CITY OF NEWTON, KANSAS

STANDARD CONSTRUCTION SPECIFICATIONS

FOR

PAVING AND DRAINAGE IMPROVEMENTS

OCTOBER 2017

No.	Revision	Date

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00800 SUPPLEMENTARY CONDITIONS

The following revisions apply to the Standard General Conditions of the Contract for Construction (No. 1910-8, 1996 Edition prepared by Engineers Joint Contract Documents Committee).

Where any article, paragraph, or sub-paragraph of the General Conditions is supplemented by one of the following paragraphs, the provisions of such article, paragraph, or sub-paragraph shall remain in effect, and the supplementary provisions of such shall be considered as added thereto. Where any article is superseded by one of the following paragraphs, the provisions of such article, paragraph or sub-paragraph not so amended, voided or superseded shall remain.

1. ARTICLE 1 - DEFINITIONS - No changes, additions, or amendments.

2. ARTICLE 2 - PRELIMINARY MATTERS

2.02 Copies of Documents: A. - delete the phrase "ten copies" from the first sentence and insert the phrase "six copies" in lieu thereof.

2.05 Before Starting Construction: C. - delete the paragraph in its entirety and substitute the following:

> "C. Evidence of Insurance: Before any work at the site is started, CONTRACTOR shall file certificates of Insurance acceptable to the OWNER with the OWNER which the CONTRACTOR is required to purchase and maintain in accordance with Article 5."

3. ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 Intent: - add the following paragraph:

> "D. Within the Specifications the order of precedence shall be as follows: Addenda, Supplementary General Conditions, Information for Bidders, General Conditions, and Technical Provisions."

4. ARTICLE 4 - AVAILABILITY OF LANDS: SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

4.02 Subsurface and Physical Conditions: A.1 and A.2. - delete these paragraphs in their entirety and substitute the following:

> "1. See Section 01030 - Special Project Procedures."

4.05 Reference Points: - add the following paragraph:

> "B. Surveys to be furnished to the CONTRACTOR by the OWNER will be as specified in Division 1 GENERAL REQUIREMENTS."

5. ARTICLE 5 - BONDS AND INSURANCE

5.01 Performance, Payment and Other Bonds: - add the following sentence to paragraph "B":

"The CONTRACTOR shall furnish a Statutory Bond which is a surety bond, running to the State, conditioned that the CONTRACTOR, as principal, shall pay all indebtedness incurred for labor, supplies, equipment and materials furnished in making the improvements called for by the contract documents."

5.01 Performance, Payment and Other Bonds: - add the following paragraph:

"D. Upon notice of award and prior to execution of the contract, any successful bidder who is not a legal resident of the county in which the work is located shall appoint his process agent in accordance with Section 16113, General Statutes of Kansas, 1949, as amended. The term of appointment of this process agent shall be for the full term of the surety bonds to be furnished by the CONTRACTOR as a part of these contract documents."

5.04 Contractor's Liability Insurance: - add the following paragraph.

"C. The CONTRACTOR shall not commence work under this contract until the insurance required by OWNER is obtained, approved and filed with the OWNER; nor shall the CONTRACTOR allow any subcontractor to commence work until the insurance required of the subcontractor has been obtained, approved and filed with the OWNER. The certified Insurance Policy to be filed by the CONTRACTOR with the OWNER shall provide the following coverages:

1. Comprehensive General Liability covering premises---operations, xcu hazards when applicable, Products/Completed operations, Broad Form Property Damage and Contractual Liability with minimum limits as follows:

Bodily Injury Liability	$1,000,000 Each Occurrence $1,000,000 Each Aggregate
Property Damage Liability	$1,000,000 Each Occurrence $1,000,000 Each Aggregate
Or	
Bodily Injury and Property Damage Liability (Combined Single Limit)	$1,000,000 Each Occurrence $1,000,000 Each Aggregate

2. Automobile Liability-Comprehensive Form including all owned, hired and non-owned vehicles with minimum limits for

Bodily Injury Liability	$1,000,000 Each Accident
Property Damage Liability	$1,000,000 Each Accident
Or	
Bodily Injury and Property Damage Liability (Combined Single Limit)	$1,000,000 Each Accident

3. Workers' Compensation/Employers Liability for minimum limits of

Employers Liability: Statutory

In the Insurance Policy, the Insurance Company must state that the Contractual Liability includes the Liability of the OWNER and ENGINEER assumed by CONTRACTOR in the Contract Documents. The Policy must also state that the OWNER will be given written notice if the policy is cancelled or changed within ten (10) days prior to the effective date thereof.

Said Insurance Policy shall be furnished to the OWNER before the agreement is issued."

5.05 Owner's Liability Insurance: A. - delete the paragraph in its entirety and substitute the following:

"A. CONTRACTOR shall include OWNER and ENGINEER as additional insureds under CONTRACTOR'S general liability policy requirements set forth in Article 5.04 of the General Conditions."

5.06 Property Insurance: A.- delete the first sentence and substitute the following in lieu thereof.

"CONTRACTOR shall purchase and maintain property insurance upon the Work at the site to the full insurable value thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations)."

5.06 Property Insurance: B. and E. - delete these paragraphs in their entirety. No substitution will be made.

5.07 Waiver of Rights: A. - delete the last sentence of the paragraph in its entirety. No substitutions will be made.

5.08 Receipt and Application of Insurance Proceeds: A. and B. - delete these paragraphs in their entirety. No substitutions will be made.

5.09 Acceptance of Bonds and Insurance; Option to Replace: A. - Delete the first sentence and substitute the following in lieu thereof.

"A. If the OWNER has any objections to the coverage afforded by or other provisions of the Bonds or Insurance required to be purchased and maintained by the CONTRACTOR in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the OWNER shall so notify the Contractor in writing within 10 days after receipt of the certificates (or other evidence required) required by Paragraph 2.05.C."

6. ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.10 Taxes: - add the following paragraph

"B. For tax exempt status see Section 01060 Regulatory".

6.11 Use of Site and Other Areas: A. Limitation of Use of Site and Other Areas - add the following paragraph:

"4. During the progress of the work the convenience of the local public and of residents along the work shall be considered and, where possible, their rights of access shall be preserved. Temporary driveways, approaches and crossings shall be provided where practicable and maintained in good condition. Construction materials shall be so stored or stockpiled as to cause as little obstruction as possible and still be readily accessible for use or inspection. No material shall be stored within 2 feet of any tree or building nor within 5 feet of any fire hydrant; fire hydrants shall remain ready for immediate use by the fire department. The CONTRACTOR'S proposed schedule for beginning new sections of the work shall be coordinated with and approved by the ENGINEER. To prevent extended inconvenience to the local residents, the CONTRACTOR will not be permitted to open up extensive areas for work during periods when cold or other weather conditions which would curtail the work are normally expected."

Shop Drawings and Samples: 6.17A and B - The number of copies of shop drawings and samples to be submitted will be six.

7. ARTICLE 7 - OTHER WORK - No changes, additions or amendments.

8. ARTICLE 8 - OWNER'S RESPONSIBILITIES - delete paragraph 8.06.A in its entirety, no substitution will be made.

9. ARTICLE 9 - ENGINEER'S STATUS DURING CONSTRUCTION

9.03 Project Representation: - add the following paragraph:

"B. Exhibit SG-1 - "A LISTING OF THE DUTIES, RESPONSIBILITIES AND LIMITATIONS OF AUTHORITY OF THE RESIDENT PROJECT REPRESENTATIVE" is attached hereto and is a part of these supplemental conditions."

10. ARTICLE 10 - CHANGES IN THE WORK; CLAIMS - No changes, additions, or amendments.

11. ARTICLE 11 - COST OF THE WORK; CASH ALLOWANCES; UNIT PRICE WORK - No changes, additions, or amendments.

12. ARTICLE 12 - CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

Add the following paragraph to 12.01.

"B.4. CONTRACTOR shall not be entitled to a change in the Contract Price, payment, or other compensation at any time due to damages caused by inaccuracy or admission of information referred to in Article 4 of the General Conditions. A claim for an extension of Contract time may be made as provided in Article 12".

13. ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.02 Access To Work: - add the following paragraph.

"B. The ENGINEER and/or OWNER may provide one or more Resident Project Representatives to inspect materials to be used in the work and observe construction methods to determine compliance with the Contract Requirements. The ENGINEER and the Resident Project Representatives shall be provided free access to all parts of the work at the project site and to offsite locations where materials or equipment proposed for use in the work are to be produced or fabricated. Resident Project Representatives shall have the authority to reject defective materials; to delay specific construction operations while the acceptability of materials is being determined, or while equipment or machines are being adjusted or calibrated; and to suspend operations on any part of the work not meeting Contract Requirements. Project Representatives shall have no authority to deviate from or waive the requirements of the specifications without written permission of the ENGINEER. Resident Project Representatives will not perform as Superintendent or Foreman for the CONTRACTOR and neither the presence or absence of the Project Representative on the work shall relieve the CONTRACTOR of his responsibility to perform all work in accordance with the Contract Requirements."

13.03 Tests and Inspections: - Add the following paragraph:

"4. Contractor shall pay for the services of an independent laboratory to perform soil testing, including field density testing and moisture/compaction testing. All costs for this work shall be considered subsidiary to other related items of work."

14. ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.02 Progress Payments: A. Applications for Payment - add the following paragraph:

"4. The Contractor shall submit three (3) copies of each Application for Payment to the Engineer for review."

15. ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION - No changes, additions or amendments.

16. ARTICLE 16 - DISPUTE RESOLUTION - No changes, additions and amendments.

NOTE TO ENGINEER: DELETE IRRELEVANT SECTIONS OF ARTICLE 17 IF NOT APPLICABLE TO JOB.

17. ARTICLE 17 - MISCELLANEOUS - Add the following paragraphs:

Historical And Archeological:

17.11 If during the course of construction evidence of deposits of historical or archeological interest is found, the contractor shall cease operations affecting the find and shall notify the Owner who shall notify the Regional Office of EPA, and Executive Director, Kansas State Historical Society, 120 West 10th, Topeka, Kansas 66612. No further disturbance of the deposits shall ensue until the Contractor has been notified by the Owner that he may proceed. The Owner will issue a notice to proceed only after the state official has surveyed the find and made a determination to EPA and the Owner. Compensation to the Contractor, if any, for lost time or changes in construction to avoid the find, shall be determined in accordance with changed conditions or change order provisions of the specifications.

Contractor's Payment Schedule:

17.12 The Contractors and Subcontractors must provide in writing, within 30 days after initiation of construction, a monthly schedule of estimated payments; these schedules shall be updated any time there is a variation of more than 10 percent in contract price.

18. ARTICLE 18 - DUTIES, RESPONSIBILITIES AND LIMITATIONS OF AUTHORITY OF THE RESIDENT PROJECT REPRESENTATIVE

18.01 General: RPR is ENGINEER's agent at the site, will act as directed by and under the supervision of ENGINEER, and will confer with ENGINEER regarding RPR's actions. RPR's dealings in matters pertaining to the on-site work shall in general be with ENGINEER and CONTRACTOR keeping OWNER advised as necessary. RPR's dealings with subcontractors shall only be through or with the full knowledge and approval of CONTRACTOR, RPR shall generally communicate with OWNER with the knowledge of and under the direction of ENGINEER.

18.02 Duties and Responsibilities of RPR

A. *Schedules*: Review the progress schedule, schedule of Shop Drawing submittals and schedule of values prepared by CONTRACTOR and consultant with ENGINEER concerning acceptability.

B. *Conferences and Meetings*: Attend meetings with CONTRACTOR, such as preconstruction conferences, progress meetings, job conferences and other project-related meetings, and prepare and circulate copies of minutes thereof.

C. *Liaison*:

1. Serve as ENGINEER'S liaison with CONTRACTOR, working principally through CONTRACTOR's superintendent and assist in understanding the intent of the Contract Documents; and assist ENGINEER in serving as OWNER's liaison with CONTRACTOR when CONTRACTOR's operations affect OWNER's on-site operations.

2. Assist in obtaining from OWNER additional details or information, when required for proper execution of the Work.

3. Refer all contacts or inquiries by the general public (any person who does not represent an agency which has jurisdiction over the project) to the Engineer.

D. Shop Drawings and Samples:

1. Record date of receipt of shop Drawings and samples.

2. Receive samples which are furnished at the site by CONTRACTOR, and notify ENGINEER of availability of samples for examination.

3. Advise ENGINEER and CONTRACTOR of the commencement of any Work requiring a shop Drawing or sample if the submittal has not been approved by ENGINEER.

E. *Review of Work, Rejection of Defective Work, Inspections and Tests*:

1. Conduct on-site observations of the Work in progress to assist ENGINEER in determining if the Work is in general proceeding in accordance with the Contract Documents.

2. Report to ENGINEER whenever RPR believes that any Work is unsatisfactory, faulty or defective or does not conform to the Contract Documents, or has been damaged, or does not meet the

requirements of any inspection, test or approval required to be made; and advise ENGINEER of work that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

3. Verify that tests, equipment and systems startups and operating and maintenance training are conducted in the presence of appropriate personnel, and that CONTRACTOR maintains adequate records thereof; and observe, record and report to ENGINEER appropriate details relative to the test procedures and startups.

4. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the results of these inspections and report to ENGINEER.

F. *Interpretation of Contract Documents*: Report to ENGINEER when clarifications and interpretations of the Contract Documents are needed and transmit to CONTRACTOR clarifications and interpretations as issued by ENGINEER.

G. *Modifications*: Consider and evaluate CONTRACTOR's suggestions for modifications in Drawings or Specifications and report with RPR's recommendations to ENGINEER. Transmit to CONTRACTOR decisions as issued by ENGINEER.

H. *Records*:

1. Maintain at the job site orderly files for correspondence, reports of job conferences, Shop Drawings and samples, reproduction of original Contract Documents including all Work Directive Changes, Addenda, Change Orders, Field Orders, additional Drawings issued subsequent to the execution of the Contract, ENGINEER's clarifications and interpretations of the Contract Documents, progress reports, and other Project related documents.

2. Keep a diary or log book, recording CONTRACTOR hours on the job site, weather conditions, data relative to questions of Work Directive Changes, Change Orders or changed conditions, list of job site visitors, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to ENGINEER.

3. Record names, addresses and telephone numbers of all CONTRACTORS, subcontractors and major suppliers of materials and equipment.

I. *Reports*:

1. Furnish ENGINEER periodic reports as required of progress of the Work and of CONTRACTOR's compliance with the progress schedule and schedule of Shop Drawing and sample submittals.

2. Consult with ENGINEER in advance of scheduled major tests, inspections or start of important phases of Work.

3. Draft proposed Change Orders and Work Directive Changes, obtaining backup material from CONTRACTOR and recommend to ENGINEER Change Orders, Work Directive Changes, and Field Orders.

4. Report immediately to ENGINEER and OWNER upon the occurrence of any accident.

J. *Payment Requests*: Review applications for payment with CONTRACTOR for compliance with the established procedure for their submission and forward with recommendations to ENGINEER, noting particularly the relationship of the payment requested to the schedule of values. Work completed and materials and equipment delivered at the site but not incorporated in the Work.

K. *Certificates, Maintenance and Operation Manuals*: During the course of the Work, verify that certificates, maintenance and operation manuals and other data required to be assembled and furnished by CONTRACTOR are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to ENGINEER for review and forwarded to OWNER prior to final payment for the Work.

L. *Completion*:

1 Before ENGINEER issues a Certificate of Substantial Completion, submit to CONTRACTOR a list of observed items requiring completion or correction.

2. Conduct final inspection in the company of ENGINEER, OWNER and CONTRACTOR and prepare a final list of items to be completed or corrected.

3. Observe that all items on final list have been completed or corrected and make recommendations to ENGINEER concerning acceptance.

18.03 Limitations of Authority

A. Resident Project Representative:

1. Shall not authorize any deviation from the contract Documents or substitution of materials or equipment, unless authorized by ENGINEER.

2. Shall not exceed limitations of ENGINEER's authority as set forth in the Contract Documents.

3. Shall not undertake any of the responsibilities of CONTRACTOR, subcontractors or CONTRACTOR's superintendent.

4. Shall not advise on, issue directions regarding or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction unless such advice or directions are specifically required by the Contract Documents.

5. Shall not accept Shop Drawings or sample submittals from anyone other than CONTRACTOR.

7. Shall not authorize OWNER to occupy the Project in whole or in part.

8. Shall not participate in specialized field or laboratory tests or inspections conducted by others except as specifically authorized by ENGINEER.

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010 - SUMMARY OF WORK

1. GENERAL

The work covered by these specifications and drawings shall consist of all materials, transportation costs, equipment, tools, and labor which are required and are related to, or are to be incorporated in this Contract and must be received, unloaded, stored, installed, erected, service connections provided, and coordinated with the construction by the Contractor under this Contract. Installation of equipment and materials shall mean furnishing of all labor and materials as required to place the Improvements in successful operation. The Contractor shall be responsible for all equipment and materials and shall replace at his own expense all such equipment and materials found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all equipment, materials and labor required for the replacement of installed equipment and materials discovered defective prior to the final acceptance of the work. All equipment and materials shall be installed in strict accordance with manufacturer's instructions.

This Contract shall include minor items not specifically mentioned herein but shown on the accompanying plans or obviously necessary to provide a complete job.

The following description, while not intended to cover all details, outlines some items of work to be accomplished under this Contract.

ITEM	DESCRIPTION
1.	
2.	
3.	
4.	

The price named in the Proposal shall include the furnishing of all labor, material, transportation costs, equipment rental, etc. necessary to construct the project as herein specified and as shown on the accompanying plans.

SECTION 01030 - SPECIAL PROJECT PROCEDURES

1. GUARANTY

The Contractor shall guaranty all materials and equipment as specified in Article 13 of the General Conditions Page 00700-19. It shall be the Contractor's responsibility to notify all suppliers of materials and equipment that the guaranty shall extend two years from the date of substantial completion or as specified otherwise.

2. NOTIFICATION

It shall be the Contractor's Responsibility to notify the Owner a minimum of two weeks prior to all construction which requires interfacing with the existing water, sewer, or electrical systems.

Contractor shall notify the City Engineer and all adjacent property Owners and/or tenants a minimum of five (5) days prior to any street closing.

3. DISPOSAL OF WASTE MATERIALS

The Contractor shall have full responsibility for proper disposal of waste materials. They shall be disposed of at an approved Landfill or as otherwise approved in writing by the Engineer.

4. TRAFFIC CONTROL

The Contractor shall protect traffic by the use of proper and necessary flags, lights, signals, barricades or other warning devices as needed, all in accordance with the latest edition of the Manual On Uniform Traffic Control Devices, U.S. Department of Transportation, Federal Highway Administration.

5. UTILITIES

The Contractor will be required to obtain and pay for all utilities used for the project.

6. INSPECTION

No work requiring inspection may be done on city observed holidays or outside of normal working hours of Monday through Friday, 8AM-5PM, without written request 48 hours in advance and approval by the City Engineer.

7. IRRIGATION SYSTEMS

Contractor is responsible for restoration of any disturbed lawn irrigation systems to original condition or better.

8. PROPERTY IRONS

Contractor is responsible for preserving property irons. The contractor shall have a land surveyor, licensed in the State of Kansas, re-establish all property irons which are

disturbed, destroyed, or covered by more than 12” of fill by construction operations. This work shall be considered subsidiary to other contract bid items.

9. SAW CUTTING FOR PAVEMENT REMOVAL

Where saw cutting is indicated for removal of existing pavement, the cut shall be to the full depth of the existing material. Saw cuts shall be considered subsidiary to the various surface items involved.

SECTION 01040 - COORDINATION

1. COOPERATION

The Contractor shall cooperate with the Engineer, the Owner and other contractors in performing the work involved in the entire project. Fairness shall prevail as regards use of access roads, storage space, space for temporary office, utility services, and other facilities. In any arrangement as to the proportion of facilities between contractors, the decision of the Resident Engineer shall be final.

SECTION 01050 - FIELD ENGINEERING

1. SURVEYS

The surveys available to the Contractor have been performed by others for this project.

The Contractor shall re-establish all P.I.'s and Bench Marks. Prior to using any Bench Mark the Contractor shall verify its accuracy.

All other surveys necessary to prosecute the work shall be done by the Contractor with his own surveyors, materials and equipment at his own expense. This will include, but not be limited to, all baseline offset stakes, intermediate elevation hubs, facility or structure offset hubs, batter boards, stringlines, and As-Built dimensions, locations and elevations. No work that requires such surveys are complete and a copy of the field notes are delivered to the Inspector.

No special payment will be made to the contractor for survey work and such work will be considered subsidiary to other related items of work.

SECTION 01060 - REGULATORY

1. PERMITS

All necessary State, City, County, Local and Federal Permits required for construction shall be furnished by the Contractor.

2. CODES

Execute work in compliance with all applicable Federal, State and Municipal laws, codes, ordinances, and local customs regarding the trade to perform the work.

Codes shall govern in case of any direct conflict between codes and plans and specifications; except when plans and specifications require higher standards than those required by code.

3. TAXES

Materials and equipment incorporated this project are exempt from the payment of sales tax under the laws of the State of Kansas and sales tax shall not be included in the bid of the bidders.

Owner will provide the Contractor with a proper exemption certificate within 10 days of the date of the Agreement. Should the Owner fail to provide an exemption certificate number within the required time period, the Contractor will be reimbursed monthly for sales tax amounts for which he becomes liable until such certificate number is provided.

Upon issuance of a proper exemption certificate number to CONTRACTOR, CONTRACTOR shall assume full responsibility for his own proper use of the certificate number, and shall pay all costs of any legally assessed penalties relating to CONTRACTOR's improper use of the exemption certificate number.

SECTION 01100 - ALTERNATIVES

1. SUBSTITUTION OF EQUIPMENT

Whenever a material, article or piece of equipment is identified on the drawings or specifications by reference in brand name or catalog number, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered.

Prior to receiving bids the Contractor may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the Contract Documents by reference to brand name or catalog number, and if, in the opinion of the Engineer, such material, article, or piece of equipment is of equal substance and function to that specified, the Engineer may approve its substitution, and an addendum will be issued naming those additional manufacturer's which will be acceptable to the Engineer. The requests for substitutions must be received 10 days prior to bidding.

After execution of the contract, substitution of equipment of makes other than those specifically named in the contract documents will be approved by the Engineers only if the equipment named in the specifications cannot be delivered to the job in time to complete the work in proper sequence to work of other Contractors, due to conditions beyond control of the Contractor.

Requests for substitutions must be accompanied by documentary proof of equality and difference in price and delivery, if any, in form of certified quotations from suppliers of both specified and proposed equipment.

The Owner shall receive all benefits of the difference in cost involved in any substitution, and the contract altered by change order to credit Owner with any savings so obtained.

SECTION 01150 - MEASUREMENT AND PAYMENT

1. GENERAL

The total bid price for each section of the contract shall cover all work shown on the contract drawings and required by the specifications and other contract documents. All costs in connection with the work, including furnishing of all materials, equipment, supplies, and appurtenances; providing all construction plant, equipment, and tools; and performing of all necessary labor to fully complete the work, shall be included in the unit and lump sum prices named in the Proposal. No item that is required by the Contract Documents for the proper and successful completion of the work will be paid for outside of or in addition to the prices submitted in the Proposal. All work not specifically set forth as a pay item in the Proposal shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices named in the Proposal.

All incidental, subsidiary and miscellaneous items of work essential to completion of the project in a satisfactory manner shall be done at no additional cost to the Owner. Some, but not all, of the items that shall be considered incidental or subsidiary are as follows:

a. The support, protection and maintenance of existing utilities such as power and telephone poles, sanitary sewers, manholes, storm drains, and other such items that are to be maintained in place, before, during, and after construction of the proposed improvements.
b. Traffic control.
c. Acquisition of additional working space.
d. Construction Staking.
e. Other items as noted in these specifications or on the plans.

The method of measurement and basis of payment for each item as listed in the Proposal shall be as stipulated in the following paragraphs.

2. ASPHALTIC CONCRETE PAVEMENT (BITUMINOUS BASE)

These items shall be paid for at the contract unit price bid per square yard for the thickness(es) shown. The limits of the areas to be paid for are as shown on the plans. Other limits will be measured only as directed by the Engineer. Unit price bid shall be full compensation for all bituminous materials, including tack; aggregates; mixing; hauling; spreading; compacting; sampling; sample testing; and for furnishing all other material, equipment, tools, labor and incidentals necessary to complete the individual item of work.

3. COMBINED CURB & GUTTER

Concrete Combined Curb & Gutter shall be paid for at the contract unit price bid per lineal foot for the various types shown in the plans. Plan quantity is calculated along the face of curb; including length across drive entrances, storm drain inlets, flumes, and curb depressions; but excluding length across valley gutters. The unit price bid shall be full compensation for all concrete and concrete placement, finishing, jointing, curing, backfilling, and for all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

4. CRUSHED ROCK BASE

This item shall be paid for at the unit price bid per square yard. The limits of the area to be paid for are as shown on the plans. Other limits will be measured only as directed by the Engineer. The price bid shall be considered full compensation for furnishing all material, including fabric reinforcement where required; for completing all preparation, hauling, placement, and compaction, and for all labor, equipment, tools, and other incidentals necessary to complete the work.

