

*CITY OF TOPEKA*  
*and*  
*SHAWNEE COUNTY*

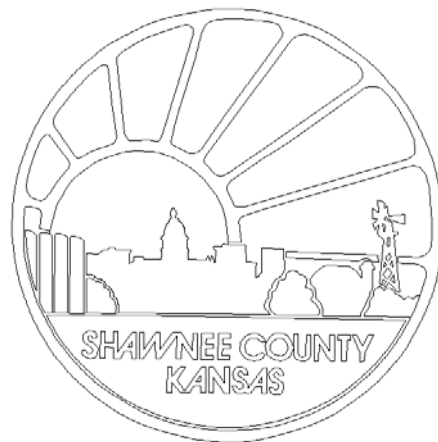
*STANDARD TECHNICAL SPECIFICATIONS*



*City of Topeka*  

---

*Shawn P. Bruns, P.E.*  
*City Engineer*



*Shawnee County*  

---

*Thomas C. Vlach, P.E.*  
*Public Works Director*

2008 Edition  
2010 REVISED

# CONTACT LIST

## CITY OF TOPEKA ENGINEERING DIVISION

Administrative/General Information .....	Ph. 368-3842 Fax 368-3881
Construction Management Section .....	Ph. 368-3971 Fax 368-3974
Survey Section .....	Ph. 368-3842 Fax 368-3881
Utility Management Section .....	Ph. 368-3971 Fax 368-3974
Development Services Office/ Permit Office .....	Ph. 368-3704 Fax 368-1650

## CITY OF TOPEKA WATER AND WATER POLLUTION CONTROL DIVISION

One-Call Center .....	368-3111
-----------------------	----------

## SHAWNEE COUNTY PUBLIC WORKS DEPARTMENT

Administrative/General Information .....	Ph. 233-7702 Fax 291-4920
Building Permits .....	Ph. 233-7702 Fax 291-4920

# TABLE OF CONTENTS

## SECTION 1 - GENERAL

1.	Scope	1-1
2.	Specifications	1-1
3.	Conflict in Drawings and Specifications or Documents	1-2
4.	Physical Data	1-2
5.	Shop Drawings and Engineering Data	1-2
6.	Contractor Use of Premises	1-3
7.	Damage to Premises	1-3
8.	Sanitation	1-4
9.	Traffic Control	1-4
10.	Measurement and Payment	1-4
11.	Construction Staking	1-4
12.	Final Inspection	1-5

## SECTION 2 – EXCAVATION, BACKFILL AND COMPACTION

1.	General	2-1
2.	Excavation	2-1
3.	Sheeting and Bracing	2-2
4.	Control of Ground Water and Surface Water	2-3
5.	Stabilizing Trench Bottoms and Structure Subgrade	2-3
6.	Bedding Material and Placement	2-3
7.	Backfill	2-4
8.	Compaction	2-5
9.	Unsuitable Backfill Material	2-6
10.	Supplementary Borrow Material	2-6
11.	Blasting	2-6
12.	Clean-Up	2-7
13.	Bid Item, Measurement and Payment	2-7

## SECTION 3 – EARTHWORK AND GRADING

1.	Clearing and Grubbing	3-1
2.	Stripping	3-1
3.	Topsoil	3-1
4.	Unclassified Excavation	3-1
5.	Supplementary Borrow Material	3-1
6.	Embankment	3-2
7.	Subgrade	3-2
8.	Subgrade Preparation	3-2
9.	Disposal of Material	3-5
10.	Rock Excavation	3-5
11.	Pavement Removal	3-5
12.	Drainage	3-5
13.	Soil Stabilization	3-5
14.	Bid Item, Measurement and Payment	3-6

## SECTION 4 – OBSTRUCTIONS AND INCIDENTAL CONSTRUCTION

1.	General	4-1
2.	Existing Utilities	4-1
3.	Public Property	4-2
4.	Private Property	4-3
5.	Access	4-3
6.	Culverts	4-3
7.	Crushed Rock Surfacing	4-4
8.	Pavement	4-4
9.	Trees, Hedges and Shrubs	4-4
10.	Finishing Disturbed Areas	4-4
11.	Stone Riprap	4-7
12.	Monument Box	4-8
13.	Guardrail	4-8
14.	Chain Link Fence	4-8
15.	Temporary Erosion and Pollution Control	4-9
16.	Pavement Marking (Material and Installation)	4-11
17.	Field Office	4-12
18.	Underdrains	4-13
19.	Project Sign	4-13
20.	Bid Item, Measurement and Payment	4-13

## SECTION 5 – CONCRETE

1.	Definition	5-1
2.	Materials	5-1
3.	Concrete Proportioning and Strength Requirements	5-4
4.	Sampling and Testing	5-6
5.	Mixing, Conveying and Placing	5-7
6.	Forms	5-9
7.	Structural Concrete	5-10
8.	Pavement, Sidewalks, Driveways, Curbs and Gutters	5-12
9.	Bid Item, Measurement and Payment	5-23

## SECTION 6 – SEWERS

1.	General	6-1
2.	Materials	6-1
3.	Construction Methods	6-5
4.	Cleaning and Testing of Sanitary Sewer Lines	6-9
5.	Cleaning and Inspection of Storm Sewer Lines	6-11
6.	Bid Item, Measurement and Payment	6-12

## SECTION 7 – ASPHALT CONCRETE

1.	Description	7-1
2.	Materials	7-1
3.	Mix Designation BM-2A	7-2
4.	Asphaltic Concrete Mix Design	7-2
5.	Equipment	7-3
6.	Construction Requirements	7-3
7.	Cold Milling	7-7
8.	Bid Item, Measurement and Payment	7-7

SECTION 8 – WATERMAINS

1.	General	8-1
2.	Materials	8-1
3.	Construction Methods	8-4
4.	Sterilizing and Pressure Testing	8-5
5.	Bid Item, Measurement and Payment	8-6

<u>STANDARD DETAIL NAME</u>	<u>CURRENT ID NO.</u>	<u>REVISION DATE</u>
Asphalt Concrete Pavement Details	DT-001	12-09
Concrete Pavement Details	DT-002	12-09
Curb & Gutter and Approach Details	DT-003	12-09
Ramp & Walk Details	DT-004	12-09
Standard Manhole Details	DT-005	12-09
Manhole Rehabilitation Details	DT-006	02-08
Sanitary Sewer Details	DT-007	02-08
Storm Sewer Details	DT-008	02-08
Type I Inlets	DT-009	02-08
Type I-P Inlets	DT-010	12-09
Type II-P Inlets	DT-011	12-09
Ditch Inlets	DT-012	02-08
Type II-P Area Inlet Manhole	DT-013	02-08
Channel Linings	DT-014	02-08
Pipe Outfalls	DT-015	02-08
Wash Check, Trickle Channel & Flume	DT-016	02-08
Miscellaneous Details I	DT-017	12-09
Miscellaneous Details II	DT-018	12-09
Typical Project Signing	DT-019	12-09
Erosion & Pollution Control - Inlet Protection & General Notes	DT-020	02-08
Erosion & Pollution Control – Silt Fence, Sediment Trap and Construction Entrance	DT-021	12-09
Typical Traffic Control	DT-116	01-07
Typical Traffic Control Plan	DT-117	01-07
Model ROW Corridor 1		
Model ROW Corridor 2		
Model ROW Corridor 3		
Model ROW Corridor 4		

## SECTION 1

### GENERAL

1. SCOPE. The intent of the Drawings and these Specifications is to provide for the execution and completion in every detail of the work described herein, and it is understood that the Contractor for all or any part will furnish all labor, material, equipment, tools, transportation and necessary supplies such as may be required to complete the project in a satisfactory and workmanlike manner in accordance with the Drawings and Specifications.

Contractor shall also pay all legally required sales, consumer and use taxes and shall obtain and pay for all required licenses and permits. The Contractor shall comply with all codes, ordinances, rules, regulations, orders and other legal requirements of public authorities that affect the performance of the work.

The Contractor shall file with the Engineering Division and/or Shawnee County Director of Public Works, the names, addresses and phone numbers of two or more responsible persons in the Contractor's organization who shall be on call at all times. If a project sign is required at the site of the work, as determined by the Engineer, phone numbers shall also be listed on the sign. Normally a sign will only be required when the work is all at one location.

Contractor shall notify all affected property owners of construction. Information shall include construction start and finish dates; project number and description; company name and phone number; and superintendent's name and phone number.

The Contractor shall give the Engineering Division, Construction Management Section and/or Shawnee County Director of Public Works 48 hours notice of his intent to begin work on City/County right-of-way.

2. SPECIFICATIONS. Accredited authorities for quality of materials and standards of practice will be referred to by their initials with the specific reference indicated by the respective reference number. It shall be understood that, unless specifically noted otherwise, the latest edition of the respective reference, at the time of advertising for bids, shall govern.

#### Reference Initials

AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AGC	Association of General Contractors
ANSI	American National Standards Institute, Inc.
AREA	American Railway Engineering Association
ASA	American Standards Association
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
OSHA	Occupational Safety and Health Administration
SSPC	Steel Structures Painting Council
USAS	USA Standard

3. CONFLICT IN DRAWINGS AND SPECIFICATIONS OR DOCUMENTS. Where a discrepancy may exist between Drawings, Specifications, etc., the order of precedence shall be as follows:

- a. Supplementary Conditions
- b. Drawings
- c. Standard Technical Specifications
- d. Other specifications incorporated by reference

4. PHYSICAL DATA. Any physical data in regard to subsoil, rock, water table or other site conditions, which are noted on the Drawings or Reports or referred to herein, represent conditions as of the date of their determination and are for information only. Any reliance by the Contractor on such data will be at his own risk.

5. SHOP DRAWINGS AND ENGINEERING DATA.

a. General. Engineering data covering all materials and fabrications that will become a permanent part of the Work shall be submitted to the Engineer for review, at or prior to the Pre-construction Conference. Submittal and review of Shop drawings shall be done in accordance with this Section and Subsections 6.23 through 6.28 of the General Conditions, Document 700, in the Project Manual.

All submittals, regardless of origin, shall be stamped with the approval of Contractor and identified with the name and number of this Contract, Contractor's name, and references to applicable Specification paragraphs and Contract Drawings. Each submittal shall indicate the intended use of the item in the Work. When catalog pages are submitted, applicable items shall be clearly identified and inapplicable data crossed out.

Contractor's stamp of approval is a representation to Owner that Contractor accepts full responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, and similar data, and that he has reviewed and coordinated each submittal with the requirements of the Work and the Contract Documents.

Contractor shall accept full responsibility for the completeness of each submission. When an item consists of components from several sources, Contractor shall submit a complete initial submittal including all components.

All deviations from the Contract Documents shall be identified on each submittal and shall be tabulated in Contractor's letter of transmittal.

Five copies of each drawing and necessary data shall be submitted to Engineer. Facsimile (fax) copies will not be acceptable. Engineer will not accept submittals from anyone but Contractor. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.

b. Engineer's Review of Drawings and Data. Engineer's review of drawings and data submitted by Contractor will cover only general conformity to the Drawings and Specifications. Engineer's review does not indicate a thorough review of all dimensions, quantities, and details of the material, or item shown. Engineer's review of submittals shall not relieve Contractor from responsibility for errors, omissions, or deviations, nor responsibility for compliance with the Contract Documents.

Engineer's submittal review period shall be 21 consecutive calendar days in length and shall commence on the first calendar day immediately following the date of arrival of the submittal or resubmittal in Engineer's office. The time required to mail the submittal or resubmittal back to Contractor shall not be considered a part of the submittal review period.

When the drawings and data are returned marked "REJECTED - SEE REMARKS" or "REVISE AND RESUBMIT", the corrections shall be made as noted thereon and as instructed by Engineer and five corrected copies resubmitted. Facsimile (fax) copies will not be acceptable.

When the drawings and data are returned marked "MAKE CORRECTIONS NOTED", "NO EXCEPTIONS TAKEN", no additional copies need be furnished unless requested by Engineer at time of review.

c. Resubmittal of Drawings and Data. Contractor shall accept full responsibility for the completeness of each resubmittal. Contractor shall verify that all corrected data and additional information previously requested by Engineer are provided on the resubmittal.

When corrected copies are resubmitted, Contractor shall in writing direct specific attention to all revisions and shall list separately any revisions made other than those called for by Engineer on previous submissions.

Requirements specified for initial submittals shall also apply to resubmittals. Resubmittals shall bear the number of the first submittal followed by a letter (A.B. etc.) to indicate the sequence of the resubmittal.

If more than one resubmission is required because of failure of Contractor to provide all previously requested corrected data or additional information, Contractor shall reimburse Owner for the charges of Engineer for review of the additional resubmissions. This does not include initial submittal data such as shop tests and field tests which are submitted after initial submittal.

Resubmittals shall be made within 30 days of the date of the letter returning the material to be modified or corrected, unless within 14 days Contractor submits an acceptable request for an extension of the stipulated time period, listing the reasons the resubmittal cannot be completed within that time.

Any need for more than one resubmission, or any other delay in obtaining Engineer's review of submittals, will not entitle Contractor to an extension of the Contract Time unless delay of the Work is directly caused by a change in the Work authorized by a Change Order or by failure of the Engineer to review any submittal within the submittal review period specified herein and to return the submittal to Contractor.

6. **CONTRACTOR USE OF PREMISES.** Contractor shall limit his construction activities and material storage to the areas delineated on the Drawings and as directed by the Engineer. Permanent and temporary easement locations are shown on the Drawings. Any additional work or storage areas shall be obtained and paid for by the Contractor. Copies of agreement signed by property owner shall be provided to the Engineer prior to use of additional areas. The Contractor shall assume full responsibility for the protection and safekeeping of all materials that are stored on the construction site.

7. **DAMAGE TO PREMISES.** Contractor shall be responsible for the repair or replacement of any public or private property which is damaged by the Contractor's operations and which is not shown on the Drawings to be removed.

8. SANITATION. 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.

9. TRAFFIC CONTROL. Contractor furnished traffic and pedestrian control for construction projects governed by these Specifications shall conform to the applicable provisions of the Manual on Uniform Traffic Control Devices, Part VI – Temporary Traffic Control. The latest edition at the time of advertising for bids shall govern.

10. MEASUREMENT AND PAYMENT. All work to be performed under this contract will be paid for at the lump sum or unit prices stated on the Bid Form of the accepted bidder. Unit price payments will be based upon measurement of installed items as hereinafter described. Payment for unit price items and lump sum items shall constitute full compensation for all labor, materials, tools, equipment and incidentals required to complete the work, as described in accordance with the Drawings and Specifications. Any material, equipment or operation not specifically mentioned shall be considered to be incidental to the unit price or lump sum pay item to which it pertains.

11. CONSTRUCTION STAKING. A minimum of forty-eight (48) hours notice shall be required for survey construction staking, said 48 hours shall not include weekends or holidays.

The General Contractor's Job Superintendent shall order all survey construction staking, priority shall be based on the order in which calls for stakes were received except in instances where conflicts with utilities may arise.

The General Contractor shall be responsible for maintaining and protecting all survey construction stakes until construction activity is completed. The General Contractor shall be charged for any survey construction stakes that are re-set due to contractor negligence and for any and all reasons other than survey errors and omissions or project re-design. Charges shall be deducted from the final payment.

The General Contractor shall be responsible for maintaining and protecting all baseline points, control points, reference points, bench marks, property and offset corners, Public Land System Survey Corners, and all other essential horizontal and vertical survey control points, In instances where any of the above said points may be endangered, the contractor shall give sufficient notice to the survey crew to enable them to re-set and/or reference said point or points before the beginning of the endangerment activity.

A Land Surveyor registered in Kansas who is employed or retained by the firm or agency providing construction staking services for the project will conduct or supervise a diligent search for all Public Land Corner monuments, property and offset corner monuments which may be disturbed or destroyed by construction. All monuments which are found will be witnessed and referenced for replacement.

All Public Land System Corner monuments, property and offset corner monuments which are disturbed or destroyed in the course of construction shall be reset by or under the supervision of a Land Surveyor registered in Kansas who is employed by or retained by the firm or agency providing construction staking services for the project.

The General Contractor shall be provided with a photocopy or fax of the construction field notes for the referral by the contractor if cut or fill stakes should become lost or destroyed.

All survey construction stakes, horizontal and vertical control points shall follow the APWA Uniform Color Code.

- White - Proposed Excavation
- Pink - Temporary Survey Markings
- Red - Electric Power Lines, Cables, Conduit and Lighting Cables
- Yellow - Gas, Oil, Steam, Petroleum or Gaseous Materials
- Orange - Communication, Alarm or Signal Lines, Cables or Conduit
- Blue - Potable Water
- Purple - Reclaimed Water, Irrigation and Slurry Lines
- Green - Sewers and Drain Lines

All survey property line and right-of-way stakes shall adhere the following schedule

- Red - Right-of-way
- Blue - Permanent Easements
- Green - Temporary Easements

12. FINAL INSPECTION. When Contractor believes that the project is ready for final inspection, he shall make the request for inspection, in writing, a minimum of 72 hours prior to the desired time. Request shall be delivered to the project inspector.

END OF SECTION

## SECTION 2

### EXCAVATION, BACKFILL AND COMPACTION

1. **GENERAL.** This section covers excavation, trenching, backfilling and grading incidental to the construction of sewers, pavement, pipelines and structures shown on the Drawings and described in these Specifications.

Unless specifically shown or designated otherwise, all excavation shall be by open cut.

The Contractor shall assume full responsibility for satisfactory performance of the work and for the safety of the work, working personnel and the general public.

All excavation within the City's right-of-way requires a permit from the Development Services Division prior to starting the excavation. No vehicle or machinery may be driven across any curb or sidewalk or damage, break or cut any curb, gutter or sidewalk except as authorized under a permit. Curb and gutter shall not be bridged or filled with any material to gain access to private property thus obstructing the drainage of the gutter except by written permit.

#### 2. EXCAVATION.

a. Structure Excavation. Excavation for structures shall be to lines and grades shown on the Drawings.

Extend excavation for formed structures sufficiently to permit construction and inspection of forms, and for installation of drain tile or other below-grade work.

All excavation for structures will be unclassified except when rock excavation is listed as a pay item on the Bid Form. Unclassified excavation will be subsidiary to the structure for which the excavation is performed.

Provisions governing rock excavation as set forth in this section shall apply to rock excavation for structures.

Measurement for rock excavation will be of the volume of rock actually removed except that no measurement will be made for rock excavated outside a volume bounded by vertical planes 18 inches outside the base.

The excavation shall be maintained in a condition suitable for placing reinforcing steel and concrete by such dewatering of adjacent and underlying soil as may be required. Dewatering equipment and methods shall be approved by the Engineer. Approved dewatering equipment may be used within the structure provided that any openings in walls or floors shall subsequently be closed watertight, using methods and procedures approved in advance by the Engineer.

Excavation shall be shored and braced to protect adjacent structures or installations from damage.

Before placing any concrete, excavation shall be inspected and approved by the Engineer.

b. Structure Subgrade. A normal foundation under structures will be undisturbed soil. If over-excavation occurs or is required, the subgrade may be brought back to grade using approved material

from excavation or borrow sources, uniformly compacted as specified for "Type A" compaction. Alternatives to the above corrective method are:

- (1) Using the bedding material specified in Paragraph 6.
- (2) Increasing the thickness of the concrete base.

Unless over-excavation of structure subgrade is authorized by Engineer, the corrective action shall be at Contractor expense.

c. Structure Subgrade for RCB Structures. Reinforced concrete box structures shall be constructed on a 3 inch minimum thickness concrete seal course. Seal course concrete shall have a minimum strength of 2,500 psi. When the subgrade is not capable of supporting the weight of a person without undue deformation, a stabilized stone base of a width and depth determined by the Engineer shall be installed. Stabilized stone base shall consist of crushed limestone with angular shapes for high interlocking capability. Stone gradation shall be as specified in Subsection 5 of this Section. Seal course under RCB structures shall not be paid for directly but shall be included in the price bid for Reinforced Concrete Box (RCB) Structures. Stabilized stone base shall be paid for at the unit price bid for that item.

d. Trench Excavation. Trench excavation shall be to the lines and grades indicated on the Drawings.

Banks shall be vertical from bottom of the trench to at least 6 inches above the top of the pipe. Above that point, trench walls may be sloped as required for safety and shall conform to all pertinent OSHA Regulations.

Trenches shall be excavated as near as is practical to the widths shown on the applicable Standard Sewer Detail sheet of the Drawings.

The bottom of the trench shall be undisturbed soil smoothed to the satisfaction of the Engineer by backhoe bucket or hand shovel, or both, prior to placement of bedding material.

Over-excavation shall be replaced with bedding material at no additional cost to the City/County.

All excavation for trenches shall be unclassified except when rock excavation is listed as a pay item on the Bid Form.

Dewatering, when required, shall be subsidiary to other bid items.

e. Rock Excavation. Additional payment will be allowed for rock excavation when listed as a pay item on the Bid Form.

Rock quantities listed on the Drawings are estimated quantities and will not be used as the basis for payment.

Trench width used in computing rock excavation shall be the width shown on the applicable Standard Sewer Detail sheet of the Drawings.

Rock excavation shall include the excavation of all sedimentary, igneous and metamorphic rock which is naturally in place and is firm, rigid and unweathered and all boulders or other detached stone with a volume of 2 cubic yards or more.

Rock encountered in two or more ledges with interlying strata of soil, clay, gravel or shale not more than 12 inches in thickness between each ledge will be classified as solid rock from the top of the top ledge to the bottom of the bottom ledge of rock.

Rock shall be excavated to a depth of not less than 4 inches below the bottom of structures or of sewer pipe and 12 inches below the bottom of finished subgrade for pavement construction.

3. SHEETING AND BRACING. Sheeting and bracing shall be provided in all trenches where required and shall conform to all pertinent OSHA Regulations. Sheeting may be wood or metal. Wherever, because of unstable trench conditions, it is necessary to drive sheeting below the centerline of pipe, it shall be driven to a depth of 2 feet (minimum) below the flowline of the pipe. After the trench has been backfilled up to a level 1 foot above the pipe, sheeting may be removed and the space left because of such removal shall be filled immediately and the backfill recompacted. Wood sheeting which has been driven to below the centerline of the pipe shall be left in place below a level of 1 foot above the top of the pipe. Trench boxes or shields may be used instead of sheeting and bracing. Excavations shall be braced to prevent subsidence or injury to the adjoining premises. The party excavating shall be liable for all damages arising by reason of neglect or carelessness.

4. CONTROL OF GROUND WATER AND SURFACE WATER. Where ground water or surface water is encountered, trenches shall be dewatered as necessary to permit the construction to be carried on in a satisfactory manner. Portions of sewers where all joints have been completed may be used for draining trenches, provided such drainage is free from debris. Drainage may be collected in temporary sumps and then pumped into natural drainage channels as approved by the Engineer. Surface water shall be prevented from entering trenches. Where approved by the Engineer, and approved in writing by the property owner, existing drainage channels may be temporarily diverted. After completion of the construction, the temporary channels and original channels shall be returned to their original condition unless otherwise approved by the property owner. It shall be the contractor's responsibility to obtain the permission of the property owner, in writing, for the temporary channels.

5. STABILIZING TRENCH BOTTOMS AND STRUCTURE SUBGRADE. Wet or unstable trench bottoms and structure subgrade shall be stabilized by excavating to additional depth as directed by the Engineer and replacing the unsatisfactory soil with crushed limestone with angular shapes for high interlocking capability graded as follows:

- a. 4 inch to 8 inch primary crusher run.
- b. 3 inch to 4 inch crusher run.
- c. 1 1/2 inch poorly graded.
- d. 3/4 inch poorly graded.
- e. Recycled concrete material with gradation approved by the Engineer
- f. Specification bedding material.

Field conditions shall be the determining factor for individual or combined use of these materials. The upper 2 inches of any stabilized area shall consist of specification bedding material. In sewer trenches, the minimum depth of bedding material shall be 4 inches under the pipe.

6. BEDDING MATERIAL AND PLACEMENT. Trenches shall be excavated to a depth not less than 4 inches below the bottom of the pipe and the pipe shall be laid on a bed of crushed limestone having the following characteristics:

Retained on 3/4 inch sieve.....	0%
Retained on 1/2 inch sieve.....	15% to 35%
Retained on 3/8 inch sieve.....	40% to 70%

Retained on No. 4 sieve.....90% to 100%  
Deleterious Substances, maximum..... 5%

Bedding material shall be placed and compacted as specified for "Type A" compaction.

Bedding material shall not be used in the Kansas River Valley where the native material is primarily sand or silt.

## 7. BACKFILL.

a. General. Prior to the placement of either structure backfill or trench backfill, a Standard Proctor Curve as determined by AASHTO T 99 (ASTM D 698) shall be obtained for each type of backfill material to be used. Proctor curves shall be obtained from soil samples selected by a certified testing laboratory from materials excavated by the Contractor. All costs associated with the selection of soil samples and performing the necessary tests to obtain the Proctor curves shall be paid by the Contractor. Selection of the correct Proctor curve for a particular backfill material shall also be done by the Contractor's certified testing laboratory.

During backfill operations, soil density tests shall be taken by the Engineer or his representative. When results indicate that compaction does not meet the requirements of these Specifications, the material shall be removed and replaced or recompacted as necessary to meet the specified requirements at no additional expense to the City/County. Additional tests shall be performed on recompacted area to insure compliance with the requirements.

If the Contractor elects to backfill with material for which no Standard Proctor Curve has been completed, the backfill shall still be tested by nuclear densimeter and the readings saved for later comparison with the Proctor Curve. If this comparison indicates that Contractor had failed to achieve the required compaction, the backfill shall be removed and recompacted at no additional expense to the City/County.

b. Recommendations for Compaction Equipment. Most manufacturers of compaction equipment provide information for the use of their equipment.

For compaction of cohesive soils such as clay or clay-silt mixes, the recommended equipment includes rammers which shear and knead the soil and sheepsfoot rollers, either towed or backhoe mounted static types or self-propelled static or vibratory, which shear, blend and bond the soil.

These recommendations also indicate that the thickness of the soil layer being compacted should not exceed the capabilities of the compacting force of the equipment being used. Proper thickness allows full and uniform densification of each layer and is directly proportional to the number of passes required to achieve the desired result.

Steel wheeled smooth rollers, either static or vibratory or vibratory smooth plates are not normally recommended for use on cohesive soils but are highly recommended for consolidating granular soils.

When compacting a mixture of cohesive and granular soils, equipment designed for the predominant soil type should be used.

c. Basis for Acceptance of Compaction. Normally the nuclear densimeter test shall be the basis for acceptance of compacted backfill. However, when backfill materials consist of a mixture of different

soil types or contain a substantial amount of rock chips, the nuclear densimeter may give erroneous results. Therefore, the test results may be tempered by the judgement of the Engineer's representative after observing the compaction effort. The decision to accept or reject compacted backfill may be influenced by the thickness of lift, type of compaction equipment, number of passes of compaction equipment, depth of penetration of a steel probe into the compacted material or successful proof rolling with a fully loaded tandem axle dump truck.

d. Backfill Around Structures. Backfill around structures with approved material after completion of below grade construction and removal and cleanup of all forms, lumber and trash. Each layer shall be placed and compacted as specified for Type A compaction and shall include emphasis on the area adjacent to the structure walls.

e. Trench Backfill. Backfill trenches only after pipelines, joints, wyes and bedding have been inspected and approved. Backfill with approved material from excavation or supplementary borrow areas, free from rocks or clods larger than 3 inches in any dimension.

(1) Initial Backfill for Pipes with Pipe Stiffness (PS) of 100 or less. This category includes PVC pipe meeting the requirements of ASTM D 3034 SDR 35 and ASTM F 679 PS 46. Initial backfill shall consist of specified bedding material to a point 6 inches above the top of the pipe. Care shall be taken to insure that bedding material is worked in around the haunches of the pipe. Bedding material shall be compacted as specified for Type A compaction.

(2) Initial Backfill for Pipes with Pipe Stiffness (PS) over 100. This category includes PVC pipe meeting the requirements of ASTM D 2665 (Schedule 40), ductile iron pipe, vitrified clay pipe, reinforced concrete pipe and corrugated steel pipe. For pipe up to and including 12 inches in diameter, the initial backfill shall consist of specified bedding material to the top of the pipe. For pipe over 12 inches in diameter, initial backfill shall consist of specified bedding material to the springline of the pipe. Care shall be taken to insure that bedding material is worked in around the haunches of the pipe. Bedding material shall be compacted as specified for Type A compaction.

(3) Backfill from Springline to One Foot Over Top of Pipe. This applies to all types of pipe regardless of where the top of bedding material is located. Selected backfill material shall be placed on both sides of the pipe equally to the full width of the trench in loose layers not to exceed 6 inches thick. Each layer shall be compacted as specified for Type A compaction. Continue to place and compact subsequent layers until the pipe is covered to a depth of at least one foot. All material to this depth shall be compacted as specified for Type A compaction.

(4) Backfill for the Remainder of the Trench. After selected backfill and compaction to 1 foot above the top of pipe, the remaining backfill shall be composed of selected excavated materials free from large clods, rocks, frozen materials, debris or junk or of approved supplementary borrow material. Backfill material shall be deposited and compacted as detailed for the required type of compaction.

