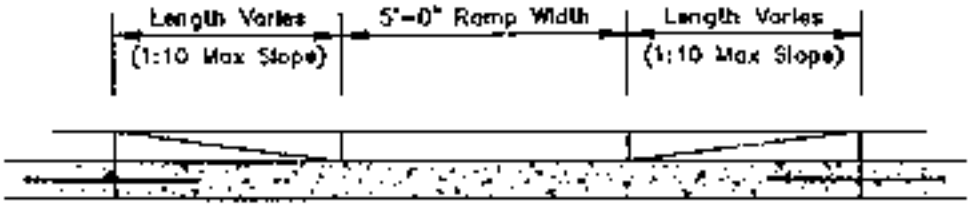


AUXILIARY VIEW SEC. B-B

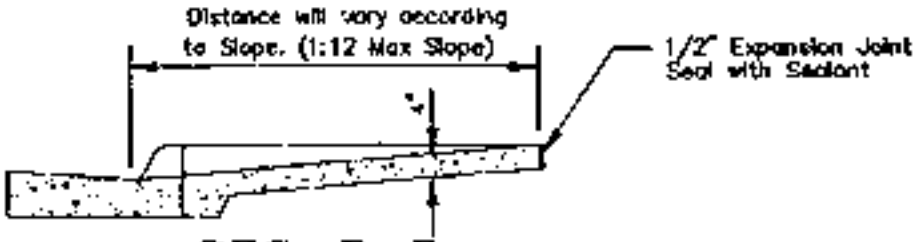
DRAWN BY DDR	CITY OF DODGE CITY, KANSAS CITY HALL ENGINEERING DEPARTMENT (316) 225-8106	PROJECT NO.
CHECKED BY	CURBED A.D.A. RAMP	SHEET 1 OF 1
DATE FEB.94		REVISIONS



