City of Lawrence

PUBLIC WORKS

STANDARD

TECHNICAL

SPECIFICATIONS

2017

SECTION 0010 - GENERAL TECHNICAL PROVISIONS

PURPOSE

These Technical Specifications ("Specifications") are adopted by the City of Lawrence, Kansas to provide minimum construction standards to safeguard the public welfare by regulating and controlling construction and the quality of materials; to promote uniformity and clarity of intent; and to encourage standardization.

SCOPE

Alternative Materials, Processes and Equipment: The provisions of these Specifications are not intended to prevent the installation of any material or to prohibit any construction process or equipment not specifically prescribed by these Specifications. Alternative materials, processes or equipment may be approved provided the material or work offered is, for the purpose intended, at least the equivalent in quality, strength, effectiveness, durability and safety to that prescribed by these Specifications as determined by the Department of Public Works. All deviations must be approved in writing by the Engineer.

Specific sections of the Kansas Department of Transportation Standard Specifications for State Road and Bridge Construction ("KDOT Standards") are referenced throughout. These specific sections are hereby made a part of these specifications.

GENERAL REQUIREMENTS

Protection of Property Pins and Monuments. The contractor shall be responsible for the protection and preservation of all property pins and monuments. Prior to the beginning of construction, the contractor shall locate and record the location of all such property pins and monuments and shall erect suitable markers and barricades to protect said pins and monuments. After the construction is complete and before final payment is made by the City, the contractor shall account for all pins and monuments that existed prior to construction and shall have replaced any such pins or monuments which have been damaged or destroyed without the permission of the Engineer. The replacement of any pins or monuments shall be by a surveyor licensed in the state of Kansas and acceptable to the City.

Utilities Encountered. Utility lines and facilities are located on the plans based upon the best information available. The actual location of these facilities is the responsibility of the Contractor and should any such facilities have to be relocated, it shall be the responsibility of the contractor to give adequate notice to do so to the respective utility company.

Traffic Control. All construction areas shall have adequate traffic control devices in accordance with the following.

1. All traffic control devices shall conform to applicable sections of the current edition of the Manual on Uniform Traffic Control Devices (MUTCD). This includes signs, signals, lighting devices, markings, barricades, and channelizing and hand signaling devices.
2. Specific traffic control plans shall be reviewed and approved by the Engineer prior to beginning any work.
3. The Contractor shall be responsible for notifying City departments including police, fire/medical and transit, and the school district if work is to be done while school is in session, before closing any street.
4. Notice of all revisions to planned or in-place traffic control shall be given to the City and other agencies 48 hours in advance of making changes.
5. The Contractor shall furnish and maintain adequate signs, barricades, warning lights, and all other necessary equipment in accordance with the MUTCD. The Contractor will be responsible for redirecting traffic and providing flaggers as required.

Environmental Compliance. Contractor shall be responsible for conducting all work in compliance with city, state and federal environmental regulations. Erosion control measures and practices shall conform to the approved Kansas Department of Health and Environment (KDHE) National Pollutant Discharge Elimination System (NPDES) permit and the approved Stormwater Pollution Prevention Plan (SWP3) for the project. No direct discharge of water used for washout, cleanup or other construction processes shall be allowed into the storm drainage system. Inlet protection, designated ponding and settling areas, or other best management practices shall be used to prevent contaminated runoff from entering the drainage system.

Access to Adjacent Properties. When access to adjacent property is required to be maintained during construction, the Contractor shall be responsible for providing and maintaining temporary surfacing to each location to be accessed for the duration of the work. Unless otherwise indicated in the drawings or specifications, temporary surfacing shall be crushed rock, gravel or other approved materials. Material shall be supplemented or replaced as needed to maintain required access. Once permanent access has been restored or provided, all temporary surfacing material shall be removed from the site and the area restored to pre-construction conditions.

Temporary Facilities. Contractor shall provide portable toilets on the project site. Contractor shall be responsible for providing temporary field offices and sheds, job trailers, and temporary utilities as required for performance of the work. An on-site field office is not mandatory unless specified in the Project Special Provisions and/or included in the proposal.

Site Maintenance. The Contractor shall be responsible for maintenance of the site for the duration of the work. Contractor shall execute periodic cleaning to keep the Work, site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris resulting from construction operations.

Provide sufficient onsite containers for the collection of waste materials, debris and rubbish. Containers shall be clearly marked with the Contractor's name and shall be conveniently located for use by workers. Refuse containers shall be covered to prevent wind from removing debris, and Contractor shall relocate containers as required during the course of the Work for convenient use by workers.

Construction debris includes, but is not limited to, excess dirt, rock, pavement materials, concrete splatters, overspray, and oil tracking from the area of the construction. The debris removed on this project becomes the property of the Contractor and must be hauled off site.