## 8. COMPACTION.

a. Type A Compaction. Unless otherwise specified on the drawings and/or geotechnical report, Type A compaction shall be used under all paved areas, except sidewalks, which lie within the dedicated right-of-way of all public thoroughfares. Type A compaction shall also be used where sewers intersect stream beds and at other locations designated on the Project Drawings, around structures including behind RCB wingwalls, and to a level not less than 1 foot above the top of sewer pipes, as specified elsewhere in this section. Backfill shall be composed of selected excavated material or approved supplementary borrow material.

Backfill material shall be deposited in loose layers not more than 6 inches thick, and compacted to at least 95 percent of maximum density in accordance with AASHTO T 99 (Standard Proctor).

Moisture control shall be as detailed in Section 3, Subsection 8, Paragraph a.

b. Type AB Compaction. Within the dedicated right-of-way of all public thoroughfares, except as heretofore specified, backfill shall be composed of selected excavated material or approved

supplementary borrow material, deposited in loose layers not more than 6 inches thick, and compacted to at least 90 percent of maximum density in accordance with AASHTO T 99 (Standard Proctor).

Moisture control shall be as detailed in Section 3, Subsection 8, Paragraph a.

c. Type B Compaction. In areas where Type A or Type AB compaction is not specified, approved backfill material shall be placed in the trench in loose layers not more than 10 inches thick and compacted to a density equal to or greater than that of the material in the adjacent trench wall.

9. UNSUITABLE BACKFILL MATERIAL. No material shall be used for structure backfill or trench backfill that contains rocks or clods larger than 3 inches in any dimension, frozen material, debris, junk, or organic material. Such material shall be removed from the backfill material and disposed of as directed by the Engineer. Removal and disposal of unsuitable material is subsidiary to other bid items.

Sand backfill will not be allowed except in areas adjacent to the Kansas River where sand is the existing natural material.

10. SUPPLEMENTARY BORROW MATERIAL. In lieu of following the below procedure for determining quantity of supplementary borrow material, the Contractor may elect to accept and receive payment for plan quantity. Such election by the Contractor shall be made in writing to the Engineer. If suitable excavated materials are not sufficient to complete the backfill, the Contractor shall provide supplementary borrow material. The quality of the proposed supplementary borrow material shall be approved by the Engineer before the material is transported to the project site. The quantity of borrow material provided shall be measured by the cubic yard of compacted material, in place on the project site, determined by the following method: The Contractor shall give the Engineer 24 hours notice before starting to haul borrow. The Engineer or his designated representative will observe the loading of the first truck of each type to be used and will follow that truck to a scale approved by the Engineer where the truck will be weighed. The cost of weighing the first truck shall be subsidiary to the price bid for Supplementary Borrow Material. The capacity of each type of truck will be determined by the net weight of the load and the unit weight of compacted borrow obtained from the standard density test (AASHTO T 99) run on the material. The unit weight shall be the maximum material density at the optimum moisture content as determined by AASHTO T 99. The Engineer's representative will observe the loads delivered by subsequent trucks and compare them to the first weighed load. If the Engineer's representative does not feel that the load on a subsequent truck is equal to or greater than the base load used to establish load volumes, then that load shall be weighed and the volume calculated. The Contractor shall pay for weighing any subsequent loads that are more than 10 percent below the established capacity of the truck. The City/County will pay the weighing cost if the load is within 10 percent.

#### 11. BLASTING.

a. General. Blasting is prohibited unless specifically permitted by the Drawings, Supplementary Conditions, City Engineer or County Public Works Director.

Blasting shall be done only by persons experienced in the handling of explosives.

In locations where flying rock would constitute a hazard to persons or property, blast charges shall be of limited size. Before detonation, the trench shall be backfilled or covered with woven metal protective mats or other mats if approved by the Engineer.

Compliance with these procedures does not relieve the Contractor of responsibility for damage to life or property.

The Contractor will be required to secure a blasting permit in accordance with applicable provision of the Code of the City of Topeka.

b. Vibration Monitoring Requirements. The Contractor shall be responsible for monitoring the vibration due to the impact source at any foundation adjacent to or nearest the point of removal.

Foundations shall include garage, shed, house, and pool slabs, footings and foundation walls.

Monitoring measurements shall be obtained within three (3') feet of the nearest adjacent structure foundation at the nearest point to blasting. The transducer will be buried six inches (6") to one foot (1') below the surface. Surface spiking is acceptable if the ground accelerations do not exceed 1.0 g. The maximum ground velocity at the point of measurement shall not exceed 2 inches per second, as measured by an approved engineering seismograph.

The engineering seismograph shall be a Dallas Instrument Company Model ST-4 or approved equal and shall be operated by qualified personnel.

If vibration exceeds the allowable maximum limits, the Contractor shall use an alternate method for removal of the rock, provided it complies with the vibration requirements herein.

All vibration monitoring shall be subsidiary to other bid items.

12. CLEAN-UP. Clean-up is considered an integral part of the work. The working area shall be promptly restored to a condition equal to or better than that prevailing before construction. The Engineer may, at his discretion, withhold payment for otherwise completed items of work in areas in which clean-up is not completed, unless the Contractor submits, in writing, acceptable reasons why clean-up is incomplete, and provides an acceptable schedule for completion.

### 13. BID ITEM, MEASUREMENT AND PAYMENT.

#### a. Trench Excavation and Backfill.

##### 1. Bid Item.

**TRENCH EXCAVATION AND BACKFILL;  
\_\_\_\_\_ ' to \_\_\_\_\_ ', Type \_\_\_\_\_ Compaction \_\_\_\_\_ L.F.**

2. Measurement will be by the linear foot, to the nearest foot, from center to center of manholes, for the various depths and widths of trench. Depths of trench excavation will be considered to be from the surface of the ground to the invert grade of the pipeline. The initial increment of depth will be 0 foot to 6 foot. Each succeeding depth increment will be 2 feet.

3. Payment will be made at the unit price bid per foot for each compaction category and for each classification of trench depth completed. Control of ground water, sheeting and bracing, and pipe bedding material are subsidiary to "Trench Excavation and Backfill".

b. Rock Excavation.

1. Bid Item.

**ROCK EXCAVATION \_\_\_\_\_ C.Y.**

2. Measurement will be by the cubic yard of rock excavated.

3. Payment will be made at the unit price bid for "Rock Excavation" (when listed as a pay item on the Bid Form). This price bid shall include the cost of backfilling over-excavation specified in Subsection 2, Paragraph d.

c. Crushed Material for Stabilizing Trench Bottoms.

1. Bid Item.

**CRUSHED MATERIAL FOR STABILIZING TRENCH BOTTOM \_\_ TON**

2. Measurement will be by the ton for crushed material, in place, used for stabilizing trench bottom.

3. Payment will be made at the unit price bid per ton.

d. Supplementary Borrow Material.

1. Bid Item.

**SUPPLEMENTARY BORROW MATERIAL \_\_\_\_\_ C.Y.**

2. Measurement will be by the cubic yard, in place, of compacted fill.

3. Payment will be made at the unit price bid when listed as a pay item on the Bid Form.

END OF SECTION

## SECTION 3

### EARTHWORK AND GRADING

1. CLEARING AND GRUBBING. This work shall consist of clearing, grubbing, removing and disposing of all vegetation and debris within the right-of-way and easements, except such objects, vegetation and material that are shown on the Drawings or are designated by the Engineer to remain. Disposal of all materials shall be accomplished in accordance with all Federal, State and local ordinances and regulations. The cost of this work shall be subsidiary to other bid items, unless listed as a pay item on the Bid Form.

2. STRIPPING. All areas to receive embankment shall be stripped of existing organic and other undesirable material to a maximum depth of 6 inches. This material shall be disposed of in a manner approved by the Engineer. Stripping shall be subsidiary to other bid items.

3. TOPSOIL. Topsoil is defined as the top 6 inches of loam that contains a good supply of humus and a high degree of fertility. Topsoil shall be removed from the area within the construction limits and stockpiled separately for use in finish grading. Topsoil removal, stockpiling and replacement shall be subsidiary to other bid items.

4. UNCLASSIFIED EXCAVATION. Unclassified Excavation consists of the excavation of any and all materials encountered during the course of the work. Excavated materials that are not suitable for use in the embankment shall be disposed of in a manner approved by the Engineer at no additional cost unless excavated materials with special disposal requirements are encountered. If special disposal required material is encountered, the Engineer must be notified immediately for agreement that the material requires special disposal. No extra payment will be made for rock or wet excavation unless there is a pay item on the Bid Form. All required grading within construction limits shall be incidental to Unclassified Excavation. All suitable excavated material shall be used in the embankment or site grading. No excavated material shall be wasted without permission of the Engineer.

The Contractor shall be paid for plan quantity unless the Contractor requests and it is agreed upon in writing before the start of the project that 1) another method of quantity determination will be followed or 2) the plan quantity is questionable and further quantity determination is needed. If another method of quantity determination is followed, all pay requests must accurately reflect the quantities to date. No payment for back quantities will be allowed.

5. SUPPLEMENTARY BORROW MATERIAL. If suitable excavated materials are not sufficient to complete the backfill, the Contractor shall provide supplementary borrow material. The quality of the proposed supplementary borrow material shall be approved by the Engineer before the material is transported to the project site.

The Contractor will be paid for plan quantity unless the Contractor elects to follow the procedure listed below for determining the quantity of supplementary borrow material or elects to follow another agreed upon method of determination. Such election by the Contractor shall be made in writing to the Engineer before the start of the project. If so elected, the quantity of borrow material provided shall be measured by the cubic yard of compacted material, in place on the project site, determined by the following method: The Contractor shall give the Engineer 24 hours notice before starting to haul borrow. The Engineer or his/her designated representative will observe the loading of the first truck of each type to be used and will follow that truck to a scale approved by the Engineer where the truck will be weighed. The cost of weighing the first truck shall be subsidiary to the price bid for Supplementary Borrow Material. The

capacity of each type of truck will be determined by the net weight of the load and the unit weight of compacted borrow obtained from the standard density test (AASHTO T 99) run on the material. The unit weight shall be the maximum material density at the optimum moisture content as determined by AASHTO T 99. The Engineer's representative will observe the loads delivered by subsequent trucks and compare them to the first weighed load. If the Engineer's representative does not feel that the load on a subsequent truck is equal to or greater than the base load used to establish load volumes, then that load shall be weighed and the volume calculated. The Contractor shall pay for weighing any subsequent loads that are more than 10 percent below the established capacity of the truck. The City/County will pay the weighing cost if the load is within 10 percent. The Engineer or their representative and the Contractor shall agree on the amount of Supplementary Borrow Material provided to a project on a weekly basis, at a minimum. All pay requests must accurately reflect the quantities to date. No payment for back quantities will be allowed.

6. EMBANKMENT. Prior to placement of any embankment, a Standard Proctor Curve shall be obtained as detailed in Section 2, Subsection 7, Paragraph a. for each type of material to be incorporated in the embankment. Embankment shall not be constructed on or of frozen soil, nor shall organic material be incorporated into the embankment.

The surface of the embankment foundation shall be tilled or disked uniformly and fully to a minimum depth of 6 inches to insure a thorough bond between the original surface and the new embankment.

Fill material shall be deposited in loose layers not more than 6 inches thick, and compacted to 90% of maximum density as determined in accordance with AASHTO T 99 (Standard Proctor). Compacting operations shall include blading each lift of embankment material to insure uniformity. Water shall be added or removed, if necessary, in order to obtain the required density within a moisture range not lower than three percentage points below the optimum moisture content nor higher than three percentage points above the optimum moisture content of the soil involved. Where fill material is placed within subgrade limits, it shall be compacted to 95% of the maximum density.

Compaction equipment selected by the Contractor to construct an embankment fill must be of such a design and size necessary to achieve the density requirements specified.

Embankment shall be subsidiary to "Unclassified Excavation" unless listed as a pay item on the Bid Form.

7. SUBGRADE. Subgrade is defined as the area upon which curb and gutter or pavement is to be placed. The subgrade limits for streets extend one foot on each side beyond the back of curb or edge of pavement, whichever is appropriate. Subgrade limits for drive entrances and sidewalks extend to the edge of the entrance or walk.

The subgrade shall be free of organic material, trash and debris, and rocks larger than 3 inches in any dimension, and shall not be frozen while construction is in progress.

#### 8. SUBGRADE PREPARATION.

a. Streets. A geotechnical report that provides site-specific recommendations for the construction of Public Streets must be submitted for all street or road functional classifications (principal arterials, minor arterials, collectors, sub-collectors and locals).

The report must be approved before the project will be released for construction.

Prior to construction plan approval, the Project Engineer will require three (3) approved copies of the geotechnical report, sealed by a Kansas licensed Professional Engineer or a Kansas licensed Geologist.

At a minimum, the following items must be addressed in the report:

1. Suitable material shall be defined as entirely imperishable with that portion passing the No. 40 Sieve having a liquid limit not exceeding 40 and a plasticity index not exceeding 25 when tested in accordance with ASTM D 4318. The liquid limit is the water content of the soil at the change between the liquid and the plastic states and shall be tested in accordance with ASTM D 4318. The plastic limit is the water content at the boundary between the plastic and semi-solid states as stated in ASTM D 4318-83. The plasticity index is the numerical difference between the liquid limit and the plastic limit. If the on-site soils do not meet these requirements, the geotechnical report must specify how the on-site soils will be modified to achieve these requirements. As an alternative, the geotechnical engineer may specify alternative liquid limits and/or plastic indices for consideration, provided adequate justification is given.
2. The report must identify the soils to be used for fill (excluding any material being brought onsite). The report must contain an evaluation of the soils proposed to be used. The evaluation must include all the following as a minimum:
  - i. Sieve analysis
  - ii. USCS classification
  - iii. Atterberg limits
  - iv. Maximum dry density (ASTM D 698)
  - v. Optimum moisture content
  - vi. Moisture density curve (Standard Proctor)
3. The geotechnical report must also indicate the methods to be used for placement and compaction of the subgrade. The subgrade for all streets shall be treated with fly ash, lime, or other approved material. The geotechnical report shall detail the treatment, placement, incorporation and compaction procedures to be used. The contractor is responsible for regulating the sequence of work, processing a sufficient quantity of material, providing full depth as specified on the plans, using proper amounts of fly ash, lime or approved material, maintaining the work, and reworking areas necessary to meet the requirements. The contractor shall cover the treated subgrade before it is subject to freezing. Proofrolling with a loaded tandem dump truck carrying a minimum load of 15 tons will be required before acceptance of finish subgrade. The subgrade soil shall be uniform in quality and gradation, and shall be approved by the Engineer. Details not specifically covered in the geotechnical report shall conform to the requirements specified in the latest edition of the "Standard Specifications for State Road and Bridge Construction", Kansas Department of Transportation.

The subgrade shall be trimmed to grade with a machine having electronic elevation controls. Other methods for trimming must be approved by the Engineer.

The Contractor shall determine the subgrade elevations before treatment so that after incorporation, compaction and trimming, the full depth of required treated subgrade is provided.

b. Alleys and Drive Entrances. The subgrade shall be tilled or disked to a depth of at least 6 inches and the loosened material compacted to the required crown and elevation.

Subgrade shall be compacted to 95% of maximum density, determined in accordance with AASHTO

T 99 (Standard Proctor).

The moisture content of the soil at the time of compaction shall be uniform and shall not be lower than three percentage points below the optimum moisture content nor higher than three percentage points above the optimum moisture content of the soil involved. If the soil is unstable at this moisture range, the moisture may be varied to the point at which it is stable as determined by the Engineer.

After compaction, the subgrade shall be maintained and if, in the opinion of the Engineer, it becomes excessively dry or wet the Contractor will be required to apply water or aerate and recompact the subgrade. This work will be subsidiary to "Subgrade Preparation".

The prepared subgrade must support the weight of vehicles and equipment without producing ruts in the surface.

The elevation and cross section of the surface shall be thoroughly checked immediately prior to placing pavement on the subgrade. All high places shall be removed and low places filled with suitable material and rolled or tamped until smooth and firm. The use of water on dry subgrade may be required. The water shall be uniformly applied at a controlled rate.

The subgrade shall be completed and checked not less than 100 feet in advance of the paving operation. If hauling over the completed subgrade results in ruts or other objectionable irregularities, the Contractor shall restore it to a satisfactory condition. If the subgrade cannot be restored to satisfactory condition, paving shall be stopped.

c. Sidewalks. Subgrade shall be compacted to the requirements of AB compaction, detailed in Section 2, Subsection 8, Paragraph b. The moisture content of the soil at the time of compaction shall be uniform and shall be such that the soil can be compacted to the required density.

d. Aggregate Base – Type AB-3.

(1) Materials shall comply with Section 1104 of the latest edition of the “Standard Specifications for State Road and Bridge Construction”, Kansas Department of Transportation. The standard proctor, gradation and plasticity test results shall be provided prior to construction of the aggregate base.

(2) Construction Requirements:

- i. Subgrade Preparation -- Subgrade shall be watered, scarified, bladed and compacted to meet 95% compaction requirements within a moisture range of +/-3% of optimum moisture. Subgrade shall be proof rolled with a fully loaded, tandem-axle dump truck. Soft or unsuitable areas identified during proof rolling operation shall be undercut and replaced with controlled structural fill. This work will not be paid for directly, but shall be subsidiary to Aggregate Base construction.
- ii. Subgrade Trimming – Prior to aggregate placement, subgrade shall be trimmed with a rotary style trimmer referencing a taut string line.
- iii. Mixing Method – Aggregate shall be delivered to project at or above optimum moisture content.

- iv. Placement – Aggregate shall be placed to the depth and thickness shown on the plans. Maximum compacted lift thickness shall be 8 inches. Material shall not be placed on frozen subgrade.
- v. Compaction – Compact aggregate base to a minimum density of 95% of the standard density at a moisture content of +/-3% of the optimum moisture.
- vi. Curing – Aggregate base shall be protected from traffic, including construction traffic, for a minimum of 3 days. Aggregate base shall support fully loaded tandem dump trucks carrying a minimum load of 15 tons before placement of pavement.
- vii. Finishing – Upon completion of the curing period, the aggregate base shall be trimmed with a rotary style trimmer referencing a taut string line. Other methods for trimming must be approved by the Engineer. Aggregate base shall be compacted after trimming with a steel-drum or pneumatic-tire roller.

9. DISPOSAL OF MATERIAL. Unless otherwise shown on the Drawings, any excess excavated material shall be disposed of by the Contractor at his own expense. The Contractor shall not dispose of any excavated material until he is certain there is sufficient material to complete all necessary project embankments. If excavated material is disposed of, the Contractor shall furnish approved borrow material at his own expense.

If, in the opinion of the Engineer, excavated material is not suitable for construction of embankments, he may direct that the material be disposed of in the manner specified for excess material. Replacement material shall be supplied as specified for "Supplementary Borrow Material".

10. ROCK EXCAVATION. Should rock, as defined in Section 2, Subsection 2, Paragraph e., be encountered, it shall be removed to a depth of 1 foot below the top of the subgrade and fill material placed and compacted as provided for in Section 3, Subsections 6 or 7.

11. PAVEMENT REMOVAL. Pavement removal shall include the removal and disposal of Portland cement concrete pavement, Portland cement base course, concrete curb and gutter, brick, bituminous mix material over six inches in thickness, and all bituminous mix material laid upon these materials. Limits of pavement removal shall be back of curb, or edge of pavement if curb does not exist.

12. DRAINAGE. Wherever water collects on the project or on adjacent property, as a result of construction activities, the water must be removed and the drainage problems corrected as soon as possible to keep the subgrade dry and to prevent damage to adjacent property.

13. SOIL STABILIZATION. Soil stabilization shall be performed in areas designated on the drawings or geotechnical report.

The Contractor must take measures to limit the amount of dusting of the stabilization material during mixing operations. If unsatisfactory dusting occurs, in the opinion of the Engineer, the Contractor may be required to take corrective measures.

It is the Contractor's responsibility to ensure that the depth of subgrade stabilization shown on the Drawings is provided. If it is necessary to provide stabilization deeper than what is shown on the

Drawings to maintain the minimum required depth after final trimming, the additional material and labor costs will be the responsibility of the Contractor.

14. BID ITEM, MEASUREMENT AND PAYMENT.

a. Clearing and Grubbing.

1. Bid Item.

**CLEARING AND GRUBBING** \_\_\_\_\_ **L.S.**

2. Measurement will be Lump Sum.

3. Payment will be paid at the contract price bid for completed and accepted work.

b. Unclassified Excavation.

1. Bid Item.

**UNCLASSIFIED EXCAVATION** \_\_\_\_\_ **C.Y.**

2. Measurement will be by the cubic yard in its original position. The method of average end areas will be used to calculate yardage. Areas will be measured to a width 2 feet wider than the finished pavement and will be measured to neat lines for other locations.

3. Payment will be made at the contract unit price bid per cubic yard.

c. Supplementary Borrow Material.

1. Bid Item.

**SUPPLEMENTARY BORROW MATERIAL** \_\_\_\_\_ **C.Y.**

2. Measurement will be by the cubic yard of compacted material in place on the project site, either accepted as plan quantity or agreed to be calculated by the number of truck loads and the capacity of each type of truck or another approved method.

3. Payment will be made at the contract unit price bid per cubic yard.

d. Embankment.

1. Bid Item.

**EMBANKMENT, IN PLACE** \_\_\_\_\_ **C.Y.**

2. Measurement will be by the cubic yard in place.

3. Payment will be made at the contract unit price bid per cubic yard.

e. Subgrade Preparation.

1. Bid Item.

**SUBGRADE TREATMENT (TYPE )**  
**AGGREGATE BASE – TYPE AB-3**

\_\_\_\_ S.Y.  
\_\_\_\_ S.Y.

2. Measurement will be by the square yard, and shall be from back of curb to back of curb plus 2 feet.

3. Payment will be made at the contract unit price bid per square yard which price shall include all material, placement, manipulation, compaction and trimming necessary to complete the work.

f. Rock Excavation.

1. Bid Item.

**ROCK EXCAVATION**

\_\_\_\_ C.Y.

2. Measurement will be by the cubic yard of rock excavated.

3. Payment will be made at the unit price bid for "Rock Excavation" (when listed as a pay item on the Bid Form).

g. Pavement Removal.

1. Bid Item.

**PAVEMENT REMOVAL**

\_\_\_\_ S.Y.

2. Measurement will be by the square yard of pavement removed.

3. Payment will be made at the unit price bid for "Pavement Removal", which price shall include all cutting, breaking, sawing, removal of rubble, labor and incidentals.

END OF SECTION

## SECTION 4

### OBSTRUCTIONS AND INCIDENTAL CONSTRUCTION

1. **GENERAL.** The work covered in this section consists of incidental construction and clearing of obstructions to permit construction of public projects through, past and around existing properties and utilities.

2. **EXISTING UTILITIES.**

a. **General.** The Contractor shall notify the utility owner and other proper authorities concerned not less than seven days before starting work in any area. He shall furnish all necessary information as to the nature and extent of the work and shall obtain their cooperation and instructions in locating and protecting all underground pipes, cables, and other utilities. All utility line locations shown on the Drawings are approximate. House connections are generally not shown.

b. **Protection.** The Contractor shall protect utilities from damage by workmen, equipment, and natural causes.

Where utility poles interfere with construction, the Contractor shall arrange with the utility companies concerned to relocate or properly anchor and tie back the poles.

c. **Damaged Utilities.** Any damage to utility lines, house connections or structures by action or negligence of the Contractor shall be repaired or replaced by the Utility owner at the Contractor's expense. This shall also apply to utilities installed after the award of the contract.

d. **Conflicting Utilities.** Wherever the proposed sewers or appurtenances in this project cross or are to be located over or under underground pipes or conduits, the Contractor shall uncover the pipes or conduits at least 3 days prior to construction to allow the Engineer sufficient time to check grades and the utility sufficient time to move them, should it be necessary. If utility lines or their appurtenances obstruct construction of sewers and appurtenances, they will be relocated by the respective utility. Ample notice shall be given to permit the required relocation to be accomplished without delaying construction of the project. Any delay in construction resulting from the relocation of utility lines or their appurtenances will not be grounds for modification of the contract unless agreed upon by the Engineer. In cases of utility conflicts, the Contractor may elect to tunnel in lieu of open cut, at no additional cost.

e. **Restoration for Utility Work.**

(1) Hydro Excavation Process. The maximum diameter of a cored hole in pavement for a hydro excavation procedure shall be six inches. After completion of the hydro-excavation process, each hole shall be backfilled with flowable fill to the bottom of the adjacent pavement. The pavement shall be replaced with asphalt or concrete matching the existing pavement. If the contractor has more than 2 holes in a single concrete panel, then the entire panel shall be replaced. This restoration process shall also be followed for potholing operations.

(2) Utility Project Restoration (City Projects Only). All planned utility projects shall be coordinated with the City in order to ensure the preservation of new pavement or new overlay for a minimum of 36 months after new pavement or overlay is constructed. The City will notify the utility companies of all planned street improvement or repair projects at utility coordination meetings to enable

utility companies to complete their planned projects before new pavement or overlays are constructed. Non-emergency utility repair work that removes and replaces pavement less than 3 years old will only be allowed with the approval of the City Engineer.

The use of temporary steel traffic plates in street repair projects shall be limited to 30 calendar days from the date a utility project begins during the asphalt production season (approximately April through November). During winter months when asphalt production is limited, the use of temporary steel traffic plates will be allowed until 30 calendar days after asphalt production starts up in the spring.

In the restoration process, backfill material shall be deposited in loose layers not more than 6 inches thick and compacted to at least 95 percent of maximum density in accordance with AASHTO T 99 (Type A Compaction) in all paved areas, except sidewalks, which lie within the dedicated right-of-way of all public streets. Sidewalk areas shall be compacted to at least 90 percent of maximum density (Type AB Compaction). Moisture control shall be as detailed in Section 3, Subsection 8, Paragraph (a) of the Standard Technical Specifications.

Flowable fill meeting the requirements listed in Section 5, Subsection 3, Paragraph (h) of the Standard Technical Specifications may be used for backfill. Contractor shall verify de-watering/curing is complete prior to covering the flowable fill material. Subgrade shall be placed and compacted in like kind to the existing subgrade.

Pavement removed for a utility project shall be replaced in kind. For concrete pavement, entire concrete panels must be removed and replaced unless otherwise directed by the Engineer. In asphalt pavement less than 3 years old (includes pavement with a concrete base and an asphalt overlay), an area shall be milled surrounding the repaired area to a full lane width in the transverse direction and 10 linear feet minimum in the longitudinal direction with a one foot minimum of milled surface surrounding all squared edges of the patch. If the milled area extends over to an adjacent lane, the full adjacent lane must be included in the mill and overlay area. Final mill and overlay limits shall be perpendicular to the centerline of the roadway unless approved otherwise by the Engineer. The asphalt pavement replacement shall meet the requirements of Section 7, Asphalt Concrete, of the Standard Technical Specifications. If the distance between two repair areas is closer than 20 feet, then the mill and overlay operation shall be extended to combine the areas into one area. If there are more than 3 repair areas in a 100 feet section of street, then the areas shall be combined into one large mill and overlay area. Where pavement markings are removed or disturbed, the utility company shall replace the markings in kind.

If repair work is completed in an area where the existing asphalt pavement is more than 3 years old, then a minimum one foot milled area shall surround the patch area. Final mill and overlay limits shall be perpendicular to the centerline of the roadway unless approved otherwise by the Engineer. The asphalt pavement replacement shall meet the requirements of Section 7 of the Standard Technical Specifications. If the distance between two repair areas is closer than 10 feet then the mill and overlay operation shall be extended to combine the areas into one area. If there are more than 3 repair areas in a 50 feet section of street, then the areas shall be combined into one large mill and overlay area. Where pavement markings are removed or disturbed, the utility company shall replace the markings in kind.

The utility company is responsible for final cleaning, grading and seeding of all disturbed areas immediately after completion of their projects.

3. PUBLIC PROPERTY. All highway markers, posts, guard fence, standards or other similar obstructions shall be removed and properly stored and replaced, by the Contractor, as directed by the Engineer. All City owned street signs and traffic signs shall be removed and replaced by the City of Topeka Transportation Operations Division - Signs and Marking Section (Ph. 368-3913). All County

owned street signs and traffic signs shall be removed by the County Public Works Department (Ph. 233-7702). The Contractor shall be responsible for coordinating this work.