5. UNCLASSIFIED EXCAVATION

Unclassified Excavation shall be paid for at the contract unit price bid per cubic yard on the quantity as shown in the plans. The price bid shall be full compensation for excavation of all material encountered, stripping, hauling, wasting, and for the furnishing of all labor, tools, equipment and incidentals necessary to complete the work. The price bid shall also include the compaction of all fill material as directed by the plans and elsewhere in these specifications. Materials which are unsuitable for use as fill shall be wasted at locations as shown on the plans or as directed by the Engineer.

6. STORM SEWER AND CULVERT PIPE

Pipe shall be paid for on a linear foot basis as measured from the inside face of structure walls, or to the end of the full barrel portion of pipes which do not terminate at a structure. The contract unit price bid shall be full compensation for excavation, placing of pipe and backfill, etc. End sections shall be paid per each, including installation.

7. STORM SEWER STRUCTURES

These structures shall be measured and paid for at the contract unit price bid per each, complete in place. Measurement of curb inlet shall be in addition to and not in lieu of measurement of Combined Curb and Gutter at inlet locations. The unit price bid for each type of structure shall be full compensation for all excavation, compaction and backfill; concrete and concrete placement; reinforcing steel; finishing and curing; and for furnishing all other material, equipment, tools, labor, and incidentals necessary to complete the work including connection of the inlet to the curb and gutter.

8. TEMPORARY & PERMANENT PROJECT SEEDING

These items shall be paid for at the contract unit price bid per acre. The price bid shall be full compensation for furnishing seed, mulch, and water; ground preparation; application of seed and mulch as required by the plans and specifications; watering as required in these specifications; and for all tools, labor, and incidentals necessary to complete the work.

9. SITE PREPARATION AND RESTORATION

Site Preparation and Restoration shall be paid for at the Contract lump sum price bid and, unless noted otherwise in the plans, shall be full compensation for clearing, grubbing of shrubs, trimming of trees and plant where permitted; removal of trees; removal and replacement of fences, culverts, and signs; removal of debris, placement of safety fencing, and temporary fencing, barricades and flashers, clean-up, and seeding or sodding of all disturbed areas in kind. Removal, repair, and replacement of damaged pavements and travelways for removal and replacement shown in the drawings shall be considered subsidiary to site preparation and restoration. The price bid shall cover all incidental items affected by the work including furnishing all material, equipment, tools, energy and labor necessary to complete the work.

10. SEDIMENT AND EROSION CONTROL

Sediment and Erosion Control shall be paid for at the lump sum price bid, which shall be full compensation for furnishing, installing, and maintaining all erosion control items necessary to meet the requirements of the Sediment and Erosion Control Details in the plans. Said price shall include inspecting, cleaning, and rebuilding erosion control items as needed, and all materials, labor, equipment, tools, and incidentals necessary to establish and maintain a working system of erosion control throughout construction.

11. LIGHT STONE RIPRAP

Light Stone Riprap shall be paid for at the contract unit price bid per square yard to the limits shown on the plans or as directed by the Engineer. Said price bid shall include furnishing, hauling and placing the material as specified, including filter course and/or filter fabric as shown in the plans; and all labor and equipment necessary to complete the work.

12. 6" REINFORCED CONCRETE VALLEY GUTTER PAVEMENT

Concrete valley gutter shall be paid for at the contract unit price bid per square yard. The limits of the area to be measured are shown on the plans. Payment shall be full compensation for all costs of excavating, removing, and disposing of excess and waste materials; construction of bituminous base if required; forming; furnishing, placing, finishing, and curing concrete; furnishing and placing reinforcing steel; aggregates; mixing; hauling; spreading; compacting; sampling; sample testing; and for furnishing all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

13. MONOLITHIC EDGE CURB

Monolithic Edge Curb shall be measured and paid for at the contract unit price bid per linear foot, in place. Measurement will be made along the face of curb. The unit price bid shall be full compensation for all concrete and concrete placement, finishing, jointing and joint sealing, curing, backfilling, and for furnishing all other materials, equipment, tools, labor and incidentals necessary to complete the work.

14. SUBGRADE MANIPULATION

Subgrade Manipulation shall be paid for at the unit price bid per square yard. The price bid shall be considered as full compensation for completing all preparation and for all excavation, hauling, mixing, compaction, and curing of the lime and soil mixture; and or all labor, equipment tools, and other incidentals necessary to complete the work. Water for subgrade mixing and lime hydration shall be subsidiary to the price bid for manipulation.

15. PEBBLE OR HYDRATED LIME

Pebble or Hydrated lime (as shown on the plans) shall be paid for at the contract unit price bid per tone for the quantity shown on the plans. The unit price bid shall be considered full compensation for furnishing, hauling, and placing the lime, and for all equipment, tools, labor and incidentals necessary to complete the work.

16. SIDEWALK CONCRETE (4”)

This item shall be measured and paid for at the contract unit price bid per actual square foot, in place. The limits of the areas to be measured and paid for are as shown on the plans. Payment shall be full compensation for all costs of forming, furnishing, placing, finishing, and curing concrete; furnishing and placing reinforcing steel; aggregates; missing; hauling; spreading; compacting; sampling; sample testing; jointing; and for furnishing all other materials, equipment, tools, labor, and incidentals necessary to complete the work. Wheelchair ramps shall be paid per each ramp constructed and the area of such ramps shall not be included in the measured quantity of sidewalk pavement.

17. CONCRETE PAVEMENT

Concrete pavement shall be paid for at the contract unit price bid per square yard. The limits of the areas to be paid for are as shown on the plans. Payment shall be full compensation for all costs of excavating, removing, and disposing of excess and waste materials; construction of bituminous base if required; forming; furnishing, placing, finishing, and curing concrete; furnishing and placing reinforcing steel; aggregates; mixing; hauling; spreading; compacting; sampling; sample testing; and for furnishing all other materials, equipment, tools, labor, and incidentals necessary to complete the work.

18. CONCRETE OR ASPHALT PAVEMENT REMOVED

This item shall be paid for at the contract unit price bid per square yard for the area shown on the plans. Removal of adjacent curb and gutter, where required, is included in the area shown on the plans and shall not be measured or paid for separately. Payment shall be full compensation for removal and disposal of the specified pavement type, including saw cuts; and for furnishing all equipment, tools, labor and incidentals necessary to complete the work.

19. ADJUSTMENT OF MANHOLES

This item shall be paid for at the contract unit price bid per each manhole. Payment shall be considered full compensation for furnishing and installing adjusting rings; removing and replacing field caps; mastic; testing (when required by the Engineer); and for furnishing all equipment, tools, labor and incidentals necessary to complete the work.

20. PAVEMENT MARKING

Pavement markings of the various types shown on the plans shall be paid for at the contract unit price per each or per lineal foot as indicated in the summary table. This price shall be full compensation for all layouts required, surface preparation, furnishing and properly placing all materials, and for all labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 01300 - SUBMITTALS

1. CONSTRUCTION SCHEDULE

The Contractor shall submit his proposed progress schedule for the Engineer's approval within 10 days after the effective date of the Notice To Proceed. The Contractor's progress schedule, when approved by the Engineer, shall be used to establish major construction operations and to check on progress of the work. The Contractor shall provide sufficient materials, equipment and labor to assure completion of the work in accordance with the approved schedule.

The Contractor shall review the construction phasing or sequencing requirements noted on the plans when preparing the construction schedule. Any deviation from the phasing or sequencing requirements shall be noted and an alternative submitted in writing to the Engineer for approval.

If the Contractor's progress falls significantly behind the approved schedule, the Contractor shall, upon the Engineer's request, submit a revised schedule for completion of the work within the contract time and modify his operations to provide such additional materials, equipment and labor necessary to meet the revised schedule. Should the prosecution of the work be discontinued for any reason the Contractor shall notify the Engineer at least 24 hours in advance of resuming operations.

2. SUBMITTALS

a. The Contractor shall within 15 days after award of contract start sending submittals for approval. The Contractor shall prepare or have prepared in a neat and workmanlike manner, submittal drawings and shop details for all equipment and materials furnished under this Contract. The submittals shall contain the following:

(1) Six sets of identical submittal data separately stapled with Engineer's submittal form as a cover sheet.

(2) Where catalog cuts are used mark them to indicate equipment, capacities, controls, fittings, valves, sizes, etc.

(3) Reference each item to applicable specification paragraph number and plan sheet number. Reference items not appearing in base specification to applicable alternate numbers, change order numbers, letters of authorization, etc.

(4) Shop drawings:

(a) All shop drawings shall be checked and signed by the contractor prior to submittal to the Engineer.

(b) Shop drawings submitted without contractor's signature or approval and verification will not be approved.

SECTION 01510 - TEMPORARY UTILITIES

1. GENERAL

The Contractor shall furnish and pay for all compressed air, electricity, gas, telephone and potable water service required at the project site. Water necessary for earthwork compaction or other construction operations shall be furnished and paid for by the Contractor. The utilities are as scheduled on the drawings.

2. TEMPORARY SANITARY FACILITIES

The Contractor shall furnish and pay for temporary toilet facilities for use by his employees. Facilities shall be serviced regularly and maintained so as to not constitute a nuisance or health hazard.

SECTION 01700 - CONTRACT CLOSEOUT

1. CLEANING

The Contractor shall remove all debris and thoroughly clean the project prior to final inspection.

All salvaged materials shall be delivered to their respective owner(s) unless otherwise noted on the plans.

DIVISION 2 - SITEWORK

SECTION 02001 - GENERAL

1. SCOPE OF WORK

The work covered under this Section shall include clearing and grubbing; all excavation required for construction of roads, streets, drives, and parking areas; formation of embankments, fills, and backfills; demolition, dewatering, excavation for culverts, storm drains, sanitary sewers, water lines, manholes, drainage structures, channels, and ditches; subgrade preparation, area and finish grading; hauling, placing, watering and compacting; disposal of surplus and waste materials; utilities; and all miscellaneous and incidental operations necessary to construct and complete the work in compliance with the dimensions, lines and grades as shown on the plans.

2. OBSTRUCTIONS

The Contractor shall work around all utilities, structures, fences, trees, shrubs, pavement, and other items shown to remain within the work site, easements, and rights-of-way, unless he determines removal, resetting, replacement, or adjustments will be required to accomplish the work. The Contractor shall bear all costs for the removal, resetting, replacement, and/or adjustment or repair of those items affected as directed by the Engineer, at no additional cost to the Owner.

3. CLEANUP

Upon completion of construction the Contractor shall remove all debris resulting from construction. All spoil banks shall be leveled and excess material disposed of as specified in Section 02200, for Type B Compaction. The entire area involved in this contract shall be left in a clean and sightly condition.

4. DISPOSAL OF WASTE MATERIALS

Materials obtained from demolition of the existing facilities, sewer lines, manholes, concrete rubble, concrete encasement excavation, existing fence, trees, shall be removed from the project site and disposed of at the County Landfill or as directed by the Engineer. Material containing vegetation stripped from the site shall be stockpiled during construction and spread for topsoiling of grassed areas after the site grading is completed. Excess soil shall be wasted on site or at other approved sites and placed in accordance with Type B compaction requirements.

5. IRRIGATION SYSTEMS

Contractor shall be responsible for restoration of any and all disturbed sprinkler systems to original condition or better. This work shall be subsidiary to “Site Preparation and Restoration”.

SECTION 02100 - SITE PREPARATION

1. STRIPPING

The Contractor shall strip all vegetation and other objectionable material from all areas of original ground on which pavement, concrete slabs, fill or footings are to be placed. Where shown on plans, the strippings shall be deposited at approved locations on the site, but shall not be used for backfilling trenches, or structures. No direct payment will be made for stripping.

2. DISPOSAL OF SURPLUS MATERIALS

All material from stripping and all excess excavation or trenching material not required for filling or backfilling shall be wasted at the jobsite, as shown in the plans or as directed by the Engineer.

SECTION 02200 - EARTHWORK

1. GENERAL

1.1 Related Documents: General Conditions and Supplementary Conditions apply to this Section.

1.1.1 Related Work Specified Elsewhere Are Titled:

(1) "Excavation, Trenching and Backfilling for Utilities"; Section 02206.

(2) “Manholes”; Section 02601.

(3) "Earthwork – Streets”; Section 02201.

(4) “Lime Treated Subgrade”; Section 02512.

(5) “Reinforced Crushed Rock Base”; Section 02514.

(6) “Concrete Pavement”; Section 02522.

(7) “Asphaltic Concrete”; Section 02513.

1.2 Description: Upon completion of the backfilling of trenches and placing fill around structures, the entire site of the work included in this Contract shall be graded to form smooth, uniform slopes around structures. All the remaining area included in this Contract shall be graded to the elevations shown on the Plans to provide adequate drainage away from the structures and to present a neat and workmanlike appearance.

1.3 Quality Assurance: Equipment: Type approved prior to use, for capability of equipment to perform work in an acceptable manner. Compact using tamping rollers, pneumatic tired rollers, three-wheeled power rollers or other type equipment.

1.4 Compaction Control: Contractor shall, at his expense, make field density tests to assure correct moisture content and compaction.

2. MATERIALS

2.1 Satisfactory Materials: All suitable material taken from excavations shall be used in the formation of embankments, subgrade, and backfill to complete the site grading as indicated on the plans or as directed by the Engineer. All unsuitable excavated materials together with all debris, junk, stones, logs, stumps, roots, and other unsuitable materials shall be removed from the site and disposed of by, and at the expense of, the Contractor.

Satisfactory and unsatisfactory materials will be determined by the engineer.

2.2 Topsoil: If quantity of topsoil is not available on site and additional topsoil is required, provide approved crumbly surface soil having characteristics of soils in vicinity that produce heavy growth of vegetation.

3. EXECUTION

3.1 Conservation Of Topsoil: In cut areas, and in areas under proposed paving, walks, structures and/or buildings, remove topsoil without contamination with subsoil. Spread topsoil in areas prepared for topsoil, or when directed stockpile in locations convenient to areas to receive topsoil later. Strip to depth of 6-inches and keep free of roots, stones or other undesirable materials.

3.2 Excavation: General: Excavate to lines and grades indicated. If unsatisfactory material is encountered, stop work and notify Engineer of condition. Unsatisfactory material directed to be removed, other than that specifically indicated to be removed in this contract, will be made in accordance with a change order. Use satisfactory excavated material for fills. Remove unsatisfactory material and surplus excavated material not required for fill and dispose of off site, unless specified otherwise.

3.2.1 Under Proposed Walks: Excavate to subgrade elevations.

3.2.2 For excavation under proposed buildings, paving, utilities, sewers and subdrains see the section noted in Paragraph 1.1.

3.2.3 Classification of Excavation: Unclassified regardless of nature of material encountered.

3.2.4 Protection or Removal of Utility Lines: Protect from damage existing utility lines, etc., shown on the drawings or in locations made known to Contractor prior to excavation and to be retained, as well as utility lines constructed during excavation operations; if damaged, repair at Contractor's expense. Existing utility lines not shown on drawings and existing utility lines in locations not known by Contractor, if damaged, shall be repaired and restored to service at Contractor's expense. When utility lines to be removed are encountered, notify Engineer in ample time for necessary measures to be taken to prevent interruption of service.

3.3 Preparation Of Ground Surfaces For Fill: Strip or remove unsatisfactory material within area upon which fill will be placed. Scarify to depth of 9" and compact to required density at a moisture content of at least optimum.

3.4 Fills and Embankments: Construct at locations and to lines and grades indicated; conform to shape of typical section indicated. Provide and haul in approved material for fill, if material is not available from excavated areas. Fill material shall be satisfactory materials, reasonably free of roots, and other organic material and trash, and from stones greater than 6 inches maximum diameter. Frozen materials are not acceptable for fill. Stones over 3" maximum diameter not acceptable in upper six inches in fills or embankments. Place material in successive horizontal layers of 6" to 9" in loose depth. Compact each layer to required density.

3.5 Backfill Adjacent To Structures: Place and compact uniformly in manner to prevent wedging action or eccentric loading upon or against structures. During backfilling and in forming embankments, do not use equipment that will overload structure in compacting fills. Additional requirements for backfilling for pavements, buildings, sewers and utilities are specified in related sections.

3.6 Compaction Of Earthwork

3.6.1 General: This item shall consist of the compaction of earthwork by rolling or tamping, or any combination of these methods in accordance with the method and/or type and at the location indicated on the plans or ordered by the Engineer.

3.6.2 Standard Density Tests: This test is designed to determine the moisture content at which maximum compaction is obtained, and to determine the density (dry weight per unit volume) which is obtained at the moisture content and the test will be made as described in the latest edition of ASTM D698.

3.6.3 Moisture Content Requirement: When sufficient moisture does not exist in the soil or earth material to provide thorough bonding under rolling, a sufficient amount of water shall be added to the soil before it is rolled or tamped to insure bonding during the compaction process. Moisture control shall be one of the following types as depicted on the plans.

3.6.3.1 Moisture Range 03 (MR 0-3). The moisture content of the soil shall be uniform and shall not be higher than three (3) percentage points above optimum nor lower than optimum of the soil involved. If the soil is unstable at this moisture range, the moisture shall be lowered to the point it is stable as determined by the Field Engineer.

3.6.3.2 Moisture Range 90 (MR-90). The moisture content of the soil shall be uniform and shall be such that the soil can be compacted to the requirements of the type of compaction designated on the plans or ordered by the Engineer.

If Type B compaction is specified with this moisture control, the moisture content shall be sufficient to produce a uniform mixture of the soil and moisture. It will be determined by visual inspection that satisfactory compaction and moisture content is obtained.

The water may be added to the material as it is placed in the embankment, or to the cut area and borrow pits. When it is added to the embankment it shall be thoroughly and uniformly mixed with the material before compaction. The mixing shall be accomplished by the use of spring tooth harrows, disc harrows, disc plows or other equipment, or by other methods approved by the Engineer. When water is added to cut areas or borrow pits, the surface of the areas shall be plowed or otherwise roughened or shaped to permit more rapid penetration of the water and to prevent undue loss of the water.

3.6.4 Compaction Requirements: Compaction requirements are separated into types, depending upon the nature of the soil to be compacted and the degree of compaction desired. The method of attaining the compaction for each of the several types shall be as herein described.

The Design Engineer shall make compaction studies of each type of soil to determine the Standard Density for the soil and the minimum moisture content at which each type of soil may be compacted.

3.6.4.1 Type AA The Contractor shall carefully level up each successive lift or layer and shall make a sufficient number of trips with the roller over the entire surface to insure that all soils are uniformly compacted to a density equal to or greater than ninety-five (95) percent of the Standard Density for each soil in conformance with the latest edition of ASTM-D-698. Each successive lift shall contain only that amount of soil material which will insure sufficient and uniform compaction, but in no instance shall any lift or layer exceed six (6) inches of compacted depth.

3.6.4.2 Type B The Contractor shall carefully level up each successive lift or layer and shall make a sufficient number of trips with tamping or sheepsfoot type rollers over the entire surface to insure that all soils are uniformly compacted. Compaction shall be continued until the roller feet ride the surface of the compacted lift. Compaction will be considered as adequate when additional trips do not result in additional compaction or in bringing the roller feet closer to the surface of the lift. Each successive lift shall contain only that amount of material which will insure efficient and uniform compaction, but in no instance shall any lift or layer exceed six (6) inches of compacted depth.

If, due to the sandy material that may be encountered, or due to the high moisture content that may be encountered with some of the soils, the roller will not "build up" so that the tamping feet will ride the surface, or the roller continues to pick up excessive amounts of soil due to excessive moisture content to the soil, the sheepsfoot roller may be discontinued and a pneumatic tired roller used, with the permission of the Engineer. When pneumatic tired rollers, meeting the requirements as set out above or as approved by the Engineer are used, each lift shall be rolled not less than ten (10) trips over its entire surface and not more than fifteen (15) trips will be required.

3.6.5 Tamping Adjacent to Structures: Whenever embankments are placed adjacent to structures or at locations where it is not practical to use a roller, the embankment materials shall be tamped by the use of mechanical rammers or tampers. Each layer shall be compacted to a density equal to or greater than that obtained under the above rolling procedure for the type of compaction designated. Each successive lift shall contain only that amount of material which will insure proper compaction, but in no instance shall any layer be greater than six (6) inches of compacted depth. When the quantity of work is small, a hand tamper may be used with the permission of the Engineer.

4. BORROW

4.1 General: If there is insufficient material from the excavations to build the embankments and fills required, the Contractor shall borrow the additional fill material required. The Engineer will designate the area from which the borrow material is to be secured and the depth to which the cut will be permitted.

4.2 Dressing of Borrow Pits: Upon completion of work, borrow pits shall be dressed, graded, and sides trimmed to uniform slopes and left in a condition which will present a neat appearance, minimize soil erosion and standing water, and permit accurate measurement.

5. SETTLEMENT

The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within one year after final completion of the contract under which the work was performed.

The Contractor shall make, or cause to be made, all repairs or replacement made necessary by settlement, within 48 hours after notice from the Engineer or Owner.

6. DRAINAGE

6.1 Drainage in Vicinity of Structures: The Contractor shall control the grading in the vicinity of structures and trenches so that the ground surface is properly pitched to prevent water from running into the excavated areas. Water which has accumulated in the excavation through the failure of the Contractor to take proper precautions to prevent such accumulation, shall be removed by the Contractor at his own expense, and the subgrade shall be restored to its proper bearing capacity.

7. TOPSOILING

7.1 Location: Apply topsoil to areas of project other than areas to receive structures, buildings, walks, gravel strips and pavings. Coordinate with landscape drawings and specifications.

7.2 Preparation: Excavate cut areas 4" below finish elevation and scarify and compact to required density. Leave fill areas down 4" below finish elevations.

7.3 Installation: Place and compact to 90% of Standard Proctor Density to a thickness after compaction of 4". Finish to elevations called for on the drawings and to a smoothness suitable for seeding, sprigging or planting as called for on landscape drawings.

7.4 Protection: Protect newly graded areas from traffic and erosion. Repair areas of settlement or washing away that may occur and reestablish grades to required density, elevations and slopes.

SECTION 02201 - EARTHWORK - STREETS

1. GENERAL

The work covered under this Section shall include clearing and grubbing; all excavation required for construction of roads, streets, drives, and parking areas; formation of embankments, fills, and backfills; excavation for culverts, storm drains, manholes, drainage structures, channels, and ditches; subgrade preparation, area and finish grading; hauling, placing, watering and compacting; disposal of surplus and waste materials; and all miscellaneous and incidental operations necessary to construct and complete the work in compliance with the dimensions, lines, and grades as shown on the plans.

1.1 Related Documents: General Conditions and Supplementary Conditions apply to this Section.

1.1.1 Related Work Specified Elsewhere Are Titled:

(1) "Excavation, Trenching and Backfilling for Utilities"; Section 02206.

(2) “Manholes”; Section 02601.

(3) "Earthwork – Streets”; Section 02201.

(4) “Lime Treated Subgrade”; Section 02512.

(5) “Reinforced Crushed Rock Base”; Section 02514.

(6) “Concrete Pavement”; Section 02522.

(7) “Asphaltic Concrete”; Section 02513.

2. WATER

Water can be obtained from any source such as wells, streams, ponds, lakes, waterlines, etc., provided that the Contractor shall obtain all permits and withstand all costs for obtaining and transporting the water to the work site.

3. CLEARING AND GRUBBING

This item shall consist of clearing and/or grubbing, including the disposal of materials, for all areas within the limits designated on the plans or as required by the Engineer.

Clearing and grubbing shall consist of clearing the surface of the original ground of the designated areas, areas to be excavated, or areas to receive embankment of all trees, stumps, down timber, logs, snags, brush, undergrowth, hedges, grass, weeds, fences,

debris, and rubbish of any nature to a minimum depth of two feet below grade or subgrade, and the disposal from the project site of all spoil materials resulting from clearing and grubbing operations.

The manner and location of disposal of materials shall be subject to applicable laws and ordinances and to the approval of the Engineer. When the Contractor is required to locate a disposal area outside the limits of the project site, he shall obtain and file with the Engineer, permission in writing from the property owner for the use of his property for this purpose.

4. REMOVAL OF EXISTING STRUCTURES

This item shall consist of the removal and satisfactory disposal of such portions of existing structures as provided in the plans and specifications or ordered by the Engineer.

Where pipe culverts, or other items with a salvage value are removed, reasonable care shall be exercised in their removal.

All such salvageable items shall remain the property of the Owner, and shall be stored on the project site at locations approved by the Engineer.

All material which is not considered of value by the Engineer shall be disposed of under the same provisions as listed for clearing and grubbing.