Contractor shall not allow concrete trucks to washout on the project site, in curb inlets and storm sewers, or on adjacent or nearby properties unless an approved washout area has been provided. All material in the washout area shall be removed at the end of construction and the area restored to original condition. If no washout area is provided concrete trucks must return to the plant before washing out. Concrete trucks that do not observe restrictions on washout may be prohibited from further deliveries to the project site.

The Contractor shall be responsible for keeping trucks and equipment clean for the duration of the Contract. If mud is deposited as a result of any of the Contractor's actions on any paved area, the Contractor will remove the mud immediately after being notified by the Engineer.

Contractor Employee Conduct: Contractor’s personnel shall not use sanitary facilities or utility services on adjacent or nearby private property without specific written permission from the property owner. Any worker observed not using portable toilet facilities provided on the site will be removed from the project. Contractor’s personnel must not take breaks or eat lunch on adjacent private property.

MEASUREMENT AND PAYMENT

The Work of this Contract consists of furnishing all equipment, labor, material, and incidentals required, and performing all construction, installation and testing of all improvements, modifications and additions, all as shown on the drawings and detailed in the specifications. The term “all costs”, as used in the payment descriptions is defined as full compensation for all equipment, labor, material and incidental costs.

Measurement and payment shall be as specified in this Section. All work shown on the drawings or detailed in the specifications and not specifically set forth in the Itemized Proposal as a pay item shall be considered a subsidiary obligation

of the contractor, and all costs in connection therewith shall be included in the prices named in the proposal.

Items not listed in this Section but included in the Proposal shall be paid for based on the plan quantities and at the unit prices indicated in the Proposal unless otherwise specified in the Project Special Provisions.

Bid Items

1. Demolition And Removal

    a. Final measurement will not be made. Contract quantity shall be plan quantity unless changes to the bid quantity are authorized.

    b. Payment for demolition and removal shall be based on the lump sum price as set forth in the Proposal. Said price shall include all costs necessary to complete the work including, but not limited to, demolishing, removing, disposing, plugging and capping of all structures and improvements, such as existing pavement, curb, sidewalk, pipes and structures (such as sanitary, storm and water) fences, poles and footings, within the construction limits, unless included in other items of work, as required by the drawings and specifications.

2. Clearing And Grubbing

    a. Final measurement will not be made. Contract quantity shall be plan/bid quantity unless changes to the bid quantity are authorized.

    b. Payment for clearing and grubbing shall be based on the lump sum price as set forth in the Proposal. Said price shall include all costs necessary to complete the work including, but not limited to, demolishing, removing and disposing of all trees, shrubs, bushes, stumps and roots within the construction limits as required by the drawings and specifications.

3. Excavation And Embankment

    a. Final measurement will not be made. Contract quantity shall be plan/bid quantity unless changes to the bid quantity are authorized.

    b. Payment for excavation and embankment shall be based on the unit price per cubic yard as set forth in the Proposal. Said price shall include all costs necessary to complete the work including, but not limited to, roadway grading, excavation of whatever material is encountered (earth, shale, limestone), borrow material, loading, hauling, placement, compacting, finish grading, subgrade preparation and reconstruction, topsoil removal and replacement (including

additional materials to sustain plant growth) and loading and hauling excess material as required by the drawings and specifications.

4. Subgrade Stabilization

   a. Final measurement will not be made. Contract quantity shall be plan/bid quantity unless changes to the bid quantity are authorized.

   b. Payment for stabilized subgrade shall be based on the unit price per square yard as set forth in the Proposal, per the type of material and thickness of the installed item. Said price shall include all costs necessary to complete the work including, but not limited to, placing, compacting, rolling and watering as required by the drawings and specifications.

5. Drainable Base

   a. Final measurement will not be made. Contract quantity shall be plan/bid quantity unless changes to the bid quantity are authorized.

   b. Payment for drainable base shall be based on the unit price per square yard as set forth in the Proposal, per the type of material and thickness of the installed item. Said price shall include all costs necessary to complete the work including, but not limited to, placing, compacting, rolling and watering as required by the drawings and specifications.

6. Drain Tile (Edge Drain Or Under Drain)

   a. Final measurement will be based on the horizontal length of the completed and installed item.

   b. Payment for edge drain shall be based on the unit price per linear foot as set forth in the Proposal, per the type and size of the installed item. Said price shall include all costs necessary to complete the work as required by the drawings and specifications. Note: Drain tile installed in retaining walls will be considered subsidiary to the wall pay item.