#### 4. PRIVATE PROPERTY.

a. Easements. No work shall be performed on private property unless an easement or right of entry has been obtained for the purpose of doing the work.

b. Mailboxes. The Contractor shall carefully remove any mailbox in the way of construction and, after construction is completed, shall replace it in good condition in accordance with U. S. Postal Regulation P.O.D. Form 4056. If directed by the Engineer, the Contractor shall temporarily set any mailboxes removed at a location accessible for delivery of mail. Temporary mailboxes shall be considered subsidiary to other bid items of the contract.

c. Fences and Retaining Walls. Where fences or retaining walls interfere with the construction work, and the Drawings do not call for their removal, the Contractor shall be responsible for their removal and replacement. The replacement shall be in a condition similar or better than that which existed prior to construction as determined by the Engineer. The Contractor shall be responsible for notifying the Engineer or his representative prior to the removal of any fence or wall. In areas used for livestock, fences not removed shall be maintained in good condition at all times or temporarily relocated in order to contain the livestock during the construction, then re-erected in the original location after the construction is complete. This work shall be considered subsidiary to other bid items.

d. Septic Tank Systems. Where septic tanks or septic tank lateral systems, which are to remain in service on private property, interfere with or are in the line of construction, the Contractor shall be responsible for their removal and replacement. The replacement shall be made in such a manner as to restore the system to a condition as good or better than existed prior to the start of construction, as determined by the Engineer. This work shall be considered subsidiary to other bid items.

e. Sprinkler Systems. Sprinkler systems affected by construction shall be capped by the contractor and notice given to the property owner. Sprinkler systems located within existing right-of-way will not be repaired. If a sprinkler system located on private property is damaged, it shall be replaced at the completion of construction. This work shall be considered subsidiary to other bid items. The project engineer shall notify the contractor if any special agreements have been made with the property owner regarding the sprinkler system.

5. ACCESS. Unless otherwise directed, the Contractor shall maintain traffic on roads affected. In no event shall more than 300 feet of roadway be left in such condition that it will not support vehicular traffic for access to residences or places of business.

6. CULVERTS. Culverts that are removed during construction of the project shall be cleaned and replaced at the location directed by the Engineer. Salvageable culverts that have been damaged by the construction operations shall be replaced with new material at the Contractor's expense. This work shall be considered subsidiary to other bid items.

a. Culverts Replaced. Culverts or pipes found not to be salvageable due to deterioration or damage not the fault of the Contractor, shall be replaced with reinforced concrete pipe or Aluminized Steel Type 2 corrugated steel pipe conforming to the requirements of Section 6. Size of pipe used shall be the size removed or as directed by the Engineer.

7. CRUSHED ROCK SURFACING. Where the aggregate surfacing of existing traveled ways has been disturbed by construction or construction equipment, the Contractor shall resurface the disturbed area with 4 inches of crushed rock or as indicated on the Drawings. Surfacing material shall conform to the requirements of AB-3 specified in Subsection 1104 of the latest edition of the "Standard Specifications for State Road and Bridge Construction", Kansas Department of Transportation or it may be 3/4 inch Asphalt Stone conforming to the following gradation:

<u>Sieve Size</u>	<u>Percent Retained</u>
3/4" . . . . .	0
1/2" . . . . .	25
3/8" . . . . .	52
#4 . . . . .	93
#8 . . . . .	97
#100 . . . . .	97
#200 . . . . .	98

Surfacing material shall be spread and rolled until a dense and tight surface is obtained. Water shall be applied as needed until the project is accepted for maintenance by the Owner.

8. PAVEMENT.

a. Protection. Should the Contractor's construction equipment damage any pavement surface, whether new or existing, the Contractor shall be responsible for the repair of the damaged pavement surface, at his expense, as directed by the Engineer.

b. Removal and Replacement. Where sewer lines are constructed in paved areas of streets, alleys, parking lots or driveways, the existing pavement shall be removed to the limits required to permit safe trench excavation as specified in Section 2. For concrete pavement, entire concrete panels must be removed and replaced unless otherwise directed by the Engineer. Regardless of the width of pavement removed, measurement and payment will be made only for the linear feet of pavement removed and replaced along the centerline of the trench. In removing the pavement, care should be used to prevent breaking or cracking the pavement beyond the limits of the trench. After the backfill is completed, as specified in Section 2, sufficient pavement shall be removed and replaced to provide a minimum shoulder width of 9 inches on undisturbed soil on each side of the trench. The pavement shall be saw cut (full depth) and carefully removed. The entire width from sawcut to sawcut shall be replaced as shown on the applicable standard sewer detail sheet.

9. TREES, HEDGES AND SHRUBS. Trees designated on the Drawings "To Be Removed" and other trees, hedges, shrubs, and brush, which are wholly within the excavation areas shall be removed to a minimum depth of 2 feet below the ground surface and disposed of as directed by the Engineer. Where hedges and trees have limbs and branches which overhang and interfere with the construction, these limbs and branches may be trimmed by sawing and coating the cut with an approved pruning sealer, or may be removed with the written approval of the property owner.

10. FINISHING DISTURBED AREAS.

a. General. All areas which have been disturbed by the Contractor during construction shall be graded and shaped to the grades shown on the Drawings, and shall be finished with 4 inches of top soil to be provided by the Contractor. Driveways shall be bladed and compacted until level with adjacent areas. Paved streets and other paved areas shall be cleaned. Contractor shall seed or sod disturbed areas with

vegetation matching that which existed prior to construction unless noted otherwise on the Drawings. This work shall be subsidiary to other items of the contract unless listed as a bid item.

b. Seeding, Fertilizing & Mulching. All unpaved areas within the construction limits shall be seeded, fertilized and mulched upon completion of construction. Mulching may be deleted with the approval of the Engineer.

(1) Seeds. Seeds shall comply with the requirements of the latest edition of the "Standard Specifications for State Road and Bridge Construction", Kansas Department of Transportation. Seed shall be Blue Tag certified seed free of noxious weeds. Seeds shall be delivered to the site in convenient containers, each fully labeled, bearing the name, trade name, or trade mark, and a warranty of the producer and a certificate of the percentage of the purity and germination of each kind of seed specified.

(2) Fertilizer. Fertilizer shall be inorganic 12-24-12 grade, uniform in composition, free flowing and suitable for application with approved equipment. The fertilizer shall be delivered to the site in convenient containers, each fully labeled, bearing the name, trade name or trademark, and a warranty of the producer.

(3) Equipment. The seeding operation shall be accomplished with equipment suitable for preparing the seed bed and sowing the seed and fertilizer in accordance with the applicable requirements of this specification.

(4) Preparation of the Seed Bed. Areas to be seeded shall be cleared and graded as required preparatory to tilling the surface. The top 4 inches shall consist of good quality black topsoil sufficiently free of stones, gravel, trash, and large lumps of earth to permit normal mowing with hand equipment. Residual soil not suitable shall be replaced with suitable soil.

(5) Application of Fertilizer. Following the proper tilling of the soil, the fertilizer shall be distributed uniformly at the rate of 100 pounds per acre and incorporated into the soil to a depth of at least 2 inches by disking, harrowing or drilling methods.

(6) Planting Seeds. The seed shall be uniformly planted by a seed drill method, unless otherwise approved. A seed mixture and suggested rates of application are listed below. The Contractor shall be responsible for adapting the seed mixture and rate of application to the site conditions so as to insure a uniform stand of healthy grass in reasonable conformity with adjacent areas. Seed mixtures and rates, if different from those given herein, shall be approved by the Engineer.

Seed Type and Rate of Application

<u>Seed Type</u>	<u>Rate of Application (lbs/acre)</u>
Kentucky Blue Grass Seed	65
Tall Turf Fescue	348

(7) Seeding Season. The Spring seeding season shall be between February 15th and April 30th. The Fall seeding season shall be between August 15th and September 30th. The seeding seasons may be extended a few days if approved by the Engineer. The Engineer reserves the right to vary the seeding seasons shown above due to weather or soil conditions or for other causes.

(8) Compaction. Immediately following the completion of seeding operations, the entire area shall be compacted with a roller weighing not less than 60 but not more than 90 pounds per linear foot of roller.

(9) Mulching. Straw or hay mulch shall be applied uniformly to seeded areas at the rate of not less than two (2) tons per acre. Bales must meet the North America Weed Free Forage Standards. Baled straw or hay shall be broken up and loosened sufficiently before being fed into the blower hopper to avoid the placing of matted or unbroken clumps. The use of wet straw or hay is prohibited.

Mulching shall be performed within 24 hours after seeding, but shall not be performed when wind speeds are greater than 15 mph or when it is raining. Mulching shall be started at the windward side of relatively flat areas, or at the upper part of steep slopes and shall continue until the area is covered. The mulch shall be applied loose enough to allow sunlight to penetrate and air to circulate, but thick enough to partially shade the ground, reduce water evaporation, and reduce wind and water erosion.

Immediately after applying the mulch, the Contractor shall anchor it to the soil using a mulch crimper or other approved equipment with perpendicular, dull, disc blades. This process to partially cover the mulch will protect it from erosion by wind or water. The mulch tilling operation shall be performed parallel to the ground contours.

(10) Protection, Repair and Reseeding. If at any time before acceptance of the completed contract, any portion of the seeded surface becomes gullied or otherwise damaged or eroded, or the seeding has been damaged or destroyed, the affected area shall be repaired to re-establish the specified condition prior to the acceptance of the work. The Contractor shall rework, if necessary, and reseed any areas that do not have at least 70% overall grass coverage within 12 months after the initial seeding operations.

(11) Watering. Immediately following compaction and mulching, the seeded area shall be watered in sufficient amount to penetrate the seed bed to a depth of at least ¼ inch and seed bed shall not be allowed to dry out. Watering shall be performed in a manner not to cause erosion or damage to the seeded surface, and shall be repeated daily for a period of thirty (30) days after seeding, except when thoroughly wetted by rain.

c. Sodding.

(1) Sod. The sod shall be a Tall Turf Fescue/Bluegrass Blend (90% / 10%), unless otherwise specified. The sod shall be cut in strips of uniform thickness with a topsoil thickness of ¼” to ½”. Sod shall be cut in strips not less than 18 inches wide. Badly torn, broken or dry sod will not be accepted. Sod containing noxious weeds or excessive quantities of foreign grass will not be accepted.

(2) Fertilizer. Fertilizer shall be inorganic 13-13-13 grade, uniform in composition, free flowing and suitable for application with approved equipment. The fertilizer shall be delivered to the site in convenient containers, each fully labeled, bearing the name, trademark or trade name, and a warranty of the producer.

(3) Preparation of the Sod Bed. The sod bed shall have a uniform surface free from washes, depressions, rocks, clods and other vegetation and shall conform to the finished grade and cross section shown on the Drawings. The soil, except where fresh topsoil has just been applied and compacted, shall be thoroughly tilled to a depth of 2 inches, and rolled with a roller weighing not less than 60 and not more than 90 pounds per linear foot of roller.

(4) Fertilizing. After tilling operations are completed, fertilizer, as previously specified, shall be spread uniformly at the rate of 10 pounds per 1,000 square feet, and mixed 2 inches deep into the soil by disking, harrowing, cultivating or drilling.

(5) Placing Sod. Tall Turf Fescue/Bluegrass Blend sod shall not be placed during drought conditions nor during the period from June 15th to September 1st, unless authorized by the Engineer, and shall not be placed on frozen ground. Zoysia sod shall be placed only during the period from May 15<sup>th</sup> to August 15<sup>th</sup>. The sod shall be moist when it is placed. Dry or frozen sod will not be accepted.

The fertilized sod beds shall be in a firm but not overly compacted condition, with a relatively fine texture at the time of sodding. Transverse joints between sod strips shall be staggered. The sod shall be carefully placed to produce tight joints. The sod shall be firmed, watered, and refirmed immediately after it is placed. "Firming" shall be accomplished by rolling the newly placed sod with a roller weighing not less than 60 or more than 90 pounds per linear foot of roller.

When sod is to be placed on slopes 2:1 or steeper, the sod shall be pegged with ½ inch by 12 inch wooden pegs driven into the ground on about 3 foot centers, leaving about 1-1/2 inch of the peg above the sod. Pegging shall be done immediately after the sod is firmed.

(6) Watering. The sodded area shall be thoroughly watered daily, for a period of not less than 21 days after placing, except when thoroughly wetted by rain. Any portion of sod that is not in good growing condition shall be replaced with fresh live sod and shall be maintained in good live condition until final acceptance of the contract.

## 11. STONE RIPRAP.

a. Materials. Stone riprap shall be limestone or dolomite meeting the requirements of "Standard Specifications for State Road and Bridge Construction", Kansas Department of Transportation, latest edition.

b. Class. The classes of riprap shall be as described below.

(1) Class I shall be pit run material with a maximum size of 100 pounds (1.0 foot dia.) and a minimum size of 12 pounds (0.5 foot dia.).

(2) Class II shall be pit run material with a maximum size of 700 pounds (2.0 feet dia.) and a minimum size of 25 pounds (0.7 foot dia.).

(3) Class III shall be pit run material with a maximum size of 2,000 pounds (3.0 feet dia.) and a minimum size of 40 pounds (0.8 foot dia.).

c. Filter Fabric. Filter fabric shall be a pervious sheet of nonwoven needle punched fabric. Weight of fabric shall be at least 6.0 ounces per square yard. The water flow rate shall be approximately 110 gallons per minute per square foot. Fabric shall have a minimum puncture resistance of 100 pounds and be resistant to freeze-thaw cycles, soil chemicals and ultraviolet light exposure

d. Installation. Riprap shall be installed in accordance with the details on the Pipe Outfall Standard Detail Sheet. Riprap shall be placed over filter fabric when fabric is called for on the project Drawings. Sheets of fabric shall be overlapped a minimum of 18 inches.

12. **MONUMENT BOX.** Monument box locations will be as shown on the Drawings and/or marked in the field by the Engineer. The Contractor shall carefully protect from disturbance or injury all monuments and bench marks of the City, County, State or Federal government and shall not excavate nearer than 5 feet to any of them without permission of the Engineer, or until they have been removed, witnessed or otherwise disposed of by the Engineer. The monument box casting shall be installed with a concrete support ring. The monument box casting shall be No. 2193-01-4100 by Clay and Bailey Manufacturing Co., with the utility designation omitted from the lid.

13. **GUARDRAIL.** Guardrail material and installation locations shall be shown on the Drawings.

14. **CHAIN LINK FENCE.**

a. General. Chain link fence shall be installed in locations shown on the Drawings or as marked in the field by the Engineer. Fence shall consist of galvanized or aluminum coated steel fabric, with top rail and bottom tension wire, and with fabric heights as indicated on the Drawings. Posts shall be set in concrete or on galvanized steel base plates as shown on the Drawings.

b. Materials. All steel or malleable iron parts and accessories shall be hot-dip galvanized or aluminum coated after fabrication.

(1) Fabric shall be 9 gauge, 2 inch mesh; galvanized, ASTM A392, Class 2, or aluminum coated, ASTM A491; knuckled selvage on top, twist selvage on bottom.

(2) Posts: Minimum post sizes shall be as listed below:

(1st number is outside diameter, 2nd is weight per foot)

<u>Number</u>	<u>6 foot fence</u>	<u>4 foot fence</u>
Line post	2 3/8", 3.11 lb.	1 7/8", 2.72 lb.
Corner or pull post	2 7/8", 4.64 lb.	2 3/8", 3.65 lb.
Top rail & bracing	1 5/8", 2.27 lb.	1 5/8", 2.27 lb.
Gate post	4", 9.10 lb.	2 7/8", 5.79 lb.
Gate frame	1 7/8", 2.72 lb.	1 7/8", 2.72 lb.
Vehicle gate post	6 5/8", 18.97 lb.	4", 9.10 lb.

Post caps may be aluminum or galvanized steel.

(3) Bottom Tension Wire shall be 7 gauge, galvanized or aluminum coated coil spring wire.

(4) Stretcher Bars shall be steel, ASTM F626, 3/16 inch by 3/4 inch, or equivalent area.

(5) Fabric Ties shall be aluminum bands or wires, ASTM F626.

c. Gates. Gate frames shall be constructed of galvanized pipe of the size and weight shown above and to the dimensions shown on the Drawings. Frames shall be welded at all joints to provide watertight construction or the pipe shall be connected with watertight heavy malleable iron corner fittings. All weld-damaged areas shall be painted with zinc rich paint. All gates shall be equipped with approved hinges, latches, stops, locking devices and satisfactory fittings for padlocking. The same type and weight of fabric shall be used in the gate as is used in the fence in which the gate will be installed. Hinges shall be heavy pattern with large bearing surfaces and shall not twist or turn under the action of the gate.

d. Fence Construction. Posts shall be set plumb, spaces approximately 10 feet apart. Posts set in earth shall be provided with concrete foundations 36 inches deep. Foundations for line posts shall be 10 inches in diameter. For terminal and gateposts, the foundations shall be the post OD plus 9 inches in diameter. Foundations shall extend 1 inch above the ground surface and be crowned. Concrete for foundations shall be structure class. Concrete shall cure for 72 hours before additional work is done on post.

Where posts are set in rock, post excavation shall be continued to the 36-inch depth or 18 inches into the rock, whichever is less. Diameter of foundations in rock shall be a minimum of 6 inches larger than the OD of the post.

Top rails and bottom tension wires shall be installed before the fabric. Top rails shall be securely connected to gate and terminal posts. Tension wires shall be attached to each post and securely anchored at terminal and gateposts.

Fabric shall be attached to top rail and bottom tension wire at 24-inch centers, and to the line posts at 15-inch centers. Stretcher bars shall be provided at each gate and terminal post. Each stretcher bar shall be threaded through the fabric and anchored to the post at 15 inch centers by positive mechanical means.

Each gate and terminal post shall be braced by a horizontal pipe brace and an adjustable truss extending to an adjacent line post. Corner posts shall be braced in both directions.

Fabric shall be stretched taut and anchored so that a pull of 150 pounds at the middle of a panel will not lift the bottom of the fabric more than 6 inches.

Completed fence shall conform to the alignment and finish grade indicated on the Drawings. Ground surface shall be graded as required to maintain not more than 2-inch clearance below the bottom of the fence fabric.

## 15. TEMPORARY EROSION AND POLLUTION CONTROL

a. General. The Contractor shall take all necessary measures to prevent erosion on the project and pollution of any drainage course. Any earth moving activity shall minimize the amount of exposed soil and maintain as much vegetative cover as possible. Erosion and pollution control measures shall include berms, ditch checks, silt fence, sediment basins, inlet sediment barriers, temporary seeding, and erosion control blankets.

b. Regulatory Requirements. Any project or combination of projects where construction activities will disturb one (1) or more acres must receive authorization to discharge stormwater runoff under the Kansas Department of Health and Environment (KDHE) construction stormwater general NPDES permit. A project disturbing less than one acre may also require authorization to discharge stormwater runoff when KDHE believes the water quality impact warrants consideration. If a permit from KDHE is not required, an erosion control plan must still be implemented to prevent soil loss and other pollutants from entering any storm water system.

Application for the construction stormwater permit is made by completing a Notice of Intent (NOI) form from the Kansas Department of Health and Environment (KDHE) and submitting it at least 60 days before starting construction. The primary requirement of the general permit is that a Stormwater Pollution Prevention Plan (SWPPP) be developed and implemented. The City will obtain the NOI for a city funded project, and then transfer the NOI to the Contractor, unless other arrangements are made. The Contractor then becomes the permittee for the construction stormwater permit. For developer projects, located on either private property or public property, the developer is responsible for obtaining the permit to

discharge stormwater runoff from the site. When the soil disturbing activity is completed, all areas are restored, and all requirements of the NPDES permit are complete, then the permittee must submit a Notice of Termination (NOT) form to KDHE to terminate the authorization to discharge.

c. Construction. Erosion control devices must be installed to establish a perimeter control of the project in areas where it is anticipated that storm water runoff will leave the project site. The SWPPP or erosion control plan shall cover all areas that the Contractor's work may affect including outside the project limits, including disposal sites, haul roads, and nearby bodies of water.

The Contractor shall thoroughly review the SWPPP or erosion control plan in detail and shall provide a schedule for implementing the plan to the Engineer. The Contractor shall provide to the Engineer in writing any modifications to the SWPPP or erosion control plan. The Contractor shall obtain the Engineer's approval of the erosion control plan and schedule prior to issuing the start work order. If the erosion control schedule changes, the Contractor shall notify the Engineer.

All erosion control devices shall be installed according to the approved SWPPP or erosion control plan prior to or simultaneously with the clearing and grubbing operations. Grading shall not be performed until the erosion control devices are installed and approved by the Engineer. Temporary or permanent ditches graded on site shall either be stabilized or have temporary sediment control installed immediately after their grading. The Contractor shall be responsible for updating the SWPPP or erosion control plan during construction to reflect any changes in erosion control devices which have been installed and are not currently specified on the SWPPP or erosion control plan.

d. Maintenance and Inspections. The Contractor shall maintain the effectiveness and performance of all erosion control measures as long as required to contain sediment runoff. If erosion and pollution control measures are not implemented and maintained, the Engineer may order that all work on the project shall cease until conditions are brought into compliance. Additionally, the Engineer may order defective erosion control measures immediately corrected or cause the correction to be made by a third party, costs of which shall be paid by Contractor in accordance with 15(e) below. Failure to implement and/or maintain all or part of the erosion control plan shall not make the City/County liable to the Contractor for any work delays.

The Contractor shall perform all inspections and complete all inspection and maintenance reports required by the NPDES permit. During the construction season, the Contractor shall inspect the erosion and pollution control devices and complete the inspection and maintenance reports every 7 days and within 24 hours of a precipitation event of ½ inch or more. During inactive seasons, such as winter shutdowns, inspection of the site condition shall be made at least once a month. The devices shall be monitored at least daily during prolonged rainfall. Corrective action must begin within 48 hours of any deficiencies being found and must be completed within 7 calendar days.

Each inspection report shall contain, at a minimum, the name of the contractor's representative, date of inspection, observations relative to the effectiveness of the erosion and pollution control measures, actions taken or necessary to correct deficiencies, and areas where activities have been completed. Site inspection reports shall be maintained onsite with the SWPPP or erosion control plans. Copies of the reports shall be provided to the City/County within 3 calendar days of a request to furnish copies of the reports.

All disturbed areas with no activity on them for a period of 14 calendar days shall be temporarily seeded and mulched.

Any soil stockpiled for more than 7 calendar days shall have silt fence or another type of sediment barrier placed around it to trap sediment.

Any soil disturbing activity upstream from an inlet shall require inlet protection at the inlet. As an alternative, silt fence may be installed along the soil disturbing activity at the back of curb.

The temporary pollution control provisions contained herein shall be coordinated with the permanent erosion control features specified elsewhere in the Contract to the extent practical to assure economical, effective and continuous erosion control throughout the construction and post construction period.

When erosion control is no longer required and 70% of the permanent ground cover is established, erosion control measures shall be removed by the Contractor. After removing the erosion and pollution control devices, any silt accumulation shall be removed and disposed of and any reseeding shall be performed if needed.

When erosion and pollution control devices are installed according to the SWPPP or erosion control plan, or as approved by the Engineer, and such devices are no longer effective because of normal deterioration or functional incapacity, payment will be made for replacement of these devices, as directed by the Engineer. No payment will be made for replacing erosion and pollution control devices that become ineffective because of improper installation, lack of maintenance or the Contractor's failure to pursue timely installation of permanent erosion control devices according to the Contract Documents. Further, no payment shall be made to repair or replace the erosion control devices damaged by the negligent or intentional acts of the Contractor.

e. Cost of Corrective Action. If the Contractor fails to complete corrective actions of the erosion control measures within 7 calendar days of notice that deficiencies have been identified, then the City/County will deduct from final payment to the Contractor all costs incurred to prevent erosion or pollution at the site or to prevent or remedy a violation of any term or condition of the NPDES permit specifically including but not limited to correction of defective erosion and pollution control devices. All direct, indirect and consequential costs to correct a deficiency will be added together, and a Change Order will be issued incorporating the necessary revisions to the Contract Amount into the Contract Documents.

f. Temporary Seeding. Temporary seeding shall consist of 120 lbs. per acre of winter wheat and 75 lbs per acre of ryegrass unless otherwise directed by the Engineer. Seed shall be evenly applied with a broadcast seeder, drill, or hydroseeder over the prepared area. Mulching shall follow the seeding operation, unless approved otherwise.

## 16. PAVEMENT MARKINGS.

a. General. The materials described herein shall be new and of first run materials and shall meet the specifications described.

b. Materials. All material shall meet the current specifications and requirements of Kansas Department of Transportation.

(1) Preformed Thermoplastic - A preformed thermoplastic that is heated with a propane torch on site to liquefy and fuse the material to the road surface. The material should provide a service life of three to five years.

(2) Extruded Thermoplastic - A molten, extruded plastic that should provide a service life of four to six years.

(3) Epoxy Markings - A two-part material that should provide a service life of three to five years.

(4) Waterborne Traffic Line Paint - A sprayed, resinous material that should provide a service life of three to twelve months.

(5) Temporary Pavement Markings - A material that has a service life of four to eight weeks.

**c. Applications.**

(1) Transverse lines, Legends, Arrows - A preformed thermoplastic shall be used.

(2) Longitudinal Lines on PCC Concrete - A preformed thermoplastic or epoxy shall be used when the project is less than a quarter (1/4) mile. KDOT specified epoxy markings shall be used for projects a quarter (1/4) mile or longer.

(3) Longitudinal Lines on Asphaltic Concrete - A preformed thermoplastic or epoxy markings shall be used when a project is less than a quarter (1/4) mile. A extruded thermoplastic shall be used on projects a quarter (1/4) mile or longer.

(4) Timeframe for Installation - Markings shall be installed within two (2) weeks of the road surface being completed. Temporary markings shall be used until the permanent markings are installed.

(5) Temperature Limitations - All permanent markings except preformed thermoplastic shall be installed when the temperature of both surface and air has reached fifty five (55) degrees Fahrenheit and rising. Preformed thermoplastic may be installed per manufactures recommendations.

d. Installation. Pavement marking contractor shall have previous installation experience with the products to be used for the project.

e. Warranty. Shall be a minimum of one (1) years from date of application for materials and installation.

f. Traffic Control. The contractor must provide traffic and pedestrian control. All traffic and pedestrian control shall conform to the MUTCD and City of Topeka requirements. All cost for traffic and pedestrian control for pavement marking installation are to be secondary to unit bid prices for pavement markings, unless otherwise detailed by the plans or specifications.

**17. FIELD OFFICE**

a. General. When specified on the plans, a Field Office shall be provided at the job site meeting the requirements for the specified type as shown in Section 803, Field Office and Laboratory, of the latest edition of the "Standard Specifications for State Road and Bridge Construction", Kansas Department of Transportation.

b. Field Office (County Only). The Field Office will be set up and maintained by Contractor for the exclusive use of the Project Field Representative at a location designated by the Project Field

Representative. In addition to specification requirements defined in Section 803, Field Office and Laboratory, the Field Office shall have DSL with wireless router or equivalent service provided.

18. UNDERDRAINS.

a. General. The Contractor shall construct an underdrain system as specified on the plans. This system will collect and transport subsurface water under the roadway. The perforated underdrain pipe shall have a minimum diameter of 4 inches and shall be laid on a minimum grade of 1%, unless shown otherwise on the plans. Underdrain pipe shall be non-perforated within five (5) lineal feet of connection to an inlet. The minimum trench width shall be 8 inches plus the exterior diameter of the underdrain pipe. The trench shall be backfilled with underdrain aggregate and enveloped with geotextile fabric to within one foot of finished grade or as shown on the plans.

Underdrain aggregate shall conform to the requirements of BD-1 or UD-1 as specified in Section 1107.2 (d) of the latest edition of the "Standard Specifications for State Road and Bridge Construction", Kansas Department of Transportation. Underdrain pipe (outside of roadway) shall be polyethylene pipe complying with AASHTO M252 or polychloride pipe complying with AASHTO M278. Underdrain pipe (under roadway) shall be polyethylene or polyvinyl chloride pipe having a minimum pipe stiffness value of 100 psi.

19. PROJECT SIGN

a. General. When specified on the plans, project signs shall be installed at locations determined by the Engineer.

For City projects, the City will have a yearly contract with one sign contractor to provide a standard Project Sign Type A or Project Sign Type B at a set price. The Contractor will be responsible for ordering project signage from the City's sign contractor and will be responsible for payment to the sign contractor at the set price. The unit price bid by the Contractor for each type of sign shall include the set price of the sign plus any additional costs to install, maintain, and remove after project completion.

When signs are required, the signs shall be installed prior to any construction activity and maintained by the Contractor throughout construction. Signs shall be removed upon project completion by the Contractor.

20. BID ITEM, MEASUREMENT AND PAYMENT.

a. Culverts Replaced.

1. Bid Item.

**CULVERTS REPLACED;**

<u>      </u> " RCP, Class <u>      </u> , In Place	<u>      </u> L.F.
<u>      </u> " CSP, <u>      </u> Gauge, In Place	<u>      </u> L.F.

2. Measurement will be by the linear foot to the nearest foot of various sizes of culverts replaced with new material as listed on the Bid Form.

3. Payment will be made at the unit price bid per foot for each size of "Culverts Replaced", which will include all pipe, connecting bands or jointing materials. Excavation, backfill, laying, removal and disposal of old culverts, labor and incidentals, will not be paid for separately but shall be considered subsidiary to other bid items.

b. Crushed Rock Surfacing.

1. Bid Item.

**CRUSHED ROCK SURFACING** \_\_\_\_\_ TON

2. Measurement will be by the ton.

3. Payment will be made at the unit price bid per ton for "Crushed Rock Surfacing" which price shall include all placement, grading, watering as needed, compacting and finishing, labor, and incidentals.

c. Pavement Removed and Replaced.