5. EXCAVATION FOR STREETS

This work shall consist of excavating the project proper, removing and satisfactorily disposing of all materials taken from within the limits of the work, also such excavation as is necessary for inlet and outlet ditches, channels, shaping and sloping of embankments, excavation for combined curb and gutter, street, alley, and driveway returns and pavement, strictly to the required alignment, grade and cross sections as shown on the plans.

5.1 Classification of Excavation. All material excavated shall be defined as "Unclassified Excavation".

5.2 Construction Methods. All suitable materials removed from the excavation shall be used, as far as practicable, in the formation of the embankment, subgrade, and at such other places as directed by the Engineer.

During construction, the roadbed shall be maintained in such condition that it will be well drained at all times. Unsuitable roadbed material encountered in cuts shall be excavated to the lateral limits and depth indicated on the plans or specified by the Engineer. The material removed shall be replaced with suitable embankment material, or with special backfill when so indicated on the plans or in the specifications.

5.3 Construction Requirements. The subgrade shall be excavated or filled until it is, after proper compacting, at such an elevation that the pavement or surfacing, when constructed as shown on the plans, will conform to the established grade and cross section.

Included in earth excavation shall be all incidental work such as stripping, plowing, scarifying, refilling, shaping, trimming, watering, compacting, resetting valves, boxes, and all preliminary work required to make the site ready for pavement or surfacing construction.

When the plans do not indicate use of a Subgrade Treatment, the Subgrade for the pavement or surfacing shall be scarified to a depth of eight (8) inches, and worked free of clods by disking and blading to insure a uniform depth of compacted material.

After scarifying, disking, and blading is completed, the entire area shall be compacted as specified hereinafter and a final rolling by means of a pneumatic roller or a smooth steel roller. Pneumatic-tired rollers shall be loaded to provide a gross weight of at least two hundred and twenty-five (225) pounds per inch of width of tire tread. Smooth steel rollers shall weigh not less than two hundred and fifty (250) pounds per inch of roller length. An approved type of subgrade planer shall be used in forming the subbase in lieu of the smooth rolling specified above.

Any irregularities or depressions that develop under rolling shall be corrected by loosening the material at these locations and adding, removing, or replacing material and re-rolling until the proper cross section and density are obtained. Any portion of the area which is not accessible to a roller shall be compacted to the required density by approved mechanical tampers.

In those areas that are to receive pavement or surfacing, the top of the subgrade shall be of such smoothness that, when tested with a 10-foot straightedge applied parallel and at right angles to the centerline, it shall not show any deviation in excess of 3/8 inch or shall not be more than 0.05 foot from true grade as established by grade hubs or pins. The Contractor shall protect the subgrade from damage and keep it effectively drained until surfacing material is placed thereon. In the event of ruts or erosion the subgrade shall be reshaped, refilled, and rerolled as directed by the Engineer.

All surplus excavated material shall be used to uniformly widen embankments, backfill behind curbs, flatten slopes, or shall be deposited in such locations as the Engineer may direct.

6. EMBANKMENTS

This item shall consist of the construction of embankments, including preparation of the areas upon which they are to be placed, in accordance with the specifications and to the lines, grades, and sections shown on the plans or as ordered by the Engineer.

6.1 Construction Requirements. Immediately prior to the placing of the fill materials, the entire area upon which the embankment is to be compacted to Type B or better, except where limited by rock, shall be scarified and broken by means of a disc harrow or plow, or other approved equipment, to a depth of 6 inches. Scarifying shall be done approximately parallel to the axis of the fill.

Embankments requiring compaction shall be constructed in accordance with the following item on "Compaction of Earthwork". Material to be wasted shall be placed in uniform, horizontal layers not exceeding twelve inches in thickness over the full width of the embankment. Each layer shall be bladed until it is level and uniform before the succeeding layer is placed.

The quantity and quality of equipment in use on the project and the amount of blading and rolling performed shall be sufficient to process the amount of material being delivered to the embankment area. The Engineer shall have the authority to require the suspension of embankment operations at any time until the previously delivered materials are properly placed.

During construction of the embankment, the Contractor shall route his equipment, both when loaded and when empty, over the layers as they are placed and shall distribute the travel evenly over the entire width of the embankment. Starting layers shall be placed in the deepest portion of the fill. Haul road locations from borrow pits shall be routed as approved by the Engineer.

Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material.

No payment will be made separately or directly for haul on any part of the work. All hauling will be considered a necessary and incidental part of the work and its cost shall be considered by the Contractor and included in the contract unit price for the pay items involved.

6.2 Topsoil. When topsoil is specified or required, it shall be salvaged from stripping or other grading operations. If at the time of excavation or stripping the topsoil cannot be placed in its proper and final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall not be placed on areas which will subsequently require excavation or embankment.

Upon completion of grading operations, topsoil shall be placed as directed by the Engineer.

No direct payment will be made for topsoiling. The quantity removed and placed or stockpiled shall be paid for at the contract unit price for "Unclassified Excavation". No additional payment shall be made for re-handling of stockpiled topsoil.

7. COMPACTION OF EARTHWORK

This item shall consist of the compaction of earthwork by rolling or tamping, or any combination of these methods, in accordance with the plans and specifications or at the direction of the Engineer.

7.1 Construction Requirements. The provisions of "Embankments" shall apply to the construction of embankments that are to be compacted, to subgrade compaction except where subgrade stabilization is specified, and to backfill when specified as compacted backfill.

7.1.1 Tamping or Sheepsfoot Rollers - These rollers shall consist of metal rollers, drums, or shells surmounted by metal studs with tamping feet projecting at least 6-1/2 inches from the drum surface. The weight of tamping rollers shall be such that, when fully loaded, the load on each tamper foot shall be not less than two hundred (200) pounds per square inch of cross-sectional area. The load per tamper foot will be determined by dividing the total weight of the roller (loaded) by the number of tamping feet in one (1) row parallel to the axis of the roller.

Multiple-wheel pneumatic-tired rollers shall be constructed so that they can be loaded to a gross weight of at least two hundred twenty-five (225) pounds per inch of width of tire tread. The internal pressure of the tires shall be at least forty-five (45) pounds per square inch and the tires on the front and rear axles shall be staggered so that they will cover the entire area over which the roller travels.

7.1.2 Formation of Compacted Embankments - Embankments shall be formed of satisfactory materials placed in successive horizontal layers of not more than 8 inches in loose depth for the full width of the cross section and shall be compacted as specified before the next layer is placed.

7.1.3 Moisture Requirements - The material in the layers shall be of the proper moisture content before rolling to obtain the desired compaction. Wetting or drying of the material and manipulation when necessary to secure a uniform moisture content throughout the layer shall be required. The addition of water, when required, shall be as the layer is placed on the embankment or prewatered at the source when permitted by the Engineer. Mixing shall be accomplished by the use of spring tooth harrows, disc harrows, disc plows or other approved equipment.

The moisture content of the soil at the time of compaction shall be uniform and within + 3 percentage points of optimum moisture for the soil involved, except for Type B.

The moisture content of the soil being compacted to Type B specification shall be considered too high to insure compaction when, after repeated rollings with a sheepsfoot roller, the roller continues to pick up excessive amounts of soil and refuses to "build up" so that the tamping feet eventually ride the compacted surface. When

other types of rollers are used, the moisture content of the soil shall be considered excessive when "bridging" or "building up" of the soil occurs in front of or behind the rear wheels of such rollers, and/or when earth hauling equipment produces ruts in the rolled surface.

Material containing excess water shall be dried by mechanical means or permitted to dry naturally to a moisture content which will allow satisfactory compaction.

7.1.4 Compaction Requirements - Compaction requirements are separated into types, depending upon the nature of soil to be compacted and the degree of compaction desired. Unless otherwise indicated on the plans or in the specifications, the minimum compaction shall be Type B as listed below.

Types of Compaction:

Type AA - Compacted density of the soil shall be equal to or greater than ninety-five (95) percent of Standard Proctor Density at optimum moisture as per ASTM D-698 and the latest revisions thereof.

Type A - Compacted density of the soil shall be equal to or greater than ninety (90) percent of Standard Proctor Density at optimum moisture as per ASTM D-698 and the latest revisions thereof.

Type B - The Contractor shall carefully level up each successive lift or layer and shall make a sufficient number of trips with tamping or sheepsfoot rollers over the entire surface to insure that all soils in the lift are uniformly compacted. Compaction shall continue until the roller feet "ride out" on the surface of the compacted lift. Compaction shall be considered as adequate when additional trips do not result in additional compaction or in bringing the roller feet closer to the surface of the lift. Each successive lift shall contain only that amount of material which will insure the required uniform compaction, but in no instance shall any lift exceed six (6) inches of compacted depth.

If, due to the sandy material that may be encountered, or due to the high moisture content that may be encountered with some soils, the roller will not "ride out" on the surface, or the roller continues to pick up excessive amounts of soil, the Contractor may discontinue the use of the sheepsfoot roller and, after obtaining permission from the Engineer, use a pneumatic tired roller for such portions of the work as necessary. When pneumatic tired rollers meeting the requirements listed above are used, each lift shall be rolled not less than ten trips over its entire surface and not more than fifteen trips will be required.

7.1.5 Tamping - Whenever embankments are placed adjacent to structures or at locations where it is not practical to use a roller and compacted backfill, the embankment and backfill materials shall be tamped by mechanical tampers having a tamping face not exceeding one hundred fifty (150) square inches in area. Each layer

shall be compacted to a density equal to or greater than that obtained under the above rolling procedure for the type of compaction designated. Each successive lift shall contain only that amount of material which will insure proper compaction, but in no instance shall any layer be greater than 6 inches compacted depth.

8. EXCAVATION AND BACKFILLING FOR STRUCTURES AND PIPE

This item shall consist of all excavation and backfilling for structures including manholes, inlets, storm sewers, and culvert pipe; and shall include all the necessary clearing and grubbing, bailing, drainage, pumping, sheeting, shoring and bracing and construction of cofferdams or cribs, and their subsequent removal. The disposal of all unwanted or excess excavated material is also included under this item of work.

See also Section 02721 - "Storm Sewerage Systems".

8.1 Excavation. All excavation for structures and pipe shall be "Unclassified".

The Contractor shall install shoring required for the safety of personnel and protection of the Engineer during the prescribed excavation and trenching.

Temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his own expense.

Where ground water is encountered in excavating or trenching, the Contractor shall remove or lower the ground water by means of well point systems, sheeting and pumping, or other approved methods which will permit preparation of a satisfactory pipe bed or structural subgrade, free from running water. No additional or separate payment will be made for wet excavating or trenching.

8.1.1 Excavation For Structures. The excavation for structures shall be excavated according to the outlines of the footings as shown on the plans and shall be of sufficient size to permit the placing of the full width and length of the footings including the forms. Rounded or undercut corners and edges of footings will not be permitted.

The excavation shall be carried to the elevation shown on the plans or as established by the Engineer.

Suitable and practically watertight cofferdams shall be used whenever water-bearing strata are encountered above the elevation of the bottom of the excavation. They shall be sufficiently large to give easy access to all parts of the foundation form.

Cofferdams shall be sunk to a depth well below the bottom of the excavation or to an elevation as near the bottom of the excavation as foundation conditions will permit; shall be substantially braced in all directions, and of such construction as will permit them to be pumped free of water. Unless otherwise shown on the plans or agreed upon, cofferdams and all sheeting or bracing shall be removed after the completion of the concrete or masonry.

8.1.2 Excavating and Forming Bed for Pipe. The trench shall be excavated to the depth and grade shown on the plans or established by the Engineer. The trench shall be of sufficient width at the top of the pipe, when placed, to permit thorough tamping of the backfill under the haunches and around the pipe, but in no case shall the trench width be less than one foot greater than the external diameter of the pipe with the sides of the trench as nearly vertical as practicable.

All trenching shall be done with a ladder wheel machine (commonly referred to as a trenching machine) or a backhoe. The use of other type machines for trenching will be permitted only by written permission of the Engineer and then only when unusual trenching conditions are encountered. All excavated material not required for fill or backfill shall be removed and wasted as directed by the Engineer. The excavated material shall be laid compactly along the trench and kept trim so as to be of least inconvenience to the public and adjoining tenants. The Contractor shall not obstruct any drainage courses with excavated material.

In excavating, the bottom of the trench shall be so shaped to a template that at least ten percent (10%) of the overall height of the pipe will be in contact with the bottom of the trench as excavated. Recesses shall be excavated to receive bells, or other parts which extend below the outside perimeter of the pipe.

Where a firm foundation is not encountered at the established grade due to soft, spongy, or other unstable soil, all such unstable material under the pipe and for a width equal to the width of the trench shall be removed and replaced with gravel conforming to ASTM C33 size No. 67, properly compacted and of the thickness as required by the Engineer to provide adequate support for the pipe.

When specific details for pipe bedding are shown on the plans they shall control the construction requirements. Specification provisions not in conflict are considered complimentary and shall be complied with in addition to the details provided.

8.2 Backfilling. Structures, culverts and sewers shall be backfilled in accordance with the following requirements. Only approved materials that will produce a dense, well compacted backfill shall be used for backfilling. Materials such as sod, frozen soil, debris, and soil that contains a large amount of organic matter shall not be used. When

permitted by the Engineer, compacted sand may be used in lieu of earth for compacted backfill except for the top two feet. Water shall be drained from the areas to be backfilled. If, in the opinion of the Engineer, it is not practicable to drain the areas to be backfilled, the backfill areas shall be dewatered by means of bailing or pumping.

No backfilling shall be placed against any structure until permission is given by the Engineer.

The backfill material shall be deposited on both sides of all structures and sewers at approximately the same elevation and the same time. Special care shall be taken to prevent any wedging action against the structure, or lateral displacement of the pipe.

The material shall be placed in layers and compacted by means of mechanical tampers or hand tampers. Each layer shall be compacted to a minimum density equal to or greater than that of the surrounding undisturbed soil and the top two feet shall be compacted to meet the requirements of Type II Compaction. Each successive layer shall contain only the amount of material that is required for proper compaction, but in no case shall any layer be greater than four (4) inches compacted depth. The moisture content of the soil shall be sufficiently near optimum to insure the required density.

The compaction of the earthwork around any structure shall be carried to the grade as shown on the plans or set by the Engineer. Catch basins, manholes, inlets, sewers, and miscellaneous structures shall be backfilled in accordance with the methods outlined above, except that compaction of the backfill will not be required where structures are outside the roadway right-of-way or any other traveled way. Sewers outside the roadway shall be compacted to the springline of the pipe and the remaining trench backfilled as approved by the Engineer.

When specific details for backfilling in trenches for pipe or culverts, or around structures are shown on the plans they shall control the construction requirements. Specification Provisions not in conflict are considered complimentary and shall be complied with in addition to details provided.

8.3 Settlement. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within one year after final completion of the contract under which the work was performed, as defined in the General Conditions.

The Contractor shall make, or cause to be made, all repairs or replacement made necessary by settlement, within 48 hours after notice from the Engineer.

SECTION 02206 - EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES

1. GENERAL

1.1 Related Documents: General Conditions and Supplementary Conditions apply to this Section.

1.1.1 Related Work Specified Elsewhere Are Titled:

(1) "Excavation, Trenching and Backfilling for Utilities"; Section 02206.

(2) “Manholes”; Section 02601.

(3) "Earthwork – Streets”; Section 02201.

(4) “Lime Treated Subgrade”; Section 02512.

(5) “Reinforced Crushed Rock Base”; Section 02514.

(6) “Concrete Pavement”; Section 02522.

(7) “Asphaltic Concrete”; Section 02513.

1.2 Description: This Section includes Trenching and Backfilling for Site Utilities from 5 feet outside building lines to the connection with City utilities and/or for City utilities within City or Public Easements. Also included in this Section is the excavation and backfilling for incidental utility structures.

1.3 Quality Assurance: Equipment: Type approved prior to use, for capability of equipment to perform work in an acceptable manner. Compact using vibrating plates, tamping rollers, pneumatic tired rollers, three-wheeled power rollers or other type equipment.

1.4 Compaction Control: Contractor shall at his expense, make field density tests to assure correct moisture content and compaction.

2. MATERIALS

2.1 Satisfactory Materials:

2.1.1 Pipe Bedding Material:

2.1.1.1 Granular Bedding Material shall be an approved material consisting of a durable crushed rock conforming with the requirements of the latest revision of ASTM C-33 Size No. 67 (3/4" to No. 4); to be placed in not more than 6" layers and compacted by slicing with a shovel or vibrating. Soundness, abrasion, and absorption limits shall be as required for coarse aggregates in Section 03010-Concrete Work.

2.1.1.2 Sand-Gravel Bedding Material - sand-gravel mix meeting Type UD-1 of the 1990 Kansas Standard Specifications for State Road and Bridge Construction.

2.1.1.3 Compacted Embedment shall be an approved sand material free from debris, organic material, and stones with 100% passing thru 3/4" sieve to be placed in uniform layers not more than 6" thick and compacted to 95 percent maximum density as determined by ASTM D698. Granular Bedding Material may be substituted for all or part of Compact Embedment Materials.

2.1.2 Trench Zone Material:

2.1.2.1 Compacted Granular Backfill material shall be an approved sand material free from debris, organic material and stones with 100% passing the 3/4" sieve and not more than 15% passing a No. 200 sieve; to be jetted and mechanically vibrated into place and compacted to 95% density as determined by ASTM D698.

2.1.2.2 Uncompacted Earth Backfill material may be natural soil free from large clods or stones, brush, roots more than 2 inches in diameter, debris, and junk. Flooding with water shall be provided as directed by the Engineer.

2.1.2.3 Compacted Earth Backfill shall consist of material existing prior to trenching or selected material as directed by the Engineer, and shall be compacted to 90% density as determined by ASTM D698. For backfilling at grade beneath existing streets or proposed streets see paragraph 3.3.5. For backfilling at grade under graveled streets see Paragraph 3.3.6.

2.2 Satisfactory and unsatisfactory bedding and trench backfilling materials will be determined by the (soils) engineer.

2.3 Topsoil: If quantity of topsoil is not available on site and additional topsoil is called for, provide approved crumbly surface soil having characteristics of soils in vicinity that produce heavy growth of vegetation.

3. EXECUTION

3.1 Structure Excavation And Backfilling: General: The Contractor shall perform all excavation to the dimensions and elevations indicated on the drawings for all structures and all incidental work thereto. After the completion of excavation, and prior to commencement of foundation footings, floor or slab construction, the excavation will be inspected and approved by the Engineer to insure that suitable subgrade has been reached. Care shall be taken not to excavate below the depths indicated on the drawings. Where the excavation is made below the elevation indicated on the drawings through the fault of the Contractor, the excavation shall be restored to the proper elevation in accordance with the procedure described below for backfill, or the heights of the walls or footings shall be increased, at the expense of the Contractor. Excavation shall extend a sufficient distance from walls and footings to allow for forms, for installation of services and for inspection, except where concrete for walls and footings is authorized to be deposited directly against excavated surfaces.

3.1.1 Drainage in Vicinity of Structures: The Contractor shall control the grading in the vicinity of structures and trenches so that the ground surface is properly pitched to prevent water from running into the excavated areas. Water which has accumulated in the excavation through the failure of the Contractor to take proper precautions to prevent such accumulation, shall be removed by the Contractor at his own expense, and the subgrade shall be restored to its proper bearing capacity.

3.1.2 Shoring: The Contractor shall do all shoring required for safety of personnel and protection of the Engineer in performing the prescribed excavation and trenching. Shoring and bracing near structures shall remain, when directed by the Engineer.

3.1.3 Pipes Under Concrete Floors: All pipes under concrete floors shall be tested before the trenches are backfilled. After testing the pipe lines, the trenches shall be backfilled with sand and compacted to a density equal to that of the adjacent earth.

3.1.4 Backfill Around Structures: After completion of foundation footings and walls and other construction below the elevation of the final grades, all forms shall be removed and the excavation cleaned of all trash and debris prior to backfilling. Material for backfilling shall consist of that excavated, or approved borrow, and shall be free of trash, lumber, or other debris. Backfill shall be placed in 6 inch layers properly moistened to approximate optimum requirements. Each layer shall be compacted by hand, machine tampers, or other suitable equipment, to a density equal to that of the adjoining earth.

3.1.5 Wet Excavation: Where ground water is encountered in excavating or trenching, the Contractor shall remove or lower the ground water by means of well point systems, sheeting and pumping, or other approved methods which will permit preparation of a satisfactory pipe bed or structural subgrade, free from running water. No additional or separate payment will be made for wet excavating or trenching.

3.2 Trenching, Backfilling And Compacting: Classification of Excavated Materials: No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof.

3.2.1 Trenching Through Earth: The Contractor shall perform all trench excavation of every description and of whatever substances encountered, to the depth shown on the plans or as directed by the Engineer. All trenching shall be done with a ladder wheel machine (commonly referred to as trenching machines) or a backhoe. The use of other type machines for trenching will be permitted only by written permission of the Engineer and then only when unusual trenching conditions are encountered. All excavated material not required for fill or backfill shall be removed and wasted as indicated on the plans, or removed and wasted as directed by the Engineer. The excavated material shall be laid compactly along the trench and kept trim so as to be of least inconvenience to the public and adjoining tenants. The Contractor shall not obstruct any drainage courses with excavated material.

Trenches shall be not less than 12 inches nor more than 18 inches wider than the outside diameter of the pipe to be laid therein. Excavation for manholes and other accessories shall have 12 inches minimum and 24 inches maximum clearance on all sides.

The Contractor shall excavate the trench to a minimum of four inches below the pipe barrel for placement of embedment material in the bedding zone in accordance with paragraph Pipe Zone Backfilling. Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

The ground adjacent to all excavation shall be graded to provide drainage away from the work. The Contractor shall remove by pumping or other means approved by the Engineer, any water accumulated in or encountered in the excavation, as specified under Wet Excavation.

The banks of trenches shall be kept as nearly vertical as possible, and shall be properly shored and braced. Shoring and sheet bracing near structures shall remain, as directed by the Engineer. Any deviation from vertical trench walls must be requested in writing from the Engineer.

Temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his own expense.

3.2.2 Trenching Through Rock: Whenever rock is encountered in the trench or elsewhere in any excavation required to be made, the rock shall be excavated to a minimum depth of six (6) inches below bottom of the barrel of the pipe for placement of embedment material in the bedding zone in accordance with paragraph Pipe Zone Backfilling. Special care shall be taken to insure that the bells do not rest on rock.

Rock shall not be drilled and blasted with explosives, unless permitted by the Engineer.

3.2.3 Trenching Through Pavement: All concrete or bituminous pavement or stabilized base encountered in the line of trenching shall be removed and replaced in a neat line. The pavement replaced shall conform in type and quality to the pavement removed, and shall be one and one third (1-1/3) times the thickness of the original pavement. The existing pavement shall be cut vertically and horizontally to a straight line.

The original cut in the pavement shall be of the same width as the trench to be excavated. After backfilling and tamping as hereinafter specified, the pavement cut shall be widened to give the new pavement base twelve (12) inches bearing on solid, undisturbed ground on each side of the trench. In the case of concrete pavement, the pavement replaced shall be reinforced with one-half (1/2) inch round bars spaced twelve (12) inches both ways, or equivalent mesh reinforcement.

Whenever the edge of the cut through concrete pavement is within five (5) feet of a joint parallel with the cut, then the pavement shall be removed to the joint and replaced as above.

The provisions of the paragraph "Trenching Through Earth" shall also apply to "Trenching Through Pavement" wherever applicable.

3.2.4 Trenching Through Graveled Surfacing: The Contractor shall carefully remove the existing gravel surfacing material over the area to be disturbed, and conserve the material free from admixture with other materials. After the gravel has been removed and the trenching performed as specified under the paragraph "Trenching Through Earth," and backfilled as hereinafter specified, the gravel surfacing material shall be replaced to a depth at least equal to the undisturbed gravel surfacing. If the gravel taken from the disturbed area has been allowed to become mixed with other material, it shall not be re-used but shall be replaced with approved clean gravel.

3.2.5 Temporary Trench Crossing: Temporary bridges or crossings over the trench shall be built and maintained by the Contractor where required to maintain traffic.

3.3 Backfilling: After the pipe joints are set and approved, backfilling shall be carefully performed and the surface brought to existing grade or to the elevations shown on the plans. Backfilling of open trenches shall be completed prior to the close of each days' work.

3.3.1 Pipe Zone Backfilling: Bedding material placement both below and above the bottom of the pipe shall conform to Figure 02206-1 and to the following:

(1) Class A "Concrete Cradle" and/or Class A "Concrete Encasement" is not required unless specified on the plans. However, where unexpected trench conditions exist or improper trenching is performed Class A Bedding may be required as determined by the Engineer.

(2) Class B Bedding shall be used for all flexible pipe.
   a. Class B Normal Bedding shall be used for PVC Pipe.
   b. Class B Improved Bedding shall be used for other flexible pipe.

(3) Class C Bedding shall be used for all rigid pipe.
   a. Class C Ordinary Bedding shall be used for all rigid pipe unless wet conditions are encountered.
   b. Class C Improved Bedding shall be used for wet conditions existing in the trench, as directed by the Engineer, at no additional cost to the Engineer. The dimensions shall be equal to that required for "rock" excavation.