7. Asphalt Pavement

   a. Final measurement will be based either on the tonnage or the square yards of each type of asphalt used. The Project Special Provisions and bid form will indicate which option is to be used. When square yards are used asphalt tickets must still be submitted to the Engineer.

   b. Payment for asphalt pavement shall be based on the unit price per ton or square yard as set forth in the Proposal. Said price shall include all costs necessary to complete the work including, but not limited to, preparing surface, placing pavement, compacting, rolling, connecting to existing pavement, and sealing, as required by the drawings and specifications.

c. Prices quoted for asphalt material will be based on the "Computed Monthly Asphalt Material Index" in effect for the month immediately preceding the month the project is bid as listed at http:/www.ksdot.org/burconsmain/ppreg/AsphaltPriceIndex.asp. Hot mix asphalt provided/placed in a subsequent month will be adjusted $0.50/ton for each $10.00 increase/decrease in the Computed Monthly Asphalt Material Index, based on the initial price index shown for the month immediately preceding the month the project is bid. For example, if the project is bid in March then the initial price index would be based on the month of February of the same year. The asphalt material index is established on PG 64-22, and will be applied for all grades of asphalt cement oil.

Payment for oil price adjustments will be paid based on tonnage regardless of the method of measurement for in-place pavement.

The following table provides examples of possible adjustments, but does not limit any increases/decreases to only those shown in the table.

Change in Price of Asphalt Oil/Ton (Asphalt Material Index)	Change/Adjustment in Bid Price of Combined Asphalt Mix/Ton
$00.00 to $ 9.99	$0.00
$10.00 to $19.99	$0.50
$20.00 to $29.99	$1.00
$30.00 to $39.99	$1.50
$40.00 to $49.99	$2.00

Adjustments to payments (increase or decrease) will be made for the applicable completed work. If the working days or calendar completion date for the work (or a specific portion of the work) expires, payments (or deductions) will continue to be applied, but the maximum adjustment for the rest of the project will be the adjustment for the month the contract time expired.

8. Concrete Pavement

a. Final measurement will be based on the square yard of the completed and installed item.

b. Payment for concrete pavement shall be based on the unit price per square yard as set forth in the Proposal, per the type of pavement and thickness of the installed item. Said price shall include all costs necessary to complete the work including, but not limited to, placing, compacting, saw cutting, milling, doweling, jointing, curing and sealing, as required by the drawings and specifications

9. Temporary Surfacing (Aggregate)

a. Final measurement will be based on the tons of the completed and installed item.

b. Payment for aggregate (crushed stone or gravel) shall be based on the unit price per ton as set forth in the Proposal. Said price shall include all costs necessary to complete the work, including but not limited to, hauling, grading, placing, tamping, removing, and restoring surfaces after removal as required by the drawings and specifications.

10. Driveways

a. Final measurement will be based on the square yard of the completed and installed item.

b. Payment for driveways shall be based on the unit price per square yard as set forth in the Proposal, per the type of pavement and thickness of the installed item. Said price shall include all costs necessary to complete the work including, but not limited to, placing, compacting, saw cutting, milling, doweling, jointing, curing and sealing, as required by the drawings and specifications.

11. Sidewalks and Recreation Paths

a. Final measurement will be based on the square foot or yard of the completed and installed item.

b. Payment for sidewalks and paths shall be based on the unit price per square foot or yard as set forth in the Proposal, per the type of pavement and thickness of the installed item. Said price shall include all costs necessary to complete the work including, but not limited to, placing, compacting, saw cutting, doweling, jointing, curing and sealing, as required by the drawings and specifications.

12. Access Ramps

a. Final measurement will be based on each completed and installed item.

b. Payment for access ramps shall be based on the unit price per each as set forth in the Proposal. Said price shall include all costs necessary to complete the work including, but not limited to, subgrade preparation, placing, compacting, saw cutting, jointing, curing, sealing and installing detectable surface as required by the drawings and specifications.

13. Curb And Gutter (All Types)

a. Final measurement will be based on the horizontal length of the completed and installed item, as measured along the gutter line.

b. Payment for curb and gutter shall be based on the unit price per linear foot as set forth in the Proposal, per the type of curb and gutter. Said price shall include all costs necessary to complete the work including, but not limited to, subgrade preparation, forming, placing, doweling,

jointing, deflector construction, finishing, curing and backfilling, as required by the drawings and specifications.

14. Flowable Fill/Mortar

    a. Final measurement will not be made. Contract quantity shall be plan/bid quantity unless changes to the bid quantity are authorized.

    b. Payment for flowable fill/mortar will be based on the unit price per cubic yard as set forth in the Proposal. Said price shall include all costs necessary to place the material and complete the work as required by the drawings and specifications.

15. Storm Sewer Structures (Inlets, Junction Boxes And Manholes)

    a. Final measurement will be based on each completed and installed item.

    b. Payment for storm sewer structures shall be based on the unit price per each as set forth in the Proposal, per the type and size of structure. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation (earth, rock, shale), bedding, placing or building structure, invert construction, structure to pipe connections, final grade adjustments to the top, sealing, curing, backfilling, compacting, grading and removal of excess or unsuitable material, as required by the drawings and specifications.