PLAN



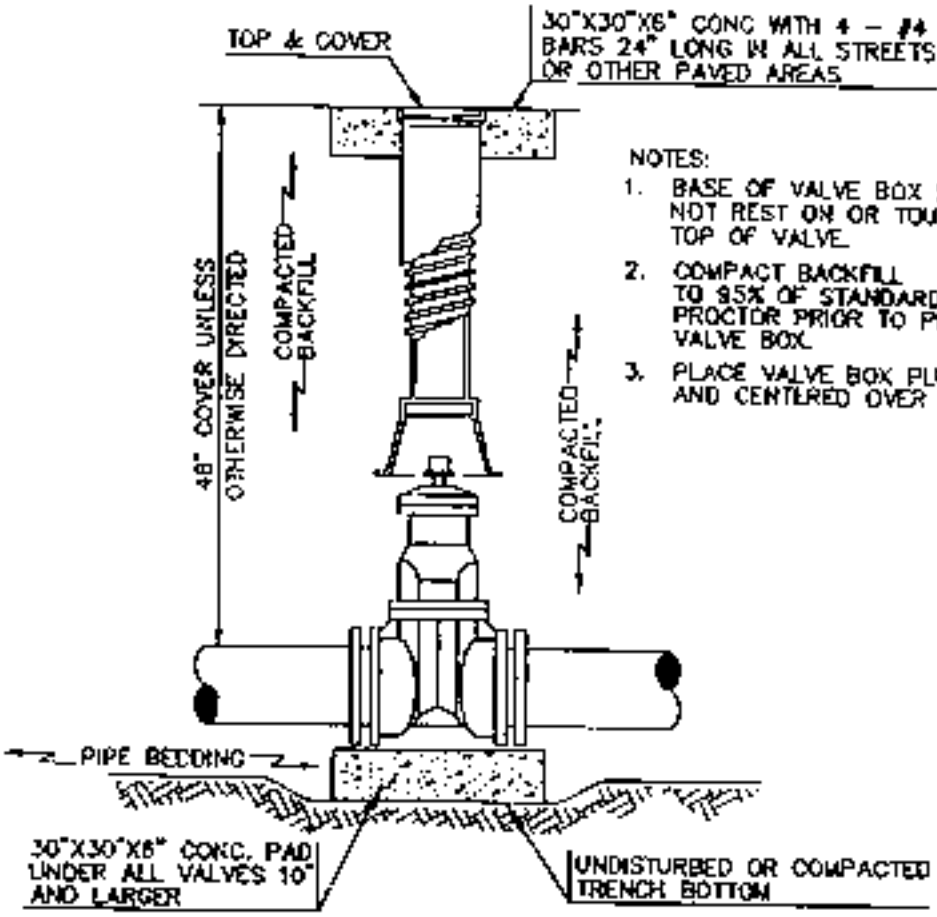
SEC. A-A



SEC. B-B

AUXILIARY VIEW SEC. B-B

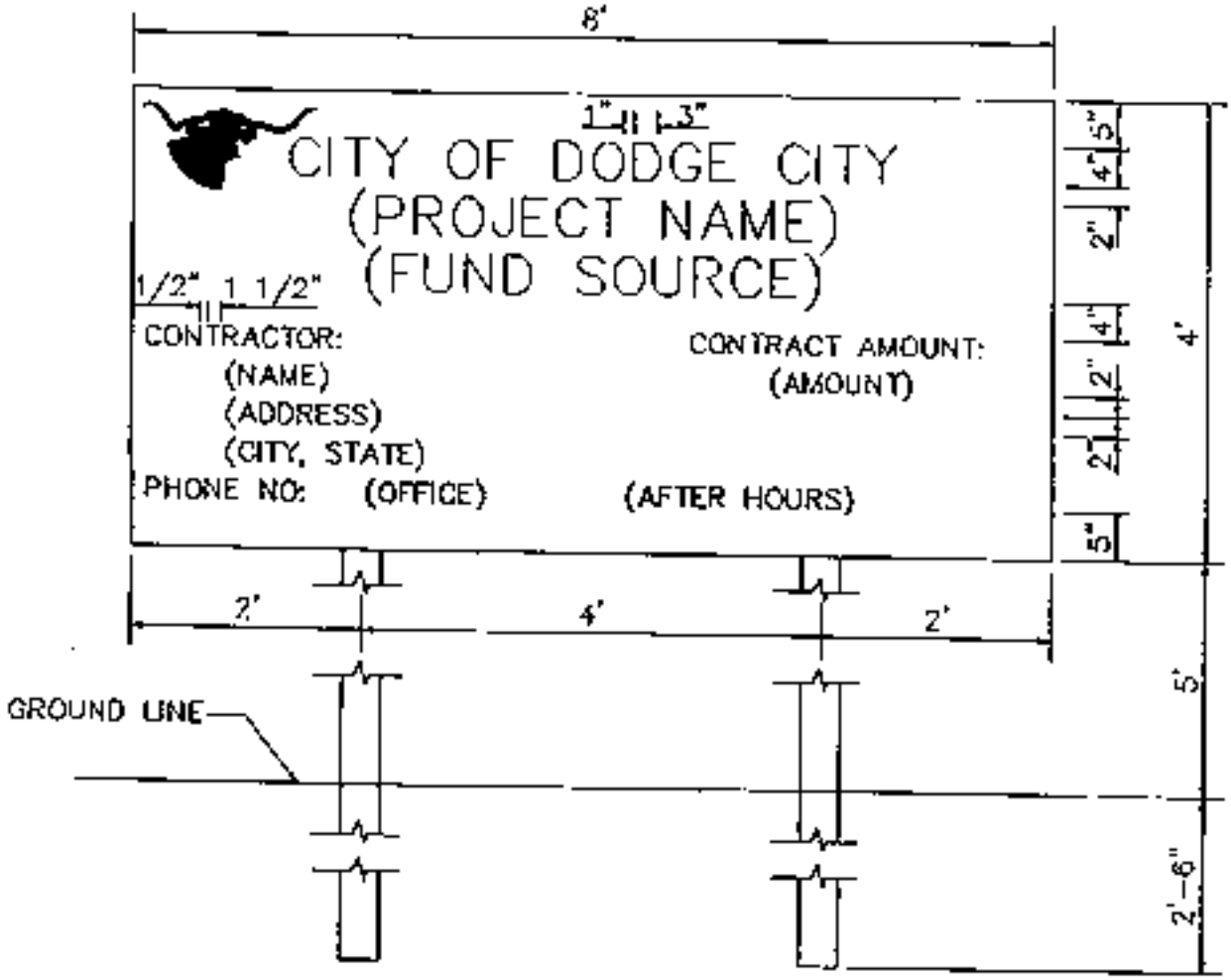
DRAWN BY DDR	CITY OF DODGE CITY, KANSAS CITY HALL ENGINEERING DEPARTMENT (316) 225-8106	PROJECT NO.
CHECKED BY CMC	FLARED A.D.A. RAMP	SHEET 1 OF 1
DATE FEB.94		REVISIONS