3.3.2 Placement and Compaction: After each pipe has been graded, aligned, shoved home and placed in final position on the bedding material, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations.

Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

3.3.3 Backfill: Backfill material and compaction requirements shall conform to either Type I, Type II or Type III as shown on Figure 02206-2. The type of backfill to be used at specific locations shall be as shown on the plans. One year's maintenance will be required on all backfill.

3.3.4 Backfilling Through Rock: Backfilling through rock shall be performed as specified in the paragraph Backfill above, except that the Pipe Zone is increased to provide eighteen (18) inches of cover over the pipe. When approved by the Engineer the remainder of the backfill may be excavated rock provided the excavated rock has been broken up so that earth and rock will thoroughly mix and not result in voids around the larger pieces of rock. Any excess rock remaining after the trench has been backfilled shall be removed or wasted as directed by the Engineer.

3.3.5 Backfilling Under Pavement: Backfilling under pavement shall be performed as Backfill Type I to a level of two (2) feet from the bottom of the pavement. The remainder of the trench shall be backfilled with selected material, sufficiently damp to be properly compacted in layers not exceeding six (6) inches in depth, compaction shall be performed with mechanical tampers and continued until a relative density of 100 percent of standard density, in conformance with ASTM D698, is attained. Type I backfill shall also be utilized on all proposed streets and shall be used to the limits of the R-O-W.

3.3.6 Backfilling Under Gravel Streets: Where the trench crosses or lies in existing gravel surfaced streets, the backfill shall be compacted as provided in the paragraph "Backfilling Under Pavement".

3.4 Settlement: The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within one year after final completion of the contract under which the work was performed.

The Contractor shall make, or cause to be made, all repairs or replacement made necessary by settlement, within 48 hours after notice from the Engineer.

3.5 Borrow: General: If there is insufficient material from the excavations to build the embankments and fills required, the Contractor shall borrow the additional fill material required. The Engineer will designate the area from which the borrow material is to be secured and the depth to which the cut will be permitted.

3.6 Tamping: Whenever embankments are placed adjacent to structures or at locations where it is not practical to use a roller, the embankment materials shall be tamped by the use of mechanical rammers or tampers. Each layer shall be compacted to a density equal to or greater than that obtained under the above rolling procedure for the type of compaction designated. Each successive lift shall contain only that amount of material which will insure proper compaction, but in no instance shall any layer be greater than six (6) inches of compacted depth. When the quantity of work is small, a hand tamper may be used with the permission of the Engineer.

SECTION 02221 - EXCAVATABLE FLOWABLE FILL

1. DESCRIPTION

This work shall consist of a flowable mortar fill material in sewer, water and utility trenches under the pavement at locations as shown on the plans or as specified. The work shall be done in accordance with this specification.

2. MATERIALS

All materials shall meet requirements for the respective items in the Standard Specifications with the following exceptions.

a. Cement shall be Type I.

b. Fly Ash shall meet requirements of ASTM C 618, Class C, and shall come from a source approved by the design engineer.

c. Fine Aggregate for flowable mortar shall be natural sand consisting of mineral aggregate particles. The gradation of this materials shall be as follows:

Sieve Size	% Passing
3/4	100
200	0 - 10

It is intended that the sand be a fine sand that will stay in suspension in the mortar to the extent required for proper flow. Generally, mortar or plaster sand works well for this purpose. The sand intended for use shall be submitted to the central laboratory before the work begins. The Engineer reserves the right to reject the intended sand if a flowable mortar cannot be produced using the specified proportions. The contractor will not be responsible for certified aggregate testing. The Engineer will provide inspection that he deems appropriate, normally source approval followed by visual inspection.

d. Mix Design. The mix design for flowable mortar is as follows:

Quantity of Dry Materials per Cubic Yard

Cement	75 pounds
Fly Ash	300 pounds
Fine Aggregate	2600 pounds

These quantities of dry materials, with approximately 70 gallons of water will yield approximately one cubic yard of flowable mortar of the proper consistency. It is intended that the mix design produce a 50 to 75 PSI strength at 28 days. Set accelerator will be required when flowable fill is placed at temperature below 85°F to obtain the necessary support required for traffic and subsequent work at the end of the specified 72-hour period.

3. PROPORTIONING AND MIXING EQUIPMENT

Sufficient mixing capacity or mixers shall be provided to permit the intended pour to be placed without interruption.

4. PLACEMENT OF MORTAR

Flowable mortar shall be placed the full depth into the area that covers two feet beyond either side of the pavement by any reasonable means. The fill shall be brought up uniformly to an elevation 12 inches above the top of the pipe or two feet below the bottom of proposed pavement, whichever is higher. Placement of mortar shall then cease and the fill protected from traffic for a period of 72 hours.

5. LIMITATION OF OPERATIONS

a. Mortar shall not be placed on frozen ground.

b. Mortar batching, mixing, and placing may be started, if weather conditions are favorable. The cold weather operation shall conform to the same conditions as specified in the Standard Specifications for Concrete Work.

c. Each filling stage shall be as continuous an operation as is practicable.

6. MEASUREMENT AND PAYMENT

All materials, labor, equipment, tools and incidentals shall be paid for at the unit price bid per linear foot of trench filled regardless of trench depth and/or pipe sizes unless indicated otherwise by plans or contract.

SECTION 02271 - ROCK RIPRAP

1. GENERAL

Rock riprap shall be furnished and installed to the lines, grades, and dimensions as indicated on the plans for the slopes and berms of the embankments.

2. MATERIAL

Material is to consist of individual fragments, dense, sound, resistant to abrasion and free of cracks, seam or other defects which would tend to increase unduly their destruction by water and frost actions. Material is to meet the following requirements:

2.1 Minimum weight per cubic foot, not less than one hundred forty (140) pounds when tested in accordance with A.S.T.M. Standard C-127.

2.2 Loss after ten (10) cycles of freezing and thawing to be less than fifteen percent (15%) when tested in accordance with AASHO Designation T-103.

2.3 Broken concrete may be used in lieu of stone, unless otherwise noted on the plans, provided that it is sound and durable and meets the above requirements for size. Trim exposed reinforcement to the surface of broken concrete. Large flat pieces and long sections of curb will not be acceptable.

2.4 The material shall have the following gradation:

TABLE 12b SIZE REQUIREMENTS FOR ROCK RIPRAP

Percent Retained on Sieve Size

Percent Heavier Than:

	250 lbs.	180 lbs.	60 lbs.	10 lbs.
Light	0%	5-15%	50-70%	85-100%

3. PLACEMENT

Rock Riprap shall be a carefully placed layer of rock a minimum of 18 inches thick. Stone riprap shall be placed on a prepared 6" subgrade, unless otherwise noted on the plans, so as to produce a reasonably well-graded mass with a minimum practicable percentage of void. Stone riprap shall be placed to its full course thickness in one operation without displacing the bedding. Placing rock riprap by dumping into chutes or any other method likely to cause segregation will not be permitted.

Placement of stone on the slope and in toe trenches shall be accomplished by controlled dumping directly in place. Bulldozing of stone from the upper banks will not be permitted. Use of a drag line or similar equipment operated from the top of the bank to pull stone into position on the upper slope will be permitted.

Larger stones should be well distributed and the entire mass of stones in their final position should be stable and free of pockets of small stones and clusters of larger ones; rearrangement of individual pieces by hand may be required to obtain the results described above.

A tolerance of plus six (6) inches from the lines and grades shown on the plans will be allowed in the finished rock riprap surface, except that the extreme tolerance should not be continuous over an area greater than 200 square feet.

Riprap may be placed below water providing it is placed by skip or another approved method which will prevent segregation.

4. GROUTED ROCK RIPRAP

Grouted rock riprap material shall be the same as rock riprap. This riprap shall be grouted to the limits shown on the plans or as directed by the engineer. Some hand placing of riprap stones shall be necessary to produce reasonably true surfaces and a close fit of stones. The spaces between the stones shall be filled with Type III concrete with sufficient water to form a plastic mix. The grout shall be poured and broomed into the spaces until they are completely filled.

SECTION 02400 - DRAINAGE

1. DEWATERING

1.1 General: Water encountered during trenching or excavating operations shall be removed or lowered by means of the following dewatering systems which will permit preparation of a satisfactory pipe bed or structural subgrade, free from water.

1.2 Well Points and Pumps: This dewatering system requires the installation of well points and pumps, connecting pipelines and continuous operation in order to permit preparation of a satisfactory pipe bed or structural subgrade.

1.3 Cased Wells and Pumps: This dewatering system requires the use of individually cased wells and pumps, connecting pipelines and continuous operation in order to permit preparation of a satisfactory pipe bed or structural subgrade.

1.4 Discharge: Water from dewatering operations shall be discharged into the drainage ditches adjacent to the sites.

1.5 Permits: The contractor shall be responsible to obtain all permits required for dewatering.

SECTION 02485 - SEEDING, SPRIGGING AND SODDING

1. GENERAL

This work shall consist of the furnishing and planting of seed, sprigs, and/or sod at locations in reasonable conformity with those shown on the Plans or designated by the Engineer and in accordance with these Specifications. The work shall include the preparation of the ground for the planting, fertilizing and mulching, and watering as specified.

2. MATERIALS

2.1 Seeds. The Contractor shall provide grass seed of the variety and at the rates as required to produce the live seed rates shown below or as specified on the Plans. The vendor's certified statement for each species of grass and grass mixture stating each variety, percentage by weight, and percentages of purity, germination, and weed seed shall be furnished. Live seed for each grass species is the product of the percentage of purity and the percentage of germination.

The seed shall be new-crop seed complying with and labeled in accordance with U.S. Department of Agriculture "Rules and Regulations under the Federal Seed Act" in effect at date of purchase of seed. All seed shall be furnished in standard containers. Seed which has become moldy, wet, or otherwise damaged in transit or storage shall not be accepted.

A certificate shall be furnished to the Engineer showing the date that the seed was treated. The treated seed shall be planted within twenty-four (24) months after treatment and any treated Buffalo grass seed held by the Contractor or supplied beyond this period shall not be used.

The seed shall be stored in a cool dry place until seeding time. Seed application rate of 8 pounds per 1,000 square feet/Premium Kansas blend Fescue temporary seeding.

2.2 Sprigs. Sprigs shall be of the grass species specified on the Plans, and shall be healthy, living stems and roots freshly harvested without adhering soil or weeds and obtained from heavy, vigorous growing and mowed turf. After loosening sprigs from the soil, they shall be immediately gathered in piles or windrows and kept moist until planted.

2.3 Sod. Sod shall be of the species and of the size as specified on the Plans. Sod shall be strongly rooted, free of weeds and undesirable grasses, not less than 2 years old, and free of disease. Turf shall be mowed to approximately 2 inches, the sod freshly cut and obtained from areas having similar climatic conditions as the project site. The sod shall have a thickness of 2 to 3 inches, and shall be kept moist until planted.

2.4 Fertilizer. Fertilizer shall be proportioned as specified on the Plans or shown below and shall be of commercial grade, uniform in composition, free-flowing and suitable for application with approved equipment, delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable State Fertilizer Laws, and bearing the same trade name or trade mark, analysis and warranty of the producer. Fertilizer shall be applied at the rate of .5 pounds of actual nitrogen, 1.0 pounds of actual phosphorus, and .5 pounds of actual potassium per 1,000 square feet.

2.5 Mulching.

(1) Hay Mulch - Prairie hay mulch shall normally be used. The hay shall not contain an excessive quantity of noxious weed seeds. The mulch shall be a sharp grade prairie hay, sedan grass hay or broom sedge or any other type of native hay or grass. Straw shall be 8 inches minimum; 50% shall be 10 inches in length or longer.

(2) Asphalt Mulch - Asphalt mulch shall be of a consistency for application by distributing machines and shall be Emulsified Asphalt type SS-1 of the type and grade as approved by the Engineer.

(3) Wood Cellulose Fiber Mulch - Wood fiber mulch shall consist of specially prepared wood cellulose fibers having no growth or germination inhibiting factors, dyed green, and as manufactured by Weyerhaeuser Company, or approved equal. The wood cellulose fiber shall have the characteristic of dispersing rapidly in water to form a homogeneous slurry and remaining in such state while being agitated in hydraulic-slurry equipment.

Wood cellulose fiber mulch shall be shipped packaged or otherwise weighed at a maximum air dry moisture content of 14 percent.

2.6 Water. Water shall not contain substances in the amounts considered harmful for the normal growth of vegetation. The Contractor shall supply water and watering equipment as required for the establishment and maintenance of grassed areas.

3. SITE PREPARATION

3.1 Project Coordination. After the construction has been completed, (except as provided below), the site has been brought to final grades as shown on the Plans, and other plantings have been accomplished, the Contractor shall prepare the areas to be grassed as specified. When so directed or permitted by the Engineer, portions of the

construction site may be grassed at different periods of time provided that the planting occurs in proper seasons as specified. Any grassed areas damaged by subsequent operations of the Contractor shall be replanted as directed by the Engineer at no additional cost to the Owner.

3.2 Tillage. The areas required to be grassed shall be prepared for planting by cultivation, removal of all objectionable material, and filling of gullies or depressions. The soil preparation shall be accomplished by disking, harrowing and firming. (Plowing will also be required if so indicated on the Plans.) The minimum depth of soil preparation shall be three (3) inches. Existing weed stubble, small weeds and grass that can be disked shall be cut by the disk and partially incorporated into the soil. Several diskings and harrowings over some areas may be required to provide a satisfactory seedbed. Areas too steep or otherwise inaccessible for disking shall be prepared by hand methods. The minimum depth of preparation of the seedbed where hand methods must be employed shall be two (2) inches. Disking, harrowing and raking shall be done longitudinally on slope areas.

The soil preparation on all slope areas shall be performed with disks and harrows unless demonstration shows such methods impracticable and that hand methods must be used.

During the process of soil preparation, extreme care shall be exercised to avoid injury to all trees that have been planted or designated by the Engineer to be saved.

The Engineer may designate local areas of desirable native perennial grasses to be omitted during the soil preparation. Areas of annual grasses such as cheat, crab grass, triple-awn, etc., shall be destroyed by thorough disking prior to seeding.

3.3 Application of Fertilizer. Fertilizer shall be distributed uniformly at rates shown in Section 2.4 and over the area to be planted, and shall be incorporated into the soil to a depth of at least 2 inches by disking, harrowing or other methods approved by the Engineer. Distribution by means of an approved seed drill or hydro seeder equipped to sow seed and distribute fertilizer at the same time will be acceptable unless otherwise noted on the Plans.

Additional soil conditioners shall be mixed into the soil by disking, harrowing, etc., when specified on the Plans, or as directed by the Engineer and furnished by the Owner.

4. SEEDING

4.1 Time of Seeding. The two general seeding seasons shall be (1) Spring Seeding Season, February 15 to April 20, and (2) Fall Seeding Season, August 15 to September 30. The permissible seeding periods for various seeds may be extended a few days in special cases when mulching is specified to follow the drilling of seeds and fertilizer.

The Engineer reserves the right to delay the drilling or seeding of any seeds or to vary the permissible seeding seasons listed above due to weather or soil conditions or for other causes.

4.2 Seed Application. Seeds shall be uniformly distributed with acceptable drills, hydraulic-slurry, or other equipment approved by the Engineer. Broadcasting with a standard grass seeder will be required on areas where it is impossible to operate a drill and this method may also be required for certain small seeds.

When a standard drill with fertilizer attachment is used, certain mixed seeds may be placed in the seed box and the fertilizer placed in the fertilizer compartment. Both may be applied during one (1) operation, unless notes on the Plans require separate applications. Fertilizer may be drilled into the soil or applied by hydraulic-slurry. Broadcasting fertilizers is permissible on rough, rocky slopes where drills cannot operate.

All drills shall be fully adjustable so that they will deliver the seeds and fertilizer at the rates specified on the Plans or ordered by the Engineer. Drills that are in poor repair or that do not deliver the seeds and fertilizer uniformly in each drill furrow, shall not be used. Drills shall be adjustable so that the seeds can be planted and covered a maximum depth of 1/2 inch.

Most of the seeds should be drilled about one-half (1/2) inch deep in a well- prepared and firm seedbed. When the fertilizing and seeding operations start on an area, that area shall be completed as soon as possible. No seeding shall be done during windy weather or when the ground is wet or otherwise non-tillable. The grass seed shall then be covered, using a flexible toothed weeder or other suitable equipment. As soon as this covering operation has been completed, the seeded area shall be rolled again with the Culti-packer, the Culti-packer being run over the area only once parallel with the contours of the ground.

Kentucky bluegrass, Bermuda grass and seeds of similar size shall not be mixed with the coarse types of seeds. The finer seeds may be planted with certain drills by removing the seed tubes or they may be broadcast with hand seeders. Broadcast seeding shall be done when the weather is reasonably calm so that the seed will lodge on the prepared seed bed areas.

4.3 Mulching.

(1) Applying Hay Mulch - Hay mulch shall be the required mulching material, unless specified otherwise on the Plans or directed by the Engineer. After seeding operations are complete the mulch shall be spaced uniformly by hand, manure spreader, or other suitable equipment. The mulch shall be anchored to the soil by a V-type

wheel land packer, a disk harrow set to cut slightly, or other suitable equipment which will secure the mulch firmly into the ground 2 inches or more to form a soil-binding mulch and prevent loss or bunching by wind. Spacing between disks shall not exceed 8 inches. Apply hay mulch at the rate of 2 tons per acre or 90 lbs. per 1000 sq. ft.

(2) Applying Asphalt Mulch - Asphalt mulch shall be used only on very sandy soils and shall not be used unless specified on the Plans or directed by the Engineer. Emulsified asphalt may be diluted with additional water, when permitted by the Engineer, and applied with approved distributing equipment. The asphalt shall be applied to all areas regardless of slope and the rate of application shall provide a bituminous residual of not less than 0.12 gallons per square yard after loss of water.

(3) Applying Wood Cellulose Fiber Mulch - Wood cellulose fiber mulch may be used in lieu of hay mulch, when the Contractor elects to use a hydro seeder and the method is approved by the Engineer. Wood cellulose fiber mulch shall be applied at the minimum rate of 2000 pounds per acre, unless specified otherwise.

4.4 Watering. The Contractor shall water the seeded areas as required to assure an acceptable stand of grass.

5. SPRIGGING AND SODDING.

5.1 Time of Planting. Cool weather grasses such as bluegrass, fescue, etc. and including Buffalo grass shall be planted in either the spring or fall seasons with periods limited to March 1 to June 15 and September 1 to November 30, except that the spring season can be extended to June 30 for Buffalo grass.

Warm weather grass such as Bermuda grass, etc. shall be planted between April 1 and August 15, except that sprigs shall be planted between April 15 and June 15.

5.2 Planting. The areas to be sodded or sprigged shall be watered prior to planting when the ground is excessively dry.

(1) Sprigging - Grass sprigs of the variety and spaced as shown on the Plans shall be established by setting root divisions in furrows two (2) inches deep, parallel to the contours, and the roots placed so that they lie end to end in the furrow. The roots shall be covered approximately one (1) inch deep, thoroughly watered and firmed. The furrows shall be left partly open to facilitate additional watering and to hold any mulch applied on slope areas.

Firming shall be done with an approved type roller, so that the top of the sprigs will be slightly below the surrounding surface after the firming process is completed.

(2) Sodding - Grass sod shall be established by means of setting plugs or strips of sod in the soil. The Plans will show the size of plugs and/or the width of strips required and the required spacing of plugs or strips. Excavation shall be made for each plug or strip so that after tamping, the sod will be flush with the final grade. All plugs or strips shall be firmly tamped and thoroughly watered. After placing, all sods shall be firmed by use of an approved roller, a tamper or other approved methods. On steep slopes the sod may be firmed by compacting with hand shovels. The firming process shall remove all air pockets and shall pack the sod roots firmly into the prepared soil.

On steep slopes, staking of plugs or strips may be required as shown on the Plans or as directed by the Engineer. Stakes shall be of lath or similar materials and shall be driven six (6) inches into the ground, leaving approximately one-half (1/2) inch of the top above the sod line.

5.3 Watering.

(1) Sprigged Areas - Sprigged areas shall be kept thoroughly watered for twenty (20) days. Immediately following, the Contractor shall cultivate all areas between the sprigs with hand tools, to kill all weed growth and leave the soil loose and friable. At the time of cultivating, areas that do not have a satisfactory stand of grass shall be replanted as directed by the Engineer.

(2) Sodded Areas - The Contractor shall water all sods immediately after placing. All sodded areas shall be kept thoroughly watered by the Contractor for twenty (20) days after laying and as often as required thereafter until completion of other items of work in the Contract.

6. PROTECTION AND MAINTENANCE.

The grassed area shall be protected against traffic or other use immediately after planting. The Contractor shall be responsible for the proper care of the grassed area until all work on the entire contract has been completed and accepted, or a minimum period of 30 days, whichever is the longest duration. The Contractor will be relieved from watering grassed areas accepted by the Engineer and the Owner.

All planted areas shall be growing when accepted. Areas not showing a stand of grass or evidence of growth shall be replanted in accordance with these specifications. All costs in connection with replanting grassed areas shall be borne by the Contractor until an acceptable stand of grass is obtained, with no additional cost to the Owner.

SECTION 02510 - SUBGRADE TREATMENT - FLY ASH

1. GENERAL

1.1 Related Documents: General Conditions and Supplementary Conditions apply to this Section.

1.2 Description Of Work: This section covers fly ash treatment of subgrade for pavings called for on the drawings, and as specified herein.

1.3 Compaction Control: Make a minimum of one field density for each 2000 square feet per each lift of fill. Recompact deficient areas as directed by Engineer.

1.4 Reference Standard: Kansas Department of Transportation (KDOT) 1990 edition of "Standard Specifications for State Road and Bridge Construction", referred to hereinafter by basic designation, form a part of this specification to extent indicated by reference thereto. Delete "Basis of Payment" since this is a lump sum contract.

2. MATERIALS

2.1 Water: As specified in Kansas Department of Transportation Standard Specifications.

2.2 Fly Ash: Fly ash shall be Class "C" as defined in ASTM C618, Section 32. For Fly Ash equipment, blending of the Fly Ash with subgrade soils shall be accomplished using a pulvi-mixer or similar equipment capable of thoroughly blending the Fly Ash with the materials to be stabilized.

3. EXECUTION

3.1 Equipment: Equal to that specified in Kansas Department of Transportation Specification. Type approved, prior to use, for capability of equipment to perform acceptable work.

3.2 Installation: Paving: After cuts and fills are made, prepare, treat and compact upper 6-inches in accordance with Kansas Department of Transportation Standard Specifications with approximately 13% to 16% Class "C" Fly Ash in accordance with Sedgwick County, Kansas Special Provision to the Standard Specifications Addition 1980, Section titled "Fly Ash Modified Subgrade". The exact content of Fly Ash shall be determined by laboratory tests on in place materials.

SECTION 02512 - LIME TREATED SUBGRADE

1. GENERAL

Work performed under this Section consists of constructing one or more courses of a mixture of soil, water, and hydrated lime or pebble quicklime in accordance with the lines, grades, thicknesses and typical sections shown on the Plans or established by the Engineer. Equipment, construction requirements, and materials shall be in accordance with Division 150, Subsection 151 - Equipment; Division 300, Subsection 305 - Lime Treated Subgrade; and Materials Division 1000, Subsection 2002 - Hydrated Lime or Materials Division 1000, Subsection 2003 - Pebble Quicklime; Division 1000, Subsection 2402 - Water and Division 1000, Section 2600 - Materials Certifications respectively; of the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation, 1990 Edition (hereinafter referred to as Standard Specifications), except as supplemented or amended herein.

2. EXCAVATION

See Section 02201 "Earthwork - Streets".

3. MATERIALS

3.1 Lime:

(1) Hydrated Lime - Subsection 2002 of Standard Specifications, except delete 2002.03(c) and 2002.04.

(2) Quicklime - Pebble - Subsection 2003 of Standard Specifications, except delete 2003.03(c) and 2003.04.

(3) Water - Subsection 2402 of Standard Specifications.

4. CONSTRUCTION REQUIREMENTS

The rate of application for any type of lime shall be as directed by the Engineer and shall be determined by soil tests performed by an approved laboratory. The Contractor shall pay all costs for sampling and laboratory testing of all soils to be treated. The job shall have a single type and source of lime, unless otherwise permitted by the Engineer. The unit price bid in the proposal for the six inch lime treated subgrade shall be based on a lime application rate of 3.5% $\pm$ 0.5%, unless a specific application rate is given in the construction plans.

The actual rate of lime application will be adjusted as required by the above specified testing. No adjustment will be made in the unit price bid per square yard of lime treated subgrade for any increase or decrease in lime application rates within the range given above.

4.1 Compaction. Delete the entire Article 305.03 (h) and add the following:

(1) After the materials have satisfactorily mixed, aged, and re-mixed, the mixture shall be laid and compacted to at least 95 percent of Modified Proctor Density in accordance with ASTM D-1557. Light sprinkling with water during laying operations may be required to keep the moisture content a minimum of 2% above optimum. Compaction shall be accompanied with sufficient blading to eliminate all irregularities.