16. Storm Sewer Pipe (All Types)

    a. Final measurement will be based on the horizontal length of the completed and installed item, as measured along the centerline.

    b. Payment for storm sewer pipe shall be based on the unit price per linear foot as set forth in the Proposal, per the type and size of pipe. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation (earth, rock, shale), bedding, placing, pipe to pipe connections, sealing, backfilling, compacting, grading and removal of excess or unsuitable material, as required by the drawings and specifications.

17. Storm Sewer End Sections (All Types)

    a. Final measurement will be based on each completed and installed item.

    b. Payment for storm sewer end sections shall be based on the unit price per each as set forth in the Proposal, per the type and size of end section. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation (earth, rock, shale), bedding, placing or building the end section, end section to pipe connections, toe wall construction, sealing, curing, backfilling, compacting, grading and removal of excess or unsuitable material, as required by the drawings and specifications.

18. Rip Rap (All Types)

    a. Final measurement will be based on the square yard of the completed and installed item.

    b. Payment for rip rap shall be based on the unit price per square yard as set forth in the Proposal, per thickness of rip rap. Said price shall include all costs necessary to complete the work item including, but not limited to, filter fabric, all excavation (earth, rock, shale), backfilling, compacting, grading and removal of excess or unsuitable material, as required by the drawings and specifications.

19. Water Line Pipe (All Types)

    a. Final measurement will be based on the horizontal length of the completed and installed item, as measured along the centerline.

    b. Payment for water line pipe shall be based on the unit price per linear foot as set forth in the Proposal, per the type and size of pipe. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation (earth, rock, shale), dewatering, bedding, polyethylene encasement, placing, pipe to pipe connections, restraint measures, flushing, disinfection, pressure testing, backfilling, compacting, grading and removal of excess or unsuitable material, as required by the drawings and specifications.

20. Water Line Valves (All Types)

    a. Final measurement will be based on each completed and installed item.

    b. Payment for valves in water mains will be paid at the unit price per each size and type as set forth in the Proposal. Said price shall include, but not be limited to, furnishing and installing the valve, valve box, and appurtenances; excavation and backfill not included under piping; and all other costs not included under other bid items.

21. Water Line Fittings (Bends, Crosses, Reducers, Sleeves, Tees)

    a. Final measurement will be based on each completed and installed item.

    b. Payment for water line fittings shall be based on the unit price per each as set forth in the Proposal, per the type and size of fitting. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation (earth, rock, shale), dewatering, bedding, polyethylene encasement, placing, pipe to pipe connections, restraint measures, flushing, disinfection, pressure testing, backfilling, compacting, grading and removal of excess or unsuitable material, as required by the drawings and specifications.

22. Water Line Connections (Main Line Connections)

a. Final measurement will be based on each completed and installed item.

b. Payment for water line connections shall be based on the unit price per each as set forth in the Proposal. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation (earth, rock, shale), dewatering, bedding, polyethylene encasement, placing, pipe to pipe connections, restraint measures, flushing, disinfection, pressure testing, backfilling, compacting, grading and removal of excess or unsuitable material, as required by the drawings and specifications.

23. Water Line Splice And Relocation

a. Final measurement will be based on each completed and installed item.

b. Payment for water line splice and relocation shall be based on the unit price per each as set forth in the Proposal. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation (earth, rock, shale), dewatering, bedding, polyethylene encasement, placing, pipe to pipe connections, restraint measures, valve box, flushing, disinfection, pressure testing, backfilling, compacting, grading and removal of excess or unsuitable material, as required by the drawings and specifications.

24. Water Meter Removal And Abandonment

a. Final measurement will be based on each completed and installed item.

b. Payment for water line relocation shall be based on the unit price per each as set forth in the Proposal. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation (earth, rock, shale), dewatering, bedding, polyethylene encasement, placing, pipe to pipe connections, capping, restraint measures, flushing, disinfection, pressure testing, backfilling, compacting, grading and removal of excess or unsuitable material, as required by the drawings and specifications.

25. Water Meter Installation or Relocation

a. Final measurement will be based on each completed and installed item.

b. Payment for water line relocation shall be based on the unit price per each as set forth in the Proposal. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation (earth, rock, shale), dewatering, bedding, polyethylene encasement, placing, pipe to pipe connections, restraint measures, flushing, disinfection, pressure testing, backfilling, compacting, grading and removal of excess or unsuitable material, as required by the

drawings and specifications. Except for the actual water meter, contractor shall supply all parts to relocate the meter. Contractor shall reuse the existing meter. If meter cannot be reused, Owner will supply a new meter.