NOTES:

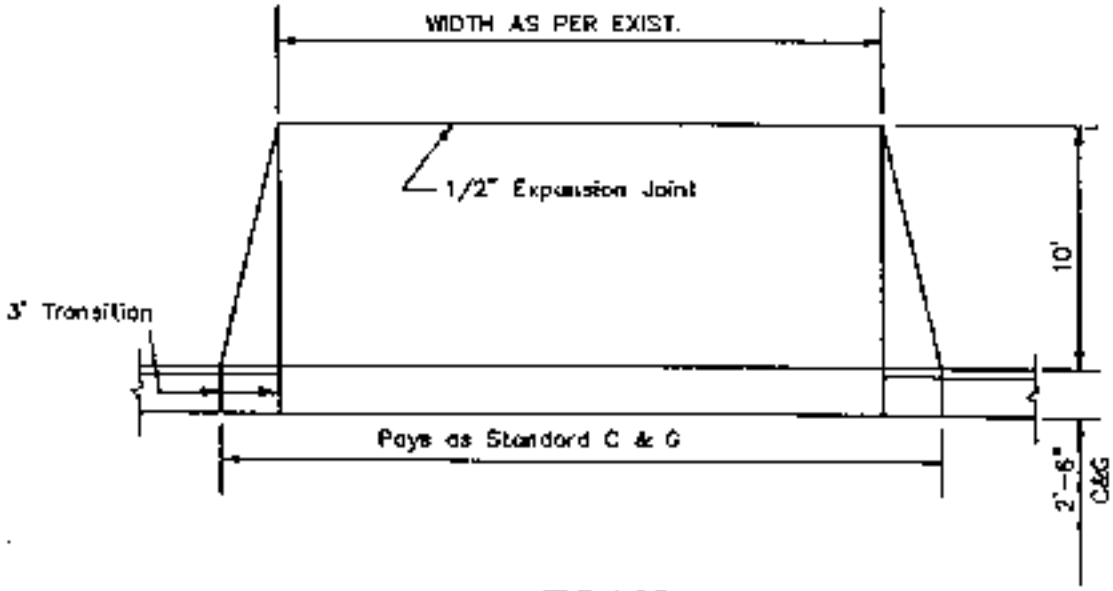
1. BASE OF VALVE BOX SHALL NOT REST ON OR TOUCH TOP OF VALVE.
2. COMPACT BACKFILL TO 95% OF STANDARD PROCTOR PRIOR TO PLACING VALVE BOX.
3. PLACE VALVE BOX PLUMB AND CENTERED OVER VALVE.

DRAWN BY DDR	CITY OF DODGE CITY, KANSAS CITY HALL ENGINEERING DEPARTMENT (316) 225-8106	PROJECT NO.
CHECKED BY CMC	STANDARD WATER VALVE & BOX	SHEET 1 OF 1
DATE MAR.94		REVISIONS

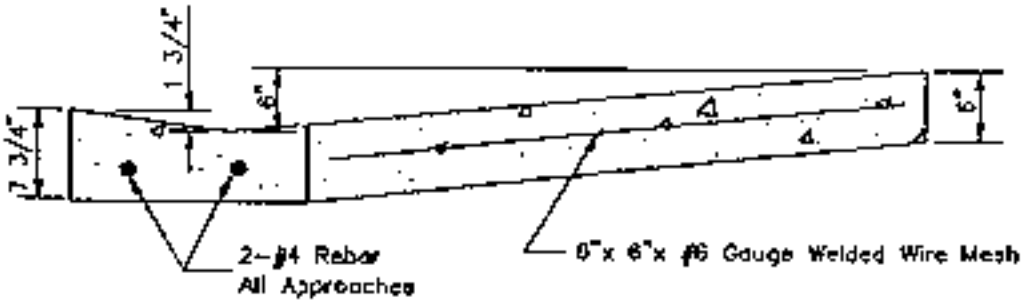


THE CONTRACTOR WILL BE RESPONSIBLE FOR FURNISHING AND INSTALLING THE REQUIRED NUMBER OF PROJECT SIGNS CALLED FOR ON THE PROPOSAL FORM. THE SIGNS SHALL HAVE BLACK PAINTED LETTERS ON A TAN PLYWOOD OR STEEL SHEET BACKGROUND AND WILL BE NEAT AND CLEAN IN APPEARANCE (SEE DETAIL). THE SIGNS WILL BE MADE TO LAST THE DURATION OF THE PROJECT WITHOUT WEATHERING. SHOULD THE SIGNS NOT LAST, THE CONTRACTOR WILL BE REQUIRED TO REPLACE THEM. THE SIGNS WILL BE INSTALLED BY USING TWO STEEL OR WOOD POSTS AT THE LOCATION SELECTED BY THE ENGINEER.