5. DELETE THE ENTIRE ARTICLE 305.04 - METHOD OF MEASUREMENT

6. DELETE THE ENTIRE ARTICLE 305.05 - BASIS OF PAYMENT

SECTION 02513 - ASPHALTIC CONCRETE PAVING

1. GENERAL

Work performed under this section consists of bituminous material to be placed on the prepared subgrade in conformance with the lines, grades, thicknesses, and typical sections shown on the Plans or established by the Engineer. Materials, equipment, and construction requirements shall be in accordance with Division 1200 Materials Details, and Division 600, Section 601 Equipment, Section 602 Asphalt Application Temperatures, and Section 603 Plant Mix Bituminous Construction, of the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation, 1990 Edition, except as supplemented herein.

2. MATERIALS

2.1 Aggregates: Aggregates for the bituminous mixture shall be following types for each course:

(1) Bituminous Sub-Base and Bituminous Base
Aggregates shall be BM-4.

(2) Asphaltic Concrete Wearing Surface
Aggregates shall be BM-2.

2.2 Bituminous Material:

(1) Bituminous materials for base courses shall be Type AC-20. Bituminous materials for the wearing surface shall be Type AC-20.

(2) Bituminous materials for tack and priming of contact surfaces of gutters, etc., shall be emulsified asphalt Types SS-1H or CSS-1H.

(3) Certified test reports of bituminous material in current production or stored in tanks shall be submitted to the Engineer for approval.

3. CONSTRUCTION REQUIREMENTS

3.1 Job Mix Design: The job mixes for each type of bituminous mixture shall be designed by Marshall tests and submitted to the Engineer for approval.

(1) Bituminous Base shall meet the following requirements:

Stability (min.)	1000
Flow	0.05 to 0.12
% Voids	3 to 7
% Voids Filled	70 to 80

Minimum asphalt content shall be 4.5 percent of the dry weight of the aggregates.

(2) Asphaltic Concrete Wearing Surface shall meet the following requirements:

Stability (min.)	1500
Flow	0.05 to 0.12
% Voids	3 to 7
% Voids Filled	70 to 85

Minimum asphalt content shall be 4.3 percent of the dry weight of the aggregates.

(3) Certified Marshall test reports of bituminous materials in current production may be submitted to the Engineer for approval and the job mix designs waived if the certified material is acceptable.

3.2 Surface Preparations:

(1) Subgrade Surface - The subgrade surface shall be maintained by the Contractor and shall not be excessively dry or wet prior to placing of bituminous mixture. No asphalt priming of the subgrade surface will be required, but moistening of the surface will be required when directed by the Engineer.

(2) Bituminous Base Surfaces Bituminous Base Surfaces shall be free of any foreign matter or moisture prior to placing of any additional courses of bituminous material. When in the opinion of the Engineer a tack coat is required, the entire bituminous surface shall be tacked at the rate of 0.1 gallon per square yard prior to placing of the next course of bituminous material.

4. DELETE ENTIRE ARTICLE 603.03 (k) MAINTENANCE OF TRAFFIC

5. DELETE ENTIRE ARTICLE 603.08 METHOD OF MEASUREMENT

6. DELETE ENTIRE ARTICLE 603.09 BASIS OF PAYMENT

SECTION 02514 - REINFORCED CRUSHED ROCK BASE

1. GENERAL: This item shall consist of hauling, furnishing, placing, and compacting crushed rock at locations shown on the plan and in conformance with the typical sections as detailed. The work shall also include the furnishing and installation of geogrid reinforcement.

2. MATERIALS:

a. Crushed Rock. Crushed Rock shall comply with the quality requirements of aggregate for aggregate base construction as specified in Section 1105 of the "Standard Specifications for State Road & Bridge Construction", Kansas Dept. of Transportation, 1990 Edition. Absorption shall not exceed 4%. Gradation of crushed rock shall be as follows:

Sieve	1-1/2"	3/4"	#4	#40	#200
% Retained	-	20-60	50-80	80-94	90-98

b. Crushed Concrete. At the Contractor's option, crushed concrete may be used in lieu of crushed rock. The absorption requirement does not apply. All other quality requirements and gradation shall be the same as that specified for crushed rock.

c. Geogrid Reinforcement. Geogrid reinforcement shall be BX 1100 by Tensar Corporation or approved equal. The geogrid reinforcement shall be a regular grid structure formed by biaxially drawing a continuous sheet of select polypropylene material and shall have aperture geometry and rib and junction cross-sections sufficient to permit significant mechanical interlock with the material being reinforced. The geogrid shall have high flexural rigidity and high tensile modulus in relation to the material being reinforced and shall also have high continuity of tensile strength through all ribs and junctions of the grid structure. The geogrid shall maintain its reinforcement and interlock capabilities under repeated dynamic loads while in service and shall also be resistant to ultraviolet degradation, to damage under normal construction practices and to all forms of biological or chemical degradation normally encountered in the material being reinforced.

The geogrid shall also conform in all respects to the property requirements listed below.

PROPERTY	TEST METHOD	UNITS	VALUE
INTERLOCK			
Aperture Size[1]	I.D. Calipered[2]		
MD		in	1.0 (nom)
CMD		in	1.3 (nom)
Open Area	COE Method[3]	%	70 (min)
Thickness	ASTM D 1777-64		
ribs		in	0.03 (nom)
junctions		in	0.11 (nom)
REINFORCEMENT			
Flexural Rigidity	ASTM D 1388-64[4]	mg-cm	250,000 (min)
Tensile			
-modulus	GRI GG1-87[5]	lb/ft	13,500 (min)
-@2% strain	GRI GG1-87[5]	lb/ft	270 (min)
-@5% strain	GRI GG1-87[5]	lb/ft	540 (min)
-ultimate strength	GRI GG1-87[5]	lb/ft	850 (min)
Junctions	GRI GG2-87[6]		
strength		lb/ft	750 (min)
efficiency		%	90 (min)
MATERIAL			
polypropylene	ASTM D 4101	%	98 (min)
	Group 1/Class 1/		
	Grade 2		
carbon black	ASTM 4218	%	0.5 (min)

NOTES:

1. MD dimension is along roll length. CMD dimension is across roll width.

2. Maximum inside dimension in each principal direction measured by calipers.

3. Percent open area measured without magnification by Corps of Engineers method as specified in CW 02215 Civil Works Construction Guide, November 1977.

4. ASTM D 1388-64 modified to account for wide specimen testing as described in Tensar test method TTM-5.0 “Stiffness of Geosynthetics”.

5. Secant modulus at 2% elongation measured by Geosynthetic Research Institute test method GG1-87 “Geogrid Tensile Strength”. No offset allowances are made in calculating secant modulus.

6. Geogrid junction strength and junction efficiency measured by Geosynthetic Research Institute test method GG2-87 “Geogrid Junction Strength”.

3. CONSTRUCTION REQUIREMENTS: Where shown on the plans, Geogrid reinforcement shall be installed directly on the subgrade and shall be installed in accordance with the manufacturer's recommendations.

The crushed rock base shall be placed and graded so that the material is uniform and segregation is minimal. The crushed rock base shall be compacted with a smooth steel roller until material is dense and to grade.

SECTION 02515 - COMBINED CURB & GUTTER, VALLEY GUTTER AND MISCELLANEOUS

1. GENERAL.

Work under this Section includes the construction of combined curb and gutter, edge curb in conjunction with valley gutter, entrances, slope drains, flumes, sidewalks, handicap ramps and inlet connections when called for on the plans or where directed by the Engineer. All concrete items shall conform to the shape and dimensions as detailed and to the lines and grades as shown on the plans. The dimensions shown are to the face of curbs unless specifically indicated otherwise.

2. EXCAVATION AND COMPACTION.

See Section 02201 "Earthwork Streets". Excavation and compaction shall be as shown on the plans and shall be wide and deep enough to accommodate any subgrade treatment. Unless otherwise indicated on the plans, the minimum subgrade treatment for combined curb and gutter, valley gutters, and entrances within public right-of-way shall be 6 inches of compaction Type B. No concrete will be placed on frozen subgrade, and all subgrade exposed to frost action or excessive moisture shall be recompacted when directed by the Engineer.

3. MATERIAL.

3.1 Concrete. See Section 03010 "Concrete Work". Concrete shall be Class I (AE), unless otherwise indicated on the plans.

3.2 Concrete Reinforcement.

3.1.1 Steel Reinforcing Bars - Steel reinforcing bars, unless otherwise specified or noted, shall be in accordance with ASTM A615, Grade 40 billet steel. The size, length, and shape shall be as shown and detailed in the plans. Each shipment of billet steel reinforcement bars used on the project shall be tagged and identified for their corresponding mill test reports. Mill test reports shall indicate the steel process, chemical, and physical properties, and shall be certified by the manufacturer and furnished by the Contractor.

3.2.2 Welded Wire Fabric - Welded wire fabric shall be in accordance with ASTM A185 and shall conform to the size and dimensions shown on the Plans.

3.2.3 Fibermesh – Fibers shall conform with ASTM C-1116, 4.1.3, Type III for durability and ASTM C-116 for toughness. Standard ACI 302 procedures for placing, finishing, and curing shall be followed.

3.3 Expansion Joint Filler. Expansion joint filler material shall be pre-formed meeting the requirements of Subsection 1503, Type B, of the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation, 1990 Edition. Joint filler shall be of the thickness indicated and shall conform to the shape of sections shown in the Plans.

3.4 Joint Sealing Compound. Joint sealing compound shall conform to the requirements of Subsection 1502, Cold Type Joint Sealing Compound, of the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation, 1990 Edition or as otherwise shown on the plans.

4. CONSTRUCTION METHODS.

4.1 General. Concrete items shall be constructed to the detailed thicknesses and to the lines and grade as shown on the plans. Concrete shall be placed over moistened and unfrozen subgrade and when the ambient temperature is 40°F or greater and rising. The subgrade shall be void of excessive moisture. If required by the Plans, the concrete shall be reinforced with the type of reinforcement indicated and the reinforcement shall be secured and tied in place prior to depositing any concrete.

4.2 Forms. Forms shall be set for the full depth of the section with the proper shape and strength to support any equipment and concrete placing operations. Forms shall be set to line and grade with adequate devices to secure them without visible spring or settlement from vibrations during the consolidating and finishing of the concrete. Flexible or curved forms shall be of a design acceptable to the Engineer for use on irregular shaped areas and true circular curves. Forms shall be checked for line and grade immediately before placing the concrete and shall not deviate from true line by more than one-fourth inch at any point.

Forms shall be thoroughly cleaned and oiled each time they are used. Builtup, battered, twisted, warped or broken forms shall be removed from the work. Steel forms shall have square ends connected with a rigid lock joint. Curved, flexible or wood forms shall be used on the returns.

4.2.1 Combined Curb and Gutter The Contractor may use a slip-form paver and mechanical finisher in lieu of the forms and metal screed specified for combined curb and gutter. The slip-form paver shall be capable of molding and satisfactorily compacting the concrete to cross section, line and grade. The machine shall be self-propelled and of such weight and traction to maintain straight neat lines.

4.3 Placing Concrete. The concrete shall be deposited on the subgrade in successive batches for the full width between forms and in a manner which will require as little rehandling as possible. Necessary hand spreading shall be done with shovels, not rakes. Workmen shall not be allowed to walk over the freshly mixed concrete without use of bridges or other approved means. The amount of material deposited shall be sufficiently in excess of that required to form the required cross section after consolidation in order to provide a roll of concrete ahead for the full length of the screed.

Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all expansion joint assemblies, by means of vibrators inserted in the concrete.

Concrete shall be deposited as near to expansion and contraction joints as possible without disturbing them, but shall not be dumped from the discharge bucket or hopper onto a joint assembly unless hopper is well centered on the joint assembly.

Should any concrete material fall on or be worked into the surface of a completed slab, it shall be removed immediately by approved methods.

4.4 Joints. All joints shall be constructed at the locations and to the types as detailed and shown on the plans, unless directed otherwise by the Engineer. Failure to construct the joints called for in the best possible manner will be cause for suspension of work until the cause of the defective work is remedied.

4.4.1 Contraction Joints - Sawed joints shall be sawed after the concrete has hardened sufficiently to prevent tearing and ravelling, but before the pavement starts shrinking and cracking. Saw cuts will be straight and uniform with a minimum depth of one-fourth the section thickness and shall be in alignment with adjacent previously sawed joints. After the joint has been sawed, it shall be cleaned with air or water jets and the curing period shall be continued.

4.4.2 Construction Joints - All construction joints shall be sawed along the abutting previously poured edge as described above for contraction joints, except that the depth shall be one inch or as detailed on the plans.

4.4.3 Expansion Joints - Expansion joints shall be constructed as shown on the plans. When not indicated on the Plans, expansion joints shall be placed between curb and gutter blocks at the tangent point of all curves, each side of inlets, at alleys, and at intervals of not more than 250 feet in straight runs. Expansion joints shall be cut to full size and shape of the cross section of the curb and gutter less one-half inch from the finished surface thereof. The edges of the blocks against the joint shall be finished with an edging tool and the joint raked clean of concrete.

4.4.4 Joint Sealer - After the specified curing period, the faces of all joints to be sealed shall be thoroughly cleaned, using compressed air, sweeping, brooming or other methods approved by the Engineer. The faces of the joint shall be dry after being thoroughly cleaned, and filled with joint sealing compound using a nozzle designed to completely fill the joint.

Joints shall be filled to within 1/4" of the top surface, but in no case shall they be overfilled. Upon completion of the joint sealing operations, all excess material and foreign material shall be removed from the concrete surface.

4.5 Finishing. After final screeding is completed, the surface shall be floated in a longitudinal direction and then tested with a ten (10) foot straightedge. All high and low places shall be corrected by wood floating operations until no irregularities exist.

4.5.1 Valley Gutter - The concrete surface shall then be textured in a transverse direction by the use of fiber brooms, canvas or rubber belting. Care shall be exercised in preserving the pavement surface by not digging into concrete pavement. Final concrete belting or brooming shall be adjusted until the texture is uniform and meets approval of the Engineer.

4.5.2 Combined Curb and Gutter - Where forms are used for placement of combined curb and gutter, there shall be provided on the job a metal screed or mule designed to give proper shape to the curb and gutter. It shall be bent to the exact shape of the finished curb and gutter and the forward edge shall be turned up slightly to prevent disturbing the concrete. It shall be designed to ride on the forms, and when properly manipulated, shall leave the face of the curb and gutter in its proper shape and condition.

A gooseneck or "S" trowel shall be used to finish the surface, and minor imperfections shall be corrected with a mason's trowel. A medium broom finish shall be applied to the face of all curbs. Care shall be taken to finish the gutter flow line to a true uniform grade.

4.5.3 Integral (Monolithic) Curb - When shown on the plans, integral curb will be placed immediately after finishing of the concrete pavement. Integral curb shall have joints at all locations to match the joints of the adjoining pavement. A medium broom finish shall be applied to the face of curbs as specified above.

4.5.4 Inlet Hookup - The entire concrete surface shall receive a trowel finish. A gooseneck or "S" trowel shall be used to finish the curb sections. Minor imperfections shall be corrected with a mason's trowel. A medium broom finish shall be applied to the face of curbs.

4.6 Curing. Curing shall be as required in the Section "Concrete Work" and as approved by the Engineer.

4.7 Surface Tolerances. The concrete pavement and gutter flowlines after hardening shall be tested with a 10-foot straightedge. All areas showing surface deviations in excess of 1/4 inch shall be ground down with an approved grinding tool until the deviations are 1/4 inch or less. Where departure from the correct cross sections exceeds 1/2 inch, the pavement shall be removed and replaced by the Contractor at his own expense when directed by the Engineer. Any area so removed and replaced shall be for the full width and a minimum of ten feet in length or between joints. If the remaining portion of the slab is less than 10 feet to the nearest joint, it shall also be removed and replaced.

5. ENTRANCES

5.1 Drive Entrances. Drive entrances for residences or commercial establishments, other than as shown on the plans, are not a part of this project. Any such construction shall be by private arrangement between the Contractor and the property owner.

SECTION 02521 - SIDEWALKS AND WHEELCHAIR RAMPS

1. GENERAL

Work under this Section includes the construction of concrete sidewalks and wheelchair ramps when called for on the plans or where directed by the Engineer. All concrete items shall conform to the shape and dimensions as detailed and to the lines and grades as shown on the plans.

2. MATERIALS

2.1 Concrete: See Section 03010 "Concrete". Concrete shall be Class I (AE), unless otherwise indicated on the plans.

2.2 Expansion Joints: Expansion joints shall be precast asphalt one-half inch in thickness.

3. CONSTRUCTION

3.1 Sidewalks: Sidewalks shall be four inches in thickness except bicycle paths which must be 5” in thickness, and must be cut through into squares not to exceed five feet. Sidewalk not cut completely through will not be accepted.

Sidewalk shall slope one inch to each four feet in width away from the property line, unless otherwise directed by the Engineer. Expansion joints one-half inch in width shall be constructed approximately every sixty-five feet and wherever the sidewalk joins a curb. Additional expansion joints shall be required where the sidewalk adjoins concrete parking lots, concrete driveways, or where the width of the sidewalk is to be greater than five feet, they shall be placed as directed by the Engineer.

The concrete shall be thoroughly tamped after being placed in the forms, giving special attention to the edges and corners of blocks or slabs so that there is no honeycomb in the concrete and the entire mass is well consolidated. The surface must be trowled followed by a light fiber broom finish transversely to construction. All outside edges and joints shall be edged with a one-quarter inch edging tool.

3.2 Wheelchair Ramps: Wheelchair ramps shall be constructed in conformance with the wheelchair ramp detail as shown on the plans. The same construction methods (concrete mixing, tamping, troweling and finishing) for wheelchair ramps will be the same as those utilized for sidewalk construction.

SECTION 02522 - CONCRETE PAVEMENT

1. GENERAL

Work under this Section includes construction of concrete pavement and integral curb. All concrete items shall conform to the shape and dimensions as detailed and to the lines and grades as shown on the plans.

2. EXCAVATION AND COMPACTION

See Section 02201. Excavation and compaction shall be as shown on the plans and shall be of adequate width and depth to accommodate the required subgrade treatment. No concrete shall be placed on frozen subgrade and all subgrade exposed to frost action or excessive moisture shall be recompacted when directed by the Engineer.

3. MATERIALS

3.1 Concrete. See Section 03010. Concrete for pavement and integral curb shall be Class I (AE).

3.2 Concrete Reinforcement.

3.2.1 Steel Reinforcing Bars and Dowel Bars shall be ASTM A6l5, Grade 40 billet steel unless otherwise specified or noted. The size, length and shape of the reinforcing bars shall be as shown and detailed on the plans. Each shipment of reinforcing bars used on the project shall be tagged and identified for their corresponding mill test report. Mill test reports, certified by the manufacturer, shall be furnished to the Engineer by the Contractor and shall show the chemical and physical properties of the steel along with the process used in its manufacture.

3.2.2 Welded Steel Wire Fabric shall conform to the requirements of ASTM A185. Fabric shall conform to the size and dimensions shown on the Plans. The Contractor shall furnish a Certification, from the supplier, to the Engineer, stating material compliance with the Plans and specifications.

3.3 Expansion Joint Filler shall be preformed meeting the requirements of Subsection 1503, Type B, of the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation, l990 Edition. Joint filler shall be of the thickness indicated and shall conform to the shape shown on the plans.

3.4 Joint Sealing Compound shall be Hot Type, Cold Type, or Silicone Joint Sealant as detailed on the plans. Materials furnished shall meet the requirements stated below and will be accepted on the basis of a certification by the manufacturer, furnished to the Engineer by the Contractor, stating that the materials meet the applicable specifications.

3.4.1 Hot type sealant materials shall comply with the requirements of Subsection 1501 of the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation, 1990 Edition.

3.4.2 Cold Type sealant material shall comply with the requirements of Subsection 1502 of the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation, 1990 Edition.

3.4.3 Silicone Joint Sealant materials shall comply with the requirements of Subsection 1507 of the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation, 1990 Edition.

4. CONSTRUCTION METHODS

4.1 General. Concrete pavement and integral curb shall be constructed to the detailed thicknesses and to the lines and grades shown on the plans. Concrete shall be placed over moistened and unfrozen subgrade and the ambient temperature shall be at least 40 deg. F. and rising. The subgrade shall be free of excessive moisture prior to concrete placement.

4.2 Forms. Straight forms shall be of metal having adequate thickness to support the equipment and shall be furnished in sections not less than ten feet in length. Forms shall have a depth equal to the prescribed edge thickness of the concrete being placed without any horizontal joints. Forms to be used as track for subgrade planers and finishing machines shall have a base width at least eight inches wide.

Flexible or curved forms of proper radius shall be used for curves of one hundred fifty foot radius or less, except approved straight forms of five foot length may be used for curves of a radius from seventy-five foot to one hundred fifty (150) foot. Flexible or curved forms shall be of a design acceptable to the Engineer. The Engineer may approve the use of wood forms in areas requiring hand finishing. The forms shall have

provisions for locking the ends of abutting form sections together tightly and for secure setting. The top face of the form shall not vary from a true plane more than one-eighth of an inch in ten feet. Forms shall be staked into place with not less than three pins for each ten foot section and a pin shall be placed at each side of every joint. Form sections shall be tightly locked together at the joints and shall be free from play or movement in any direction. Forms with battered top surfaces, and bent, twisted or broken forms shall not be used and shall be removed from the project. Repaired forms shall not be used until inspected and approved by the Engineer.

Forms shall be joined securely and set with exactness to required grade and alignment and supported firmly during the entire operation of placing and finishing so that they will not deviate more than one-eighth of an inch from a straightedge ten feet in length. A form grading machine shall be used to excavate the subgrade in preparation for setting forms to be used as track for subgrade planers and finishing machines. The foundation under the forms shall be hard and true to grade so that the form, when set, will be firmly in contact for its entire length and at the specified grade. The building of pedestals of earth to bring the forms to the required grade will not be permitted. The foundation shall be thoroughly tamped, either mechanically or by hand, at both the inside and outside edges of the forms after the forms have been set. No excessive settlement or springing of forms under the finishing machine will be tolerated. When any form has been disturbed or any grade has become unstable, the form shall be reset. The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing concrete. Forms shall be cleaned before setting and oiled prior to placing any concrete.

4.3 Subgrade Preparation. An approved type of subgrade planer shall be used to form the crown and shape the subgrade to insure that the specified pavement thickness is secured in advance of placing concrete.

An electronically controlled automatic template fine grader may be used provided the unit is capable of cutting consistently within l/8 of an inch of the required grade. The unit shall be electronically controlled so that the fine grading can be accurately controlled transversely as well as longitudinally, for both line and grade, using an approved reference line. If the concrete mixer is not operated within the strip to be paved, subgrade shall be given final rolling after the final adjustments of the subgrade which are shown to be necessary by the subgrade planer. If the concrete mixer is operated within the space to be concreted, a template having proper contour and elevation shall be dragged over the subgrade immediately behind the mixer. This template may be of either wood or metal but shall have a metal cutting edge. It shall be stiff enough to prevent springing or vertical displacement. It shall be loaded during dragging to hold it down to the forms on each side of space to be paved. No earth or other loose material excepting sand may be placed on the subgrade after the passage of the cutting template. If the subgrade is dry, it shall be thoroughly wet down immediately in advance of placing the concrete.

4.4 Placement Of Steel Reinforcement. Before placing any concrete, all reinforcing steel shall be set in proper location and position as shown on the plans. Tie bars at construction joints shall be inserted through predrilled holes in the form and supported to maintain their horizontal alignment. Dowel bars for integral curb may be inserted into the concrete pavement after placement provided care is taken to maintain the specific spacing and alignment and the concrete has not taken its initial set.

4.5 Concrete.

4.5.1 Placing - Concrete shall be placed with an approved self-propelled finishing machine of suitable design, excepting at intersections and other locations of irregular contour. The finishing machine shall be so operated and manipulated that concrete is uniformly distributed without segregation and, after final passage of the machine, is left with uniform thickness and contour and with the surface free from irregularities. Concrete shall be thoroughly spaded or otherwise compacted to avoid honeycombing at each edge of the slab or around structures.

Concrete shall be vibrated with mechanical vibrators attached to the finishing machine and which have a frequency of 3000 revolutions per minute, minimum. Vibrators shall be of the type and number that will thoroughly and completely consolidate the concrete from top to bottom for the full width of slab. At intersections and other locations in the street which do not have uniform cross sections the concrete shall be thoroughly consolidated by spading, hand vibrating, or other means approved by the Engineer.