26. Fire Hydrant Assembly Installation or Relocation

    a. Final measurement will be based on each completed and installed item.

    b. Payment for fire hydrant relocation shall be based on the unit price per each as set forth in the Proposal. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation (earth, rock, shale), dewatering, bedding, polyethylene encasement, placing, pipe to pipe connections, restraint measures, flushing, disinfection, pressure testing, backfilling, compacting, grading and removal of excess or unsuitable material, as required by the drawings and specifications.

27. Manhole or Water Valve Lid Adjustments

    a. Final measurement will be based on each completed and installed item.

    b. Payment for adjustments shall be based on the unit price per each as set forth in the Proposal. Said price shall include all costs necessary to complete the work item including, but not limited to, all pavement removal, adjustment rings, concrete and sealant as required by the drawings and specifications. Contractor shall reuse the existing lids if possible. If lids cannot be reused, Owner will supply new lids.

28. Air Release Valves

    a. Final measurement will be based on each completed and installed item.

    b. Payment for air release valves will be paid at the unit price per each size and type as set forth in the Proposal. Said price shall include, but not be limited to, furnishing and installing the valve, miscellaneous piping, valve box or manhole, and other appurtenances; excavation and backfill not included under piping; and all other costs not included under other bid items.

29. Sanitary Sewer Pipe (All Types)

    a. Final measurement will be based on the horizontal length of the completed and installed item, as measured along the centerline.

    b. Payment for sanitary sewer pipe shall be based on the unit price per linear foot as set forth in the Proposal, per the type and size of pipe.

Said price shall include all costs necessary to complete the work item including, but not limited to, all trenching (earth, rock, shale), dewatering, bedding, placing, testing, backfilling, compacting, grading and removal of excess or unsuitable material, as required by the drawings and specifications.

30. Sanitary Sewer Stubs and Plugs

    a. Final measurement will be based on each completed and installed item.

    b. Payment will be based on the unit price per each size and type as set forth in the Proposal. Said price shall include, but not be limited to, furnishing and installing stub or plug, and excavation and backfill (not included under piping) as required by the drawings and specifications.

31. Concrete Encasement

    a. Final measurement will be based on the horizontal length of the completed and installed item, as measured along the centerline.

    b. Payment for concrete shall be based on the unit price per linear foot as set forth in the Proposal. Said price shall include all costs necessary to complete the work item including, but not limited to, all placing, reinforcing, and compacting as required by the drawings and specifications.

32. Standard Sanitary Manholes (All Types)

    a. Final measurement will be based on each completed and installed item.

    b. Payment for manholes shall be based on the unit price per each as set forth in the Proposal, per the type and size of structure. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation (earth, rock, shale), bedding, placing or building manhole, invert construction, manhole to pipe connections, final grade adjustments to the top, sealing, curing, backfilling, compacting, grading, testing and removal of excess or unsuitable material, as required by the drawings and specifications.

33. Extra Depth Sanitary Manholes

    a. Final measurement will be based on the vertical height of the completed and installed item, measured from the base to the top of the cone.

    b. Payment for extra depth manholes shall be based on the unit price per vertical foot as set forth in the Proposal, per the type and size of structure. Said price shall include all costs necessary to complete the

work item including, but not limited to, all excavation (earth, rock, shale), bedding, placing or building manhole, invert construction, manhole to pipe connections, final grade adjustments to the top, sealing, curing, backfilling, compacting, grading, testing and removal of excess or unsuitable material, as required by the drawings and specifications.

34. Adjustment of Existing Manhole

    a. Final measurement will be based on each completed and installed item.

    b. Payment for adjustments shall be based on the unit price per vertical foot of adjustment as set forth in the Proposal. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation, adjustment rings or sections, sealing, curing, backfilling, grading and testing, as required by the drawings and specifications.

35. Connection to Existing Manhole

    a. Final measurement will be based on each completed and installed connection.

    b. Payment for manhole connections shall be based on the unit price per each as set forth in the Proposal. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation (earth, rock, shale), dewatering, bedding, pipe connections, testing, backfilling, compacting, grading and removal of excess or unsuitable material, as required by the drawings and specifications.

36. Force Main Connections

    a. Final measurement will be based on each completed and installed connection.

    b. Payment for force main connections shall be based on the unit price per each as set forth in the Proposal. Said price shall include all costs necessary to complete the work item including, but not limited to, all excavation, dewatering, bedding, pipe connection, testing, backfilling, compacting, grading and removal of excess or unsuitable material, as required by the drawings and specifications.

37. Traffic Control

    a. Final measurement for lump sum bids will not be made unless changes to the bid quantity are authorized. For work under a force account, final measurement will be based on records of equipment and labor used during the work.

b. Payment for lump-sum traffic control shall be based on the lump sum price as set forth in the Proposal. Said price shall include all costs necessary to complete the work including, but not limited to, temporary striping, edge drop-off treatment, construction signs, barricades and channelization devices, as required by the drawings and specifications. Payment for relocation and reuse of the items shall be considered subsidiary to the payment for the initial installation.

c. Payment for force account work shall be based on the actual quantities of equipment, materials, and labor hours used in performance of the work and the unit prices for each item as submitted by the contractor.