1. Bid Item.

**PAVEMENT REMOVED AND REPLACED;**

_____ " CONCRETE	_____ L.F.
2" Hot Mix Asph. on 7" Concrete Base	_____ L.F.
One Course of Brick on 7" Concrete Base	_____ L.F.
Rem. & Repl. Comb. Curb & Gutter, Type _____	_____ L.F.
_____ " ASPHALTIC CONCRETE PAVEMENT	_____ L.F.

2. Measurement will be by the linear foot along the center line of the trench for the total area of pavement removed and replaced, regardless of width or type, including curbs, gutters, and combined curb and gutter, within the limits permitted in these specifications.

3. Payment will be made at the unit price bid per linear foot for "Pavement Removed and Replaced", which price shall include all cutting, breaking, sawing, removal of rubble, placement of new pavement, curbs, gutters, and combined curb and gutter, finishing, curing, protection, labor and incidentals.

d. Sidewalks and Driveways Removed and Replaced.

1. Bid Item.

**SIDEWALKS AND DRIVEWAYS REMOVED AND REPLACED;**

_____ " Concrete Sidewalk	_____ S.F.
_____ " Concrete Drive	_____ S.F.

2. Measurement will be by the square foot for the total area of sidewalk and/or driveway removed and replaced.

3. Payment will be made at the unit price bid per square foot for "Sidewalks and Driveways Removed and Replaced", which price shall include all cutting, breaking,

removal of rubble, grading, forming, placement of concrete, finishing, curing, protection and labor and incidentals.

e. Remove Large Trees.

1. Bid Item.

**REMOVE LARGE TREES** \_\_\_\_\_ **EA.**

2. Measurement. Trees or clump trees for which payment will be made are those which measure 40 inches or more in circumference at a point 2 feet above the natural ground level and/or stumps of the same circumference measured 1 foot above natural ground level or at the top of the stump if it does not extend to that elevation.

3. Payment will be made at the unit price bid per each for "Remove Large Trees", which payment shall include felling, grubbing, root removal and disposal; labor and incidentals.

f. Seeding, Fertilizing & Mulching.

1. Bid Item.

**SEEDING, FERTILIZING & MULCHING** \_\_\_\_\_ **ACRES**

2. Measurement. Measurement shall be made to establish the area seeded to the nearest 0.1 of an acre.

3. Payment. The cost of furnishing all labor, equipment, tools and materials and the performance of all work required to do the seeding, fertilizing and mulching, complete as specified, shall be included in the unit price bid per acre.

g. Sodding.

1. Bid Item.

**SODDING** \_\_\_\_\_ **S.Y.**

2. Measurement. Measurement will be by the square yard for all sodded areas.

3. Payment. The cost of furnishing all labor, equipment, tools, materials and the performance of all work for sodding, complete, shall be included in the unit price bid per square yard for sodding, when listed on the Bid Form.

h. Riprap.

1. Bid Item.

**RIPRAP;**  
**Class \_\_\_\_\_ Stone Riprap** \_\_\_\_\_ **S.Y.**  
**Broken Concrete Riprap** \_\_\_\_\_ **S.Y.**

2. Measurement will be by the square yard for each class of riprap.

3. Payment will be made at the unit price bid per square yard for "Riprap" which price shall include all grading, furnishing and installing of riprap, filter fabric if required, finishing, labor and incidentals.

i. Monument Box.

1. Bid Item.

**Monument Box** \_\_\_\_\_ **EA.**

2. Measurement will be for each monument box installed.

3. Payment will be made at the unit price bid per each for "Monument Box" which price shall include removing the existing monument box casting, unless directed otherwise by the Engineer; furnishing all materials, all labor, equipment, tools, supplies, and incidentals necessary to complete the work; mobilization; and providing all traffic control unless bid as a separate item.

j. Guardrail

1. Bid Item

**GUARDRAIL** \_\_\_\_\_ **L.F.**

2. Measurement will be by the linear foot.

3. Payment will be made at the unit price bid per linear foot for "Guardrail", which price shall include furnishing and installing all materials, labor, equipment, tools and incidentals.

k. Chain Link Fence.

1. Bid Item.

\_\_\_\_\_ ' **Chain Link Fence** \_\_\_\_\_ **L.F.**

2. Measurement will be by the linear foot for each height of fence installed.

3. Payment will be made at the unit price bid per linear foot for "Chain Link Fence", which price shall include furnishing and installing all materials, labor and incidentals.

l. Gates.

1. Bid Item.

\_\_\_\_\_ ' **Gate** \_\_\_\_\_ **EA.**

2. Measurement will be for each gate installed.

3. Payment will be made at the unit price bid per each for "Gate" which price shall include furnishing and installing all materials, labor and incidentals.

m. Mailbox Removed and Replaced.

1. Bid Item

**MAILBOX REMOVED AND REPLACED** \_\_\_\_\_ **EA.**

2. Measurement will be for each mailbox removed and replaced.

3. Payment will be made at the unit price bid per each for "Mailbox Removed and Replaced" which price shall include removing the existing mailbox and furnishing all materials, all labor, equipment, tools, supplies and incidentals necessary to remove and replace the mailbox.

n. Erosion and Pollution Control.

1. Bid Item

<b>EROSION CONTROL;</b>	
<b>SILT FENCE OR HAY BALES</b>	_____ <b>L.F.</b>
<b>INLET PROTECTION</b>	_____ <b>EA.</b>
<b>TEMPORARY SEEDING</b>	_____ <b>Acre</b>
<b>CONSTRUCTION ENTRANCE</b>	_____ <b>EA.</b>
<b>TEMPORARY BERM</b>	_____ <b>L.F.</b>
<b>DITCH CHECK</b>	_____ <b>L.F.</b>
<b>SEDIMENT BASIN</b>	_____ <b>C.Y.</b>
<b>SEDIMENT REMOVAL</b>	_____ <b>C.Y.</b>
<b>EROSION CONTROL MAT</b>	_____ <b>S.Y.</b>

2. Measurement will be at the units shown above.

3. Payment will be made at the unit price bid per each unit, which price shall include all grading, furnishing, installing, maintaining, finishing, removing, disposing, labor and incidentals for both during construction and post construction. If a bid item needs to be replaced due to normal deterioration or functional incapacity during the project or prior to acceptance for maintenance, then the new item will be paid for at the unit price bid for the original item.

o. Pavement Marking

1. Bid Item.

**PAVEMENT MARKING, In Place**

_____ "Wide - WHITE	_____ <b>L.F.</b>
_____ "Wide - YELLOW	_____ <b>L.F.</b>

2. Measurement will be by the linear foot along the centerline of the pavement marking.

3. Payment will be made at the unit price bid per linear foot for “Pavement Marking”, which price shall include all materials, labor and equipment necessary to install pavement markings.

p. Field Office

1. Bid Item

**FIELD OFFICE, TYPE \_\_\_\_\_ Each**

2. Measurement will be for each type of field office provided.

3. Partial Payments will be made at specified intervals during the project – 40% of the contract unit price after the unit is installed and accepted, 70% after 3 months of use, and 100% at the completion of the project and release by the Engineer. The unit price bid shall include all work necessary for providing and installing the type of field office specified.

q. Underdrains

1. Bid Item

**UNDERDRAINS \_\_\_\_\_ L.F.**

2. Measurement will be by the linear foot along the centerline of the underdrain pipe.

3. Payment will be made at the unit price bid per linear foot for “Underdrains”, which price shall include all materials, labor and equipment necessary to install underdrains.

r. Project Sign

1. Bid Item

**PROJECT SIGN TYPE \_\_\_\_\_ Each**

2. Measurement will be for each sign installed.

3. Payment will be made at the unit price bid per each sign which price shall include all materials, labor and equipment necessary to install the sign at the required location, maintain the sign during construction and remove the sign after completion of the project.

END OF SECTION

## SECTION 5

### CONCRETE

1. DEFINITION. Concrete shall consist of a mixture of cementitious materials, water and aggregates, with admixtures if approved by the Engineer.

2. MATERIALS.

a. Cementitious Materials.

- (1) Portland Cement shall be Type I/II Portland Cement, conforming to the requirements of ASTM C 150.
- (2) Class F Flyash shall conform to the requirements of ASTM C618.
- (3) Grade 120 Ground Granulated Blast Furnace Slag shall conform to the requirements of ASTM C989.
- (4) Cement, flyash and slag in storage or stockpiled on the site shall be protected from any damage by climatic conditions which would change the characteristics or usability of the material.

b. Aggregates.

(1) General. All aggregates shall conform to the requirements of Subsection 1102 of the “Standard Specifications for State Road and Bridge Construction”, Kansas Department of Transportation, latest edition, except where otherwise provided by these specifications.

(2) Fine aggregate shall meet the requirements for FA-A, as defined by Subsection 1102 of the “Standard Specifications for State Road and Bridge Construction”, Kansas Department of Transportation, latest edition. This aggregate shall consist of sand having clean, hard, durable, uncoated grains. Gradation as follows:

<u>Sieve Size</u>	<u>% Retained</u>
No. 4-----	0 - 10
No. 8-----	0 - 27
No. 16-----	15 - 55
No. 30-----	40 - 77
No. 50-----	70 - 93
No. 100-----	90 - 100

(3) Course aggregate for all Pavement Class concrete except concrete in sidewalks/trails/ramps shall be entirely granite, quartzite or trap rock easily field identifiable in the concrete and shall meet the requirements of CPA-3. Course aggregate for concrete in sidewalk/trails/ramps shall meet the requirements for CPA-3, Class I Aggregate or the hard rock requirements listed above for Pavement Class concrete. Course aggregate for Structural Class concrete shall meet the requirements of SCA-2. These aggregate designations are defined in Subsection 1102 of the Kansas Department of Transportation’s “Standard Specification for State Road and Bridge Construction”, latest edition. Aggregate shall consist of washed, crushed stone having clean, hard, durable, uncoated particles. Size gradation shall be as follows:

<u>Sieve Size</u>	<u>% Retained</u>
1½ Inch-----	0
1 Inch-----	0
¾ Inch-----	0
½ Inch-----	0 - 35
3/8 Inch-----	30 - 70
No. 4-----	75 - 100
No. 8-----	95 - 100

(4) Deleterious Substances and Physical Property Requirements. Deleterious substances and test results shall not exceed the following percentages by weight.

<u>Substance or Test</u>	<u>Fine Agg.</u>	<u>Coarse Agg.</u>
Clay Lumps and Friable Particles	1.0	1.0
Sum of Clay Lumps, Friable Particles and Chert	-	1.0
Material Finer than No. 200 Sieve	2.0	2.5
Coal and Lignite	0.5	0.5
Soundness (ASTM C 88)		
Magnesium Sulfate	15	18
Organic Impurities (ASTM C 40)	Pass Color Test	-
<u>Absorption</u>	-	<u>0.5</u>

(5) Storage of Aggregates. Aggregates shall be stored in a manner to permit free drainage and to avoid the inclusion of any foreign matter in the concrete. Stockpiles of aggregates shall be built in horizontal layers to avoid segregation. Heating of aggregates may be required when concreting is performed in cold weather. Aggregate, when heated, shall be from heated bins. Direct application of flame or steam through the aggregate will not be permitted.

c. Water.

- (1) Water used in mixing concrete shall be potable water.
- (2) When authorized due to low air temperature, heated water may be used in the concrete. Water shall be heated to at least 70° F. and not more than 150° F.

d. Admixtures.

- (1) Air entraining agent shall conform to the requirements of ASTM C 260.
- (2) Water reducers, which may include set retarders, may be required when placing or finishing or when weather conditions are unfavorable and would be improved by use of a water reducer. The Contractor shall submit the type of admixture for approval by the Engineer. The Contractor is solely responsible for the appropriate use and effect of the admixture. The amount of admixture shall be determined by the Contractor. No additional compensation will be allowed for furnishing and incorporating the admixture in the work.

(3) Plasticizers are not to be used unless approved by the Engineer. If approved, the Contractor is solely responsible for the appropriate use, amount and effect of the admixture. No additional compensation will be allowed for furnishing and incorporating the admixture into the work. The maximum slump allowed with a plasticizer admixture is 8 inches.

(4) No other admixture may be used except upon written approval of the Engineer.

e. Form Materials. Forms may be of wood or metal.

f. Reinforcing Steel.

(1) General. All reinforcing steel shall be free from mud, oil, paint, grease or other organic material that may adversely affect or reduce bond with the concrete. Shop drawings, bar lists and splicing details shall be furnished by the Contractor when required.

(2) Reinforcing bars shall conform to the requirements of ASTM A 615, Grade 40 or Grade 60 as specified on the Drawings.

(3) Welded steel wire fabric shall conform to the requirements of ASTM A 185.

(4) Tie bars shall be Grade 40 deformed steel bars, which conform to the requirements for reinforcing bars.

(5) Dowels shall be plain round steel bars conforming to the requirements of ASTM A 615 (40 KSI).

(6) Use a sufficient number of metal bar supports or pins to hold all bars in proper position according to the drawings. Plastic chairs are not allowed.

g. Fiber Reinforcement. When allowed by the Engineer, fiber reinforcement shall be synthetic macro fibers that are monofilament, non-fibrillating made of 100% virgin polyolefin. The fibers shall have a length between 1.38" and 2.00". The minimum tensile strength of the fibers is 90 ksi. The application rates shall be based on the manufacturer's recommendations to provide a residual strength greater than 150 psi. Fiber reinforcement shall be mixed into the concrete according to manufacturer's requirements.

h. Expansion Joint Filler. Expansion joint filler material shall be non-extruding and resilient filler which conforms to the requirements of AASHTO M 213 and ASTM D 1751.

i. Joint Sealants.

(1) Hot type joint sealants. This specification covers joint sealants of the hot-pour type intended for use in sealing joints in Portland cement pavements. The contractor shall furnish to the Engineer certification that the sealant used meets all applicable requirements of ASTM 3405. Sealant shall be applied with a pressure applicator.

(2) Cold type joint sealants shall conform to the requirements of ASTM D 1850. Sealant shall consist of a cold applied formulation that is self-priming and compatible with Portland cement concrete. Acetic acid cure sealants will not be accepted.

(3) Silicone joint sealant shall be self-priming and compatible with Portland cement concrete.

(a) Joint Sealant. Silicone joint sealant shall be prequalified prior to use on City/County projects. The joint sealant shall be either Type I (Non Self-Leveling) or Type II (Self-Leveling). Joint sealants shall be a one-part cold applied silicone formulation that is self priming to and compatible with Portland cement concrete. Acetic acid cure sealants are not acceptable. Type II sealants shall be self-leveling within the joint and shall provide a satisfactory surface configuration without tooling. The silicone sealants shall comply with the following applicable test requirements:

<u>Property</u>	<u>Type I</u>	<u>Type II</u>
(1) Skin development time, minutes	120 max.	120 max.
(2) Cure-through	pass	pass
(3) Extrusion rate, grams/minute	90/250	200/600
(4) Non-volatile content, %	90 min.	90 min.
(5) Bond to concrete, @ 0° F., 5 cycles, 100% extension	pass	pass
(6) Compression set	pass	pass
(7) Elongation, %	600 min.	1000 min.

(b) Acceptance of joint sealant furnished under this Specification shall be in accordance with Subsection 1502.5, of the "Standard Specifications for State Road and Bridge Construction", Kansas Department of Transportation, latest edition.

j. Curing.

(1) All newly placed concrete shall be cured immediately after finishing for a minimum of 5 days, unless otherwise shown. Formed surfaces shall be cured if forms are removed prior to 5 days after concrete placement.

(2) A liquid membrane-forming curing compound shall be used for all applications, unless otherwise specified by the Engineer. The compound shall conform to the requirements for Type 2 - White Pigmented Compound as specified in AASHTO M 148 and to the requirements of ASTM C 309. The surface shall be completely coated and sealed with a uniform layer at a minimum rate of 1 gallon per 150 square feet of surface.

(3) Other curing materials, including burlap, white polyethylene sheeting, cotton mats, and insulating blankets may be used when approved or specified by the Engineer.

3. CONCRETE PROPORTIONING AND STRENGTH REQUIREMENTS.

a. General. The Contractor shall furnish data on the proposed mix design for each concrete mix. The mix design shall indicate the source of the aggregates and cementitious materials. The test results from a trial batch or test results from a previous project using the mix design shall be submitted for review by the Engineer.

Concrete under these specifications shall be divided into three classes: 1) Structures, 2) Pavement (the pavement class shall include all concrete used for pavement, valley gutters, sidewalks, ramps, drives, curb and gutter, and cast-in-place inlet tops; and 3) Concrete Commercial Grade. Commercial grade concrete shall be used for seal courses and temporary slabs or pavements as designated by the Engineer.

b. Strength Requirements.

(1) Structure Class. The minimum 28 day compressive strength of concrete for structures shall be 4,000 pounds per square inch, unless otherwise specified for individual projects

(2) Pavement Class. The minimum 28 day compressive strength of concrete for pavements shall be 4,000 pounds per square inch. The minimum 28 day flexural strength (Modulus of Rupture) shall be 600 pounds per square inch as determined by the third point loading method, unless otherwise specified for individual projects.

(3) Commercial Grade. The minimum 28 day compressive strength shall be 2500 pounds per square inch.

c. Minimum Cementitious Material Content. The minimum cementitious material content per cubic yard of concrete for each class shall be as follows:

Structure Class	602 lbs. Type I/II Portland Cement (6.4 sacks)
Pavement Class <u>(See Exception listed Below for Sidewalks/ Trails/Ramps)</u>	<u>600 lbs. – a minimum of 450 lbs of Type I/II Portland Cement combined with Grade 120 Ground Granulated Blast Furnace Slag at a maximum of 25% of the combined total cementitious weight or a minimum of 450 lbs. of Type I/II Portland Cement combined with Class F Flyash at a maximum of 25% of the combined total cementitious weight.</u>
<u>Pavement Class (Exception for Sidewalk/Trails/ Ramps When Hard Rock is not Used)</u>	<u>600 lbs. Type I/II Portland Cement (6.4 sacks)</u>
Commercial Grade	470 lbs. Type I/II Portland Cement (5.0 sacks)

d. Water-Cement Ratio. The selected ratio of water to cementitious material, by weight, in the mix must be low enough to ensure that durability, strength and wear resistance requirements are satisfied. Maximum water-cementitious material ratios for each class shall be as follows:

	<u>Pounds of Water per Pound of Cementitious Materials</u>
Structure Class	0.49
Structure Class (AE)	0.49
Pavement Class	<u>0.44</u>
Commercial Grade	per approved design

e. Aggregate Proportioning. All mixes will consist of at least two individual aggregates - fine aggregate and coarse aggregate. Proportioning of materials will be done on the basis of weight. Except where otherwise directed by the Engineer, the proportion of coarse aggregate to total aggregate in the concrete shall be between 50 - 60% for Pavement Class concrete. Structural Class concrete mixes will be 50% coarse aggregate. Exact proportions of coarse and fine aggregates shall be stated in the mix design.

f. Entrained Air. All concrete under these specifications except Commercial Grade, shall be air entrained, unless otherwise specified for individual projects. Air content for Pavement Class shall be 6.5% ( $\pm 1.5\%$ ) and for Structural Class shall be 6.0% ( $\pm 1.5\%$ ) measured before placement and post-placement of the concrete.

g. Slump. The slump of fresh concrete for each class shall be within the following ranges:

Structure Class	:	1 inch - 3 inches
Pavement Class	:	1 inch - 3 inches
Commercial Grade:		3 inches - 5 inches

(Concrete specified in supplemental conditions shall be based on approved mix design slump  $\pm 25\%$  unless otherwise approved).

h. The total alkali content of the concrete shall be limited to the sum of the acid soluble alkali content of portland cement plus either 1/6 of the alkali content of fly ash or 1/2 of the alkali content of slag, to a maximum of 5 lb/yd<sup>3</sup>.

Mortar bar expansion tests are required if the cementitious combination contains less than 25% slag or fly ash. The Mortar bar expansion shall be a maximum of 0.10% at 16 days when tested according to ASTM C 1567.

i. Flowable Fill. Flowable fill shall consist of Portland cement, fly ash, water, and fine aggregate. Accelerators may be used. Flowable fill shall be self-leveling. The 28 day strength shall be equal to or greater than 50 psi but shall not exceed 150 psi, to permit future excavation. The mix design shall be designed and tested by the suppliers, but shall conform to the following requirements unless approved otherwise by the Engineer:

<u>Cement:</u>	<u>50 lbs./CY</u>
<u>Fly Ash:</u>	<u>240 lbs./CY</u>
<u>Fine Aggregate:</u>	<u>2600 - 2800 lbs./CY</u>
<u>Entrained Air:</u>	<u>5%-16%</u>
<u>Unit Weight:</u>	<u>116-125 pcf</u>
<u>w/c ratio:</u>	<u>0.85-1.21</u>

#### 4. SAMPLING & TESTING.

a. General. Sampling and testing of the materials used in the concrete, including the fine and coarse aggregates, and cementitious materials shall be the responsibility of the Contractor. Tests shall be performed in accordance with the requirements of the various ASTM standards referenced in MATERIALS. Certified test results shall be furnished with the mix design.

Sampling and testing of the fresh concrete will be the responsibility of the City Engineering Division for city projects and as specified for county projects.

b. Sampling Fresh Concrete. Samples of fresh concrete shall be obtained and handled in accordance with ASTM C 172, Sampling Fresh Concrete.

c. Consistency (Slump). Slump tests of fresh concrete shall be made in accordance with ASTM C 143, slump of Portland Cement Concrete.

d. Air Content. The air content of fresh concrete shall be determined by the volumetric method, ASTM C 173 or by the pressure method, ASTM C 231.

e. Compressive Strength. During the progress of the work, compression tests will be made at designated time intervals when directed by the Engineer. A test will consist of a minimum of two compression cylinders. A set of cylinders will be made, at a minimum, for each 150 cubic yards of concrete placed.

Compression test specimens will be made in accordance with the provisions of ASTM C 31. They will be laboratory cured cylinders to test the potential of the concrete that is delivered. No field-cured cylinders will be made unless required by the Engineer.

No individual test shall fall more than 500 pounds per square inch below design strength.

The average of three consecutive tests shall equal or exceed design strength.

Compression test strengths exceeding the required compressive strength will not be considered as justification for increasing the water-cement ratio; should test strengths fail to reach the required compressive strength, the Engineer will require the Contractor to adjust the mix design. Concrete that fails to meet requirements may be removed from the work or not accepted for payment at the Engineer's discretion.

f. Flexural Strength. Flexural strength tests may be required by the Engineer. A minimum of two beams shall be cast per test. Test procedures shall be in accordance with ASTM C 31 and ASTM C 78.

g. Durability of Coarse Aggregate Test. Testing of the durability of the coarse aggregate may be required by the engineer.

## 5. MIXING, DELIVERY, AND PLACEMENT.

a. Mixing. All concrete shall be ready-mixed concrete complying with the provisions of ASTM C 94.

b. Conveying. The normal method of transporting concrete shall be via ready-mix truck.

c. Delivery Tickets. A concrete delivery ticket shall be provided to the Engineer's representative for each concrete load containing the following information: plant name, w/c ratio, time batched, batch weights, design slump, water withheld (2 gallons per cubic yard maximum), dosage of all approved admixtures, and number of cubic yards of concrete batched.

d. Placing. Concrete shall be deposited as nearly as practicable in its final position. Chutes used shall be such that the concrete slides in them and does not flow. Where a vertical drop greater than 5 feet is necessary, placement shall be through elephant trunks or similar devices to prevent segregation.

Concrete shall be placed before initial set has occurred, and in no event after it has contained its water content for more than 90 minutes. Unless otherwise specified, all concrete shall be deposited upon clean, damp surfaces, free from running water, or upon properly consolidated fills, but never upon soft mud or dry porous earth. No concrete shall be placed on frozen subgrade.

Concrete shall be placed under water only with the permission of the Engineer. The minimum cement content per cubic yard shall be increased by 10% at no additional cost to the City/County and the slump shall be increased to 6 inches. When depositing concrete in standing water, the concrete shall be carefully

placed in the space in which it is to remain in a compact mass, by means of a tremie, bottom-dumping bucket or other approved method that does not permit the concrete to fall without adequate protection. Concrete shall not be disturbed after being deposited. Concrete shall be placed under water only in forms that are reasonably watertight. Unless authorized by Engineer, water shall not be pumped from inside forms while concrete is being deposited.

(d.1.) Cold Weather. In cold weather, a concrete protection plan shall be submitted to the Engineer for review and approval. This plan shall include any admixtures and the means and methods for protecting the concrete from physical damage or reduced strength caused by frost, freezing actions, or low temperatures during the cure period. Concrete shall be mixed and placed only when the temperature is at least 35° F. and rising unless other arrangements have been approved by the Engineer. When the air temperature is at or is expected to fall below 40 degrees F, the water and aggregates should be uniformly heated before mixing to obtain a concrete mixture temperature of not less than 50 degrees F and not more than 80 degrees F at point of placement. The concrete pavement shall be maintained at a minimum temperature of 50 degrees F, as measured along the surface of the concrete, for a minimum of 5 days after placing. A sufficient supply of approved moisture barrier material, other than liquid curing compound, and suitable blanketing material, such as straw, hay and burlap, shall be available if needed for all concrete placed between November 1 and April 1. Frozen materials or materials containing ice or snow shall not be used in the concrete. Calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, shall not be used in the mix unless approved by the Engineer. If, during the curing period, the temperature of the concrete falls below 32°F, the concrete shall be removed.

When structural concrete is to be placed in cold weather and the air temperature has been below 35° F. for 24 hours or more, the reinforcing steel shall be placed and the forms set. Forms and reinforcing shall then be heated to a minimum of 50° F., using an enclosure and space heaters, before concrete is placed.

When structural concrete is being placed and the ambient air temperature may be expected to drop below 35° F. during the curing period, the Contractor shall provide insulating blankets or other approved insulating materials and/or housing and artificial heat to maintain the concrete temperature between 50° F. and 80° F. as measured on the surface of the concrete. The surface of the concrete shall be kept moist by use of an approved moisture barrier such as wet burlap or polyethylene sheeting. The moisture barrier shall be maintained in intimate contact with the concrete during the entire curing period. After the completion of the required curing period, the Contractor shall remove the curing and protection in such a manner that rapid cooling of the concrete will be prevented. If, during the curing period, the temperature of the concrete falls below 32°F, the concrete shall be removed.

(d.2.) Hot Weather. When concrete is being placed in warmer weather (ambient air temperatures above 80°F) the following shall apply:

(1) When the ambient air temperature at the time of batching is expected to be below 80°F, concrete must be in place within ninety minutes after the water has been added.

(2) When the ambient air temperature at the time of batching is expected to be between 81°F and 90°F, concrete must be in place within one hour after the water has been added unless an approved set-retarding admixture is used.

(3) When the ambient air temperature at the time of batching is expected to rise above 90°F, concrete must be in place within forty-five minutes after the water has been added unless an approved set retarding admixture is used. In no case shall the concrete temperature exceed 90°F at the time of placement.

When concrete is being placed and the ambient air temperature may be expected to rise above 90°F, a specific hot weather protection plan shall be submitted to the Engineer for review and approval. Depending on the severity of the weather, the plan may include cooling of concrete mix to below 90°F, scheduling work to place and finish concrete during cool periods of the day, prewetting of forms and subgrade, rapid placement of curing material, use of fog spray or other methods recommended by ACI 305. Use of a retarder will be considered only in the most severe conditions and then only if delay of placement poses a threat to public welfare.

e) Consolidation. Consolidation of concrete shall be accomplished with internal mechanical vibration generally with the aid of mechanical vibrating equipment. Vibration shall be transmitted directly to the concrete and in no case shall vibration be transmitted through the forms. The duration of vibration at any location in the forms shall be held to the minimum necessary to produce thorough compaction. Vibration shall be supplemented by forking or spading by hand adjacent to the forms on exposed faces in order to secure smooth, dense and even surfaces. Concrete shall be compacted and worked into all corners and angles of the forms and around reinforcement and embedded fixtures in such a manner as to prevent segregation of the coarse aggregate. Use of vibrators to move concrete within forms shall not be permitted. Vibrators shall not be dragged horizontally thru the concrete.

Construction of forms for the lifts of vertical walls shall be such as to make all parts of the walls easily accessible for the placement, spading and consolidation of the concrete as specified herein.

The use of vibrators is not required on concrete slabs 4 inches or less in thickness

## 6. FORMS.

a. Construction Forms shall be sufficiently strong to support all loading without deflection either horizontally or vertically.

Form surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed faces.

Forms shall be built true to line and grade, and shall be mortar tight and sufficiently rigid to prevent displacement or sagging between supports. They shall be staked or braced sufficiently so that they will not be knocked out of line by any of the normal operations of placing and finishing the concrete.

Items to be constructed that are curved shall be formed using curved forms unless they have a radius larger than 60 feet.

Joints in the forms shall be locked rigidly in true alignment so as to prevent play or movement.