Where conditions are such that it is not feasible to use a self-propelled finishing machine and vibrator, a screed with a vibrator attachment may be used in place of the finishing machine when approved by the Engineer. The screed may be a manually propelled "Razorback" type or other type as may be approved by the Engineer. The screed operation shall be supplemented with spud-type vibrators to consolidate concrete next to the forms and at other locations as directed by the Engineer to maximize the density of the in-place concrete and provide a uniformly consolidated slab. In the event the finished slab behind the screed operation is not acceptable to the Engineer in terms of thickness, consolidations, surface texture or surface tolerance, paving operations shall cease and necessary adjustments be made to achieve acceptable results.

4.5.2 Finishing - After final screeding is completed the surface shall be floated in a transverse direction and then tested with ten (10) foot straightedges. All surface irregularities and high or low spots shall be corrected by additional wood floating.

4.5.2.1 Pavement - After floating operations are completed the surface of the concrete pavement shall be textured in the transverse direction by the use of fiber brooms or by belting with canvas or rubber belts. Final concrete belting or brooming shall be adjusted until the finished surface is uniform as approved by the Engineer.

4.5.2.2 Integral Curb - Integral curb shall be placed immediately after finishing of the concrete pavement. Integral curb shall have joints at all locations to match the joints in the adjoining pavement. A medium broom finish shall be applied to the face of all integral curbs to produce a uniform surface texture.

4.5.3 Curing - Curing shall be in accordance with the requirements of Section 03010, "Concrete Work", except that alternate curing methods described under 9.f. will not be permitted.

4.5.4 Joints - All joints in concrete pavement shall be constructed at the locations and in accordance with the details shown on the plans unless otherwise directed by the Engineer. Failure to construct the specified joints in an acceptable manner will be cause for suspension of the work until the cause of the deficiencies is remedied. The Contractor shall so plan his paving operations that the end of each days placement terminates at a designated joint location.

4.5.4.1 Contraction Joints shall be made by sawing after the concrete has hardened sufficiently to prevent tearing or ravelling but before the pavement has started to shrink. Saw cuts shall be straight and uniform and shall align with adjacent previously sawed joints. After sawing of the joint is completed, it shall be cleaned with air or water jets and the curing period shall be continued.

4.5.4.2 Dowelled Transverse Construction Joints as detailed on the plans shall be used at the end of a days placement in lieu of a Transverse Contraction Joint. Sawing as required shall be completed as specified above for Contraction Joints.

4.5.4.3 Tied Longitudinal Construction Joints shall be made as detailed on the plans at the designated locations. Sawing as required shall be completed as specified for Contraction Joints.

4.5.4.4 Expansion Joints shall be constructed at the locations designated and in accordance with the details shown on the plans. Expansion joint material of the specified thickness shall be cut to the size of the pavement and integral curb less the detailed joint sealant dimension from the surface thereof. Care shall be taken in constructing expansion joints to maintain the joint filler material in a vertical position during placement of adjacent concrete. The edges of the concrete abutting the joint, except those requiring sawing, shall be finished with an edging tool and the joint raked clean of all concrete.

4.5.4.5 Hot or Cold Type Joint Sealer - After the specified curing period, the faces of all joints to be sealed shall be thoroughly cleaned using compressed air, sweeping, brooming or other approved methods. After cleaning and when the faces of the joints are dry, the joint shall be filled with sealer material using an approved nozzle so that the joint is completely filled without air voids or vacations. Upon completion of the joint sealing operations all excess sealant and foreign material shall be removed from the concrete surface.

4.5.4.6 Silicone Joint Sealant - When the plans require sealing joints with silicone sealant, the following shall apply

4.5.4.6.1 Sawing - All transverse joints shall be sawed in accordance with Specifications and Plan details. Should any spalling of the sawed edges occur which would detrimentally affect the joint seal, it shall be patched with an approved epoxy patching compound and allowed to harden prior to installation of the joint material. Each patch shall be true to the intended neat lines of the finished cut joint.

4.5.4.6.2 Cleaning Joints - Air compressors used for cleaning joints shall be equipped with suitable traps capable of removing all surplus water and oil in the compressed air. This compressed air will be checked daily by the Engineer for contamination. No contaminated air shall be used.

Cleaning Freshly Cut Sawed Joints. Immediately after sawing the joint, the resulting slurry shall be completely removed from the joint and the immediate area by flushing with a jet of water under pressure, and by the use of other tools as necessary. In the event freshly cut sawed joints become contaminated before they are sealed, they shall be cleaned as many times as necessary by the following method:

High Pressure Water Jet. The joint shall be thoroughly cleaned of all foreign material. After cleaning, the joint will be allowed to become thoroughly dry before sealant is installed.

4.5.4.6.3 Installing Backup Material - A resilient rod type backup material will be installed in a manner that will produce the shape factor specified. If the sealant bonds to the backup material, a bond-breaking tape may be required.

4.5.4.6.4 Sealing Joints - The location, size, configuration and acceptable joint sealant shall be shown on the plans.

4.5.4.6.5 Filling the Joint - A joint shall not be sealed until it is thoroughly clean and dry. Sealant shall not be applied to wet or damp concrete or installed during inclement weather. The sealer shall be placed to reasonably close conformity with dimensions shown on the plans. Any unreasonable deviation will be cause for rejection of the joint until satisfactory corrective measures are taken. Joint sealer application will not be permitted when the air temperature near the joint is less than 40°F or is 40°F and falling.

4.5.4.6.6 Equipment - The joint sealer shall be applied by an approved mechanical device from inside the joint in such a manner which causes it to wet the joint surfaces. The silicone sealant is not self leveling and will not position properly in the joint under its own weight, therefore, sealant surface shall be tooled using the appropriate tool to produce a slightly concaved surface approximately 1/4 inch below the pavement surface as shown on the plans. Tooling shall be accomplished before a skin forms on the surface. The use of soap or oil as a tooling aid will not be permitted. Any failure of the joint material in either adhesion or cohesion will be cause for rejection, and the joint shall be repaired to the Engineer's satisfaction at the contractor's expense.

4.5.4.6.7 Cleaning Pavement - After a joint has been sealed, all surplus joint sealer on the pavement or structure surfaces shall be promptly removed.

4.5.4.6.8 Traffic. Traffic shall not be permitted over sealed joints until the sealer is tack free, or until debris from traffic does not imbed into the sealant.

4.5.5 Surface Tolerances - The concrete pavement after hardening shall be tested with a ten (10) foot straight edge. Areas showing surface deviations in excess of 1/4 inch shall be ground with an approved grinding tool until the deviations are 1/4 inch or less. Where surface deviations exceed 1/2 inch, the pavement shall be removed and replaced by the Contractor at his own expense. Any area so removed and replaced shall extend to the nearest joint on each side of the deficient section.

4.6 Clean-Up

The pavement surface shall be swept and/or washed down to remove all dirt, debris or foreign materials prior to opening to traffic.

4.7 Opening To Traffic. The Contractor shall not permit traffic on the pavement until the concrete has attained a compressive strength of 4000 psi or an age of fourteen (14) days.

SECTION 02525 – ROLLER COMPACTED CONCRETE PAVEMENT

1. General Provisions

1.1 Description. Roller-Compacted Concrete (RCC) shall consist of aggregate, portland cement, possibly other supplementary cementing materials (fly ash, slag and silica fume) and water. RCC shall be proportioned, mixed, placed, compacted and cured in accordance with these specifications; and conform to the lines, grades, thickness, and typical cross sections shown in the Plans or otherwise established by the Engineer.

1.2 Caveat. This specification is intended to serve as a guide to format and content for normal RCC pavement construction. Most projects have features or requirements that should be incorporated in the project documents.

2. Submittals

2.1 Submittal Requirements. The Contractor shall submit the following to the Engineer at least 30 days before start of any production of RCC pavement:
2.1.1 Certification for aggregate source, quality and sizing as required by the specification.
2.1.2 Certification for portland cement and supplementary cementitious materials as required by the specification.
2.1.3 Proposed RCC Mix Design. If the proposed mix design is developed by the Contractor or there is a suggested change to the mix design, it must be submitted to the Engineer for approval at least four weeks prior to RCC construction. This mix design shall include details on aggregate gradation, cementitious materials, admixtures (if used), compressive and/or flexural strengths, and required moisture and density to be achieved.

3. Materials

3.1 General. All materials to be used for RCC pavement construction shall be approved by the Engineer based on laboratory tests or certifications of representative materials which will be used in the actual construction.

3.2 Portland Cement. Cement shall comply with the latest specifications for portland cement (ASTM C 150).

3.3 Aggregates. Unless otherwise approved in writing by the Engineer, the quality of aggregates shall conform to ASTM C 33. The plasticity index of the aggregate shall not exceed five. Aggregates may be obtained from a single source or borrow pit, or may be a blend of coarse and fine aggregate. The aggregate shall be well-graded without gradation gaps and conform to the following gradation:

Sieve Size	Percent passing by weight
1" (25 mm)	100
3/4" (19 mm)	90-100
1/2" (12.5 mm)	70-90
3/8" (9.5 mm)	60-85
No. 4 (4.75 mm)	40-60
No. 16 (1.18 mm)	20-40

No. 100 (150 µm)	6-18
No. 200 (75 µm)	2-8

3.4 Mineral Admixtures. Mineral admixtures shall conform to the requirements of ASTM C 618 (flyash). Unless specifically directed by the Engineer, total mineral admixture content including the content in blended cements shall not exceed the weight of portland cement in the RCC mix.

3.5 Chemical Admixtures. Chemical admixtures including waterreducing and retarding admixtures shall conform to ASTM C 494 and must be approved by the Engineer prior to use.

3.6 Water. Water shall be clean, clear and free of acids, salts, alkalis or organic materials that may be injurious to the quality of the concrete. Non-potable water may be considered as a source for part or all of the water, providing the mix design indicates proof that the use of such water will not have any deleterious effect on the strength and durability properties of the RCC.

3.7 Curing Compound. Concrete curing compounds shall conform to ASTM C 309 or ASTM D 977.

4. Equipment

4.1 General. All necessary equipment shall be on hand and approved by the Engineer before work will be permitted. Roller-compacted concrete shall be constructed with any combination of equipment that will produce a completed pavement meeting the requirements for mixing, transporting, placing, compacting, finishing, and curing as provided in this specification.

4.2 Mixing Plant.
4.2.1 Location of Plant The mixing plant shall be located within a 30 minute haul time from the RCC placement. With prior testing and Engineer's approval, a set retarding admixture may be used to extend the haul time.
4.2.2 Plant Capacity The plant shall be capable of producing an RCC mixture in the proportions defined by the final approved mix design and within the specified tolerances. The capacity of the plant shall be sufficient to produce a uniform mixture at a rate compatible with the placement equipment. The volume of RCC material in the mixing chamber shall not be more than the rated capacity for dry concrete mixtures. Multiple plants shall be supplied if a single plant can not provide an uninterrupted supply of RCC to the paver(s) during peak paving operations.
4.2.3 Pugmill Plant A pugmill plant shall be a central plant with a twin shaft pugmill mixer, capable of batch or continuous mixing, equipped with synchronized metering devices and feeders to maintain the correct proportions of aggregate, cement, mineral admixture and water. Other pugmill plant requirements are as follows:
4.2.3.1 Aggregate Storage If previously blended aggregate is furnished, storage may be in a stockpile from which it is fed directly to a conveyor feeding the mixer. If aggregate is furnished in two or more size groups, aggregate separation must be provided at the stockpiles.
4.2.3.2 Aggregate bins shall have a feed rate controlled by a variable speed belt, or an operable gate calibrated to accurately deliver any specified quantity of material. If two or

more aggregate size stockpile sources are used, the feed rate from each bin shall be readily adjustable to change aggregate proportions, when required. Feed rate controls must maintain the established proportions of aggregate from each stockpile bin when the combined aggregate delivery is increased or decreased.

4.2.3.3 Plant Scales Plant scales for any weigh box or hopper shall be either of beam or springless-dial type, and be sensitive to 0.5 percent of the maximum load required. Beam-type scales shall have a separate beam for each aggregate size, with a single telltale actuated for each beam, and a tare beam for balancing hopper. Belt scales shall be of an approved design. Standard test weights accurate to plus or minus 0.1 percent shall be provided for checking plant scales.

4.2.3.4 Cement and Mineral Admixture Material Storage Separate and independent storage silos shall be used for portland cement and mineral admixture. Each silo must be clearly identified to avoid confusion during silo loadings. If the Contractor chooses to preblend the cementitious material he must employ blending equipment acceptable to the Engineer and demonstrate, with a testing plan, the ability to successfully produce a uniform blended material meeting the mix design requirements. Testing of the preblended cementitious material shall be done on a daily basis to assure both uniformity and proper quantities.

4.2.3.5 Cement and Mineral Admixture Feed Unit Satisfactory means of dispensing portland cement and mineral admixture, volumetrically or by weight, shall be provided to assure a uniform and accurate quantity of cementitious material enters the mixer.

4.2.3.6 Water Control Unit Required amount of water for the approved mix shall be measured by weight or volume. The unit shall be equipped with an accurate metering device. The water flow shall be controlled by a meter, valve or other approved regulating device to maintain uniform moisture content in the mixture.

4.2.3.7 Surge Hopper For continuous operating pugmills, a surge hopper attached to the end of the final discharge belt shall be provided to temporarily hold the RCC discharge to allow the plant to operate continuously.

4.2.4 Rotary Central-Mix Drum Plant A rotary drum batch mixer shall be capable of producing a homogeneous mixture, uniform in color and having all coarse aggregate coated with cementitious paste. The mixer shall be equipped with batching equipment to meet the following requirements:

4.2.4.1 The amounts of cement, mineral admixture and aggregate entering into each batch of RCC shall be measured by direct weighing equipment. Weighing equipment shall be readily adjustable to compensate for the moisture content of the aggregate or for changing the proportionate batch weights, and shall include a visible dial or equally suitable device which will accurately register the scale load from zero to full capacity. The cement and mineral admixture may be weighed separately or cumulatively in the same hopper on the same scale, provided the cement is weighed first.

4.2.4.2 Bulk cement and mineral admixture weigh hoppers shall be equipped with vibrators to operate automatically and continuously while weighing hoppers are being dumped. The weigh hopper shall have sufficient capacity to hold not less than 10 percent in excess of the cementitious material required for one batch.

4.2.4.3 The amount of water entering each batch of RCC shall be measured by weight or volume. The equipment shall be capable of measuring the water to within a tolerance of plus or minus one percent and shall be equipped with an accurate gauge or dial measuring device. During batching, water shall be admitted to the mixer only through the water measuring device and then only at time of charging.

4.2.4.4 Drum mixers shall be equipped with an accurate clock or timing device, capable of being locked, for visibly indicating the time of mixing after all the materials, including the water, are in the mixer.
4.2.5 Alternative Mixing Equipment Other types of batching and mixing equipment and configurations including dry batch plants and concrete truck mixers may be used with the approval of the Engineer. The Contractor must demonstrate that the mixing equipment has the ability to produce a consistent, well-blended, non-segregated RCC mix satisfying the minimum capacity requirements of Section 4.2.2 and within the tolerance limits as specified in Section 5.2.2.

4.3 Paver
4.3.1 RCC shall be placed with a high-density or conventional asphalt type paver subject to approval by the Engineer. The paver shall be capable of placing RCC to a minimum of 85% of the maximum wet density in accordance with ASTM D 1557 or equivalent test method. The paver shall be of suitable weight and stability to spread and finish the RCC material, without segregation, to the required thickness, smoothness, surface texture, cross-section and grade.
4.3.2 Alternative Paving Equipment. Any alternative paving equipment such as graders and dozers must be approved by the Engineer prior to use. The equipment shall be capable of producing a finished product that results in a smooth, continuous surface without segregation, excessive tearing, or rock pockets.

4.4 Compactors
4.4.1 Self-propelled steel drum vibratory rollers having a minimum static weight of 10 tons (9.07 metric tons) shall be used for primary compaction. For final compaction either a steel drum roller, operated in a static mode, or a pneumatic-tire roller shall be utilized.
4.4.2 Walk-behind vibratory rollers or plate tampers shall be used for compacting areas inaccessible to the large rollers.

4.5 Haul Trucks Trucks for hauling the RCC material from the plant to the paver shall have covers available to protect the material from rain or excessive evaporation. The number of trucks shall be sufficient to ensure adequate and continuous supply of RCC material to the paver.

4.6 Water Trucks At least one water truck, or other similar equipment, shall be on-site and available for use throughout the paving and curing process. Such equipment shall be capable of evenly applying a fine spray of water to the surface of the RCC without damaging the final surface.

4.7 Inspection of Equipment Before start-up, the Contractor‘s equipment shall be carefully inspected. Should any of the equipment fail to operate properly, no work shall proceed until the deficiencies are corrected.

4.8 Access for Inspection and Calibration The Engineer shall have access at all times to any plant, equipment or machinery to be used on this project in order to check calibration, scales, controls or operating adjustments.

5. Construction Requirements

5.1 Preparation of Subgrade/Subbase Before RCC processing begins, the area to be paved shall be graded and shaped to the lines and grades as shown in the Plans or as directed by the Engineer. During this process any unsuitable soil or material shall be removed and replaced with acceptable material. The subgrade shall be uniformly compacted to a minimum of 95% of the maximum dry density in accordance with ASTM D 1557. The Contractor shall check for any soft or yielding subgrade areas by proof rolling with a loaded dump truck or pneumatic-tire roller over the entire area to be paved. All soft or yielding subgrade areas shall be corrected and made stable before RCC construction begins. If a subbase is shown on the Plans, it shall be uniformly compacted to a minimum of 95% of the maximum dry density in accordance with ASTM D 1557.

5.2 Mixing Process.
5.2.1 General Except for minor variations in moisture content, the same mixture proportions shall be used for the entire project, unless otherwise stated in the project documents. The water content shall be varied by the Contractor, as necessary, to provide a consistency that is most conducive to effective placement and compaction. If during mixing there is a change in the type or source of cementitious materials, or aggregates, the mixing must be suspended, and a new mix design shall be developed.
5.2.2 Mixture Ingredient Tolerances The mixing plant must receive the quantities of individual ingredients to within the following tolerances:

Material	Variation in % by Weight
Cementitious materials	+/- 2.0
Water	+/- 3.0
Aggregates	+/- 4.0

5.2.3 Mixing time will be that which will assure complete and uniform mixing of all ingredients. For drum mixers and dry batch facilities, the time of mixing shall be determined from uniformity test results.
5.2.4 All material must be discharged before recharging. The mixing chamber and mixer blade surfaces must be kept free of hardened RCC or other buildups. Mixer blades shall be checked routinely for wear and replaced if wear is sufficient to cause inadequate mixing.
5.2.5 Plant Calibration Prior to commencement of RCC production, the Contractor shall carry out a complete and comprehensive calibration of the plant in accordance with the manufacturer's recommended practice. All scales, containers and other items necessary to complete the calibration shall be provided by the Contractor. After completion of the initial calibration, the plant shall be recalibrated as directed by the Engineer.

5.3 Transportation The transportation of the RCC pavement material from the plant to the areas to be paved shall be in dump trucks fitted and equipped, when necessary, with retractable protective covers for protection from rain or excessive evaporation. The trucks shall be dumped clean with no buildup or hanging of RCC material. For paver placed RCC, the dump trucks shall deposit the RCC material directly into the hopper of the paver or into a secondary material distribution system which deposits the material into the paver hopper. Dump truck delivery must be scheduled so that RCC material is spread and compacted within the specified time limits.

5.4 Placing

5.4.1 Condition of the Subgrade/Subbase Prior to RCC placement, the surface of the subgrade/subbase shall be clean and free of foreign material, ponded water and frost prior to the placement of the RCC pavement mixture. The subgrade/subbase must be uniformly moist at the time of RCC placement. If sprinkling of water is required to remoisten certain areas, the method of sprinkling shall not be such that it forms mud or pools of free-standing water. Prior to placement of RCC, the subgrade/subbase shall be checked for proper density and soft or yielding areas and these areas shall be corrected as specified in Section 5.1.

5.4.2 Paver Requirements RCC shall be placed with an approved paver as specified in Section 4.3 and shall meet the following requirements:

5.4.2.1 The quantity of RCC material in the paver shall not be allowed to approach empty between loads. The material shall be maintained above the auger shaft at all times during paving.

5.4.2.2 The paver shall operate in a manner that will prevent segregation and produce a smooth continuous surface without tearing, pulling or shoving. The spread of the RCC shall be limited to a length that can be compacted and finished within the appropriate time limit under the prevailing air temperature, wind, and climatic conditions.

5.4.2.3 The paver shall proceed in a steady, continuous operation with minimal starts and stops. Paver speed during placement operations shall not exceed the speed necessary to ensure that minimum density requirements as specified in Section 5.6.7 are met and surface distress is minimized.

5.4.2.4 The surface of the RCC pavement once it leaves the paver shall be smooth, uniform and continuous without excessive tears, ridges or aggregate segregation.

5.4.3 Lift Thickness Lift thickness of compacted RCC pavement shall be as indicated on the Plans. If RCC pavements are to be constructed in a thickness greater than 10 inches, the use of two lifts shall be utilized. No lift shall be less than 4 inches.

5.4.4 Adjacent Lane Placement Adjacent paving lanes shall be placed within 60 minutes. If more than 60 minutes elapses between placement of adjacent lanes, the vertical joint must be considered a cold joint and shall be prepared in accordance with Section 5.7.2. At the Engineer's discretion, this time may be increased or decreased depending on the use of set retarding admixtures or the ambient weather conditions of temperature, wind, and humidity.

5.4.5 Multiple Lift Placement For multiple lift placement, the total pavement thickness shall be as shown on the Plans, and the Contractor shall submit his method of placement and lift thickness as part of a paving plan subject to approval by the Engineer. In multiple lift construction, the second lift must be placed within 60 minutes of the completion of the first lift. If more than 60 minutes has elapsed, the interface between the first and second lifts shall be considered a cold joint and shall be prepared in accordance with Section 5.7.3.1. At the discretion of the Engineer, this time may be increased or decreased depending on the use of set retarding admixtures or the ambient weather conditions of temperature, wind and humidity.

5.4.6 Hand Spreading Broadcasting or fanning the RCC material across areas being compacted will not be permitted. Such additions of material may only be done immediately behind the paver and before any compaction has taken place. Any segregated coarse aggregate shall be removed from the surface before rolling.

5.4.7 Segregation If segregation occurs in the RCC during paving operations the spreading shall cease until the cause is determined and corrected.

5.4.8 RCC placement shall be done in a pattern so that the curing water from the previous placements will not pose a runoff problem on the fresh RCC surface or on the subbase layer.
5.4.9 Paving Inaccessible Areas Areas inaccessible to either paver or roller may be placed by hand and compacted with equipment specified in Section 4.4.2. Compaction of these areas must satisfy minimum density requirements as specified in Section 5.6.7. An alternate and preferred method for paving inaccessible areas is to use cast-inplace, air-entrained concrete with a minimum compressive strength of 4000 psi or as specified by the Engineer. In areas that may be subjected to high load transfer, the Engineer may require the cast-in-place concrete to be doweled into the RCC.
5.4.10 Placement of RCC with graders, dozers or other alternative paving equipment as specified in Section 4.3.2 shall meet the requirements of paver placed RCC where applicable.

5.5 Weather Conditions

5.5.1 Cold Weather Precautions RCC material shall not be placed on any surface containing frost or frozen material or when the air temperature is below 40°F, except when the air temperature is at least 35°F and rising. When the air temperature is expected to fall below 40°F, the Contractor must present to the Engineer a detailed proposal for protecting the RCC pavement. This proposal must be accepted by the Engineer before paving operations may be resumed. A sufficient supply of protective material such as insulating blankets, plastic sheeting, straw, burlap or other suitable material shall be provided by the Contractor at his expense. The methods and materials used shall be such that a minimum temperature of 40°F at the pavement surface will be maintained for a minimum of five days. Approval of the Contractor‘s proposal for frost protection shall not relieve the Contractor of the responsibility for the quality and strength of the RCC placed during cold weather. Any RCC that freezes shall be removed and replaced at the Contractors expense.

5.5.2 Hot Weather Precautions During periods of hot weather or windy conditions, special precautions shall be taken to minimize moisture loss due to evaporation. Under conditions of excessive surface evaporation due to a combination of air temperature, relative humidity, concrete temperature and wind conditions, the Contractor must present to the Engineer a detailed proposal for minimizing moisture loss and protecting the RCC. Precautions may include cooling of aggregate stockpiles by use of a water spray, protective covers on dump trucks, temporary wind breaks to reduce wind effect, cooling of concrete mix water, and decreasing the allowable time between mixing and final compaction.
5.5.3 Rain Limitations No placement of RCC pavement shall be done while it is raining hard enough to be detrimental to the finished product. Placement may continue during light rain or mists provided the surface of the RCC pavement is not washed-out or damaged due to tracking or pickup by dump trucks or rollers. Dump truck covers must be used during these periods. The Engineer will be the sole judge as to when placement must be stopped due to rain.