38. Pavement Marking (Permanent and Temporary)

a. Final measurement will be based on the horizontal length for each of the completed and installed items.

b. Payment for pavement marking shall be based on the unit price per linear foot or per each as set forth in the Proposal. Said price shall include all costs necessary to complete the work item including, but not limited to, removal of old markings, surface preparation, layout, and taping, as required by the drawings and specifications.

39. Permanent Signage

a. Final measurement will be based on each completed and installed item.

b. Payment for permanent signage shall be based on the unit price per each as set forth in the Proposal, per each type of sign. Said price shall include all costs necessary to complete the work item including, but not limited to, excavation, concrete, posts, signs face, and hardware as required by the drawings and specifications.

40. Fence (All Types)

a. Final measurement will be based on the horizontal length of the completed and installed item.

b. Payment for fence shall be based on the unit price per linear foot as set forth in the Proposal, per each type of fence. Said price shall include all costs necessary to complete the work item, as required by the drawings and specifications.

41. Seeding (Temporary Or Permanent)

a. Final measurement will not be made. Contract quantity shall be plan/bid quantity unless changes to the bid quantity are authorized.

b. Payment for seeding shall be based on the unit price per acre as set forth in the Proposal, per each type of seed. Said price shall include all costs necessary to complete the work item including, but not limited to, aeration, fertilization, mulching and watering, as required by the

drawings and specifications. Contractor shall water seed until final acceptance.

42. Sod (All Types)

    a. Final measurement will be based on the square yards of the completed and installed item.

    b. Payment for sod shall be based on the unit price per square yard as set forth in the Proposal, per each type of sod. Said price shall include all costs necessary to complete the work item including, but not limited to, aeration, fertilization, mulching and watering, as required by the drawings and specifications. Contractor shall water sod until final acceptance.

43. Sediment Control Devices (All Types)

    a. Final measurement will be based on counting the number, measuring the linear footage or measuring the area of the completed and installed item.

    b. Payment for sediment control shall be based on the unit price as set forth in the Proposal, per linear foot for sediment fence and per each for inlet protection and check dams. The unit price shall include full compensation for equipment, labor, material, repair, maintenance and incidental costs, including removal of materials. Removal of sediment, repair and maintenance of installed sediment control shall be subsidiary to sediment control.

MATERIAL TESTING.

This section shall apply to all required testing services for soils, asphalt and concrete. Unless otherwise indicated or specified, on-site testing, may be performed by an inspector employed by the City of Lawrence or by personnel of an approved testing firm hired by the City at the City's option.

1. Asphalt Testing. Sampling and testing of the asphalt mix may be required on all asphalt paving projects constructed in the City of Lawrence.

   Samples of the actual asphalt mix being used on a paving project shall be acquired at either the construction site or the batching plant per ASTM Standards D979 and D3665. These samples shall be used to perform an aggregate gradation test (ASTM C136), asphalt extraction test (ASTM D2172), and bulk specific gravity test (ASTM D2726).

   In-place density tests may be conducted with a nuclear testing device during the course of the work by City inspectors at the City's option to give general indication of level of compaction. The inspector shall determine the number of tests to be taken and the locations thereof based upon observation of the paving process. Tests performed with a nuclear device shall be conducted as per the requirements of ASTM D2950. Actual in-

place density for payment purposes shall be determined from pavement cores unless otherwise specified.

During compaction, cores may be taken to verify final in-place densities, unless otherwise specified, and as an aid for verifying thickness. Cores shall be made by means approved by the Engineer. Core locations shall be repaired using epoxy concrete, high-strength non-shrink grout, or other approved product. Contractor shall supply equipment and labor for obtaining cores and repairing holes.

2. Concrete Testing. Sampling and testing may be required on all concrete work including curb and gutter, sidewalk, slope paving, retaining walls, inlets, manholes or any other structures.

   During the progress of the work, compression tests of the concrete used shall be made as directed by the Engineer in accordance with the requirements of ASTM C31, C143, and C172. Cylinder will generally be broken at seven (7) days, fourteen (14) days and twenty-eight (28) days noting the compressive strength of each break. Slump and air tests will also be taken with cylinders.

3. Soil Testing. Sampling and testing may be required on all subgrade preparation for street construction and all trench backfilling operations within the City of Lawrence.

   Prior to commencing earthwork for any street improvement project, the Contractor shall acquire samples of soil and submit samples to an approved laboratory to perform a moisture density test (ASTM D698 for cohesive soils and ASTM D2049 for non-cohesive soils). These tests shall be at the Contractor's expense. The number of tests required will be based on the types of soils encountered on the project. Contact project inspector prior to obtaining samples in order to allow inspector to be present during sampling if desired.