All metal including form ties shall have at least 2 inches clearance from the face of the concrete unless otherwise specified. Wire ties will not be permitted where concrete surface will be exposed to weathering and discoloration will be objectionable. Form ties shall be removed to a depth of ½ inch below the concrete surface. The cavities, on all exposed surfaces, shall be filled with Portland cement mortar. The resulting surface shall be smooth, sound and match in color and texture the adjacent surfaces. Cavities on unexposed surfaces shall be filled with an approved material, including roof cement or Portland cement at the Contractor's option. All forms shall be so constructed that they can be removed without hammering or prying against the concrete. Unless otherwise indicated, suitable molding shall be placed to bevel or round all exposed edges and at expansion joints.

b. Coating. Forms, other than those having non-absorptive form lining for exposed surfaces, shall be coated with a non-staining mineral oil which shall be applied shortly before the concrete is placed. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete, except that in freezing weather oil shall be used. Form oil shall not be applied in a manner that will cause it to come in contact with reinforcing steel.

c. Removal. The removal of forms shall be accomplished in such a manner as will prevent injury to the concrete. Forms shall not be removed before the expiration of the minimum time indicated below, except when specifically authorized by the Engineer. During cold weather the time limits may be increased at the discretion of the Engineer depending upon the amount of protection provided. Permission to remove forms shall not constitute authority to backfill structures. Backfill shall proceed only upon approval of the Engineer and shall be based on concrete attaining 75% of design strength.

Pavement and Slabs -----	12 hours*
Walls and Vertical Faces -----	2 days*
Columns -----	7 days
Unsupported Beams & Slabs -----	Spans less than 10' = 4 days
	Spans from 10' to 20' = 7 days
	Spans over 20' = 10 days

\*Curing of surfaces exposed by form removal is required.

## 7. STRUCTURAL CONCRETE.

### a. Reinforcement.

(1) General. The Contractor shall furnish and install all reinforcement, including bars, fabric, and structural shapes as indicated on the Drawings or otherwise required by standard structural practice.

(2) Placing Reinforcement. All reinforcement shall be accurately placed, with clear spacing between main reinforcement and concrete surfaces as shown on the Drawings or as may be directed by the Engineer.

The minimum clear distance between parallel bars shall be  $1\frac{1}{2}$  times the nominal diameter of the bar,  $1\frac{1}{2}$  times the maximum size of the coarse aggregate, or  $1\frac{1}{2}$  inches, which ever is greater.

Prior to placement of concrete, reinforcement shall be in place and reviewed by the Engineer. Reinforcing steel shall be supported by spacers, hangers, or other reinforcing steel and secured in place with wire ties or suitable clips. Embedments shall be secured with templates.

Positioning tolerances for centerline of reinforcing shall be  $\pm 1/4$  inch for members less than 12" thick and  $\pm 3/8$  inch for larger members. Locations of laps and bends shall be true to  $\pm 2$  inches. Location of ends of reinforcing shall be true to  $\pm 1/2$  inch. Location of embedments shall be true to  $\pm 1/4$  inch.

(3) Splicing. Shall be in accordance with the Drawings and shop drawings. Where splices in reinforcement, in addition to those indicated, are necessary and approved by the Engineer, there shall be sufficient lap to transfer the stress by bond, as may be directed. Bars shall be lapped not less than 30 diameters unless otherwise shown and splices shall be staggered. Welding or tack welding of reinforcement shall not be permitted.

(4) Supports. All reinforcement shall be secured in place, true to the lines and grades indicated, by the use of metal or concrete supports, spacers, or ties. Such supports shall be of sufficient strength to maintain the reinforcement in place throughout the concreting operation, and shall be used in such a manner that they will not be exposed on the face or, in any way discolor or be noticeable in the surface of the finished concrete.

b. Placing.

(1) Walls and Columns. Walls and columns supporting concrete beams, concrete joists, or concrete slabs shall be poured to the underside of such beams, joists, or slabs at least 8 hours before the placement of the superimposed work, or as directed by the Engineer.

(2) Vibration. Concrete shall generally be compacted with the aid of mechanical vibrating equipment. Vibration shall be transmitted directly to the concrete and in no case shall vibration be transmitted through the forms. The duration of vibration at any location in the forms shall be held to the minimum necessary to produce thorough compaction. Vibration shall be supplemented by forking or spading by hand adjacent to the forms on exposed faces in order to secure smooth, dense and even surfaces. Use of vibrators to move concrete within forms shall not be permitted. Vibrators shall not be dragged horizontally thru the concrete.

c. Finishing.

(1) Unexposed Surfaces. Concrete for which no other finish is specified shall have fins and rough edges removed.

(2) Surfaces Exposed to Sight or Weather. All unsightly ridges or lips shall be removed and local bulging shall be remedied by tooling and rubbing. All holes left by the removal of rods and all voids, unless otherwise directed, shall be reamed and filled with mortar as directed.

(3) Top Surfaces of Walls. Walls shall be brought to the proper elevations as shown on the Drawings and top surfaces finished with a wood float to a true and regular surface. The application of sand or cement drier will not be permitted. No water shall be present when the surfaces are finished.

(4) Floors. Concrete floors shall be finished by the proper use of the bull float. The use of the jitterbug will not be permitted. Troweling shall not be done until concrete has hardened sufficiently to prevent excess fine material being worked to the surface. An approved clear hardener/anti-dusting compound shall be applied after curing. Slabs shall be sloped as shown on the Drawings.

(5) Tolerances. Formed surfaces shall be within the following tolerances:

(a) Vertical lines, edges and surfaces shall be plumb to 1/4 inch in 10 feet, and 1/2 inch in the entire length.

(b) Horizontal lines and edges shall be level to within 1/4 inch in 20 feet, and 1/2 inch in the entire length.

(c) Linear elements shall be at position shown on Drawings to within 1/2 inch. Embedments shall be at position shown on Drawings to within 1/4 inch.

(d) All members except inverts and footings shall be no more than 1/4 inch thinner nor 1/2 inch wider than shown on the Drawings. Thickness of footings shall be no more than 5% thinner than shown on Drawings.

## 8. PAVEMENT, SIDEWALKS, DRIVEWAYS, CURBS AND GUTTERS.

### a. Pavement.

(1) Placing of Concrete. The concrete shall be deposited on the subgrade for the full width between forms and in a manner that will prevent segregation and which will require as little rehandling as possible. Concrete shall not be placed on frozen or muddy subgrade. Any additional spreading necessary shall be done with hand shovels. The amount of material so deposited shall be in excess of the amount required.

After placement in its approximate final position, the concrete shall be consolidated by means of spud vibrators inserted into the concrete. This operation may be performed by hand or may be performed by vibrators attached to an approved machine in a spreading and strike-off operation.

(2) Reinforcement. If the Drawings provide for wire reinforcement it shall be placed in the location shown on the Drawings and shall be prevented from shifting due to normal finishing operations.

(3) Finishing. After the concrete is spread it shall be struck off and further consolidated and screeded with an approved finishing machine or machines. This machine shall be designed specifically for paving operations and shall be capable of producing an adequately consolidated concrete surface, true to grade, free of large open-textured areas and without excessive flushing of the mortar. It shall be accurately adjustable to conform to the plane of the pavement surface. It shall be moved ahead at an approximately uniform rate. It shall have a vibration unit in the screed that shall be stopped when the machine is not moving forward. A slight excess of concrete shall be kept ahead of the screed at all times. If a slipform paver is used, no tolerance will be allowed for edge sloughing. If edge sloughing occurs during paving operations, these operations shall cease until adjustments in the paver or concrete are made. The Contractor shall verify that the edge of the pavement is a true plane surface during paving operations. The intention of this requirement is to have all full lanes and uniform sections of pavement, 75 lineal feet or greater in length, paved with a self propelled slipform or bridge deck paver. The pavement equipment shall be approved by the Engineer prior to submittal of bids for all trafficway projects.

Moisture shall not be applied to the surface of the fresh concrete unless the Engineer approves the use of additional water.

Commercially made vibratory screeds and roller screeds may be used only on irregular sections of pavement if approved by the Engineer. Screeds must be of the heavy-duty type, have mechanical propelling mechanism, be adjustable as to length, and be adjustable as to crown or valley.

Hand finishing operations may be used for narrow widths and irregular areas where the use of an approved finishing machine is impractical. Hand finished concrete shall be thoroughly consolidated with hand spud vibrators. Following hand strikeoff, the concrete shall be in a condition equal to that produced by an approved finishing machine. There shall be no increase in slump in hand finished areas.

(4) Straightedging. After the final pass of the finishing machine, the entire surface shall be floated with straightedges not less than 10 feet in length. The straightedges shall be operated parallel to the pavement centerline starting at the center and progressing toward the forms. Advance along the road shall be in successive stages of not more than half the length of the straightedges. The edges of the

pavement will be checked transversely by straight edge at close enough intervals to assure a plane surface at the pavement edge or form line. All laitance, surplus water and inert material shall be removed from the surface. All high places shall be worked down and all low places filled by combined operations of flats and straightedges until no irregularities exist. The proper crown of the pavement shall be maintained throughout the operations.

(5) Texturing. As soon as all excess moisture has disappeared and while the concrete is still plastic enough to make a granular surface possible, a drag shall be used which shall consist of a seamless strip of damp burlap or cotton fabric, which shall produce a uniform surface of gritty texture after dragging it longitudinally along the full width of pavement. For pavement 16 feet or more in width, the drag shall be mounted on a bridge which travels on the forms. The dimensions of the drag shall be such that a strip of burlap or fabric at least 3 feet in width is in contact with the full width of pavement surface while the drag is used. The drag shall consist of not less than 2 layers of burlap with the bottom layer approximately 6 inches wider than the upper layer. The drag shall be maintained in such condition that the resultant surface is of uniform appearance and reasonably free from grooves over 1/16th inch in depth. Drags shall be maintained clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new drags substituted.

(6) Curing. The Contractor shall use a liquid membrane-forming compound to cure the pavement. Immediately after the free water has left the surface, the compound shall be applied in one application at a uniform rate of at least one gallon per 150 square feet of surface. Thinning the white membrane compound will not be permitted.

The treated surface shall be protected by the Contractor from injury of any sort for a period of at least 5 days. Any damage shall be repaired immediately. Immediately after forms are removed, the entire area of the sides of the slab shall be coated with curing compound at the rate specified for the pavement surface.

(7) Joints.

(a) General. Joints shall be constructed in accordance with the details shown on the Drawings and these Specifications with the best of workmanship. All joints formed by sawing will be sealed with an approved joint sealant compound. Surface joints formed by "tooling" do not need to be sealed. 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.

If existing pavement of any type is required to abut with the new pavement, and the termination of the removal is not at an existing joint, the new joint shall be made by sawing the existing pavement not less than two inches deep before removal.

(b) Contraction Joints. Contraction joints shall be at the spacing shown on the Drawings. Spacing will generally not exceed two times the pavement thickness or 15 feet maximum.

(c) Longitudinal Joint. Longitudinal joints shall be constructed as shown on the Drawings. Approved guide lines or devices shall be furnished to insure cutting the longitudinal joint on the true line as shown on the Drawings.

(d) Construction Joints. A butt construction joint shall be made perpendicular to the centerline of the pavement at the close of each day's work, and also when the process of depositing concrete is stopped for a length of time such that, in the opinion of the Engineer, the concrete will have taken its initial set. Dowel bars shall be spaced along the joint as shown on the Drawings. No construction joint shall be placed within 10 feet of an expansion joint or another construction joint.

(e) Sawing of Joints. All joints shall be wet sawed and constructed as shown on the Drawings. Sawing of joints shall be constructed in two stages as follows:

(e.1) First Stage. The first saw cut shall be a relief cut approximately 1/8 inch wide and to a minimum depth of 1/3 the thickness of the slab. Joints shall be sawed as soon as concrete has hardened sufficiently to prevent excessive tearing and raveling and before conditions induce uncontrolled cracks, regardless of the time or weather. The Contractor is responsible for sawing at the appropriate time and making sure that any equipment used does not damage the new pavement. Suitable guide lines or devices shall be used to insure the joint is cut straight and has the correct geometrics in relation to centerline. Curing membrane damaged during sawing operation shall be repaired by the Contractor as directed by the Engineer.

(e.2) Second Stage. Widening of the relief joints to full width (3/8" maximum) shall not be performed until the concrete is at least 48 hours old and shall be delayed longer when the sawing causes raveling of the concrete. If second stage sawing is performed prior to completion of the curing period, the Contractor shall maintain the cure by use of curing tapes, plastic devices or other materials approved by the Engineer. Membrane curing damaged during the sawing operation shall be repaired by the Contractor as directed by the Engineer.

The joint groove shall be centered over the relief cut and sawed to the specified dimensions shown on the Drawings.

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.

Any transverse joint requiring hand finishing and edging shall be edged with a tool having a radius of 1/8 inch unless otherwise directed by the Engineer. The horizontal surface of the edger should not indent the surface of the pavement.

(e.3) 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.

(f.) Cleaning Joints. Just prior to sealant being applied, a final cleaning of the joint shall be made by sandblasting the joint, followed by an air blast to clean incompressibles from the joint. If one sandblaster nozzle is used, the joint shall be cleaned once in each direction, concentrating on one joint face at a time. If a two nozzle arrangement is used, the nozzles shall be aimed so each nozzle concentrates its blast on one joint face.

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. When contaminated air is found to exist, work shall not resume until suitable adjustments are made and the air stream is found to be free of such contaminants.

(g) Sealing Joints. All sawed joints shall be sealed with an approved sealant. The location and configuration of the joint sealant shall be as shown on the Drawings. Joints must be sealed prior to opening to traffic.

(g.1) Filling the Joint. Joints shall not be sealed until they are thoroughly clean and dry and the pavement is at least five days old unless otherwise stipulated in the manufacturer's

publications and approved by the Engineer. Sealant shall not be applied to wet or damp concrete or installed during inclement weather. The sealer shall be placed in reasonably close conformity with dimensions shown on the Drawings. Any unreasonable deviation will be cause for rejection of the joint until satisfactory corrective measures are taken. Joint sealant application will not be permitted when the ambient air temperature is less than 40° F. or as specified in the manufacturer's publications.

(g.2) Equipment. The joint sealer, silicone or hot type, shall be applied by an approved mechanical device from inside the joint in such a manner that 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, the sealant surface shall be tooled using the appropriate tool to produce a slightly concave surface approximately 1/4 inch below the pavement surface as shown on the Drawings. 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. Hot type joint sealant shall fill the joint to a point level with the pavement surface.

(g.3) Cleaning Pavement. After a joint has been sealed, all surplus joint sealer on the pavement or structure surfaces shall be promptly removed.

(g.4) 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.

(g.5) The Contractor shall provide a manufacturer's technical representative on the project at the beginning of the joint sealing operation in order to have available the technical expertise in proper joint preparation, storing, handling, and application of the sealant. The purpose is to assure strict compliance with manufacturer's recommendations and these Specifications, and he shall instruct both the City/County inspector and Contractor in the proper procedures. Sufficient time shall be spent with both the Contractor and City/County inspector to ensure they are familiar with the proper procedure.

(8) Pavement Protection. Fresh concrete shall be adequately protected from heavy rains and mechanical injury including vandalism. No construction traffic shall be permitted to use fresh concrete pavement for a period of 4 days unless otherwise approved. Rapid evaporation of water with resultant drying out of exposed surfaces may cause problems like mortar flaking and shall be prevented. In cold weather, suitable means shall be provided for maintaining the concrete at a temperature of at least 50° F., for not less than 5 days after placing. Concreting operations during cold weather shall be continued only with the specific authorization of the Engineer who may authorize special construction methods.

(9) Opening to Traffic. New concrete pavement\* shall not be opened to vehicular traffic until the 5 day curing period is complete and the minimum strength shown in the table below has been achieved :

<u>Slab Thickness</u>	<u>Compressive Strength (psi)</u>
<u>Less than 7.0"</u>	<u>3,500</u>
<u>7.0" or thicker</u>	<u>3,000</u>

\*With a high-early strength concrete mix, the pavement may be opened to traffic in 24 hours if a minimum compressive strength of 3,000 psi is achieved.

(10) Profilograph Testing.

(a) General.

(a.1) Scope. This subsection covers methods and requirements for testing and reporting pavement trueness. Topics covered are locations for profilograph test, equipment, surface test, smoothness evaluations, and corrective action. When designated on the Drawings, profilograph testing shall be performed in lieu of straightedge testing. This does not preclude the use of straightedging to maintain a true pavement surface.

(a.2) Submittals. Contractor shall submit the following for review:

(a.2.1) Profilograph and operator certifications.

(a.2.2) Profilograph trace and certified interpretation and checking template.

(a.3) Test Locations. Contractor shall provide trueness testing, interpretation and corrective action at the following locations:

(a.3.1) Pavements identified for profilograph, smoothness, or trueness testing in the special conditions or on the Drawings shall be tested and corrected.

(a.3.2) Pavements, which are not otherwise identified for testing, shall be tested when they exhibit poor subjective ride quality, as determined by the Engineer. Such determination may include all or part(s) of the pavement on a given project.

(a.3.3) The following areas are excluded from the trueness testing requirements: bridge decks, shoulders, acceleration and deceleration lanes, patches or hand finished pavements less than 100 feet in length.

(a.3.4) Within the pavements subject to testing the following areas shall be excluded for determination of initial index, but shall be subject to "must grind" requirements: horizontal curves with centerline radius of less than 1000 feet, pavement within superelevation transitions and pavement within warp section of an at-grade intersection.

(b) Equipment. The profile index will be determined using a California type profilograph or other style of machine that yields compatible results and which is approved by the Kansas Department of Transportation, Bureau of Materials and Research. The equipment shall be furnished and operated by the Contractor as specified in KT-46I.

(c) Surface Test. The Contractor shall furnish paving equipment and employ methods that produce a riding surface having an average profile index of 45.0 inches or less per mile on roadways with a posted speed of 45 MPH or less per 0.1 mile section, except as provided for in subsequent paragraphs. Initial profiles over 45.1 inches on roadways with a posted speed of 45 MPH or less may be accepted after corrective measures have been performed.

Pavement profiles will be taken in accordance with KT-46I. Additional profiles may be taken only to define the limits of an out-of-tolerance surface variation.

A profilogram will be made for each continuous placement of 50 feet or more. The profilogram will include the 15 feet at the ends of the section only when the Contractor is responsible for the adjoining surface.

Individual sections shorter than 50 feet shall be inspected by testing with a ten-foot straightedge, a responsibility of the Engineer. The 15 feet at the ends of longer sections will also be inspected in this manner when excluded from the profilogram.

(d) Smoothness Evaluation. During the initial pavement operations, either when starting up or after a long shutdown period, the pavement surface will be tested with the profilograph as soon as the concrete has cured sufficiently to allow testing. Curing membrane damaged or protective cover removed during the testing operation shall be repaired or replaced by the Contractor as directed by the Engineer. Initial testing will be used to aid the Contractor and the Engineer in evaluating the pavement methods and equipment. If the initial pavement smoothness, paving methods, and paving equipment are acceptable to the Engineer, the Contractor may proceed with the paving operation.

A daily average profile index will be determined for each day's paving operation. A day's paving operation is defined as a minimum of 0.1 mile of full-width pavement placed in a day. If less than 0.1 mile is paved, the day's production will be grouped with the next day's production. If the production of the last day of project paving is less than 0.1 mile, it will be grouped with the previous day's production. If an average profile index of 65.0 inches per mile on roadways with posted speeds of 45 MPH or less is exceeded in any one day's paving operation, the paving operation will be suspended and will not be allowed to resume until corrective action is taken by the Contractor. In the event that paving operations are suspended as a result of the average profile index exceeding 65 inches per mile per 0.1 mile section on roadways with posted speeds of 45 MPH or less, subsequent paving operations will be tested in accordance with the initial testing procedures.

The Contractor shall furnish the profilogram and his evaluation to the Engineer. The testing and evaluation shall be performed by a trained and certified operator, and the evaluation shall be certified by the operator. The testing procedure and evaluation of the tract shall be performed in accordance with KT-46I. Results shall be furnished to the Engineer within two working days after placement of the pavement and again within two working days after any corrections are made.

(e) Corrective Actions. For determining pavement sections where corrective work or pay adjustments will be necessary, the pavement will be evaluated in 0.1 mile sections using the profilogram. Within each 0.1 mile section, all areas representing high points having deviations in excess of 0.4 inches in 25 feet or less shall be corrected by the Contractor.

(e.1) For roadways with a posted speed of 45 MPH or less and the following:

(e.1.1) Ramps from the nose to the intersection of the adjoining roadway.

(e.1.2) Acceleration and deceleration lanes including the taper. Acceleration lanes that become a through lane are limited to 500 feet from the nose.

Any 0.1-mile section, including bumps, having an initial profile index between 45.1 and 65.0 inches per mile shall be corrected to reduce the profile index to 45 inches or less per mile on each trace. Any 0.1 mile section, including bumps, having an initial profile index of 65.1 inches per mile or greater shall be corrected to reduce the profile index to 45.0 inches or less per mile on each trace or replaced at the Contractor's option.

On sections where corrections are made, the pavement will be tested by the Contractor to verify that corrections have produced a profile index of 45.0 inches or less per mile for each trace.

Corrections shall be made using an approved profiling device or by removing and replacing the pavement. Bush hammers or other impact devices will not be permitted. Where surface corrections are

made, the Contractor shall establish a uniform texture the full width of the lane but transverse grooving will not be required. Corrective work shall be at the Contractor's expense and shall be completed prior to determining pavement thickness.

The Engineer may perform profilograph testing on the surface for monitoring and comparison purposes. The Engineer may test the entire project length if he determines that the Contractor-certified test results are inaccurate, and the Contractor will be charged for this work at a rate of \$400.00 per mile, per profile track, with a minimum charge of \$800.00. Furnishing inaccurate tests may result in decertification of the Contractor's certified operator.

(f) Pay Adjustments. No pay adjustment will be made based on results of profilograph testing. The Contractor shall correct work as outlined in this section including removal and replacement of pavement as required to comply with specified tolerances.

(11) Manholes and Valve Castings. Manholes and valve castings located in a traffic lane shall be adjusted to meet the grade of the adjacent pavement surface within a tolerance limit of  $1/8 \pm$  inch. The tolerance shall be measured as the vertical distance between a 10 foot straight edge, centered over the manhole or valve casting in both the longitudinal and transverse directions, and the top of the manhole or valve casting.

(12) Tolerance in Pavement Thickness. The thickness of the pavement will be determined by average caliper measurement of cores.

For the purpose of establishing an adjusted unit price for pavement, units to be considered separately are defined as 1,000 linear feet of pavement in each traffic lane starting at the end of the pavement bearing the smaller station number. Bridge wearing surfaces shall not be included in the 1,000 linear foot unit. The last unit in each lane shall be 1,000 feet plus the fractional part of 1,000 feet remaining. One core will be taken at random in each unit.

For the purpose of establishing an adjusted unit price for ramps, widening, acceleration and deceleration lanes, intersections, entrances, crossovers, etc., that are less than 1,000 feet in length, units to be considered separately are defined as 1,000 square yards of pavement or fraction thereof. At such points as the Engineer may select, one core will be taken in each unit.

When the measurement of the first core from any unit is not deficient more than 0.2 inch from the Drawing thickness, full payment will be made. When the measurement of the first core from any unit is deficient more than 0.2 inch from the Drawing thickness, two additional cores within the 1,000 foot unit will be taken at intervals of not less than 300 feet or two additional cores within the 1,000 square yard unit will be taken at locations such that the pavement will be well represented. The average thickness of the unit will be determined by using the measurements of the three cores taken in that unit. In calculating the average thickness of the pavement, measurements which are in excess of the specified thickness by more than 0.2 inch will be considered as the specified thickness plus 0.2 inch and measurements which are less than the specified thickness by more than 1.0 inch will be considered as the specified thickness minus 1.0 inch. If the average thickness of the three cores is not deficient more than 0.2 inch from Drawing thickness, full payment will be made. If the average thickness of the three cores is deficient more than 0.2 inch from Drawing thickness an adjusted unit price will be paid for the unit represented.

When the measurement of any core is deficient by more than 1.0 inch from Drawing thickness, exploratory cores will be taken at intervals not less than 10 feet parallel to the center line in each direction from the deficient core until in each direction an exploratory core is taken which is not deficient by more

than 1.0 inch. Exploratory cores are to be used only to determine the length of pavement in a unit that is to be left in place without pay or removed and replaced.

Where the average thickness of pavement is deficient in thickness by more than 0.2 inch, but not more than 1.0 inch, payment will be made at an adjusted price as specified in Table 1.

TABLE 1 - CONCRETE PAVEMENT DEFICIENCY

<u>Deficiency in thickness as determined by cores, inches.</u>	<u>Proportioned part of contract price allowed</u>
0.00 to 0.20 .....	100 percent
0.21 to 0.30 .....	80 percent
0.31 to 0.40 .....	72 percent
0.41 to 0.50.....	68 percent
0.51 to 0.75.....	57 percent
0.76 to 1.00.....	50 percent

When the pavement is more than 1 inch deficient in thickness, the Contractor will be required to remove such deficient areas and to replace them with pavement of satisfactory quality and thickness. When the length of a slab between the end of a section which it is necessary to remove and replace and an expansion, contraction or construction joint is less than 10 feet, the entire pavement up to the joint shall be removed and replaced at the expense of the Contractor, and such an area shall be removed so that new construction joints are a minimum of 10 feet apart. The Contractor shall receive no compensation for materials or labor involved in the removal or the replacement of the deficient pavement. With the consent of the Engineer, the Contractor may leave the deficient pavement in place and receive no compensation or payment for such pavement. The area of concrete pavement for which no payment is made shall be identical with the area of pavement that the Contractor would be required to remove and replace as provided above.

Deductions for deficient thickness may be entered on any payment estimate after the information becomes available.

(13) Partial-Depth Concrete Pavement Repair. The Engineer shall mark in the field the limits of the deteriorated concrete pavement to be removed and replaced. The thickness of any partial-depth concrete pavement repair shall be determined by the Engineer. All partial-depth concrete pavement repairs shall have a minimum thickness of 1½ inches and a maximum thickness not greater than one-third of the slab thickness. The limits of the partial depth patches shall be a minimum of 2 inches beyond the area of deteriorated pavement. If areas defined for partial depth patches are less than 12 inches apart, include the areas into a single patch.

The deteriorated concrete pavement shall be removed by first sawing around the perimeter of the patch area. The repair area shall be broken out until sound and clean concrete is exposed by using a pneumatic chipping hammer (30 pound max.) and/or a carbide-tooth milling machine. The remaining edges should be as near to vertical as possible.

All exposed edges and surfaces of the existing concrete shall be cleaned and free of dust or loose particles.

When a partial-depth concrete pavement repair will abut a longitudinal joint, a transverse joint or a full-depth pavement crack, a compressible joint insert or a bondbreaking board shall be placed against the existing adjacent concrete prior to placing the patch material.

The locations of existing transverse and longitudinal joints in the concrete pavement shall be referenced before removing the deteriorated pavement. During the patching operations, new joints shall be established at the same location as the original joints.

When a partial-depth concrete pavement repair will abut an edge of an asphalt or aggregate shoulder, the edge of the patch must be formed.

The patch material used for partial-depth concrete pavement repair may be: 1) normal set PCC mixes, for example an 8 sack Pavement Class concrete mix, 2) high early strength PCC mixes containing Type III cement or 3) rapid strength proprietary materials. When using normal set PCC mixes, the existing concrete surfaces of the patch area shall be pre-wetted to a surface-saturated state without standing water in the patch. When using high early strength PCC mixes containing Type III cement, an epoxy bonding agent shall be used on the existing concrete surfaces of the patch area in accordance with the manufacturer's recommendations. When using rapid strength proprietary materials, the patch material shall be installed in accordance with the manufacturer's recommendations.

Place and consolidate the specified concrete in the areas prepared for patching, strike off the concrete flush with the surface of the existing pavement and finish with an approved method. The repair's surface texture should be similar to that on the surrounding existing pavement.

Transverse and longitudinal joints shall be sawn at the same locations as the original joints, flushed with water, sand blasted, cleaned with compressed air and sealed.

Concrete patches shall not be placed if the ambient air temperature is below 40 degrees Fahrenheit.

Unless directed otherwise by the Engineer, the concrete patches shall be cured by applying liquid membrane forming compound at the rate of 1 gallon per 150 square feet to the finished patch.

(14) Full-Depth Concrete Pavement Repair. The Engineer shall mark in the field the limits of the deteriorated concrete pavement to be removed and replaced. The minimum patch length for full-depth concrete pavement repairs shall be six feet in the longitudinal direction and the full extent of one lane in the transverse direction.

The deteriorated concrete pavement shall be isolated from the adjacent sound concrete with a full-depth saw cut around the perimeter of the patch area. The deteriorated concrete pavement shall be lifted out of place wherever possible. If lifting is unsafe or not possible, then the pavement will need to be broken up and removed mechanically or by hand. Care should be taken to not damage the remaining pavement.

All damaged or soft areas in the subgrade shall be removed, replaced and re-compacted with approved material.