DRAWN BY DDR	CITY OF DODGE CITY, KANSAS CITY HALL ENGINEERING DEPARTMENT (316) 225-8106	PROJECT NO.
CHECKED BY CMC	PROJECT SIGN	SHEET 1 OF 1
DATE JUN.93		REVISIONS

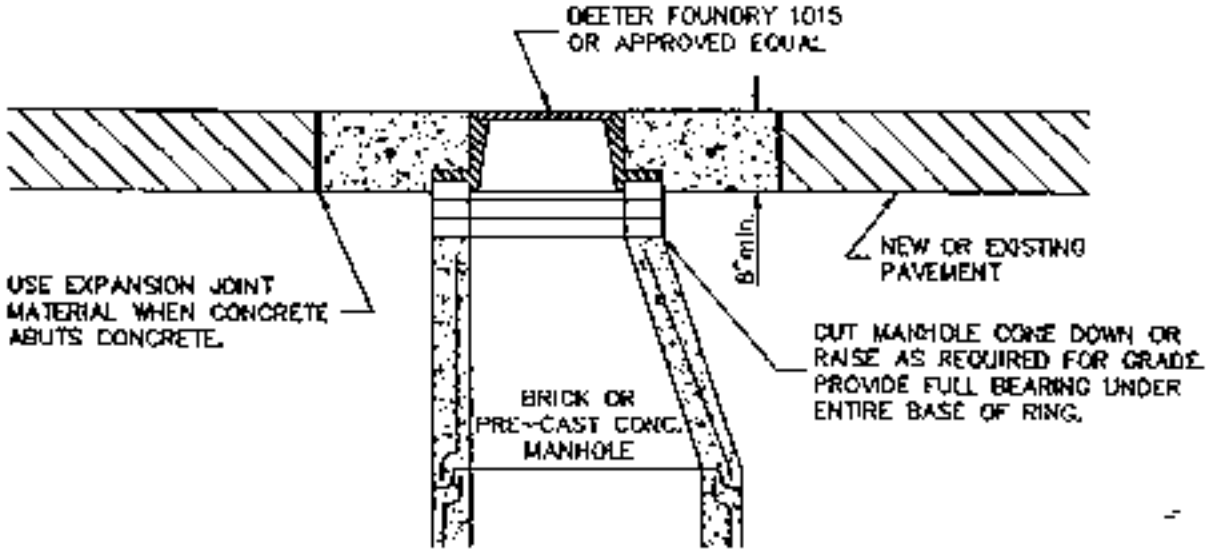


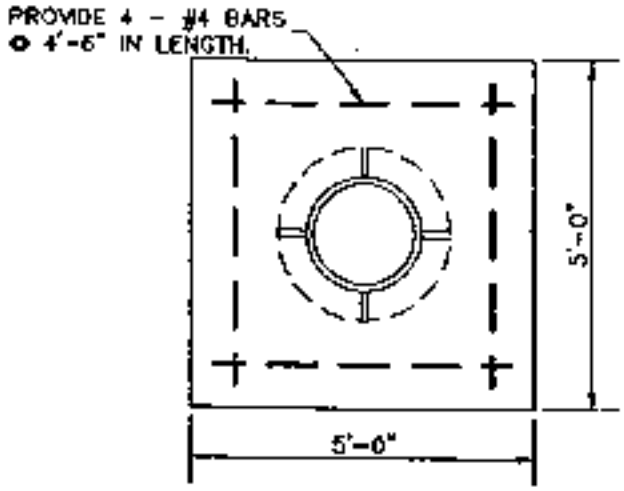
PLAN



SECTION

DRAWN BY DDR	CITY OF DODGE CITY, KANSAS CITY HALL ENGINEERING DEPARTMENT (316) 225-8106	PROJECT NO.
CHECKED BY CMC	STANDARD ALLEY AND DRIVEWAY APPROACH	SHEET 1 OF 1
DATE FEB.94		REVISIONS