   Reports for moisture-density tests shall include the date, the location of the tests, the elevation or depth at which the test was taken, the maximum dry density, and the optimum moisture content as well as properly constructed moisture-density curves for each sample. Also included shall be a determination of the soils plasticity index (PI) and liquid limit and classification in accordance with ASTM D2487. Submit test results to Engineer a minimum of 48 hours prior to beginning earthwork.

   During the progress of the earthwork, in-place density tests shall be performed with a nuclear density meter. The inspector shall determine the number of tests to be taken and the location thereof based upon his observation of the work. Results of these tests shall indicate whether or

not the performance specifications stated in Sections 1100 and 1200 of this specification manual have been achieved. If the tests indicate the compaction is not sufficient, the Contractor shall increase the compactive effort on all such inadequately compacted areas. Tests performed with a nuclear device shall be conducted as per the requirements of ASTM D2922.

During the progress of the work of trench backfilling, in-place density tests shall be performed with a nuclear meter. The inspector shall determine the number of tests to be taken and the locations thereof based upon his observation of the backfilling process. Results of these tests shall indicate whether or not the performance specifications stated in Sections 1100 and 1200 of this specification manual have been achieved. If the tests indicate the compaction is not sufficient, the Contractor shall increase the compactive effort on all such inadequately compacted areas.

Waterline and Sanitary Sewer Testing

1. Waterline testing shall conform to the requirements outlined in Section 2I of the technical specifications.
2. Sanitary sewer testing shall conform to the requirements outlined in Section 2509 of the technical specifications.

SECTION 1000 - SITE PREPARATION

1001 SCOPE. This section covers the necessary clearing, grubbing, demolition, and other appurtenant work at the locations shown on the contract drawings.

1002 DEFINITIONS.

A. Clearing. Clearing shall consist of the removal of all vegetative matter, such as trees, brush, downed timber, rotten wood, sod, grass, agricultural crop or residue, and other objectionable materials encountered on or above the surface of the site. It shall include the removal of fences, lumber, waste dumps, and trash, the salvaging of such materials as may be specified, and the disposal of the debris in accordance with all applicable federal, state and local regulations and ordinances.

B. Grubbing. Grubbing shall consist of the removal of all stumps, roots, buried trees and brush, and other objectionable materials encountered on or below the surface of the ground or subgrade, whichever is lower, which has not been included under the definition of "*Clearing*" above.

C. Stripping all areas to receive embankment shall be stripped of existing organic and other undesirable material to a minimum depth of six (6) inches. This material shall be disposed of in a manner approved by the Engineer. All topsoil shall be removed and stockpiled for use in final grading.

D. Demolition. Demolition shall consist of the destruction and removal of all non-vegetative matter encountered above, on, or below the ground surface within the construction limits. This shall include, but not be limited to, buildings, abandoned utilities, all material derived from the demolition of concrete items such as base courses, curbs, curb and gutters, sidewalks, floors, steps, driveways, drainage structures of all sorts, guard fences, and other miscellaneous items such as foundations or walls of any sort, iron or steel items, and asphaltic items such as pavement and base courses. Materials shall salvaged as indicated or specified, or disposed of in accordance with all applicable federal, state and local regulations and ordinances.

E. Trees. Vegetative growth forty (40”) inches or greater in circumference, measured two (2’) feet above the ground shall be classified as a tree.

F. Brush. Vegetative growth less than forty (40”) inches in circumference, measured two (2’) feet above the ground shall be classified as brush.

G. Salvageable Material. All salvageable material indicated or specified for the project shall be handled with care and delivered to a location as directed by the Engineer.

1004 LIMITS OF CONSTRUCTION. The limits for clearing, grubbing, and demolition shall be as defined on the plans or as specified but in no case shall work extend beyond the limits of the right-of-way, city property lines, or easements.

1005 PROGRESS OF CONSTRUCTION.

A. General. Clearing, grubbing and demolition shall proceed well in advance of the construction operation so as not to delay the progress of the work. Grubbing shall parallel the clearing as nearly as the sequence of operations will permit..

B. Clearing. The refuse resulting from clearing may be hauled to a waste site secured by the Contractor or shall be burned or buried in such a manner as to meet all laws, regulations, and requirements of any governing authority regarding health, safety, and public welfare. When authorized by the fire department, the Contractor may dispose of such refuse by burning on the site of the project, provided all requirements as determined by the Fire Marshall are met. Under no circumstances will the authorization to burn on the site relieve the Contractor in any way from damages, which may result from his operations. In no case shall any materials be left on the project site, shoved into abutting properties, or buried in embankments or trenches on the site.

B. Grubbing. Except for the special circumstances enumerated below, all stumps, roots, and other objectionable matter within the construction area shall be removed to a minimum depth of twelve (12”) inches below the subgrade or the original ground, whichever is lower. All stumps, roots, and other objectionable matter outside the limits of the construction area, but within the right-of-way shall be cut off flush with the final grade.