Load transfer shall be provided at the transverse joint faces for all full-depth concrete pavement patches. Smooth dowels that are 18 inches long shall be drilled and epoxied 9 inches into either side of the patch's transverse joints. The dowels shall be ½ inch for 6 inch pavement, 1 inch for 7 inch to 8 inch thick pavements, 1-1/4 inch for 9 inch and thicker pavements. Three dowel bars shall be placed in each wheel path at 1 foot centers.

Full-depth concrete pavement repairs shall have deformed tiebars provided at the longitudinal joint faces. Tiebars that are 3 feet long shall be drilled and epoxied 18 inches into each side of the longitudinal joint. The tiebars shall be ½ inch and spaced at 5 feet centers (max.).

The repair area should be reinforced the same as the area removed.

The location of existing joints in the concrete pavement shall be referenced before removing the deteriorated pavement. During the patching operations, new joints shall be established at the same locations as the original joints.

When a full-depth concrete pavement repair will abut an edge of an asphalt or aggregate shoulder, the edge of the patch must be formed.

The patch material used for full-depth concrete pavement repair shall be normal set PCC mixes, for example an 8 sack Pavement Class concrete mix, with a typical time to opening strength of 24 to 72 hours.

Place and consolidate the specified concrete in the areas prepared for patching and strike off the concrete flush with surface of the existing pavement. Full-depth repairs with a length longer than 10 feet shall be finished longitudinally using a vibratory screed. Full-depth repairs with a length of 10 feet or less shall be finished transversely using a 10 foot straight edge. The repair's surface texture should be similar to that of the surrounding existing pavement.

The transverse and longitudinal joints shall be sawn at the same locations as the original joints, flushed with water, sand blasted, cleaned with compressed air and sealed.

Concrete patches shall not be placed if the ambient air temperature is below 40 degrees Fahrenheit.

Unless directed otherwise by the Engineer, the concrete patches shall be cured by applying liquid membrane forming compound at the rate of 1 gallon per 150 square feet to the finished patch.

b. Sidewalks and Driveways.

(1) Finishing. The concrete shall be placed in a continuous operation and consolidated by the use of hand-operated screeds, tampers, and longitudinal floats. The use of vibrators is required on concrete slabs greater than 4 inches in thickness. The surface shall receive a light broom finish (no steel troweling). All exposed edges, including joints, shall be rounded with an edging tool having a radius of 3/8 inch. All surfaces shall be plane and true to form. Addition of water to the surface of concrete to assist in finishing operations will not be permitted.

(2) Joints.

(a) Expansion Joints. Expansion joints shall be placed at all intersections between sidewalks and driveways; sidewalks and ramps; between old and new walks where old and damaged walks are being repaired and replaced; between driveways and pavement curb, and at all other locations called for in the Drawings. Expansion joints shall be formed with 1/2 inch prefabricated non-extruding filler and shall extend the full depth of the slab. All expansion joints shall be sealed with approved joint sealant.

(b) Contraction Joints. Contraction joints shall be formed at intervals shown on the Drawings or if not shown, the interval shall be equal to the width, but not to exceed 10 feet, (e.g., a 4 foot sidewalk jointed at 4 foot intervals; a 20 foot driveway jointed at 10 foot intervals, with a longitudinal joint at the center.) They shall be formed by making a 1/4 inch groove 25% of the depth of the slab while the concrete is still plastic enough to be worked but hard enough so it will not slump after grooving. Contraction joints formed by "tooling" do not need to be sealed with joint compound. Contraction joints in driveways may also be formed by sawing. All joints formed by sawing will be blown clean and sealed with an approved joint sealant compound.

(c) Construction Joints. A butt construction joint shall be made at the close of each day's work or when the work is stopped long enough so that the previously placed concrete would have taken its initial set. This joint shall extend completely through the slab and be perpendicular to the finished surface.

(3) Curing. Curing shall be the same as the provisions for curing listed under Pavement.

(4) Sidewalk Ramps. Sidewalk ramps shall be constructed using 6" thick pavement class concrete (4,000 pounds per square inch). Ramps shall have a detectable warning area complying with ADA Accessibility Guidelines (ADAAG). A 6 inch concrete thickness shall be placed under the detectable warning area.

(a) Size. Detectable warnings shall be 24 inches in the direction of travel and extend the full width of the traversable portion of the ramp (full width of the walking surface), but shall not extend onto the portion of the ramp transitioning back to curb height.

(b) Material. Detectable Warning Pavers shall have a compressive strength greater than 8000 psi, a water absorption maximum of 5% and shall meet or exceed ASTM C-936 and freeze-thaw testing per Section 8 of ASTM C-67. Pavers shall be Pavestone Detectable Warning Pavers, or approved equal. Armortile Detectable Warning System or approved equal will also be allowed.

(c) Dome size and spacing. Truncated domes shall have a diameter of 0.9 inch at the bottom, a diameter of 0.4 inch at the top, a height of 0.2 inch and a center-to-center spacing of 2.35 inches measured along one side of a square arrangement.

(d) Dome alignment. Domes shall be aligned on a square grid in the predominant direction of travel to permit wheels to roll between domes.

(e) Visual Contrast. There shall be a minimum of 70 percent contrast in light reflectance between the detectable warning and an adjoining surface.

(5) Fine Grading Material. Crushed rock, conforming to requirements of AB-3 as specified may be used ONLY under Sidewalks and Driveways (Residential and Commercial) within the public right-of-way for the purpose of making final adjustment to dirt subgrade, where necessary, to insure proper final grade and thickness of sidewalks and driveways. Allowable maximum thickness of compacted AB-3 Crushed Rock shall be 2 inches.

### c. Curbs and Gutters

(1) Finishing. Exposed surfaces shall be shaped to the section shown on the Drawings by using steel tools and trowels and then brushed lightly. Moisture shall not be applied to the surface of the fresh concrete unless approved by the Engineer. All exposed edges and joint edges shall be rounded with an edging tool having a radius of 3/8 inch. The cross section of the finished shape of the curb and gutter section shall not be more than 1/2" deviated from the standard dimensions shown on DT-003 of the Standard Technical Specifications. If deviations are more than 1/2", then curb and gutter sections must be removed and replaced. The finished gutter flowline shall be checked with a 10 feet straight edge to ensure positive drainage in the gutter.

Consolidation of the concrete shall be accomplished with internal mechanical vibration. Vibration shall be transmitted directly to the concrete and in no case shall vibration be transmitted through the forms. The duration of vibration at any location in the forms shall be held to the minimum necessary to produce thorough compaction. Vibration shall be supplemented by forking or spading by hand adjacent to the forms on exposed faces in order to secure smooth, dense and even surfaces.

(2) Joints. Joints shall be constructed at the locations or spacings shown on the Drawings. Where curb and gutter sections are adjacent to concrete pavement sections, the joints shall match those in the pavement. Spacing shall not exceed 15 feet maximum. Tooled joints shall be formed by taking an approved tool, such as a margin trowel, at the joint location and separating the aggregate in the concrete through the entire curb section from the curb down its face and along the gutter to a depth of at least 4 inches below the surface. A 1/4 inch groove 1 inch deep is then made at the joint location while the concrete is still plastic enough to be worked but hard enough so it will not slump after grooving. Joints formed by "tooling" are not required to be sealed with joint compound. Contraction joints in curb & gutter sections may also be formed by sawing. All joints formed by sawing will be blown clean and sealed with an approved joint sealant compound.

A butt construction joint shall be made at the close of each day's work or when the work is stopped long enough so that the previously placed concrete would have taken its initial set. This joint shall extend completely through the slab and be perpendicular to the finished surface.

(3) Stamp. (City Projects Only) Each continuous strip of curb & gutter shall be stamped on both ends (or at the end of each block for new streets) with the name of the prime contractor performing the work and the year that the work is done. When short sections of curb & gutter 10 feet in length or less are reconstructed, only one end shall be stamped.

The stamped letters and numbers shall be at least 5/8 inch in height at the concrete surface in sharp-faced Arial or approved equal typeface with a minimum depth of 1/4 inch. Additional text or logos shall not be permitted. Maximum vertical dimension of the stamp shall be 5 inches. Maximum horizontal dimension shall be 10 inches.

The stamp shall be placed with the text oriented parallel to the street centerline. The stamp shall be located within the top of curb if the size allows or otherwise in the face of the curb.

(4) Curing. Curing shall be the same as the provisions for curing listed under Pavement.

9. BID ITEM, MEASUREMENT AND PAYMENT.

a. Concrete.

1. Bid Item.

<b><u>STRUCTURE CLASS CONCRETE</u></b>	_____	<b>C.Y.</b>
<b><u>STRUCTURE CLASS CONCRETE (AE)</u></b>	_____	<b>C.Y.</b>
<b><u>REINFORCEMENT, GRADE _____</u></b>	_____	<b>LBS.</b>
<b>CONCRETE PAVEMENT;</b>		
_____ " Reinforced Concrete Pavement	_____	<b>S.Y.</b>
_____ " Non-Reinforced Concrete Pavement	_____	<b>S.Y.</b>
<b>CONCRETE CURB, CURB AND GUTTER;</b>		
<b>Combined Curb and Gutter, Type _____</b>	_____	<b>L.F.</b>
<b>6" Integral Curb</b>	_____	<b>L.F.</b>
<b>6" Edge Curb</b>	_____	<b>L.F.</b>
<b>CONCRETE VALLEY GUTTER</b>	_____	<b>S.Y.</b>

**CONCRETE DRIVE;**  
\_\_\_\_\_ " Concrete Drive \_\_\_\_\_ S.F.

**CONCRETE SIDEWALK;**  
\_\_\_\_\_ " Concrete Sidewalk, \_\_\_\_\_ ' wide \_\_\_\_\_ S.F.  
**Combined Sidewalk Retaining Wall** \_\_\_\_\_ L.F.

**PARTIAL-DEPTH CONCRETE PAVEMENT REPAIR** \_\_\_\_\_ S.Y.

**FULL-DEPTH CONCRETE PAVEMENT REPAIR** \_\_\_\_\_ S.Y.

•The Bid Item “Combined Sidewalk Retaining Wall” shall include payment for all work necessary to construct the retaining wall and the adjacent sidewalk.

2. Measurement for the bid items listed above shall be by the unit of measure stated. If there is a conflict between units shown and those on the Bid Form, the Bid Form shall govern.
3. Payment will be for the amount of completed and accepted work at the Contract unit prices bid for the units stated above or as changed by the Bid Form.

b. Sidewalk Ramps.

1. Bid Item.

**SIDEWALK RAMP** \_\_\_\_\_ S.F.

2. Measurement. Ramp shall be paid to a maximum 6 foot length at centerline by the unit of measure stated. If there is a conflict between units shown and those on the Bid Form, the Bid Form shall govern.
3. Payment will be for the amount of completed and accepted work at the Contract unit prices bid for the unit stated above or as changed by the Bid Form. There will be no separate payment for the detectable warning system, as all costs associated with the work shall be included in the price bid for “sidewalk ramps”.

END OF SECTION

## SECTION 6

### SEWERS

1. **GENERAL.** This section covers the construction of all storm sewers (Reinforced Concrete Pipe and Aluminized Type 2 Corrugated Steel Pipe material only), sanitary sewers, manholes, inlets, reinforced concrete sewer structures, and other appurtenances as shown on the Drawings.

#### 2. MATERIALS.

a. **Ductile Iron Pipe** (sanitary sewer only). Push-on or mechanical joint. Construction of pipe to conform to ANSI/AWWA C151/A21.51.

(1) **General** Unless otherwise indicated on the Drawings or required by trench load or internal working pressure, all 4 inch pipe shall be Class 51 and all 6 inch and larger pipe shall be Class 50. Thickness design of ductile iron pipe shall be in accordance with ANSI/AWWA C150/A21.50.

(2) **Mechanical Joint and Flanged Fittings** shall conform to the requirements of ANSI/AWWA C110/A21.10.

(3) **Lining.** Unless otherwise specified or indicated on the Drawings, all ductile iron pipe and fittings shall be coated and lined with the manufacturer's standard asphaltic material. Coating and lining shall conform to the requirements of ANSI/AWWA C151/A21.51. Pipe and fittings for sanitary sewer service shall be lined with either Protecto 401 ceramic epoxy or polyethylene.

(a) **Protecto 401 Ceramic Epoxy.** The lining material shall be amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Lining shall have a nominal dry film thickness of 40 mils. In no case shall the lining thickness be less than 30 mils.

(b) **Polyethylene.** The lining material shall be virgin polyethylene complying with ANSI/ASTM D 1248, shall be heat-bonded to the interior of the pipe or fitting, and shall have a nominal thickness of 40 mils. In no case shall the lining thickness be less than 30 mils.

The Protecto 401 or polyethylene lining on all pipe barrels and fittings shall be tested for pinholes with a nondestructive 2,500 volt test. Any defects found shall be repaired prior to shipment. The lining thickness shall be checked using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PA-2 Film Thickness Rating.

(4) **Bolts, glands and Gaskets.** All bolts, glands, and gaskets for mechanical joint pipe and fittings shall conform to ANSI/AWWA C111/A21.11.

(5) **Flanged Joints** Flanged joints shall conform to ANSI/AWWA C115/A21.15. Flanges shall be ductile iron, flat faced, and of solid construction. The use of hollow-back flanges will not be permitted. Flanged gaskets shall be neoprene, 1/8 inch thick, full-face type. Flange bolts shall conform to ASTM A307 with chamfered or rounded ends and shall project 1/4 to 1/2 inch beyond the outer face of the nut. Nuts shall be hexagonal ANSI/ASME B18.2.2 heavy semifinished pattern, conforming to ASTM A307.

(6) **Encasing** Unless otherwise specified or indicated on the Drawings, all buried ductile iron pipe and fittings shall be encased in seamless, 8 mil, polyethylene tube conforming to ANSI/AWWA

C105/A21.5. Encasement shall be installed in accordance with installation Method A. Ends of tubing shall be overlapped at least 12 inches and shall be thoroughly sealed with polyethylene adhesive tape. All cuts, tears, punctures, or other damage to the polyethylene shall be repaired using adhesive tape or with a short length of polyethylene sheet or tube cut open, wrapped around the pipe to cover the damaged area, and secured in place.

b. Vitrified Clay Pipe and Fittings (sanitary sewer only).

- (1) General. All pipe shall meet the requirements of ASTM C 700.
- (2) Joints. Compression joints shall conform to the requirements of ASTM C 425.
- (3) Couplings. Compression couplings shall conform to the requirements of ASTM C 425.

c. PVC (Polyvinyl Chloride) Pipe (sanitary sewer only).

(1) General. Pipe and fittings shall conform to the requirements of ASTM D 2665 (schedule 40 wall thickness) for 4 inch and 6 inch, to the requirements of ASTM D 3034 SDR 35 for 8 inch through 15 inch, and to ASTM F 679 - PS 46 for 18 inch through 36 inch nominal pipe sizes. The pipe shall be made of PVC plastic having a cell classification of 12454-B or 12454-C as defined in ASTM D 1784.

(2) Joints. Push-on joints shall conform to ASTM D 3212 and gaskets to ASTM F 477. Solvent cements for joining pipe and socket-type fittings shall conform to ASTM D 2564.

d. Reinforced Concrete Pipe (storm sewer only).

(1) General. Pipe shall conform to the requirements of ASTM C 76 wall "B" or "C". ASTM pipe class designation shall be in accordance with the Drawings.

(2) Joints. Joints shall be slip joints, sealed as specified in Paragraph 2.n.

(3) Lift Holes. Concrete pipe 15" through 30" shall be fabricated without lift holes. Concrete pipe larger than 30" and all elliptical pipe may be fabricated with lift holes. A preformed polyethylene plug shall be used to fill and cover lift holes. The plug shall be *POPIT* manufactured by POPIT Inc, Levittown, PA or approved equal.

e. Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe (storm sewer only) shall conform to the requirements of ASTM C 507.

f. Aluminized Steel Type 2 Corrugated Steel Pipe, Pipe Arches and Fittings (storm sewer only) shall comply with the requirements of AASHTO M 36. U.S. Standard Gage for corrugated steel pipe shall be in accordance with the Standard Detail Drawings. Joints shall be either Hugger-type or Bell and Spigot.

(1) Bell and Spigot Joints. Shall conform to "CONTECH Quick Stab Joint", or equal for pipe sizes 15" through 48" diameter.

(2) Hugger-type Joints. Shall conform to "CONTECH HUGGER Band", or equal for pipe sizes 15" and larger.

g. Precast Concrete Box Sections.

(1) General. Box sections used for culverts, storm drains or sewers shall conform to ASTM C 789 and AASHTO M 259.

(2) Loading. Box sections used as culverts, storm drains or sewers, and having less than 2 feet of cover and subjected to highway loading, shall conform to ASTM C 850 and AASHTO M 273.

(3) Reinforcement shall conform to ASTM A 185.

(4) Strength. Minimum concrete strength shall be 5000 psi at 28 days.

(5) Joints shall be sealed with joint cement or flexible gasket-type sealants.

h. Precast Reinforced Concrete Manholes, Risers and Tops shall conform to the applicable requirements of ASTM C 478. The minimum shell thickness shall be as follows.

<u>Depth</u>	<u>Minimum Shell Thickness</u>
0 to 16 feet	One twelfth internal shell diameter.
16 feet or greater	One twelfth internal shell diameter plus one inch.

i. Precast Reinforced Concrete Structures, Risers and Tops excluding concrete pipe, box culverts and precast reinforced concrete manholes, shall conform to the requirements of ASTM C 913. This shall include septic tanks, distribution boxes, catch basins, inlets (including Type I-P and II-P) and similar structures.

j. Structural Steel shall conform to the requirements of ASTM A 36.

k. Iron Castings

(1) Governing Standard Except as modified or supplemented herein, all castings furnished shall conform to the requirements of ASTM A48, Class 35B or higher.

(2) Dimensions and Weight. All castings shall conform to the dimensions and weights indicated on the Drawings. Dimensions shall not deviate more than 1/16 inch per foot. Surfaces of lids or covers shall not vary more than 1/16 inch above or below surfaces of accompanying frames or rings when properly seated. Variations in the weight of individual castings shall not vary by more than 4 percent.

(3) Minimum Tensile Strength. The tensile strength of each casting provided under this specification shall be at least 30,000 psi.

(4) Workmanship. All castings shall be manufactured true to pattern. Compatibility and fit of component parts shall be subject to inspection and acceptance or rejection. Castings shall be free of defects, to include but not necessarily limited to, blow holes, sand inclusions, cracks, distortion, and/or deviations from specified or indicated dimensions. All castings shall be furnished in bare metal.

(5) Compliance with U.S. Customs Regulations. All castings imported into the United States shall conform to the applicable provisions of United States Customs regulations.

(6) Interchangeability. Manhole frames and covers shall be manufactured so as to be fully interchangeable. All of the covers provided shall be suitable for installation on any of the frames provided and shall not rock or tip under an applied load.

(7) Marking. All castings shall have the manufacturer's name and Julian heat date legibly cast thereon. Indistinct markings shall be grounds for rejection of individual castings. All castings of foreign origin must comply with current U.S. Customs marking regulations.

(a) Sanitary Sewers. The designation "CITY OF TOPEKA SANITARY SEWER" shall be cast in 2-1/2 inch high block letters flush with the traffic surface on all manhole covers intended for wastewater use. Letters shall be arranged around the circumference of the cover. A surface pick slot and concealed pick slots shall be manufactured into the lid.

(b) Storm Sewers and Inlets. The designation "DRAINS TO RIVER DO NOT DUMP" shall be cast in 2-1/2 inch high block letters arranged around the circumference of the cover. A likeness of a catfish shall be cast in the center of the lid. A standard open pick slot shall be manufactured into the lid.

(8) Acceptable Products. Castings shall be the product of Clay & Bailey, Deeter, Neenah or equal.

(9) Submittals.

(a) Cast Test Bars. Cast test bars shall be delivered to the Purchaser with the castings. Laboratory verification of chemistry, Brinell Hardness, or tensile strength will be required at the Purchaser's request and shall be delivered within two weeks of request at no additional cost.

(b) Certificate of Insurance. Manufacturer shall purchase and maintain product liability insurance in the amount of \$3,000,000.00. Prior to delivery of castings, the manufacturer shall deliver to the Purchaser a properly completed certificate of insurance.

l. Concrete shall conform to the requirements of Section 5.

m. Mortar shall consist of one part Portland Cement and 1½ parts clean sharp sand with only enough water for workability.

n. Joint Sealants for Concrete Pipe. For concrete pipe 24-inch diameter and smaller, joints shall be sealed using an approved preformed mastic sealant. Mastic sealant must be designed to fit the type of pipe joint for which it is to be used.

Preformed mastic shall conform to the requirements of AASHTO M 198 and must be pre-approved by the Engineer.

Joints in concrete pipes larger than 24 inches shall be sealed using approved preformed mastic sealant or cold troweled-on mastic sealant such as Philip Carey "Sewertite" or approved equal. After joint is completed, excess mastic inside the pipe shall be removed.

o. Joint Sealants for Precast Manholes. Approved preformed mastic sealant may be used in the joints between manhole sections, except at the top joint between wall and cast iron manhole ring. Two rings of approved 3/4 inch preformed mastic sealant must be used at that location. Preformed mastic shall conform to the requirements of AASHTO M 198 and must be pre-approved by the Engineer.

p. Nonshrink Grout shall not be a gas liberating type, shall be non-metallic and non-corrosive. Grout shall be Five Star by U.S. Grout Corporation or Supreme by Gifford-Hill and Company.

q. Resilient Connectors. A flexible pipe to manhole connector shall be used whenever a pipe penetrates into a concrete manhole or structure and shall be of two types:

(1) General. Type cast into manhole wall at the manufacturing facility. The connector shall be the A•LOK X-CEL as manufactured by A•LOK PRODUCTS, INC., Tullytown, PA or approved equal. The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C-923. The connector shall meet or exceed the performance requirements prescribed in ASTM C-923.

To ensure a flexible watertight connection, no mortar shall be placed around the connector on the outside of the structure or around the top half of the connector on the inside when completing the invert work.

The Z•LOK pipe to manhole connector as manufactured by A•LOK PRODUCTS, INC., Tullytown, PA or approved equal may be used with approval of the Engineer.

(2) Connector. Pipe to manhole connector for penetrations into existing concrete manholes and structures. The connector shall be the G3 Boot System featuring component packaging as manufactured by A•LOK PRODUCTS, INC., Tullytown, PA or approved equal.

The connector shall be made from materials that conforms to the physical and chemical requirements outlined in Section 4, “Materials and Manufacture” of ASTM C-923 “Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals”, and the overall design will meet or exceed Section 7, “Test Methods and Requirements” of ASTM C-923. To ensure a flexible watertight connection, no mortar shall be placed between the pipe and the wall of the concrete structure.

### 3. CONSTRUCTION METHODS.

a. General. Pipelines shall be constructed using the type of pipe material which meets the requirements of the Drawings and Specifications. Pipe shall be inspected before laying and any defective or damaged lengths shall be rejected. Bell ends (when bell and spigot pipe is used) shall be carefully cleaned before pipes are lowered into the trenches.

Pipe shall be laid in the finished trench to a true and uniform grade as shown on the Drawings, with the bedding conforming to the requirements of Section 2. Construction of gravity sewers shall begin at the lower end with bell ends facing upstream, and with bell holes excavated as required. All pipes shall be laid with ends abutting and true to line and grade and shall be fitted and matched so that when laid together they will form a smooth and uniform invert.

The downstream end of extensions of existing sewers shall be plugged in a positive manner satisfactory to the Engineer until construction, cleaning, and testing are complete and the new construction is accepted by the City/County.

All required precautions shall be taken to assure adequate trench ventilation and protection for workers installing the pipe.

All storm sewer pipe within “Critical Areas” shall be concrete pipe. Critical areas shall be defined as the area upon which curb and gutter or pavement is to be placed. The critical area for streets shall extend one foot on each side beyond the back of curb or edge of pavement, whichever is appropriate. This requirement does not apply to areas outside the corporate limits of the City of Topeka.

b. Ductile Iron Pipe shall be installed in accordance with the Drawings and Specifications. The Contractor has the option of using any of the following types of pipe joints, except that flanged joints will not be permitted in any underground location.

(1) Mechanical Joints. Clean inside of bell and 8 inches of spigot end of pipe and coat with a soap solution (½ cup granulated soap per gallon of water). Place gland and rubber gasket on the spigot and seat the spigot in the bell. Press gasket and gland into place, set bolts and tighten nuts by hand. Tighten nuts with wrench on opposite sides of joint alternately. Complete tightening with torque limiting wrench set in accordance with the following table:

<u>Bolt Size (Inches)</u>	<u>Range of Torque (ft./lb.)</u>
5/8	40 - 60
¾	60 - 90
1	70 - 90
1¼	90 - 120

(2) Push-on Joint construction shall be in accordance with the recommendations of the manufacturer. Gaskets shall be placed on the pipe before installation in the trench.

(3) Flanged Joints. Flanged gaskets shall be placed and flanged pipes shall be joined in such a manner as to not damage either the flange facing or the gasket. Flanged pipe joints shall be cleaned, assembled and tightened in accordance with Paragraph 3.b.1.

c. Vitrified Clay Pipe with resilient material joints shall be installed in accordance with the manufacturer's recommendations. All joints shall be wiped clean as work progresses. Exposed ends of vitrified clay pipe shall be protected from damage and the ends shall be plugged or covered to prevent entry of obstructing matter. Joints in vitrified clay pipe shall not be covered until inspected and approved by the Engineer.

d. PVC (Polyvinyl Chloride) Pipe shall be installed in accordance with ASTM D 2321. Installations of solvent weld joint pipe and fittings shall be made in accordance with ASTM F 402.

e. Reinforced Concrete Pipe shall be installed in accordance with the Drawings and Specifications and shall be sealed as specified in Paragraph 2.q in a manner satisfactory to the Engineer.

When pipe is in place, prior to sealing, the joints of all pipes shall be visually inspected for the interior joint gap. The maximum allowable gap at any location on the joint shall be ¾ inch.

If troweled-on mastic sealant is used for pipes larger than 24 inches in diameter, mastic shall be placed around the entire inside periphery of the bell and on the outside of the upper half of the spigot. After the spigot is seated completely in the bell, the inside of the joint shall be smoothed and any excess mastic material removed from the inside of the pipes.

f. Corrugated Steel Pipe, unless otherwise noted, shall be installed in accordance with the manufacturer's recommendations and shall be tightly joined by the use of connecting bands. Space

between the connecting bands and pipe shall be kept free from dirt and grit so that the corrugations fit snugly. Slack in the bands should be taken up when tightening the bolts.

g. Precast Reinforced Concrete Manholes shall be constructed in accordance with the Drawings.

(1) General. Handle with care to avoid damage to joint ends of each section. Damaged sections may be subject to rejection at the discretion of the Engineer. All manhole construction shall be watertight. The invert and walls shall be cleaned of excess grout and laitance.

(2) Joints. Joints between sections shall be sealed with a preformed mastic sealant as specified in Paragraph 2.o.

(3) Base & Invert. Cast-in-place or Precast Concrete Base shall be constructed of Structure Class concrete as detailed on the Drawings. Invert channels shall be smooth and shall conform to adjacent sewer sections.

(4) Workmanship. Precast Reinforced Concrete Manholes shall be constructed in sections. Precast reducer cone sections 4'-0" diameter shall be of the concentric type. Manholes of 5'-0" and larger diameter may have cones or concrete flattop lids of the eccentric type. All joints shall be set and sealed with an approved preformed mastic sealant except for the joint between manhole and cast iron ring where two rings of preformed mastic sealant must be used. (See Paragraph 2.o)

(5) Sanitary Sewer Pipe Connections. All sanitary sewer pipe connections shall be flexible, unless approved by the Engineer. Storm sewer pipe connections may be either rigid or flexible. All connections shall be made carefully to prevent leakage and breakage of the pipe.

(a) Rigid connections shall be made using concrete or grout to fill the annular space around the pipe in manhole walls. Pipes shall be encased with concrete as shown on the Standard Detail Drawing.

(b) Flexible connections allow for limited differential settlement to occur between the pipe and manhole. The uniform compaction of the bedding material under the pipe and up to the springline of the pipe is essential to the control of this differential settlement. Cast-in-place resilient connectors shall be used with all flexible connections. Pipes installed with flexible connections shall not have concrete encasement at the outside of the manhole.

(6) Manhole Castings shall be sealed with two rings of preformed mastic sealant. In situations where the exterior walls of the manhole will be exposed to weather, the manhole casting shall be bolted to the precast cone section or flat slab top using 5/8 inch diameter galvanized bolts and threaded inserts in the concrete.

(7) Inside Drops for manholes shall be constructed as detailed on the Standard Manhole Details Drawing. Stainless steel straps shall be secured to the structure wall with 3/8" stainless steel fasteners at 4 ft. intervals (minimum of 2). Straps shall be 1-1/2" wide, 11 gauge (.1196") stainless steel. Pinch bolt and nuts shall be 3/8" diameter, Type 18-8 stainless steel. Inside drop system by Reliner/Duran Inc. has been approved for use in drop manholes.

h. Connection to Existing Structures shall be done in such a manner as to prevent damage to existing structures. New invert channels shall be constructed as needed to conform to the standard details.