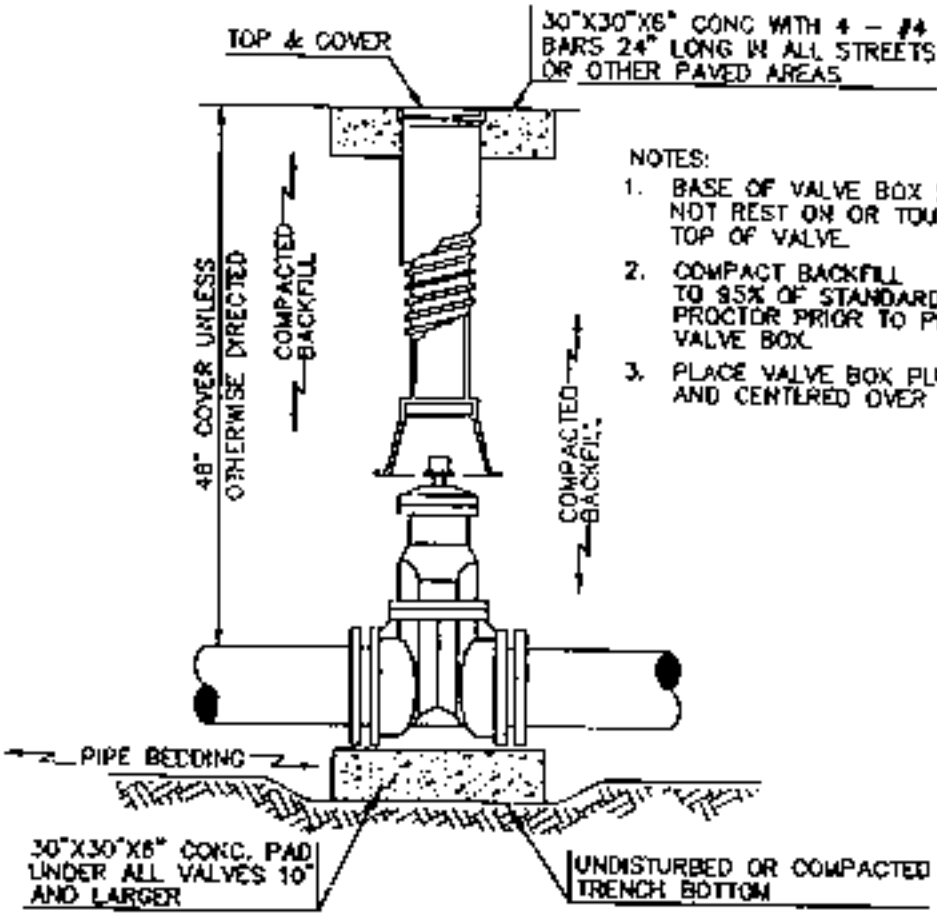




NOTES:

CONCRETE MANHOLE PAD: IN ASPHALTIC PAVEMENT, SAW CUT AND REMOVE 5'x5' SQUARE AFTER NEW PAVEMENT IS CONSTRUCTED.
IN CONCRETE PAVEMENT, BLOCK OUT AND CONSTRUCT MANHOLE PAD SEPARATE FROM PAVEMENT SLAB.

DRAWN BY DDR	CITY OF DODGE CITY, KANSAS CITY HALL ENGINEERING DEPARTMENT (316) 225-8106	PROJECT NO.
CHECKED BY CMC	STANDARD MANHOLE COVER	SHEET 1 OF 1
DATE FEB.94		REVISIONS



NOTES:

1. BASE OF VALVE BOX SHALL NOT REST ON OR TOUCH TOP OF VALVE.
2. COMPACT BACKFILL TO 95% OF STANDARD PROCTOR PRIOR TO PLACING VALVE BOX.
3. PLACE VALVE BOX PLUMB AND CENTERED OVER VALVE.

DRAWN BY DDR	CITY OF DODGE CITY, KANSAS CITY HALL ENGINEERING DEPARTMENT (316) 225-8106	PROJECT NO.
CHECKED BY CMC	STANDARD WATER VALVE & BOX	SHEET 1 OF 1
DATE MAR.94		REVISIONS