5.6 Compaction

5.6.1 Compaction shall begin immediately behind the placement process and shall be completed within 60 minutes of the start of plant mixing. The time may be increased or

decreased at the discretion of the Engineer depending on use of set retarding admixtures or ambient weather conditions of temperature, wind and humidity.
5.6.2 Rolling The Contractor shall determine the sequence and number of passes by vibratory and non-vibratory rolling to obtain the minimum specified density and surface finish. Rollers shall only be operated in the vibratory mode while moving. Pneumatic-tire rollers may be used during final compaction to knead and seal the surface.
5.6.3 Rolling Longitudinal and Transverse Joints The roller shall not operate within 12 in. of the edge of a freshly placed lane until the adjacent lane is placed. Then both edges of the two lanes shall be rolled together within the allowable time. If a cold joint is planned, the complete lane shall be rolled and cold joint procedures, as specified in Section 5.7.2 shall be followed.
5.6.4 Longitudinal joints shall be given additional rolling as necessary to produce the specified density for the full depth of the lift and a tight smooth transition occurs across the joint. Any uneven marks left during the vibrating rolling shall be smoothed out by non-vibrating or rubber tire rolling. The surface shall be rolled until a relatively smooth, flat surface, reasonably free of tearing and cracking is obtained.
5.6.5 Speed of the rollers shall be slow enough at all times to avoid displacement of the RCC pavement. Displacement of the surface resulting from reversing or turning action of the roller shall be corrected immediately.
5.6.6 Areas inaccessible to large rollers shall be treated as specified in Section 5.4.9.
5.6.7 Density Requirements. In-place field density tests shall be performed in accordance with ASTM C 1040, direct transmission, as soon as possible, but no later than 30 minutes after completion of rolling. Only wet density shall be used for evaluation. The required density shall be not less than 98% of the maximum wet density obtained by ASTM D 1557 or equivalent test method based on a moving average of five consecutive tests with no test below 96%.

5.7 Joints

5.7.1 Fresh Vertical Joints A vertical joint shall be considered a fresh joint when an adjacent RCC lane is placed within 60 minutes of placing the previous lane, with the time adjusted depending on use of retarders or ambient conditions. Fresh joints do not require special treatment.
5.7.2 Cold Vertical Joints Any planned or unplanned construction joints that do not qualify as fresh joints shall be considered cold joints and shall be treated as follows:
5.7.2.1 Longitudinal and Transverse Cold Joints Formed joints that do not meet the minimum density requirements of Section 5.6.7 and all unformed joints shall be cut vertically for the full depth. The vertical cut shall be at least 6 in from the exposed edge. Cold joints cut within two hours of placement may be cut with an approved wheel cutter, motor grader or other approved method provided that no significant edge raveling occurs. Cold joints cut after two hours of placement shall be saw cut 1/4 to 1/3 depth of the RCC pavement with the rest removed by hand or mechanical equipment. Any modification or substitution of the saw cutting procedure must be demonstrated to and accepted by the Engineer. All excess material
from the joint cutting shall be removed.
5.7.2.2 Prior to placing fresh RCC mixture against a compacted cold vertical joint, the joint shall be thoroughly cleaned of any loose or foreign material. The vertical joint face shall be wetted and in a moist condition immediately prior to placement of the adjacent lane.

5.7.3 Fresh Horizontal Joints For multi-layer construction a horizontal joint shall be considered a fresh joint when a subsequent RCC lift is placed within 60 minutes of placement of the previous lift. This time may be adjusted at the discretion of the Engineer depending on use of retarders or ambient weather conditions. Fresh joints do not require special treatment other than cleaning the surface of all loose material and moistening the surface prior to placement of the subsequent lift.
5.7.3.1 Horizontal Cold Lift Joints For horizontal cold joints the surface of the lift shall be kept continuously moist and cleaned of all loose material prior to placement of the subsequent lift. The Engineer may require other action such as use of a cement slurry or mortar grout between lifts. If supplementary bonding materials are used, they shall be applied immediately prior to placement of the subsequent lift.
5.7.3.2 RCC Pavement Joints at Structures The joints between RCC pavement and concrete structures shall be treated as cold vertical joints.

5.7.4 Control Joints (Optional). Control joints may be constructed in the RCC pavement to induce cracking at pre-selected locations. Joint locations shall be shown on the Plans or as directed by the Engineer. Early entry saws should be utilized as soon as possible behind the rolling operation and set to manufacturer's recommendations. Conventionally cut control joints shall be saw cut to 1/4 depth of the compacted RCC pavement. Joints shall be saw cut as soon as those operations will not result in significant raveling or other damage to the RCC pavement.

5.8 Finishing.

5.8.1 Surface Smoothness The finished surface of the RCC pavement, when tested with a 10 foot straight edge or crown surface template, shall not vary from the straight edge or template by more than 3/8 inch at any one point. When the surface smoothness is outside the specified surface tolerance the Contractor shall grind the surface to within the tolerance by use of selfpropelled diamond grinders. Milling of the final surface is not acceptable, unless it is for the removal of the pavement.
5.8.2 Thickness The thickness of the RCC pavement shall not deviate from that shown on the plans or as directed by the Engineer by more than minus 1/2 inch. Pavement of insufficient thickness shall be removed and replaced the full depth. No skin patches shall be accepted.
5.8.3 When surface irregularities are outside the tolerances cited above, the contractor shall grind the surface to meet the tolerance at no additional cost to the Owner.

5.9 Curing Immediately after final rolling and compaction testing, the surface of the RCC pavement shall be kept continuously moist for 7 days or until an approved curing method is applied.
5.9.1 Water Cure Water cure shall be applied by water trucks equipped with misting spray nozzles, soaking hoses, sprinkler system or other means that will assure a uniform moist condition to the RCC. Application of this moisture must be done in a manner that will not wash out or damage the surface of the finished RCC pavement.
5.9.2 Curing Compound The specified membrane curing compound shall be applied in two separate applications at right angles to one another, with the first coat being allowed to become tacky before the second is applied. This application must ensure a uniform void-free membrane across the entire RCC pavement. If the application rate is

found to be excessive or insufficient, the Contractor, with approval of the Engineer, can decrease or increase the application rate to a level which achieves a void-free surface without ponding.

5.9.3 Sheet Materials Curing paper, plastic and other sheet materials for curing RCC shall conform to ASTM C 171. The coverings shall be held securely in place and weighted to maintain a close contact with the RCC surface throughout the entire curing period. The edges of adjoining sheets shall be overlapped and held in place with sand bags, planking, pressure adhesive tape, or other Engineer-approved method.

5.10 Traffic The Contractor shall protect the RCC from vehicular traffic during the curing period. Completed portions of the RCC pavement may be opened to traffic after seven days or as approved by the Engineer.

5.11 Maintenance The Contractor shall maintain the RCC pavement in good condition until all work is completed and accepted. Such maintenance shall be performed by the Contractor at his own expense.

6. Measurement and Payment

6.1 Measurement. The work described in this document will be measured (1) in square yards of completed and accepted RCC pavement as determined by the specified lines, grades and cross sections shown on the Plans and (2) in cubic yards or tons of mixed and hauled RCC material.

6.2 Payment

6.2.1 The work described in this document will be paid for at the contract unit price per square yard of completed and accepted RCC pavement. The price shall include placement, compaction, curing, inspection and testing assistance and all other incidental operations. Also payment shall be made at the contract unit price per cubic yard or ton of mixed and hauled RCC material. The price shall include mixing, hauling and all material costs. Such payment shall constitute full reimbursement for all work necessary to complete the RCC pavement.

SECTION 2530 - PAVEMENT MARKING PAINT

1. Description: This specification covers water-borne pavement marking paint and glass beads suitable for use as retroreflective pavement markings on portland cement concrete or asphalt pavement.

2. Requirements

a. Paint. Use white or yellow paint that is specifically manufactured for use as pavement markings. Formulate the paint to consist of acrylic resin, lead free pigments and water as the solvent. The paint must comply with volatile organic compound (VOC) requirements, be lead and other toxic heavy metal free, and exhibit the following qualities:

(1) Formulation:

Yellow paint- The pigment of the Yellow paint shall consist of the following for each 100 gallons of paint:

A. 30 lbs. of approved Hansa Yellow

B. 17 lbs. of Rutile Titanium Dioxide

C. Other such extender pigments as necessary to produce a close match to the yellow color requirement.

White and yellow paint shall be composed of 100% acrylic polymer, which shall be Rohm and Haas HD-21 acrylic resin or Dow Chemical's DT400.

(2) Dry-Opacity: A contrast ratio of not less than 0.96 when the paint is applied with a 0.012 inch film applicator.

(3) Daylight Reflectance: Daylight Reflectance of the white paint not less than 80% relative to magnesium oxide.

(4) Color: Yellow color must meet the following minimum chromaticity coordinates:

COLOR	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
Yellow	0.475	0.450	0.490	0.433	0.520	0.450	0.495	0.475

(5) Bead Embedment: At least 90% of the glass beads must be embedded between 50 and 70%.

(6) Dry to No Pick-Up Time: Maximum 5 minutes when tested according to KT-MR1

b. Glass Beads for Pavement Marking Paint (Double Drop System).

(1) For the first drop, furnish large beads, which are compatible with the paint being used and comply with AASHTO M247 except with the following gradation (FP-96, Type 3):

Sieve Size	Percent Passing
No. 12	100
No. 14	95 – 100
No. 16	80 – 95
No.18	10 – 40
No. 20	0 – 5
No. 25	0 – 2

(2) For the second drop, furnish beads which are compatible with the paint being used, and which comply with the requirements of AASHTO M247 Type I.

(3) Both types of beads are to be coated with a moisture resistant coating and an adhesion promoting coating which is compatible with the paint being used.

(4) A blended bead which contains equal portions of both bead types may be substituted if double drop application equipment is not available.

Sieve Size	Percent Passing
No. 12	100
No. 14	98 – 100
No. 16	88 – 97
No. 18	48 – 70
No. 20	28 – 50
No. 50	5 – 25
No. 80	0 – 5

c. Verification Sampling and Testing.

(1) The Engineer will take 2 one-quart samples of each color of paint used on each project. Forward the sample to MRC for verification testing.

(2) The Engineer will take 2 one-quart samples of each type of glass beads used on each project. Forward the sample to the Materials and Research Center for verification testing

3. Test Methods

a. Paint.

(1) Dry Opacity. ASTM D 2805.

(2) Daylight Reflectance. ASTM E 1347.

(3) Bead Embedment. Apply paint to a Leneta plain white paper chart at a wet film thickness of 0.025 inch followed immediately by an application of glass beads (FP-96, Type 3) dropped onto the surface of the paint. After drying for at least 24 hours observe the amount of bead embedment with a 30-power microscope.

(4) Dry to No Pick-Up Time. KT-MR12, “Dry to No Pick-Up Time for Water-Borne Traffic Paint.”

b. Glass Beads. AASHTO M 247, plus

(1) Moisture Resistance. KTMR-8, “Moisture Resistance of Glass Beads for Traffic Markings.”

4. Prequalification
None Required.

5. Basis of Acceptance

Acceptance of pavement marking paint and glass beads will be made on the basis of Type D certifications as specified in DIVISION 2600, and visual inspection of performance and consistency on the job site.

SECTION 02601 - MANHOLES

1. GENERAL

Manholes shall be constructed at the location to the size and with the type as shown on the plans and in accordance with the drawings. The invert channels shall be smooth and semi-circular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be constructed by laying a full section of sewer pipe through the manhole and cutting out the top half after the surrounding concrete has hardened. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than l inch per foot nor more than 2 inches per foot. Free drop inside the manholes (inside drop) shall not exceed 2 feet measured from the invert of the inlet pipe to the top of the floor of the manholes outside the channels. Outside drop manholes shall be constructed whenever the free drop would otherwise be greater than 2 feet and as shown on the plans.

Manholes shall be constructed to be watertight and shall be vacuum tested per Section 02626.

2. MATERIALS

2.1 Concrete: Section 03010 except as noted herein.

2.2 Quick Set Hydraulic Cements: Thoro "Waterplug", Quikrete "Waterstop" or equal.

2.3 PreCast Reinforced Concrete Manholes: Precast Reinforced Concrete manholes shall conform to the latest revision of ASTM C478 except for the following modifications:

(1) Cement, Section 5 shall be revised to read: Cement used in construction of precast reinforced concrete manholes shall conform to the requirements of the Standard Specifications for Portland Cement (ASTM Designation: C150).

(2) Thickness of precast sections shall be at least one-twelfth of the internal shell diameter plus one inch, or 5 inches total, whichever is greater. The minimum internal diameter of manholes shall be 4 feet.

(3) Precast reinforced concrete manholes shall not be constructed downstream of a force main, except when two (2) or more standard cast-in-place manholes separate the precast manhole and the force main.

(4) Joints between precast reinforced concrete sections shall provide for the use of mastics (2 wraps) or rubber gaskets (natural or synthetic) to prevent leakage of infiltration.

(5) Precast sections shall be adequately reinforced with steel to withstand erection and temperature stresses.

(6) The Contractor must submit certified test results showing that a random number of precast sections have been sampled and tested in accordance with ASTM C497 prior to moving precast sections to the job site.

All costs to complete the preceding tests are to be at no additional cost to the Owner.

(7) Each precast manhole section delivered to the site shall have the date of manufacture and the manhole number included on the section when delivered.

2.4 Sand For Mortar: Concrete sand (fine aggregate) sieved through 8 mesh screen.

2.5 Mortar: Eight sacks of Type I cement per cubic yard. Use of hydrated lime shall not be allowed.

2.6 Gaskets:

(1) Mastic: Fed. Spec. SS-S-210; K. T. Snyder "RamNek" or ConSeal CS-102.

(2) Rubber: Neoprene or other synethic, 40 plus or minus 5 hardness when measured by ASTM D2240, Type A durometer.

2.7 Castings: ASTM A48-83, Class 35B. Frames and covers as shown on the plans. All weights as given are approximate and average. Variation will not exceed the specified weights by more than 4 percent. Castings are to be manufactured true to pattern and with satisfactory fit of component parts. Castings shall be free of defects. Dimensions as detailed on plans shall not deviate by +/- 1/16" per foot. Castings shall be furnished with machined horizontal bearing surfaces.

2.8 Delivery: Precast concrete section shall not be delivered to the job until representative concrete control cylinders have attained a strength of at least 80 percent of the specified minimum. The date of manufacture and manhole number shall be indicated on each manhole section upon delivery.

2.9 Inspection: Precast concrete sections shall be inspected when delivered and all cracked or otherwise visibly defective units rejected.

2.10 Quality of Materials. The manufacturer of precast manhole sections shall submit tests from a certified lab detailing quality of aggregates and the mix design, which shall be in accordance with ASTM C478 or the specifications as herein stated.

3. CONSTRUCTION METHODS.

3.1 Cast-In-Place Manholes: **Cast-In-Place Manholes will not be allowed on this project without prior written approval by the Engineer**. Forms used in the construction of cast in place circular concrete manholes shall be inspected and approved by the Engineer prior to use. The forms shall be made of metal and fabricated in sections which will permit easy installation and removal without damage to complete manhole. The forms shall be constructed such that the walls will have a thickness of 8 inches without any form marks on the interior or exterior exceeding 1/4 inch. The upper portion of the form shall be constructed such that the finished manhole will taper from 48-inch diameter to 26-inch diameter in a minimum distance of 30 inches and a maximum distance of 48 inches.

The concrete base shall be poured monolithically with the rest of the manhole as approved by the Engineer. Concrete used in the construction of cast-in-place manholes shall be Class I Mix Concrete with a maximum permissible slump of 4 inches. Concrete shall be placed and compacted in the forms in 2-foot layers in such a manner that will prevent segregation. Forms shall not be removed from the walls of the manhole until the concrete has set up sufficiently to prevent damage to the walls by the form removal operation.

Backfilling will not be permitted until a period of l2 hours has expired after the application of field applied exterior coatings.

Manhole locations which require pipe inlets through cast-in-place circular manhole walls will be constructed by cutting an opening in the manhole wall at the proper location after the forms have been removed. The pipe will than be installed in the opening using the correct alignment and grouted in place. The space between the pipe and manhole shall be completely filled with grout. All plugging or grouting shall be done with a quick set hydraulic cement as specified in Section 02601-1.

3.2 Frames and Covers: Frames shall be set so that the top of the frames will be flush with all paved surfaces.

3.3 Precast Reinforced Concrete Manholes: Thickness of precast sections shall be at least one-twelfth of the internal shell diameter plus one inch, or 5 inches total, whichever is greater. The minimum internal diameter of manholes shall be 4 feet.

All precast sections shall be adequately reinforced to withstand erection and temperature stresses as well as other applied loads.

Joints between precast sections shall provide for the use of mastics or rubber gaskets (natural or synthetic) to prevent leakage or infiltration.

Prior to moving precast sections to the job site, the Contractor shall submit certified test results showing a random number of precast sections have been sampled, tested for compressive strength and absorption and are in compliance with ASTM-C497.

3.4 Manholes Adjustment Stacks: Elevation of the manhole service entry shall be set so that the top of the frames will be flush with all paved surfaces, all other locations will be set as shown in the plans. Vertical stacks shall be constructed of 3 inch and 6 inch Keyed Steel Reinforced Concrete Adjustment Rings (S.R.C.A.R.), complying with ASTM-C150 and ASTM-C478. When more than one S.R.C.A.R. is required, only one 3 inch ring shall be allowed and it shall be placed at the bottom of the stack. The manhole entry frame and the adjustment rings shall be properly sealed using two rings of mastic (Fed. spec. SS-S210) spaced approximately 2 inches apart. The manhole entry frame shall be 'capped' with a ring of Type 1 concrete complying with ASTM-C150. The cap should extend from a maximum of (1") one inch below the top of the frame, to a point beyond the bottom of the frame joint. The surface of the cap shall be hand rubbed to provide a smooth, even texture and appearance. When it is necessary to adjust a reinforced concrete manhole with a corbel section upward more than (12") twelve inches or downward, remove the stack and the corbel section completely, then build-up or lower the barrel to the proper height to facilitate reassembly of the corbel and stack to the required elevation. The barrel may be built-up of lowered by adding and/or removing 4 foot diameter precast barrel sections. These sections can be produced in 6” increments to fulfill the elevation requirements. To meet additional elevation requirements use vertical stacks as described above. Manhole details are shown on the plans.

SECTION 02721 - STORM SEWERAGE SYSTEMS

1. GENERAL

Work under this section consists of the excavation, installation of pipe, construction of inlets, manholes, and appurtenant structures, and backfilling complete in accordance with the lines and grades as shown on the Plans or as established by the Engineer.

2. EXCAVATION AND BACKFILL.

See also Section 02201 "Earthwork - Streets".

2.1 Pipe Zone.

(1) RCP and RCPHE shall have Class C Improved Bedding, as shown in Fig. 02201-1.

(2) Overexcavation of the trench bottom for storm sewers will not be required unless directed by the Engineer.

2.2 Trench Zone. Trench zone backfill shall be Type I or Type III, as shown in Fig. 02201-2, unless otherwise directed by the Engineer. Only Type I backfill will be allaowed under pavement.

3. MATERIALS

3.1 Concrete. See Section 03010 "Concrete Work". Concrete shall be Class I, unless otherwise shown on the Plans.

3.2 Structural Steel. Structural Steel shall be in accordance with A.S.T.M. A-36, A242, or A441.

3.3 Reinforced Concrete Pipe. Reinforced concrete Pipe shall conform to ASTM Standard C76, Class III, except where indicated on plans to be Class IV.

3.4 Reinforced Elliptical Concrete Pipe. Horizontal Elliptical Pipe shall conform to ASTM Standard C507, HE-IV.

3.5 Brick. Brick used in the construction or adjustment of manholes and construction or adjustment of storm drain inlets shall be No. 1 common red brick complying with ASTM C-62 Grade SW or ASTM C-32, Grade MS.

3.6 Reinforcing Steel. Reinforcing Steel shall conform to that specified in Section 03010 "Concrete Work".

3.7 Grates, Castings, Frames, and Covers. Grates, Castings, Frames, and Covers shall be provided as shown on the plans and shall be good quality gray iron, free from cracks, holes, swells and cold shuts. Materials shall comply with ASTM A48, Class 30S. Cast iron grates for PVC Drain Basins shall be provided by the Drain Basin manufacturer.

3.8 Sand for Mortar. Concrete sand (fine aggregate) sieve through 8 mesh screen.

3.8.1 Mortar. Eight sacks of Type I cement per cubic yard. Use of hydrated lime will not be allowed.

3.9 Non-shrinking Mortar. Premixed or job mixed; job mixed shall be one part shrinkage-correcting aggregate, one part portland cement, one part sand.

3.9.1 Shrinkage-Correcting Aggregate. Master Builders "Embeco" or Sonneborn "Ferrolith G-DS", or approved equal.

4. CONSTRUCTION METHODS

4.1 Pipe Installation. The laying of pipe in the finished trench shall be set to line and grade from the lowest point and laid upgrade. Reinforced concrete pipe shall be laid with the bell or grooved end upgrade. All pipe shall be firmly and accurately set so the invert is smooth and uniform. Trenches shall be free of water, except the portions of pipe projecting into streams or ponds.

Joints in reinforced concrete pipe shall be cemented with cement mortar or sealed with mastic.

4.2 Inlets and Manholes. Inlets and Manholes shall be constructed to the lines, dimensions, and grades as shown on the Plans. Concrete structures shall conform to the applicable requirements of Section "Concrete Work".

The Contractor shall exercise care in providing adequate openings and recesses for the grates, castings, frames and covers. Castings, frames, covers and grates shall be set level and firm in the completed inlets and manholes.

The invert channels of storm sewer structures shall be filled and shaped with Class III concrete for proper drainage of storm water.

In no case shall the invert section through a manhole be greater than that of the outgoing pipe. The shape of the invert shall conform exactly to the lower half of the pipe it connects. Side branches shall be connected with as large radius of curve as practicable. All inverts shall be troweled to a smooth clean surface. The invert shaping shall have slopes of one (1) inch per foot on areas outside of the flow channels.

4.2.1 Concrete Finish - All exposed concrete surfaces shall be trowelled with a smooth steel trowel followed by a brushed finish.

4.2.2 Formed Surfaces - All formed surfaces to remain exposed after removal of forms and backfilling shall be given a rubbed finish. The rubbed surface shall be freed from uneven moulding lines, fins, etc. by use of a carborundum brick.

4.2.3 Frames and Covers - Manhole rings, covers, etc. shall be made of good quality gray iron free of cracks, holes, swells and cold shuts and, unless otherwise specified, shall be as shown on the detailed drawings, or an approved equal. Manhole rings and covers shall weigh not less than shown on the details and the covers shall not be perforated. Where noted on the plans, frames and covers shall be painted after installation.

4.2.4 Brick Work - Manhole bricks shall be laid radially. Manhole and inlet bricks shall be laid in a full bed of mortar with shove joints and staggered bond. Maximum inside face vertical joints shall be 1/4 inch for curved walls with radial brick and 1/2 inch for straight walls and maximum horizontal joints shall be 1/2 inch between courses. The entire exterior surface of brick work on manholes and inlets shall receive a full 1/2 inch mortar coating. Brick work performed during cold weather shall be protected from all damage by approved methods. No work shall be started when the air temperature is below 32º F without prior approval of the Engineer.

All mortar shall be used within 40 minutes after mixing. Mortar which has begun to take on initial set shall be discarded and shall not be used with additional cement or new mortar.

DIVISION 3 - CONCRETE

SECTION 03010 - CONCRETE WORK

1. GENERAL

Concrete shall consist of cement, coarse aggregate, fine aggregate, approved admixtures, and water; proportioned and mixed to produce a workable mixture suitable for specific conditions of placement as noted in the following specifications.

All concrete used in the work shall be air-entrained unless otherwise permitted by these specifications or approved by the Engineer.

All reinforcing steel as detailed on the drawings shall be installed and fastened by ties or supports prior to placing any concrete.

2. MATERIALS

2.1 Portland Cement:

(1) General - Portland Cement shall conform to the requirements of ASTM Designation C150 and shall be Type II. When approved by the Engineer in writing, Type I or Type III cements may be used in lieu of Type II. Use of special cements containing interground admixtures will not be permitted without approval by the Engineer.

(2) Packaged Cement - Where packaged cement is to be used in the work, it shall be stored in a suitable moisture-proof enclosure with each shipment properly marked and segregated. Bags of cement in which, for any reason, the cement has become partially set, or which contains lumps of caked cement, shall be rejected.

(3) Bulk Cement - Bulk cement may be used in the work when approved by the Engineer. Methods of transporting, handling and storage shall also be subject to approval.

(4) Tests - The Contractor shall furnish certified test reports showing that the cement being supplied complies with these specifications.

2.2 Aggregates: - The use of pit run or naturally mixed aggregates will not be permitted. Fine and coarse aggregates shall be separately furnished and stored.

The mixing of different kinds of aggregates from different sources or alternating batches of different aggregates in one stockpile will not be permitted. In no case shall aggregates containing lumps of frozen or partially cemented materials be used. Aggregates proposed for use in the work shall meet the following requirements.

(1) Deleterious Substances - Deleterious substances in aggregates shall not exceed the following percentages by weight when tested under the designated ASTM method.