(1) Rigid Connections. Hole for installation of pipe shall be approximately 4 inches larger in diameter than the outside diameter of the pipe to be installed. Annular space around the pipe shall be filled solid with grout. A clamp-on resilient connector shall be installed on pipe prior to being grouted into wall.

(2) Flexible Connections. A flexible pipe to manhole connector shall be used for sanitary pipe penetrations into existing concrete manholes and structures. The connector shall be the G3 Boot System as manufactured by A•LOK PRODUCTS, INC., Tullytown, PA or approved equal.

The design of the seal shall provide a flexible, positive watertight connection between pipe and concrete wastewater structures. The connector shall assure that a seal is made between (1) the connector and the structure wall, and (2) between the connector and the pipe. The seal between the connector and the manhole wall shall be made by placing the connector and expansion ring into the center third of the concrete opening. The band is then expanded and locked by utilization of torque wrench or porta-power unit to transmit the force required to seal the rubber connector against the concrete.

The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C-923. The connector and stainless steel hardware shall meet or exceed the performance requirements proscribed in ASTM C-923.

The connector shall be of size specifically designed for the pipe material being used and shall be installed in accordance with recommendations of the manufacturer.

i. Miscellaneous Details.

(1) Supports, Cradle and Blocking. Construct to the dimensions shown on the Drawings or as directed by the Engineer.

(2) Service (Wye) Connections. Install fittings for service connections in all types of pipe at locations and in the manner designated by the manufacturer and approved by the Engineer. Wyes shall be located a minimum distance of 5' from manholes. Concrete cradle under wye will not be required for plastic pipe.

(3) Riser Pipes shall be constructed of approved sewer pipe and fittings as shown on the Drawings and/or as directed by the Engineer. Each riser pipe shall be plugged with an approved plugging device.

(4) House Service Lines shall be constructed as detailed on the Drawings or as directed by the Engineer. Connections between new and old work shall be made by means of suitable adapters or in a manner satisfactory to the Engineer. Service line connections directly into manholes shall be prohibited, unless approved by the Engineer.

(5) Abandonment of House Service Lines or Wye Connections. House service lines or wye connections due to be abandoned shall be an approved plugging device at the property line. The plugging device shall then be encased in concrete. Concrete encasement shall extend outward from the plugging device 4 to 6 inches in all directions.

j. Reinforced Concrete Structures. Forms, mixing and placing of concrete, placing of reinforcing, finishing and curing shall conform to the requirements of Section 5.

k. Inlets shall be constructed in accordance with the Drawings and Specifications. Inlets or storm drainage systems other than those conforming to the Standard Details may be used only with the approval of the Engineer and in conformance with complete details included in the Drawings.

l. Stubs and other lines designated on the Drawings to be plugged for future connections shall be plugged in such a manner that it will in the opinion of the Engineer prevent infiltration, resist deterioration, and permit future reopening without substantial damage to the existing construction. Special fittings, discs, and other devices may be installed with the approval of the Engineer in accordance with the manufacturer's recommendations.

m. Protection of Water Supplies. Sewer lines constructed of ductile iron with a polyethylene or Protecto 401 lining or plastic pipe may be constructed within 10 feet of a private water supply well provided a length of pipe is centered on the well. All other sewer lines must be at least 50 feet from a private water supply well.

Where a gravity sanitary sewer line is laid parallel with a water line, the horizontal distance between them shall be 10 feet, measured from edge to edge. The sewer and the water line shall be laid in separate trenches with undisturbed earth between them.

Where sewer lines cross water lines, the sewer shall be constructed of ductile iron with a polyethylene or Protecto 401 lining or plastic pipe. One 20 foot length of pipe shall be centered on the crossing, or, if a 20 foot length of pipe is not available, the sewer may be encased in concrete for 10 feet either side of the water line. Encasement shall be as shown on the Sanitary Sewer Standard Detail Sheet. Where the water line is at least 2 feet above the sewer, no special requirements are needed.

#### 4. CLEANING AND TESTING OF SANITARY SEWER LINES.

a. General. After installation of sewers is complete, including all backfill and compaction, the sewer shall be flushed clear of all foreign material. All debris shall be removed from manholes just after assembly. After cleaning, the sewers and manholes shall be tested as follows. Testing of manholes shall be subsidiary to the Manhole pay items and testing of gravity sewers shall be subsidiary to the Sanitary Sewer pay items. Manhole and sanitary sewer testing shall be witnessed by the inspector. The Contractor shall provide all labor, materials, tools, equipment, and incidentals required to complete testing of sanitary sewers and sanitary sewer manholes. Manholes greater than 72" diameter may be tested hydrostatically at the direction of the Engineer.

b. Manhole Testing. All manholes shall be either vacuum or hydrostatically tested in the presence of the Inspector and in accordance with the procedures given below. All lift holes shall be plugged with non-shrink grout prior to testing. Vacuum or hydrostatic testing is recommended prior to backfilling to assist in locating leaks. The final test and acceptance shall be based only on a test after the manhole is backfilled. This requirement does not apply to existing manholes or to new manholes constructed over existing lines.

(1) Vacuum Test. Plug all manhole entrances and exits other than the manhole top access using suitably sized and rated pneumatic or mechanical pipeline plugs. Follow manufacturer's recommendations and warnings for proper and safe installation of such plugs, taking care to securely brace the plugs and the pipe. Attach the vacuum test device to the manhole top and draw a vacuum to 10" of mercury. With the valve at the vacuum line connection closed and the vacuum pump off, measure the time required for the vacuum to drop to 9 inches of mercury. The manhole passes the test if the time is greater than 60 seconds for a 48" diameter manhole, 75 seconds for a 60 inch diameter manhole, and 90 seconds for a 72 inch diameter manhole. If the manhole fails the test, the Contractor shall locate the leak

and make proper repairs with non-shrink grout. The manhole shall be retested until acceptable test results are obtained.

(2) Hydrostatic Test. Manholes may be tested using internal or external hydrostatic pressure. External hydrostatic testing shall only be used where the groundwater level is at least 4 feet above the invert of the manhole. In all other cases, the internal hydrostatic test procedures must be followed. Sewers connected to the manhole shall be adequately plugged. For the internal hydrostatic test, the manhole shall be filled with water to the top or to a maximum depth of 25 feet above the invert. Water gain or loss shall not exceed 1.14 gallons per day per vertical foot of manhole for either external or internal hydrostatic testing. Infiltration and exfiltration shall be determined after 24 hours of hydrostatic testing by determining the gain or loss of water in the manhole. Contractor shall be responsible for retrieving any plugs or material accidentally washed down a sewer.

c. Gravity sewer lines. All flexible and semi-rigid pipes used for sanitary sewer lines shall be tested for deflection. Deflection shall not exceed 5% of the nominal diameter of the pipe for pipes up to and including 12 inch. For pipes over 12 inches in diameter, the allowable deflection shall not exceed 4%. The mandrel test shall not be performed within 30 days of pipe installation. The mandrel shall be made of steel or other hard metallic, non-corrodible, non-pliable material and have non-adjustable legs. The Engineer may require the mandrel to be certified by an independent testing laboratory to insure that it meets dimensional requirements.

d. Gravity Sewer Line Testing. In addition to the visual inspection, the Contractor shall furnish all labor, tools and equipment necessary to perform low pressure air tests on all pipe installed under the contract, including laterals and service stubs. The methods and equipment used to make the test shall be approved by the Engineer before any testing is started. The Contractor shall, at his own expense, correct any excess leakage and repair any damage to the pipe or its appurtenances indicated by, or resulting from, the test. For the purpose of testing, a section of the sewer shall be considered as the length of sewer between successive manholes. Any section that fails the test shall be repaired and retested by the Contractor until the leakage is within the allowable limit.

(1) Low Pressure Air Test. This test method provides procedures for testing sewer lines using low-pressure air to prove the integrity of the installed material and the construction procedures. Tests shall conform to the requirements of this section, ASTM F 1417 and C 828. The section of pipe between successive manholes shall be sealed with suitable plugs. This low-pressure air test may be dangerous to personnel if, through lack of understanding or carelessness, a line is overpressurized or plugs are installed or restrained improperly. No one shall be allowed in the manholes during the actual testing. All plugs shall be braced during the testing. Do not overpressurize the line. Do not exceed 9.0 psig. One of the plugs shall have an orifice through which to pass air into the section of pipe being tested. The air supply source (air compressor) shall have a 9 psig pressure relief valve. The air supply line shall have a positive on-off valve and suitable means for readily disconnecting it at the control panel. A second orifice in the plug shall be used for constantly reading the internal pressure of the pipe. This orifice shall be continuously connected to a pressure gauge having a range of from 0 to 10 psi. The gauge shall have minimum divisions of 0.10 psi and shall have an accuracy of  $\pm 0.04$  psi. The line under test shall be slowly pressurized to approximately 4 psi. Regulate the air supply so that the pressure is maintained between 3.5 and 4.0 psig for at least 2 minutes. The air temperature should stabilize in equilibrium with the temperature of the pipe walls. Disconnect the air supply and decrease the pressure to exactly 3.5 psi before starting the test. Determine the time required for the pressure to drop from 3.5 psi to 2.5 psi, and compare this interval to the required time to decide if the rate of air loss is within the allowable.

Minimum holding times required by pipe diameter are shown in Tables 1 and 2. If the pressure drops 1.0 psig before the appropriate time shown in Table 1 has elapsed, the air loss rate shall be considered excessive and the pipe section has failed the test. For testing of long sections or sections of larger diameter pipes, or both, a timed-pressure drop of 0.5 psig shall be used in lieu of the 1.0 psig drop as shown in Table 2. It is not necessary to hold the test for the entire period of time in Table 1 or 2 when it is evident that the rate of air loss is zero or less than the allowable if authorized by the Engineer. Upon completion of the test, open the bleeder valve and allow all air to escape. Plugs should not be removed until air pressure in the test section has been reduced to atmospheric pressure.

e. Television Inspection. After the line has passed the air test, the City shall inspect the line with their own television equipment. The Contractor at no additional cost to the City/County shall repair all defects found by this inspection.

f. Force Main Testing. After the force main has been installed, anchored or blocked as specified, the pipe shall be filled with water and subjected to pressure and leakage tests.

All piping shall be tested by water pressure at not less than twice the maximum operating pressure or 100 p.s.i., whichever is greater, for a sufficient period to examine the pipeline for leakage, cracks, defects or other faults. Any leaks shall be repaired and tests repeated until all defects have been repaired.

After approval of repairs, the pressure shall be set at twice the maximum operating pressure or 100 p.s.i., whichever is greater, and maintained for a period of 3 hours with the total loss of water being measured. The amount of water allowed to be lost during this time shall comply with AWWA C 600 for ductile iron pipe and AWWA Manual M23 for PVC pipe.

The test pressure shall be applied by a hand operated force pump, or other suitable device, with the pump taking suction from a reservoir of small enough volume so that the amount of water loss can be measured volumetrically.

The Contractor shall furnish all water necessary for filling the lines and for making the tests.

Any leaks which appear within one year after the date of substantial completion shall be repaired at the expense of the Contractor.

5. **CLEANING AND INSPECTION OF STORM SEWER LINES.** After all installations are complete, including all backfill and compaction, the sewer shall be flushed clear of all foreign materials. Lines shall be checked for alignment by visual inspection. The pipe between manholes shall not be more than  $\frac{1}{4}$  of the pipe diameter out of alignment. Precast Concrete Box Sections shall be checked for alignment with appropriate surveying equipment. The alignment shall meet the full intent of the Drawings at all points of horizontal and vertical control. At locations between control points, a maximum horizontal variation in alignment of one foot may be allowed if in the opinion of the Engineer the misalignment causes no adverse effect.

6. BID ITEM, MEASUREMENT AND PAYMENT.

a. Sanitary Sewers

1. Bid Items.

_____ "	Sanitary Sewer	_____ L.F.
_____ "	Ductile Iron Pipe (DIP)	_____ L.F.
_____ "	Vitrified Clay Pipe (VCP)	_____ L.F.
_____ "	Polyvinyl Chloride Pipe (PVC)	_____ L.F.
_____ "	Regrade Existing Manhole Covers	_____ EA.

2. Measurement will be by the linear foot to the nearest foot of the various sizes of pipe from centerline of manhole to centerline of manhole.

3. Payment will be made at the unit price bid per foot for each size of pipe placed and accepted, which price shall include all pipe, joint materials, concrete collars (if required), crushed rock for bedding, shoring, laying, jointing and testing.

b. Storm Sewers

1. Bid Items.

_____ "	Storm Sewer	_____ L.F.
_____ "	Reinforced Concrete Pipe (RCP), Class _____	_____ L.F.
_____ "x _____ "	Reinforced Concrete Pipe, (RCPHE), Class _____	_____ L.F.
_____ "	Corrugated Steel Pipe (CSP), _____ Gauge	_____ L.F.
_____ "x _____ "	Corr. Metal Arch Pipe (CMAP), _____ Gauge	_____ L.F.
_____ 'x _____ '	Reinforced Concrete Box (RCB) Connect to Existing Structure	_____ L.F. _____ EA.

2. Measurement will be by the linear foot of the various sizes, to the nearest one foot, along the center line of the pipe from end of pipe to end of pipe in inlets, manholes and other structures.

3. Payment will be made at the unit price bid per foot for each size of pipe or box placed and accepted, which price shall include trenching, shoring, backfilling, compaction, furnishing and laying pipe, all materials, labor, joints, removal of excess material, dewatering of excavations, equipment, tools, and incidentals necessary to complete the work as specified.

c. Sanitary Sewer Structures and Incidental Construction.

1. Bid Items.

Service (WYE) Connection, _____"	_____ EA.
_____ " _____ Riser Pipe	_____ L.F.
_____ " _____ House Service Line	_____ L.F.
_____ ' Dia. Standard Manhole, Type _____	_____ EA.
_____ ' Dia. Additional Depth for Standard Manhole, Type _____	_____ V.F.
Inside Drop for Manhole	_____ EA.
Connection to Existing Structure	_____ EA.
Concrete Encasement for _____ " Pipe	_____ L.F.
Concrete Cradle for _____ " Pipe	_____ L.F.
Concrete Arch for _____ " Pipe	_____ L.F.

2. Measurement.

Service (Wye) Connection - will be for each service (wye) connection installed.

Riser Pipe - will be made by the linear foot for "Service (wye) Connection", complete with all incidental construction.

House Service Lines - will be made horizontally by the linear foot, to the nearest foot, from the centerline of the main sewer to the end of the house service line.

Standard Manhole - will be made for each standard manhole installed.

Additional Depth of Standard \_\_\_\_\_ 'Dia. Manhole - will be by the vertical foot, to the nearest 0.1 foot, from the top of the ring to the flow line of the manhole less 6 feet for each manhole.

Inside Drop for Manhole - will be for each inside drop constructed.

Connection to Existing Structure - will be for each connection to an existing structure.

3. Payment.

Service (Wye) Connection - will be made at the unit price bid for "Service (Wye) Connection", complete with all incidental construction.

Riser Pipe - will be made at the unit price bid per foot for the length of "Riser Pipe" completed and accepted, which price shall include furnishing fittings as needed, riser pipe as needed and the setting and jointing of same.

House Service Lines - will be made at the unit price bid per foot for the length of "House Service Line" completed and accepted, which price shall include trenching, laying, backfilling, pipe and fittings, (cast iron if required) and bedding material. Rock Excavation required to install "House Service Line" as defined in SECTION 2, EXCAVATION, BACKFILL AND COMPACTION, Subsection 2.e. will be measured and paid for as defined in SECTION 2, Subsection 13.b.

Standard Manhole - will be made at the unit price bid for "Standard \_\_\_\_ ' Dia. Manhole, 0'-6' deep", which price shall include all excavation, backfill, compaction, shoring, sheeting, dewatering, concrete, masonry, ring and cover, labor and incidentals.

Additional Depth of Standard \_\_\_\_ ' Dia. Manhole - will be made at the unit price bid per foot for "Additional Depth of Manholes" of required wall thickness, completed and accepted, which price shall include all excavation, backfill, compaction, shoring, sheeting, dewatering, masonry, labor and incidentals.

Inside Drop for Manhole - will be made at the unit price bid for "Inside Drop for Manhole". This price shall include completion of the installation in its entirety.

Connection to Existing Structure - will be made at the unit price bid for "Connect to Existing Structure", which price shall include all excavation, cutting, rebuilding of invert, grouting, backfilling, compacting, labor, equipment and incidentals.

d. Storm Sewer Structures.

1. Bid Items.

<b>Standard Inlet, Type _____, L=_____'</b>	<b>_____ EA.</b>
<b>Additional Depth, Std. Inlet, Type _____, L=_____'</b>	<b>_____ V.F.</b>
<b>Special Structure _____“(Type) End Section</b>	<b>_____ EA.</b>
<b>Type II-P Inlet _____</b>	<b>_____ EA.</b>
<b>Additional Depth, Type II-P Inlet _____</b>	<b>_____ V.F.</b>
<b>_____ ' Dia. Standard Manhole, Type _____</b>	<b>_____ EA.</b>
<b>_____ ' Dia. Additional Depth for Standard Manhole, Type _____</b>	<b>_____ V.F.</b>

2. Measurement.

Standard Inlet - will be for each unit of the various types of inlets complete, in place.

Additional Depth of Inlet - will be by the vertical foot to the nearest 0.1 foot, from the top of curb elevation at the centerline of the inlet to the outlet flow line of the inlet, less the standard inlet depth as shown on the detail sheet, for each type inlet.

Special Structure - will be by the various special structures in place.

End Section – will be for each unit of the various types of end sections complete, in place.

Type II-P Inlet - will be for each unit of inlet complete , in place.

Additional Depth, Type II-P Inlet - will be by the vertical foot to the nearest 0.1 foot, from the top of curb elevation at the centerline of the inlet to the outlet flow line of the inlet, less the standard inlet depth as shown on the detail sheet.

Standard Manhole - will be made for each standard manhole installed.

Additional Depth of Standard \_\_\_\_' Dia. Manhole - will be by the vertical foot, to the nearest 0.1 foot, from the top of the ring to the flow line of the manhole less 6 feet for each manhole.

### 3. Payment.

Standard Inlet - will be made at the unit price bid per each for the Type inlet. This price shall include all excavation, backfill, compaction, shoring, dewatering, concrete, masonry, castings, reinforcement, steps, labor and incidentals.

Additional Depth of Inlet - will be made at the unit price bid per foot for the Type inlet. This price shall include all excavation, backfill, compaction, shoring, sheeting, dewatering, concrete, masonry, castings, reinforcement, steps, labor and incidentals.

Special Structures - will be made at the unit price bid per each for special structures. This price shall include all excavation, backfill, shoring, sheeting, dewatering, concrete, masonry, castings, reinforcement, steps, labor and incidentals.

End Sections – will be made at the unit price bid for each end section size. This price shall include all excavation, backfill, compaction, material, labor and incidentals.

Standard Manhole - will be made at the unit price bid for "Standard \_\_\_\_' Dia. Manhole, 0'-6' deep", which price shall include all excavation, backfill, compaction, shoring, sheeting, dewatering, concrete, masonry, ring and cover, steps, labor and incidentals.

Additional Depth of Standard \_\_\_\_' Dia. Manhole - will be made at the unit price bid per foot for "Additional Depth of Manholes" of required wall thickness, completed and accepted, which price shall include all excavation, backfill, compaction, shoring, sheeting, dewatering, masonry, steps, labor and incidentals.

END OF SECTION

## SECTION 7

### ASPHALTIC CONCRETE

1. DESCRIPTION. This item shall consist of placing a leveling, base, intermediate or surface course of hot-mixed, hot-laid asphaltic concrete on a prepared subgrade, base or existing pavement in accordance with these Standard Technical Specifications and in conformity with the lines, grades, widths, thicknesses and typical sections shown on the Drawings.

Any leveling or base course shall be compacted and approved before the placement of an intermediate or surface course. Unless otherwise specified, any and all leveling, base and intermediate courses shall be the same mix designation as the surface course.

2. MATERIALS. Materials shall conform to the requirements specified in Division 1200, Asphalt Materials, of the latest edition of the "Standard Specifications for State Road and Bridge Construction", Kansas Department of Transportation, except as amended herein.

Asphaltic cement shall conform to the requirements of Performance Grade Asphalt Binder as specified in Section 1202 of the latest edition of the "Standard Specifications for State Road and Bridge Construction", Kansas Department of Transportation. Unless otherwise specified or approved by the Engineer, PG 70-28 Performance Grade Asphalt Binder shall be used for the binder in BM-2A asphalt concrete in surface courses and PG 64-22 Performance Grade Asphalt binder shall be used in base courses. Asphaltic concrete shall be comprised of all new materials or a blend of new materials in combination with a maximum of 10 percent reclaimed asphalt pavement for surface and base courses.

Aggregates for asphaltic concrete shall conform to the requirements specified in Section 1100, Aggregates, Subsection 1103, Aggregates for Hot Mix Asphalt (HMA), except where otherwise provided by these specifications.

a. Gradation. The gradation for the combined aggregates in the bituminous mixture shall be as follows:

<u>Sieve Size</u>	<u>% Retained</u>	<u>Job Mix Tolerance</u>
¾ inch	0	--
3/8 inch	6-21	± 5
No. 4	23-40	± 5
No. 8	38-56	± 5
No. 30	61-82	± 4
No. 100	88- <u>99</u>	± 3
No. 200	92-99	± 2

Quality of Individual Aggregates:

Soundness, minimum	0.90
Wear, maximum	40%
Absorption, maximum	4.0%

The Plasticity Index shall not exceed 6.

The maximum moisture shall not exceed 0.5.

Deleterious Substances: The combined aggregates shall be free from alkali, acids, organic matter, or injurious quantities of other foreign substances. Other deleterious substances shall not exceed the following percentages by weight:

Sticks	0.1
Shale, shalelike or soft or friable particles Singly or in combinations	1.0
Coal	0.5

The mix may be composed of any combination of aggregates and mineral filler supplements meeting the applicable requirements in Table 1103-1 and 1103-2 of Section 1103, Aggregates for Hot Mix Asphalt, of the latest edition of the “Standard Specifications for State Road and Bridge Construction”, Kansas Department of Transportation. Not more than 30% of the material passing the 75 um sieve shall be present in the uncrushed aggregate. Surface course shall contain a natural sand from an alluvial deposit of such grading that the portion of the sand passing the 2.36 mm sieve and retained on the 75 um sieve will be not less than 15% of the total mix.

Cutback asphalt and emulsified asphalt for tack coats shall conform to the requirements specified in Section 1200, Asphalt Material, Subsection 1203, Emulsified Asphalt and subsection 1204, Cutback Asphalt. Grades may vary for surface and temperature conditions.

Tickets certifying asphalt mix and binder shall be delivered to the Project Inspector for all asphalt placed.

3. MIX DESIGNATION. The asphaltic concrete shall conform to the mix designation BM-2A. The BM-2A shall be composed only of all new materials or a blend of new materials in combination with a maximum of 10 percent reclaimed asphalt pavement (RAP) for surface and base courses.

4. ASPHALTIC CONCRETE MIX DESIGN for Street or Roads with Functional Classification of Principal / Minor Arterial, Major / Minor Collector and Local. The Marshall method of mix design shall be used to test specimens of asphaltic concrete. Specimens shall be compacted at a temperature of 200<sup>0</sup> F. to 300<sup>0</sup> F. A minimum of five sets of Marshall stability properties shall be plotted on standard graph paper. The range of asphaltic cement content shall be wide enough so that the Marshall stability curve peaks. Determination of asphaltic cement content shall be made from these graphs. The mix design shall meet the following criteria:

Principal/Minor Arterial and Street or Road Functional Classification	Major/Minor Collector	Local
Compaction – Blows per side of specimen	75	50
Marshall Stability (minimum)	1800	1200
Flow (1/100 inches)	8 – 16	8 – 18
<u>% AC (deviation from target AC content)</u>	<u>+/- 0.6%</u>	<u>+/- 0.6%</u>
% Voids – Total Mix	3 – 5	3 – 5
% Voids in Mineral Aggregate (minimum) <sup>Note 1</sup>		
Base Course	13	13
Surface Course	14	14

<sup>Note 1</sup> The target air voids for determining asphalt content shall be 4%

The technicians certified in AMD (Asphalt Marshall Design) will perform the design using Marshall tests.

No asphaltic concrete shall be produced for payment until an asphaltic concrete mix design, including a design job-mix gradation, has been approved by the Engineer. The preparation of the asphaltic concrete mix design shall be performed by an approved testing laboratory and shall be subsidiary to the bid item "Asphaltic Concrete".

5. EQUIPMENT. Equipment shall conform to the requirements specified herein or to the requirements specified in the specific subsection referenced in Division 150, Equipment, of the latest edition of the "Standard Specifications for State Road and Bridge Construction", Kansas Department of Transportation, except as amended herein.

a. Hot Mix Asphalt Plant. The hot mix asphalt plant shall conform to the requirements specified in Subsection 155.6 (c).

b. Storage or Surge Bins. Storage or surge bins for asphaltic concrete shall be used only with written approval of the Engineer. If, after approving the use of storage or surge bins, the Engineer determines that segregation is occurring with their use, he may prohibit their continued use. Storage or surge bins shall conform to requirements specified in Subsection 155.3.

c. Weighing Equipment. The weighing equipment for truck-hauled material shall consist of 1) an accurate and reliable platform scale or 2) an electronic system in which the scale is equipped with an automatic printout system that will print the weights of the material being delivered. The scale shall be accurate to ½ of 1 percent throughout the range of use. The scale shall be checked, adjusted and certified by a qualified manufacturer's representative or an approved testing firm at 1) a maximum of 6 months intervals, 2) when the scale is repaired, and 3) any other time deemed necessary by the Engineer to assure the scale's accuracy. Platform scale shall have a platform of adequate length to weigh, in one operation, the longest truck in use on the project.

d. Hauling Equipment. Any truck used for hauling asphaltic concrete shall have a tight, clean, smooth metal bed which has been thinly coated with a minimum amount of paraffin oil, lime solution, or other approved material to prevent the asphaltic concrete from adhering to the bed. The coating material shall not contaminate or alter the characteristics of the asphaltic concrete being hauled. The use of petroleum derivatives for coating the truck beds is prohibited. Trucks shall be equipped with a canvas cover or other suitable material of such size as to protect the mixture from the weather.

e. Asphalt Distributor. The distributor shall conform to the requirements specified in Subsection 155.2. The distributor is to be calibrated and checked before being used. The Contractor shall provide to the Engineer a certificate of the approval that the distributor meets the requirements specified in Subsection 155.2 and has been calibrated.

f. Paver. The paver shall conform to the requirements specified in Subsection 155.4.

g. Compaction Equipment.

a. Self-propelled steel rollers shall conform to the requirements specified in Subsection 151.4 (c).

b. Heavy self-propelled pneumatic-tired rollers shall conform to the requirements specified in Subsection 151.3 (c).

6. CONSTRUCTION REQUIREMENTS.

a. Preparation of the Asphaltic Cement. The asphaltic cement shall be heated in a manner that

will avoid local overheating within a temperature range as recommended by the liquid supplier.

b. Preparation of the Aggregate. Except for the minor fluctuations, the aggregate for the asphaltic concrete shall be dried and heated within a temperature range of 260<sup>0</sup> F. to 335<sup>0</sup> F. at time of mixing. Flames used for drying and heating shall be properly adjusted to avoid damage to the aggregate and to avoid soot on the aggregate.

c. Preparation of the Asphaltic Concrete. Dried aggregate shall be combined in the plant in accordance with the approved design job-mix gradation and the approved asphaltic concrete mix design. The combined aggregate shall be thoroughly dry mixed prior so adding the asphaltic cement. Asphaltic cement shall be introduced into the mixture in the proportionate amount in accordance with the approved asphaltic concrete mix design. The wet mixing time shall not be less than 40 seconds, but in all cases shall be sufficient to produce a homogeneous mixture in which all the aggregate is uniformly coated. The asphaltic concrete shall be within a temperature range as recommended by the liquid supplier at the time of discharge from the plant.

Sampling and testing of the asphaltic concrete to determine conformance with the asphaltic concrete mix design and the design job-mix gradation shall be made at intervals corresponding to the production of approximately 500 tons of asphaltic concrete, but not less than one set of tests shall be made each day asphaltic concrete is produced. This sampling and testing shall be performed by an approved testing laboratory and shall be subsidiary to the bid item "Asphaltic Concrete".

d. Grade Control. The Engineer will make the survey required for the reference grade and will establish the center line points and the Contractor shall maintain the location of the points until the completion of the surface course or as directed by the Engineer. The Contractor shall erect and maintain a reference string line and operate the paver to conform to the string line for the initial lift and any other lifts if specified by the Engineer. The string line shall be erected parallel with the reference grade, and the asphaltic concrete shall be spread at a constant elevation above, below or at the string line elevation as directed. If automatic profile roadbuilding type equipment is used to prepare the subgrade, the requirements for an erected reference string line may be waived by the Engineer. The Contractor shall furnish and maintain an approved mobile string line for all lifts not laid with the erected string line, and operate the paver to conform to that string line. The use of the automatically controlled paver to provide both longitudinal and transverse control shall include the furnishing and maintaining of a string line, whether it be erected or mobile, by the Contractor. The longitudinal and transverse controls shall operate independent of each other to the extent that the surface of the asphaltic concrete shall reasonably conform to the string line and be reasonably uniform in cross section or crown.

e. Preparation of the Subgrade or Base. For preparation of earth subgrade see Section 3-8. No asphaltic concrete shall be placed on frozen subgrade.

The existing base shall be cleaned of all dirt and other foreign material. Power brooms will not be acceptable for cleanup work without adequate dust control procedures. After the surface has been cleaned, a tack coat shall be applied at a rate of from 0.05 to 0.10 gallon per square yard. The tack coat shall be applied only to the area on which the asphaltic concrete is to be immediately placed. Watchmen shall be provided by the Contractor to prevent traffic from traveling over the tack coat.

f. Protection of Concrete Contact Surfaces. Asphaltic concrete shall not be laid against concrete contact surfaces such as curb and gutter, inlets, etc. until concrete is at least 4 days old and has reached 75% of its design strength.

g. Contact Surfaces. Contact surfaces of curb and gutters, manholes, valve boxes, monuments

Boxes and other similar structures shall be sprayed or painted with a thin, uniform tack coat.

h. Lift Thickness. Except for leveling courses, the nominal thickness of the compacted mat shall not, in general, exceed 2 inches for surface courses and 4 inches for other courses, unless otherwise specified by the Engineer. The Engineer may adjust the lift thickness when such adjustment is more adaptable to the total pavement thickness and when, in the opinion of the Engineer, it is not detrimental to placement and rolling conditions. The Engineer may also adjust the lift thickness to utilize the most efficient method of acquiring the required density and surface characteristics.

i. Construction Joints. Joints between old and new pavements or between successive days' shall be made so as to insure thorough and continuous bond between the two pavements.

The transverse construction joint between old and new pavements or between successive days' work shall be constructed by cutting the asphaltic concrete back for its full depth so as to expose a fresh, vertical surface. Before placing asphaltic concrete against the cut joint, the contact surface shall be sprayed or painted with a thin, uniform tack coat. Started blocks shall be placed beneath the entire length of the paver's screed, front to back, when beginning placement of asphaltic concrete from the transverse construction joint. The paver's screed shall not be set directly on the previously laid mat and drug off of the existing asphaltic concrete. The thickness of the starting blocks shall allow for the additional thickness needed for placing the uncompacted lift prior to its compaction to the required thickness for the asphaltic concrete. The approximate thickness of the starting blocks should be equal to the compacted lift thickness in inches multiplied by ¼ inch per inch.

The height of the new asphaltic concrete above the existing mat shall allow for the additional thickness needed for placing the uncompacted lift prior to its' compaction to the required thickness for the asphaltic concrete; approximate height should be equal to the compacted lift thickness in inches multiplied by ¼ inch per inch. The excess asphaltic concrete shall be bumped back onto the second lane with a lute or rake; the excess asphaltic concrete should not be scattered across the fresh mat. Compaction of longitudinal construction joint shall be achieved by pinching the bumped excess asphaltic concrete down onto the joint. The longitudinal construction joints in successive courses shall be offset not less than 6 inches nor more than 12 inches. The widths and placements of the surface course shall conform to traffic lane lines.

j. Laydown Temperature Requirements. All asphaltic concrete shall be delivered to the paver at a temperature between 260<sup>0</sup> F and 335<sup>0</sup> F.

**Recommended Minimum Laydown Temperature (°F) for Base Courses \***

Base or Subgrade Temperature (°F)	Lift Thickness					
	½”**	¾”**	1”	1 ½”	2”	3+”
32-40	---	---	---	305	295	280
+40-50	---	---	310	300	285	275
+50-60	---	310	300	295	280	270
+60-70	310	300	290	285	275	265
+70-80	300	290	285	280	270	265
+80-90	290	280	275	270	265	260
90+	275	270	265	260	260	260
Recommended Min. Rolling Time (minutes)	4	6	8	12	15	15

\* Surface course must be installed with ambient air temperature 50<sup>0</sup>F and rising.

\*\* Thicknesses less than 1 inch may be used only with written approval of the Engineer.

Operations shall be discontinued if, in the opinion of the Engineer, wind velocities create excessive cooling of the asphaltic concrete or moisture conditions cause excessive steam.

k. Paving Operations. The asphaltic concrete shall be placed reasonably true to crown and grade by an automatically controlled paver. Asphaltic concrete may be placed by hand methods only where machine methods are impractical. The paver shall spread the asphaltic concrete without tearing, shoving or gouging the surface and shall strike a finish that is smooth, true to cross section, free of segregation, uniform in density and texture, seamless at center joints and free from hollows, transverse corrugations and other irregularities. If the pavement does not conform to all of these requirements, the plant production and paving operations shall be suspended until the deficiency is corrected.

All asphaltic concrete shall be delivered to the paver in time to permit the completion of the placement and compaction of the asphaltic concrete during daylight hours. Nighttime work on projects not open to traffic may be permitted only with written approval of the Engineer. The Contractor shall supply ample, appropriate lighting.

l. Compaction. The asphaltic concrete shall be uniformly compacted immediately following placement without tearing, shoving or gouging the surface. Delays in compacting freshly placed asphaltic concrete shall not be permitted.

Compaction of the mixture shall be accomplished using a combination of steel-wheel and pneumatic tired rollers. Breakdown rolling shall be as close behind the paver as possible. Generally the breakdown roller shall be steel-wheeled and operated in the vibratory mode on the first forward pass. The pneumatic-tired roller shall be used as an intermediate roller; however it shall also roll closely behind the breakdown roller. The pneumatic-tired roller shall always be kept moving in order to keep its tires warm. Finish rolling shall be accomplished by steel-wheeled roller operating in the static mode for the purpose eliminating roller marks.

Rolling shall be continued until density is obtained in all portions of each course. Rollers and rolling procedures that result in excessive crushing of the aggregate shall not be permitted.

Compaction shall be sufficient to achieve field densities equal to or greater than 92% of the Maximum Theoretical Density as determined by tests made on specimens taken from the compacted course in accordance with the requirements of Paragraph n. Acceptance of Completed Pavement.

Compaction necessary to achieve the specified 92% of the Maximum Theoretical Density shall be accomplished before the surface temperature of the bituminous mixture falls below 175 degrees F. Subsequent lifts shall not be placed until the specified densities have been achieved, the temperature of the existing bituminous mat is below 175 degrees F, placement does not cause deformation of the existing bituminous mixture.

In all places inaccessible to the rollers, such as locations adjacent to curbs, driveways, inlets manholes, valve boxes, monument boxes and other similar structures, the required compactions shall be secured with vibratory plate compactors.

m. Surface Tolerances. The surface may be checked by the Engineer using a 10-foot straightedge at selected locations at the Engineer's discretion. The maximum variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall not exceed ¼ inch. All necessary corrections shall be at the expense of the Contractor.

n. Acceptance of Completed Pavement. All lifts of asphaltic concrete shall be compacted before the placement of a subsequent lift. Acceptance for density shall be based on random core samples taken from each completed lift. Core sampling shall be limited to an area no closer than 3.0 feet to the nearest toe of the curb, edge of pavement or within 1.5 feet of a construction joint. The contractor shall furnish and operate an approved saw or core drill for cutting pavement samples. The equipment shall be capable of cutting the mixture without shattering the edges or otherwise disturbing the density. It shall be the responsibility of the contractor to patch the core locations in the bottom and intermediate lifts immediately after the core is taken with high strength non-shrink grout or other approved material. At core locations in the top lift of asphalt, tack the sides and bottom and fill with BM-2A surface course compacted into place. If a full depth core has been taken, patch the location by tacking the sides and filling with BM-2A surface course in three equal lifts compacted into place. Core samples of the completed lift shall be obtained by the contractor or the contractor's laboratory. A minimum of one test (three cores) shall be taken for each block of completed lift, measured from ECR to ECR, and one test from each completed lift in an intersection or cul-de-sac. The three core samples shall be taken at random locations throughout the block or within an intersection/cul-de-sac as determined by the Engineer. The samples shall be tested by the contractor's laboratory to determine conformance to density. The representative density of the completed lift shall be the average of the three core samples taken. Results shall be reported to the Engineer in writing. Cores shall be at least 4 inches in diameter.

o. Asphalt Pavement Patching. The Engineer shall mark in the field the limits of the deteriorated asphaltic concrete pavement to be removed and replaced. The deteriorated pavement shall be removed by first saw cutting around the perimeter of the patch area to the depth indicated. After removal, clean the exposed edges of the existing pavement. Before placing the patch, apply a thin tack coat of emulsified asphalt to the clean edges of the existing pavement.

Place the asphalt in uniform layers of 3 inches or less thickness. Compact each layer until no further consolidation is observed. Clean the surface of the preceding layer before the succeeding layer of asphalt material is placed.

7. **COLD MILLING.** Cold milling shall consist of the removal of asphaltic concrete pavement surfaces to the depth and limits as indicated on the plans or as directed by the Engineer. Milling will require grade lines using approved equipment automatically controlled with regard to longitudinal grade and cross slope. All milling material shall be loaded into dump trucks proved by the contractor and delivered by the contractor to designated stockpile locations of the Transportation Operations Division.

8. **BID ITEM, MEASUREMENT AND PAYMENT.**

a. Asphaltic Concrete.

1. Bid Item.

_____” ASPHALTIC CONCRETE	_____ S.Y.
ASPHALT PAVEMENT PATCHING	_____ TONS
COLD MILLING	_____ S.Y.

2. Measurement. Measurement for leveling course, base course or surface course shall be in square yards of material in place on the project. Measurement for “Cold Milling” shall be in square yards of area milled. Measurement for “Asphalt Pavement Patching” shall be in tons of material used.

3. Payment. Payment shall be made at the unit price bid per square yard for “Asphaltic Concrete” which price shall be full compensation for the drying and screening of the aggregates; the mixing of the asphaltic cement with the aggregates; the preparation of the subgrade, unless bid as a separate bid item; the preparation of the base or surface to which the asphaltic concrete is applied; the application of prime and tack coats; the hauling, placing, finishing, and compaction of the asphaltic concrete; furnishing all materials, all labor, equipment, tools, supplies, and incidentals necessary to complete the work; mobilization; and providing all traffic control, unless bid as a separate item. Payment for “Cold Milling” will be made at the unit price bid per square yard which price shall be full compensation for all materials, labor, equipment and incidentals necessary to complete the work. Payment for “Asphalt Pavement Patching” will be made at the unit price bid per ton of asphaltic concrete material used.
- b. Price Adjustments (Thickness). Where the average thickness of the pavement is deficient by more than 0.25 inch, but not more than 1.0 inch, payment will be made at an adjusted price as specified in Table 1. Deductions for deficient pavement thickness may be entered on any payment estimate after the information becomes available.

Where the pavement is more than 1 inch deficient in thickness, the Contractor will be required to remove such deficient areas and to replace them with pavement of satisfactory quality and thickness. The Contractor shall receive no compensation for materials or labor involved in the removal or the replacement of the deficient pavement. With the consent of the Engineer, the Contractor may leave the deficient pavement in place and received no compensation or payment for such pavement. The area of pavement for which no payment is made shall be identical with the area of pavement which the Contractor would be required to remove and replace as provided above.

TABLE 1 – PAVEMENT THICKNESS DEFICIENCY

<u>Deficiency in specified Pavement thickness as determined by cores (inches)</u>	<u>Proportioned part of the contract price allowed</u>
0.00 to 0.25	100 percent
0.26 to 0.50	90 percent
0.51 to 0.75	75 percent
0.76 to 1.00	60 percent

- c. Price Adjustment (Density). When the average lift density of three core samples for any individual lift is deficient from the minimum 92% of Maximum Theoretical Marshall Density, payment will be an Adjusted Price calculated as follows for the area represented by the test: (Unit Price Bid for Asphaltic Concrete) x (Lift Thickness being sampled divided by total pavement thickness) x (Appropriate Price Adjustment Factor as specified in Table 2, Shown below). Deductions for deficient density may be entered on any payment estimate after the information becomes available. Where the average life density of the three core samples for any individual lift is less than 90.5% of the Maximum Theoretical Density, the Contractor will be required to remove the deficient areas represented by the test and to replace same with payment material of satisfactory quality and density. This will require full depth pavement removal and

replacement if a bottom or an intermediate lift is deficient. The Contractor shall receive no compensation for materials or labor involved in the removal of the deficient pavement.

TABLE 2 – PAVEMENT DENSITY DEFICIENCY

<u>Average Pavement Density as determined by cores</u>	<u>Proportioned part of the contract price allowed</u>
92.00% or above	100 percent
91.00% - 91.99%	80 percent
90.50% - 90.99%	70 percent
Less than 90.50%	0 percent

END OF SECTION

## SECTION 8

### WATERMAINS

1. GENERAL. This section covers the construction of 4 inch through 12 inch water mains and appurtenances as shown on the drawings. The material shall be of the manufacturer indicated. All projects with pipe and appurtenances larger than 12 inches shall have a job specific set of specifications.

2. MATERIALS.

a. Ductile Iron Pipe. Push-on or mechanical joint conforming to ANSI A 21.51 / AWWA C 151 and ANSI A21.11.

(1) Normal laying depth is 3.5 feet, not including pavement thickness, plus the diameter of the pipe and normal laying length is 20 feet.

(2) Unless otherwise noted on the Drawings, Thickness Class shall be as follows:

<u>Pipe Diameter</u>	<u>Thickness Class</u>
4"	51
6" thru 12"	50

Additional depth will require a higher (thicker) class of pipe.

(3) Outside coating is bituminous coal-tar base and inside of pipe is lined with cement mortar in accordance with ANSI A 21.4.

b. PVC (Polyvinyl Chloride) Pipe and PVCO (Molecularly Oriented Polyvinyl Chloride) Pipe. Pipe and joints conform to AWWA C 900, AWWA C909, AWWA Manual M23 "PVC Pipe Design and Installation" and accepted by Underwriter's Laboratories, Factory Mutual and the National Sanitation Foundation.

(1) Normal laying depth is 3.5 feet, not including pavement thickness, plus the diameter of the pipe and normal laying length is 20 feet.

(2) Pipe is 4 inch through 12 inch diameter, class 150, conforming to the outside diameter dimensions of ductile iron pipe.

(3) Pipe consists of an integral bell and spigot joint.

(4) Tracer wire shall be installed along the bottom of the pipe. Tracer wire shall be installed vertically outside each valve box. Tracer wire shall be 12 gauge solid black coated THHN wire.

c. Fittings. Ductile iron fittings shall be short body (Class 250 or greater) or compact (Class 350) mechanical joint.

(1) Dimensional control and joint design shall conform to ANSI A 21.10, A 21.11 and A 21.53.

(2) Fittings shall be coated as specified for the pipe.

(3) Stainless steel t-head bolts (type 304-316) with Teflon coated nuts shall be used.

(4) All fittings, glands and accessories shall be North American made. Compact accessories and glands are not acceptable.

d. Valves. Gate valves shall be standard pattern ductile iron body with “o” ring seals. The valve body, operating parts, design and materials shall comply with the latest revised AWWA standard C-509. The valve’s interior and exterior shall be epoxy coated to comply with AWWA standard C-550. The wedge shall be fully encapsulated in molded rubber complying with ASTM D-2000. Valves shall be designed for 200 PSI service with proper allowance for water hammer.

(1) Gate valves (4” through 12”) shall be Mueller Series A-2360-20 or American Series 2500 MM, mechanical joint.

(2) T-head bolts and nuts furnished with MJ ends are to be stainless steel (type 304-316) with Teflon coated nuts. All other external nuts and bolts are to be stainless steel for buried service.

(3) Valve operators: Buried operators shall be provided with a 2-inch operating nut and turn counter-clockwise to close. Operating nuts shall be painted red.

(4) All valves, glands, and accessories shall be North American made. Compact accessories and glands are not acceptable.

(5) Stainless Steel tapping sleeves, grade 18-8, Type 304 shall be full circle gasket type and be Power Seal Pipeline Products Model 3490 MJ (utilizes standard MJ gate valve), or an equivalent brand that meets all City of Topeka specifications. All nuts and bolts shall be stainless steel (type 304-316).

e. Fire Hydrant.

(1) Fire hydrant to conform to AWWA C 502 and be designed for a working pressure of 200 PSI. All hydrants, glands and accessories shall be North American made. Compact accessories and glands are not acceptable.

(2) The hydrant shall be an American Darling Model B-84-B or Mueller Type A423 with a 6 inch mechanical joint inlet, two 2½ inch hose nozzles and a 4½ inch pumper nozzle threaded City of Topeka standard.

(3) Hydrant shall have a bury length 4’-0”, 4’-6”, or maximum 5’-0” (plus city furnished and installed barrel extensions) as required to fit the installation depth of the pipeline installed. City will turn hydrant for proper orientation.

(4) The operating nut, hose and pumper nozzle cap nuts shall be the tapered City of Topeka pattern.

(5) The hydrant shall open by turning the operating nut in a clockwise direction.

f. Valve Boxes and Covers.

(1) Valve boxes for 4", 6", 8", 10", and 12" gate valves shall be 6 inch diameter C909 or C900 PVC pipe field cut to length. A mushroom style lid (Clay & Bailey item #2615-6) or a patten box (Clay & Bailey item #2196) shall be used as a valve box cover.

g. Corrosion Protection shall be loose fitting 8 mil thick polyethylene wrap in tube or sheet form conforming to ASTM D 1248.

h. Water Service Material Standards.

(1) Piping. New construction piping must be a minimum of 1" diameter.

i. 1" - 2": Piping shall be either Type K soft copper or high-density polyethylene water service line, meeting the requirements of ASTM D 2239 for pressure-rated (P.R.) pipe and AWWA C901 for pressure-class (P.C.) pipe, from corporation to property line. Piping shall be continuous from main to meter box with no intermediate couplings, unless approved by the Engineer. Polyethylene water service line must be laid with tracer wire using metal skirts with all fittings.

ii. 4" and larger: Piping shall be PVCO C909. Nominal laying length shall be twenty feet. PVCO C909 pipe must be laid with tracer wire. Fittings shall be compact ductile iron mechanical joint fittings (Class 350) conforming to ANSI A21.53 and AWWA C-153, with joints meeting ANSI A21.11 and AWWA C-111.

(2) Corporation and Meter Setter. Corporations shall be Mueller or Ford brass, cc thread x copper or cc thread x plastic, in strict compliance with AWWA C800.

i. All meter setter fittings shall be in strict compliance with AWWA C800 (latest revision) and be either Ford or Mueller brass. All setters shall consist of a Ford meter angle valve or ball valve on City side and a Ford meter check valve on Customer side.

ii. 1½" - 2" meter plastic pitsetters shall be a complete pre-assembled unit, consisting of a corrugated PVC pit tile, a meter setting device with copper risers, an inlet angle ball valve, an outlet angle dual check valve and service line connections.

(3) Meter Boxes/Pits, Rings and Covers, and Extension Rings. Meter boxes, other than pre-assembled boxes with pitsetters, shall be #MS2036B (20"x30") manufactured by Mid-States Plastics, Inc.

i. 3" and larger: Meter pits and top slab shall be constructed by Vanguard Products, model #RR71 and #RR71A.

ii. Meter box rings and covers are to be Ford Meter Box Company, 21" rings catalog #A-4 with special City of Topeka 11½" cover. Covers only shall be Ford Meter Box Company, 10 5/8" Topeka Special #Lid-11005-01A.

iii. Extension rings are to be made of the same material as box #MS2036B, 20" in diameter.

(4) Meter and Meter Reading Unit. Meters and reading unit shall be as per current City of Topeka Specification, on file with Infrastructure Inventory Specialist.

### 3. CONSTRUCTION METHODS.

#### a. General.

(1) Water mains and appurtenances shall be constructed using the types of materials which meet the requirements of the drawings and specifications.

(2) The construction shall comply with AWWA C 600 "Installation of Ductile Iron Water Mains and Their Appurtenances" and AWWA Manual M23 "PVC Pipe Design and Installation".

(3) Pipe shall be placed in a flat bottom trench accurately graded to uniformly support the entire length of the barrel of the pipe with bell holes excavated for the joints. Bedding shall be per AWWA Manual M23 standard for PVCO and PVC pipe. Bedding material shall be crushed limestone (1/4" CHIP) having the following characteristics:

Retained on No. 4 Sieve	20%
Retained on No. 8 Sieve	94%
Retained on No. 100 Sieve (wash)	
Not less than	98%
Deleterious Substances, (max)	5%

Bedding materials shall be placed and compacted as specified for Type 'A' Compaction.

(4) Approved tracer wire shall be installed with all non-metal pipes.

#### b. Pipe Handling.

(1) Pipe, fittings, valves and accessories shall be handled in a manner to insure installation in an undamaged and structurally sound condition. Improper handling of pipe and appurtenances that results in damage to the material will be grounds for rejection of the material for installation.

(2) The interior of all pipe and fittings shall be thoroughly cleaned of all foreign matter before installation and shall be kept clean until the line is put in service.

#### c. Laying of Pipe.

(1) At times when the pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug secured so that no water from the trench may enter the pipe.

(2) Except where necessary for making connections with other lines or closures, pipe shall be laid with the bells facing in the direction of progress.

(3) Pipe shall not be laid in a wet trench. In the event surface or groundwater accumulates in the trench, the excavation shall be dewatered to permit the work to continue. Pipelines in place shall not be used for draining trenches.

#### d. Anchoring and Blocking.

(1) All bends, tees, crosses and plugs shall be provided with concrete blocking or restrained joint type connections as noted on the Drawings.

(2) Concrete blocking shall be as detailed on the Drawings and shall be placed directly

against the trench wall. The trench wall is to act as a form for the concrete and shall be vertical. All blocks shall have neat lines. No blocking shall be placed within 3 inches of the jointing area.

(3) Concrete shall be 3,000 psi, 28 day strength, made with Type II or Type III cement. If Type III (High Early strength cement) is used, the curing time shall not be less than 3 days.

e. Connection to Existing Mains.

(1) After the Water Division has closed the valves, connections shall be made at the locations shown on the Drawings using the types of fittings called for, or as may be required.

(2) Water shall not be allowed to flow from the new pipe line into the existing pipe line until the new line has been thoroughly flushed, sterilized and tested.

f. Corrosion Protection. (Required for ductile iron pipe, valves and fittings). The wrapping shall be 8 mil polyethylene loose fitting tubing. The wrap shall be bunched up at each end of the pipe to provide a 1 foot overlap to adjoining pipe. It shall be taped with polyethylene adhesive tape, 2" width by 10 mil thickness, at the overlap and at 3 foot intervals along the barrel of the pipe. Care in backfilling is required to avoid tearing of the wrap; any holes in the wrap shall be repaired.

g. Tapping Sleeves and Valves. The Contractor is to furnish and install the sleeves and valves. The Water Division will make the actual wet tap and air test the installation for leaks. After the tap is complete, the Contractor shall complete the piping connections and set the valve box and cover.

h. Guarantee. All craftsmanship and pipe shall be guaranteed for one (1) year from the project acceptance date.

#### 4. STERILIZING AND PRESSURE TESTING.

a. General.

(1) The initial filling of the pipe shall be for pressure testing and shall comply with AWWA C 600.

(2) The Contractor shall furnish all materials, testing equipment, permanent brass pipe plugs, special connections required for testing and sampling and other pertinent items necessary for completion of the work.

(3) Tapping of the main for corporation stops will be performed by Water Division Personnel.

b. Pipeline Testing.

(1) After the waterline has been installed, anchored or blocked as specified, the pipe shall be filled with water and subjected to pressure and leakage tests.

(2) All piping shall be tested by water pressure at not less than 150 psi for a sufficient period to examine the pipeline for leakage, cracks, defects or other faults. Any leaks are then repaired and tests repeated until all defects have been repaired.

(3) After approval of repairs, the pressure shall be set at 150 psi and maintained for a

period of 3 hours with the total loss of water being measured. The amount of water allowed to be lost during this time shall comply with AWWA C 600 for ductile iron pipe and AWWA Manual M23 for PVC pipe.

(4) The test pressure shall be applied by a hand operated force pump, or other suitable device, with the pump taking suction from a reservoir of small enough volume that the amount of water loss can be measured volumetrically.

(5) The Water Division will furnish all water necessary for filling the lines and for making the tests up to two complete pipe volumes; after that, the Contractor will pay for the water needed.

(6) Any leaks which shall appear within one (1) year after the date of substantial completion, shall be repaired at the expense of the Contractor.

(7) After testing is complete, the Contractor is to remove the temporary corporation stops and replace them with brass pipe plugs.

c. Disinfection. Shall conform to the requirements of AWWA C 651. The new main shall be thoroughly flushed and sufficient chlorine shall then be added so that the chlorine concentration in the water in the pipe is maintained at a minimum of 50 PPM available chlorine. The chlorine applications shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least 24 hours. At the end of the disinfection period the treated water shall contain no less than 25.0 PPM of chlorine. After the 24 hour period the new water main shall be flushed of the heavily chlorinated water leaving chlorine content equal to system chlorine, but not less than 1 PPM. A neutralizing chemical shall be applied to the heavily chlorinated water as it is flushed from the main to completely neutralize the chlorine residual. During the disinfection period the City Water Division should be notified and upon completion of the period of flushing of the line, the City Water Division will collect and run a bacteriological analysis to confirm sterilization of the pipeline. If disinfection is not confirmed by the bacteriological analysis and approved by the City Water Division, the Contractor will be required to resterilize the line until disinfection is confirmed by bacteriological analysis and approved by the City Water Division. Each bacteriological analysis requires 72 hours.

## 5. BID ITEM, MEASUREMENT AND PAYMENT.

### a. Water Lines.

#### (1). Bid Items.

_____	" Water Line, Ductile Iron Pipe (DIP)	_____	L.F.
_____	" Water Line, Polyvinyl Chloride Pipe, (PVCO/PVC)	_____	L.F.

(2). Measurement will be made by the linear foot to the nearest foot of pipe installed, completed and accepted.

(3). Payment will be made for the unit price bid per linear foot for each size of pipe in place, completed and accepted, which price shall include all pipe, joint materials, corrosion protection for DIP, tracer wire for PVCO/ PVC pipe, trenching, dewatering, sheeting, shoring, cutting and fitting, laying, bedding, jointing, testing, backfilling, compaction, earthwork and grading.

b. Water Line Fittings.

(1). Bid Items.

_____ "	_____ , long Sleeve	_____ EA.
_____ "	_____ , short Sleeve	_____ EA.
_____ "	_____ , plug and block	_____ EA.
_____ "	_____ , _____ deg. bend & block	_____ EA.
_____ "x _____ "	_____ , tee and block	_____ EA.
_____ "x _____ "	_____ x _____ , reducer	_____ EA.
_____ "x _____ "	_____ , cross	_____ EA.

(2). Measurement will be made by each fitting of each type and size completed and accepted.

(3). Payment will be made at the unit price bid for each type and size of fitting in place, which price shall include all labor, excavation, backfilling, compaction, concrete blocking, anchoring, setting, joint materials, corrosion protection, jointing, strapping, testing and incidental items required to complete the installation .

c. Water Line Valve and Box.

(1). Bid Items.

_____ "	_____ valve and box	_____ EA.
	Air release valve	_____ EA.

(2). Measurement will be for each valve and valve box installed in place at the location shown on the Drawings completed and accepted.

(3). Payment will be made at the unit price for each size of valve and valve box installed, which price shall include all labor, joint materials, jointing, corrosion protection, excavation, backfilling, compaction, grading and incidentals.

d. Fire Hydrants.

(1). Bid Item.

<b>Fire hydrant setting</b>	_____ EA.
-----------------------------	-----------

(2). Measurement will be made for each fire hydrant setting furnished and installed at the location shown on the drawings.

(3). Payment will be made at the unit price bid for each fire hydrant setting, which price shall include furnishing and installing the hydrant, all 6 inch inlet pipe from the line tee (including the 6 inch valve, valve box and fittings), excavation, backfill, compaction, concrete blocking and support blocks, drainage materials, finish grading, testing and any other incidental items required to complete the work as detailed and specified.

e. Connection to Existing Water Line.

- (1). Bid Item.

**Connection at Sta.** \_\_\_\_\_ + \_\_\_\_\_ . \_\_\_\_\_ **L.S.**

- (2). Measurement will be made for each connection to existing line completed at the location shown on the Drawings.
- (3). Payment will be made at the unit price bid for each connection completed and accepted, which price shall include furnishing and installing required materials, excavation, backfill, compaction, thrust blocking, flushing, sterilizing, testing, and any other incidental items required to complete the connection which are not specifically shown in the unit price bid list. Removal of existing fittings and plugging of abandoned lines is subsidiary to the unit price bid at each location.

f. Removal of Valves, Fittings and Appurtenances.

- (1). Bid Item.

**Remove** \_\_\_\_\_ **EA.**

- (2). Measurement shall be made for each valve, fitting including blocking, pipe, and appurtenances removed as noted on the Drawings.
- (3). Payment will be made at the unit price bid, which price shall include removal, salvaging, excavation, backfill, compaction, concrete plugs and incidental items.

END OF SECTION