	Coarse	Fine	Test
Material Passing No. 200 Sieve	1.0	3.00	C117
Shale	0.5	0.5	C123
Soft Friable Pieces	0.5	0.5	C142
Sticks (wet)	0.10	0.10	
Coal	0.25	0.25	C123
Clay Lumps (wet, on No. 4 Sieve)	1.5	0.25	C142

No one of the above percentages shall be exceeded when taken separately. In addition, any combination of shale, soft friable pieces, sticks, coal or clay lumps shall not exceed 1.5 percent.

(2) Coarse Aggregate - Coarse aggregate shall be hard, durable, clean uncoated pieces of crushed rock or gravel. Coarse aggregate will be well graded within the following limits (ASTM Size #67) when tested under ASTM Standard C136.

Sieve Size	1	3/4	3/8	4	8
% Retained	0	0-10	45-80	90-100	95-100

(3) Fine Aggregate - Fine aggregate shall consist of clean, hard, durable, uncoated siliceous or calcareous particles well graded within the following limits.

Sieve Size	3/8	4	8	16	30	50	100
% Retained	0	0-5	0-20	15-50	40-75	70-90	90-99

The Fineness Modulus (F.M.) of the fine aggregate furnished shall be not less than 2.5 nor more than 3.4 when determined by using a sieve series consisting of the No. 4, 8, 16, 30, 50 and 100 sizes. After acceptance of a gradation for use in the work the F.M. shall not vary more than $\pm$ 0.2.

(4) Stockpiles - Aggregates shall be stockpiled by building up free-draining horizontal layers not greater than 4 feet in thickness. Aggregates that have become mixed with earth or foreign material shall not be used. If the water content in coarse aggregate is below that which the aggregate will absorb, such aggregate shall be wet down at least 12 hours in advance of the time the mix is to be batched.

(5) Aggregate Tests

(a) General - All aggregates proposed by the Contractor for use in the work shall be certified by an approved Testing Laboratory as complying with the above requirements covering deleterious materials and gradation. In addition, unless waived by the Engineer, certified tests also shall be provided in accordance with Paragraphs (b) thru (e) below. All costs of testing shall be borne by the Contractor.

(b) Soundness - Coarse aggregate for concrete when tested for soundness with magnesium sulphate in accordance with ASTM Standard C88 shall have a total loss not greater than 18% by weight.

(c) Abrasion - The percentage of wear of the coarse aggregates by the Los Angeles Abrasion Test, ASTM C131, shall be less than 40%.

(d) Absorption - Coarse aggregate for concrete shall have an absorption limit of 4% or less, as determined by ASTM C127.

(e) Mortar Strength - Fine aggregates shall be of such quality that when made into a mortar and tested in accordance with ASTM C87 the mortar shall develop a compressive strengths at 7 and 28 days of not less than 100 percent of that developed by the control mortar specified in C87.

2.3 Admixtures:

(1) General - Admixtures are defined by these specifications as a material, other than portland cement, aggregate or water, added to concrete to modify its properties. The following admixtures shall be used when required and may be used when permitted.

(2) Air Entraining Agent (AEA) - An approved air entraining agent shall be used to produce 5 to 8% air entrainment in the concrete as placed. The AEA shall be a neutralized solution of vinsol resin meeting the requirements of ASTM C260.

(3) Calcium Chloride - When approved by the Engineer, calcium chloride meeting the requirements of ASTM D-98 may be used as an accelerator in an amount not exceeding two (2) percent of the weight of cement. No calcium chloride, or admixtures containing calcium chloride, shall be used where aluminum conduit, couplings or accessories are embedded in the concrete.

(4) Water Reducing Admixtures - At the option of the Contractor, subject to approval of the Engineer, a water reducing admixture

(WRA) may be used. Water -reducing, set-controlling admixtures shall be of the basic chemical composition described as "hydroxylated carboxylic acid" or "hydroxylated polymers" and shall meet the requirements of ASTM C494, Type A or Type D. Before approval, the compatibility of the proposed admixture, with the other materials to be used in the concrete mixture, shall be established by test. Where a WRA has been approved for use, and design mix test results demonstrate adequate strength, the Cement Factor may be reduced by 0.5 bag below that specified in Paragraph 3.1, "Proportioning".

(5) Tests - The Contractor shall furnish three (3) copies of certified test results showing that the admixtures proposed for use comply with these specifications.

2.4 Water: Water used in concrete shall be clean, clear, and free from injurious amounts of sewage, oil, acid, strong alkalis or vegetable matter. If the water is of questionable quality, it shall be tested by a comparative mortar strength test in accordance with ASTM C87.

2.5 Metal Reinforcement: Metal reinforcement shall be Grade 60 billet steel in accordance with ASTM A615. The size, length and shape shall be shown and detailed on the drawings.

2.6 Epoxy-Coated Metal Reinforcement. Where shown on the plans, metal reinforcement shall be epoxy-coated in accordance with the requirements of the latest revision of ASTM D3963.

3. PROPORTIONING

3.1 Mix Design: Concrete mixes to be used in the work shall be proportioned in accordance with the requirements of Table 1. All materials shall be proportioned by weight considering one sack of cement as 94 pounds and one gallon of water as 8.33 pounds.

Table 1

	Minimum				
	28-Day Strength		Minimum	Maximum	
Concrete	(PSI)		Cement Factor	W/C Ratio	Slump*
Class*	Compressive	Flexural	Bags/C.Y.	Gal./Bag	(in.)
Class I	4000	500	6.5	5.5	1 to 3
Class II	3000	425	5.75	6.0	1 to 3
Class III (sand mix)	3500		8.0	5.75	1 to 3

*The Class of concrete to be used in the various parts of the work shall be as specified herein or as noted on the drawings. Where no specific class has been designated, Class I concrete shall be used.

**No concrete with slump in excess of 3-inches shall be used in the work without approval of the Engineer.

The Contractor shall design and submit for approval three (3) copies of the proposed design mix for each of the classes of concrete specified for the work. Included with the submittal shall be copies of test reports showing the 7 and 28 day strengths (Flexural and Compressive) for each proposed mix. The proposed design mixes shall be based on the specific materials and the maximum slump to be used in the work. All costs of mix design and testing shall be borne by the Contractor.

3.1 Supplemental Cementitious Materials (or Blended Cement Concrete). When approved by the Engineer the concrete mix design may include fly ash as an SCM. The fly ash shall be from an approved source as a partial replacement for portland cement. Obtain the Engineer's approval before substituting SCMs for Type III cement. Changes in SCM or cement will require a new mix design approval. Fly ash will be substituted for cement to a maximum of 25% of the total weight of cement in the mix design. Substitute 1 pound of SCM for 1 pound of cement.

3.2 Aggregate Content: The total volume of aggregate used in each cubic yard of concrete shall be the maximum consistent with the requirements of workability.

For Class I and II concretes, the composition of the total aggregate (Fine and Coarse) shall be such that not more than 70% or less than 40% will pass the #4 sieve. The exact proportions of fine and coarse aggregate may be varied within the above limits by the Engineer to produce a concrete mixture more suitable for the work at hand.

For Class III concrete l00% fine aggregate shall be used.

3.3 Variations in Mix Proportions: The initial concrete mixes used on the work for the various classes of concrete shall be in accordance with the proportions used in the approved design mixes. In the event that these mixes do not produce concretes with the required strength, workability, or air content the Engineer may order changes in the mix proportions to obtain the specified requirements, and the changes so ordered, including additional cement, will be made at no additional cost to the Owner.

3.4 Control: The Contractor shall provide all equipment necessary to determine and positively control the actual amounts of all materials, including admixtures, entering into the concrete. Batching and weighing devices for aggregates and cement shall be accurate within 0.5 percent, and for water and admixtures within 1.0 percent.

4. FORMS

Forms shall be steel or wood as approved by the Engineer and shall conform to the shape, lines, grade and dimensions of the concrete as detailed on the drawings. Lumber used in forms for exposed surfaces shall be dressed to a uniform thickness and free from knots and blemishes. Joints in the forms shall be all horizontal or vertical

where the finished surface is to be exposed. Forms shall have nails withdrawn and surfaces to be in contact with concrete thoroughly cleaned and oiled prior to each use. Form oil shall be non-staining and shall be applied to the forms before reinforcement is placed. Forms shall be sufficiently tight to prevent leakage of mortar and properly braced to maintain the desired shape, line and grade.

The removal of forms shall not be started until the concrete has attained the necessary strength to support its own weight and any construction loads. Forms shall not be removed before the expiration of 30 hours from any construction. Forms supported by false work shall not be removed until the concrete has attained its design strength. Where forms are removed less than seven days after placement of the concrete, provisions shall be made to insure curing as specified in this Section under, "Curing of Concrete".

5. REINFORCEMENT

Prior to positioning, reinforcing steel shall be cleaned of all loose mill scale and rust or coatings which might prevent or reduce bond. Reinforcement shall be positioned accurately and secured against any displacement by using annealed iron wire ties or suitable clips and be supported by suitable metal supports, spacers or hangers. All reinforcing shall be in place and securely fastened before placing any concrete. The contractor shall submit shop drawings, bar lists and bending diagrams to the Engineer for approval prior to ordering any reinforcement.

6. EPOXY-COATED REINFORCEMENT

6.1 Handling. In order to protect the coated reinforcement from damage, the contractor shall use padded or nonmetallic slings and padded straps. Bundled bars shall be handled in a manner which will prevent excessive sagging of bars which will damage the coating. The bundled bars shall not be dropped or dragged and must be stored on wooden cribbing. If, in the opinion of the engineer, the coated bars have been extensively damaged, the material will be rejected. The contractor may propose for the approval of the engineer, alternate precautionary measures.

6.2 Fabrication and Placement. The bars shall be fabricated and placed as shown on the plans and as specified. All bending should be done around nylon coated pins or wooden mandrels. The rate of bending may have to be reduced for some bar sizes to minimize cracking or disbonding of the coating. Any visible evidence of cracking or disbonding of the coating in the bent area of bars bent in accordance with the plan requirements may be patched with approval of the engineer, except that a hairline crack, 0.003 inch or less, at the base of the deformation will not be cause for rejection nor will patching of these cracks be required. All patching shall be done promptly after bending. Bars shall not be shipped until patching material has lost all tackiness.

Plastic-coated tie wires approved by the engineer shall be used in the assembly of the coated bars in the structure to protect them from physical damage.

6.3 Patching. Patching material shall be applied to all sheared ends and contact areas for hangers or couplers. Patching materials shall be applied to all damaged areas at the points of occurrence, such as the initial application, fabrication, destination or

installation points with the following exception. Damaged areas of coating not more than 0.2 inch across at the widest point of exposed area of bare steel and occurring no more than six in any lineal foot of coated bar need not be repaired.

Areas to be patched shall be clean and free of surface contaminants. They shall be promptly treated in accordance with the resin manufacturer's recommendations and before detrimental oxidation occurs.

7. MIXING

7.1 Job-Mixed Concrete: The equipment used for mixing concrete on the project site shall be capable of combining the aggregates, cement and water into a thoroughly mixed and uniform mass, and of discharging the mixture without segregation. The concrete shall be mixed in quantities required for immediate use. Concrete shall not be used which has developed its initial set or that has not been placed within one-half (1/2) hour after the water has been added. Retempering concrete by adding water or by any other means will not be permitted.

The concrete shall be mixed not less than sixty seconds. When a double compartment mixer is used, the minimum mixing time in the first compartment shall be thirty seconds and the total mixing time, including transfer time, shall not be less than sixty-five seconds.

Concrete may be mixed by a paving mixer into which the materials, including the water, can be precisely and regularly proportioned, and which will produce a concrete of uniform consistency, uniform color, and thoroughly and uniformly mixed. The paving mixer shall be equipped with a batch meter and an automatic locking timing device. The water tank shall be equipped with a scale graduated in gallons and fractions thereof. The water measuring device shall be capable of accurate measurement to within one percent of the required amount. The paving mixer shall be equipped with a boom and bucket, fully power controlled, which shall be so operated that the batches may be uniformly distributed on the subgrade.

7.2 Ready-Mixed Concrete: Ready-Mixed (Transit-mixed) concrete may be used in lieu of concrete mixed at the project site. When used, transit-mixed concrete shall comply with the applicable provisions of Division 150, Equipment and Division 400, Portland Cement Concrete of the Standard Specifications for State Road and Bridge Construction, 1990 Edition, Kansas Department of Transportation, except that testing will be in accordance with the requirements of "Control Tests" in this Section.

8. PLACING CONCRETE

8.1 General: Before beginning placement of concrete, hardened concrete and foreign materials shall be removed from the inner surface of the conveying equipment. Before depositing concrete, all debris shall be removed from the space to be occupied by the concrete; forms, if constructed of lumber, shall be thoroughly wetted (except in freezing weather) or oiled. Reinforcement shall be secured thoroughly in position and approval by the Engineer obtained before concrete is placed.

8.2 Removal of Water: Water shall be removed from the space to be occupied by the concrete before concrete is deposited, unless otherwise directed by the Engineer. Any flow of water into an excavation shall be diverted through proper side drains to a sump, or be removed by other approved methods which will avoid washing the freshly deposited concrete. If directed by the Engineer, water vent pipes and drains shall be filled by grouting, or other approved means, after the concrete has thoroughly hardened.

8.3 Handling: Concrete shall be handled from the mixer, or in the case of ready-mixed concrete from the transporting vehicle, to the place of final deposit as rapidly as practicable by methods which shall prevent the separation or loss of the ingredients. Under no circumstances shall partially hardened concrete be deposited in the work. Concrete shall be deposited in the forms as nearly as practicable in its final position to avoid rehandling. It shall be deposited as to maintain, until the completion of the unit, an approximately horizontal plastic surface. Forms for walls or thin sections of considerable height shall be provided with openings or other devices that will permit the concrete to be placed in a manner that will prevent segregation and accumulations of hardened concrete on forms or metal reinforcement above the level of concrete. Regardless of the type of transporting vehicle, concrete shall have the quality required when deposited in the forms.

8.4 Chuting: When concrete is conveyed by chutes, the equipment shall be of such size and design as to insure a continuous flow in the chute. Chutes shall be of metal or metal lined and the different portions shall have approximately the same slope. The slope shall not be less than one vertical to two horizontal and shall be such as to prevent segregation of the ingredients. The discharge end of the chute shall be provided with a baffle plate to prevent segregation. If the distance of the discharge end of chute above surface of the concrete is more than 3 times the thickness of the layer being deposited, but not more than 5 feet above surface of concrete, a spout shall be used and the lower end maintained as near the surface of deposit as practicable. When the operation is intermittent, the chute shall discharge into a hopper. The chute shall be thoroughly cleaned before and after each run and all debris and cleaning water shall be discharged outside the forms.

8.5 Compacting: During and immediately after depositing, concrete shall be compacted thoroughly by means of suitable tools. In general, concrete shall be compacted by mechanical vibration. Number and type of vibrators shall be subject to the approval of the Engineer.

For thin walls or inaccessible portions of forms where spading, rodding, or forking is impracticable, concrete shall be worked into place by vibrating or tapping forms lightly opposite the freshly deposited concrete. Concrete shall be worked thoroughly around reinforcement, and around embedded fixtures, and into corners of forms.

Accumulations of water on surface of concrete, during placement and compacting, due to water gain, segregation or other causes shall be prevented as far as possible by adjustments in the mixture. Provisions shall be made for removal of such water as may accumulate so that, under no circumstances, will fresh concrete be placed in such accumulations.

8.6 Depositing Continuously: Concrete shall be deposited continuously or in layers of such thickness that no fresh concrete will be deposited on concrete which has hardened sufficiently to cause formation of seams and planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be located at points as provided for in the drawings or approved by the Engineer.

8.7 Depositing in Cold Weather: Concrete when deposited shall have a temperature of not less than 50° F. nor more than 100° F. The Contractor shall submit for the approval of the Engineer the methods he proposes to use for protecting the concrete from freezing temperatures during the first 72 hours where Type I or II Portland cement is used, or 24 hours where Type III (high early strength) Portland cement is used.

Before placing concrete, forms or subgrade shall be free from frost and ice. Methods of heating materials shall be approved by the Engineer. Salts, chemicals or other foreign materials shall not be mixed with the concrete for the purpose of preventing freezing. Calcium Chloride may be used as an accelerator when specifically approved by the Engineer.

8.8 Bonding: Before depositing fresh concrete on or against concrete which has hardened, forms shall be retightened. The surface of the hardened concrete shall be roughened, in a manner that will not leave loosened particles of aggregate or damaged concrete at the surface, cleaned thoroughly of foreign matter and saturated with water. To provide adequate mortar at the juncture of the hardened and newly deposited concrete, the cleaned and saturated surfaces, including vertical and inclined surfaces, shall be first covered thoroughly with a coating of mortar or neat cement grout, against which new concrete shall be placed before the grout has attained its initial set.

8.9 Wet Pour Method: When approved by the Engineer, the Contractor may place a wet pour if he cannot prevent the flow of water into the area as defined in 8.2. At the time a wet pour is made the water level shall be static and below the concrete form surface elevation, unless approved otherwise by the Engineer. A wet pour shall be placed by the tremie method or by pump after the reinforcing and forms are determined to be acceptable by the Engineer. A tremie shall consist of a watertight tube having a diameter of not less than 10 inches with a hopper at the top. 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.

Concrete pump discharge tubes and tremie tubes used to deposit concrete in water shall be equipped with a device that will prevent water from entering the tube while charging the tube with concrete. Such tubes shall be supported so as to permit free movement of the discharge end over the entire top surface of the work and to permit rapid lowering, when necessary to control or stop the flow of concrete. The tubes shall be filled by a method that will prevent washing of the concrete. The discharge end shall be completely submerged in concrete at all times and the tube shall contain sufficient concrete to prevent any water entry. The flow shall be continuous until the work is completed and the resulting concrete seal shall be monolithic and homogeneous. The wet pour shall be placed in one continuous pour until the form is filled to the plan elevation and all water and unsound concrete has been removed.

When requested by the Engineer the method selected by the Contractor to place the concrete shall be submitted for approval along with sufficient details and data to review the procedure. Concrete for a wet pour shall be the same class of concrete as specified on the plans with a minimum of 10% additional cement and a slump not to exceed six (6) inches.

9. CURING OF CONCRETE

All concrete surfaces shall be protected to insure that loss of moisture from the surface is held to a minimum for a period of at least seven (7) days following initial set. Where Type III (high early strength) Portland cement is used, the period shall be not less than three (3) days. Concrete damaged by improper curing shall be subject to removal and replacement as directed. The method of curing, regardless of type, will not relieve the Contractor of his responsibility to provide concrete having required strength and surface finish. Unless otherwise specified for a specific item of work, the prevention of the loss of moisture from the concrete surface shall be accomplished by one of the following alternate methods:

a. Surface maintained continuously wet by sprinkling or inundation;
b. Covering with burlap mats kept continuously wet;
c. Covering surfaces with white or translucent polyethelene sheeting not less than .004 inch in thickness. Splices shall be made with a minimum lap of 4 inches and sealed with adhesive tape approved by the Engineer;
d. Application of a membrane curing compound such as Protex Industries "Triple Seal"; Carter-Waters' "Chlorcure"; or an equal product approved by the Engineer. Application shall be at a rate of not more than 200 square feet of surface per gallon of compound;
e. Forms left in place during the specified curing period shall be sprinkled and maintained moist as required to prevent rapid drying of the concrete;
f. Other methods of curing as may be approved by the Engineer.

10. CONTROL TESTS

All concrete and concrete materials used in the work shall be tested as directed by the Engineer. The Contractor shall provide material for all samples and test specimens required.

Control tests which will be conducted on a continuing basis include:

10.1 Slump Test: (ASTM-C143) as directed during concrete placement.

10.2 Yield Test: (ASTM-C138) as directed during concrete placement, generally once each day during concrete placement.

10.3 Compressive Strength: (ASTM-C39) for each separate pour and each class of concrete, two (2) test specimens for each 500 cubic yards or less of each class of concrete placed during one days operation to be tested at 7 and 28 days. Test specimens to be prepared in accordance with ASTM-C3l.

10.4 Air Entrainment: (ASTM-C231) as directed during concrete placement, generally at least once each day during concrete placement.

11. DEFECTIVE CONCRETE

11.1 Deficient Strength: Where the results of strength tests indicate concrete which fails to conform to these specifications, additional test specimens shall be taken, in accordance with ASTM C42, from the questioned areas, as directed by the Engineer. If the strength indicated by these core samples meets the specification requirements the concrete will be accepted. In the event that the core tests fail to meet the specifications, all concrete represented by the deficient test specimen shall be removed and replaced by the Contractor at no additional cost to the Owner. The cost of all coring and testing, including satisfactory patching of core holes, shall be borne by the Contractor.

11.2 Defective Area: Areas of concrete which are defective for reasons other than strength (i.e. Honeycombs, finish irregularities, misalignment of forms, etc.) shall be repaired by methods approved by the Engineer. When in the opinion of the Engineer satisfactory repairs cannot be made the defective concrete shall be removed and replaced by the Contractor at no additional cost to the Owner.

12. CONSTRUCTION

12.1 General: The Contractor shall ensure all pipe, pipe sleeves, reinforcing and other embedments are properly set and placed prior to any concrete pours. Concrete items shall be constructed to the detailed thickness and to the lines and grade as shown on the plans. Concrete shall be placed over moistened and unfrozen subgrade and when the ambient temperature is 40°F or greater and rising and the 72 hour period following the placement of the concrete be forecast for 32 degrees day time high temperatures. Any concrete not poured in compliances with these requirements will be subject to strength testing in accordance with Section 26.04(d) of the Uniform Building Code. The subgrade shall be void of excessive moisture. The concrete shall be reinforced with the type of reinforcement indicated and the reinforcement shall be secured and tied in place prior to depositing any concrete.

12.2 Expansion Joints: Asphalt Expansion Joints shall be composed of asphalt, vegetable fibres, and mineral fillers, formed under heat and pressure between two asphalt-saturated felt liners. Asphalt Expansion Joints shall conform to AASHTO M33 or ASTM D994, shall be 1/2" thick and weigh approximately 3 pounds per square foot, unless shown otherwise on the plans.

12.3 Waterstop: Waterstop shall be extruded P.V.C. material with multiple ribs and center bulb for construction joints. It shall be 4-7/16" wide and 3/16" thick (min.). P.V.C. waterstop for expansion joints shall be 3/16" thick (min) and be designed for 1/2" expansion (min). The waterstops shall be Labyrinth Model B3 as manufactured by Water Seals, Inc., Chicago, Illinois, phone 1-312-332-6765 or approved equal.

12.4 Joint Sealer: After the specified curing period, the faces of all joints to be sealed shall be thoroughly cleaned, using compressed air, sweeping, brooming or other methods approved by the Engineer. The faces of the joint shall be dry after being

thoroughly cleaned, and filled with joint sealing compound using a nozzle designed to completely fill the joint.

Joints shall be filled to within the top surface, but in no case shall they be overfilled. Upon completion of the joint sealing operations, all excess material and foreign material shall be removed from the concrete surface.

Joint Sealant to be polysulfide base which cures to a flexible seal with good bonding characteristics or as shown otherwise in the plans.

12.5 Finishing of Related Unformed Surface: Surfaces to receive concrete Class III (grout) or equipment foundations shall have a rake finish or broom finish. Equipment or structure foundations, floor slabs and steps not to receive concrete Class III (grout) shall receive a troweled finish. Slabs to receive a coating shall have a finish as recommended by coating manufacturer.

Sidewalks shall receive a light broomed finish.

12.6 Finishing of Formed Surfaces: All surfaces exposed to view which have been in contact with the forms shall receive a smooth rubbed finish in accordance with Section 10.3.1 of ACI 301-72 after the surfaces have been prepared as specified in Chapter 9 of ACI 301-72. All air bubbles shall be filled with a bonding grout and rubbed down with sacks before final rubbing as specified above. This shall include all exposed edges and surfaces of walls.

FLY ASH FOR USE IN CONCRETE

1. Description

This specification covers fly ash that may be used as a partial replacement for portland cement and blended hydraulic cement in concrete, when allowed by other parts of the Contract Documents.

2. Requirements

a. Provide material that complies with the chemical and physical requirements of ASTM C 618, Class C or Class F, except the loss on ignition may not exceed 3.0%. The supplementary optional physical requirements apply, except that with the “Effectiveness in Controlling Alkali-Silica Reaction,” the expansion of the test mixture as a percentage of the low-alkali cement control at 14 days may not exceed 120%. Conduct this testing with 15% fly ash and a Type I/II cement with an alkali content between 0.40% and 0.44%.

b. The flyash shall come from a source approved by the Engineer.

c. There are other requirements that must be met for the fly ash/cement mixture in addition to those cited above for qualification of the fly ash alone. Additional testing will be required for specific applications. Consult the Contract Documents before proposing the use of fly ash in concrete.

3. Test Methods

Sample and test fly ash according to ASTM C 311. Field sample according to Part V, KT-29.