All stumps, roots, and other objectionable matter within the specified limits of embankments having a depth of two (2’) feet or less shall be removed and disposed of. Piling and butts of utility poles within the limits shall be removed to a minimum depth of two (2’) feet below the subgrade or the original ground, whichever is lower.

All stumps, roots, and other objectionable matter found within borrow material to be used for embankment or fill material shall be removed. All stumps, roots, and other objectionable matter found within the

bottoms or sidewalls of excavation and trenching areas shall be completely removed from the respective bottom areas, and removed to a minimum depth of twelve (12”) inches below the respective sidewalls.

C. Demolition. Masonry and concrete walls, miscellaneous foundations, or other objects extending below ground shall be removed to a depth of at least twelve (12”) inches below the original ground or the subgrade, whichever is lower. When explosives are used in demolition, the Contractor shall comply with the provisions of the Fire Marshall.

In removing items such as concrete pavement, base courses, curbs, curb and gutters, gutters, sidewalks, and similar objects where portions of said objects are to be left in place, they shall be removed to an existing joint or to a new joint sawed to along a line and to a depth adequate to provide a true line and vertical face. Sufficient portions of these objects shall be removed to provide for the proper grade and connection to the new work.

1006 PROTECTION OF TREES AND SHRUBS. During construction operation, the Contractor shall leave in place and protect from damage all trees, shrubbery, and flower beds unless shown on the drawings to be removed. Where trees existing on the project site are not to be removed, it shall be the responsibility of the Contractor to trim low branches, which would interfere with the normal operation of his equipment. The trimming shall be performed in accordance with accepted horticultural practices prior to any machine operation.

SECTION 1100 – GRADING

1101 SCOPE. This section covers the performance of all work required for grading the project in coordination with all previous work performed at the locations shown on the contract drawings.

1102 MATERIALS AND DEFINITIONS.

A. Grading. Grading shall be defined as meaning the performance of all excavation, embankment and backfill in connection with the construction of all improvements.

B. Excavation. Excavation is defined as the removal of materials from the construction area to the lines and grades as shown on the contract drawings.

Unless otherwise provided for in the Special Provisions and included in the proposal, all excavation shall be unclassified excavation and the Contractor shall satisfactorily remove and dispose of all materials encountered regardless of their nature.

C. Embankment. Embankment - Fill or Backfill, is defined as the placing and compacting of material in the construction area to the lines and grades as shown on the contract drawings.

Materials suitable for earth embankment shall be free of organic materials, waste material, trash and debris, contain less than ten (10) percent by volume of rock and gravel, and contain no particles having a dimension greater than three (3”) inches.

Materials suitable for rock embankment shall be free of organic materials, waste material, trash and debris, and contain ten (10) percent or greater by volume of rock or gravel containing particles ranging in size from a minimum dimension of three (3") inches to a maximum of twenty-four (24") inches.

Material not suitable for use as embankment material shall include, but shall not be limited to, frozen material, organic material, topsoil, rubbish, brick, asphaltic concrete, and other debris and soil not containing the characteristics and moisture content to obtain the required compaction. Rock and broken concrete shall not be included in embankment material unless rock embankment is specified in the Special Provisions and the materials meet the size requirements indicated in this section.

D. Topsoil. Topsoil shall be soil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 1 1/2" in any dimension, and other extraneous or toxic matter harmful to plant growth. Topsoil may be obtained from the project site by segregating appropriate material from other material during excavation and trenching operations, or from off-site locations at no additional cost to the Owner.

E. FLOWABLE FILL. Provide low-strength, air-entrained flowable fill (flowable mortar) mix that has adequate flow characteristics to fill all voids and complies with the following compressive strength and unit weight requirements.

3-day Compressive Strength (minimum)	20 psi
28-day Compressive Strength (maximum)	100 psi
Unit Weight (maximum)	120 pcf

Fine aggregate, cement, fly ash, water and additives used in the mix shall conform to applicable sections of the current KDOT Standard Specifications.

F. Structures. Structures, as used herein, refers to bridges, basins, drainage structures, headwalls, retaining walls, and similar construction.

Material for structure backfill shall be composed of earth only and shall contain no organic materials, broken concrete, stones, trash, or debris of any kind.

1103 CONSTRUCTION - GENERAL. During grading the work shall be performed in a manner and sequence that will provide drainage at all times. Soft spots or areas that develop during grading operations shall be removed, the area then backfilled with suitable material and compacted to obtain the required density. No additional payment will be made to the Contractor for this work.

1104 EXCAVATION - GENERAL Excavation shall be performed to the lines and grades indicated on the contract drawings. All suitable material removed by excavation shall be used as far as practicable in the formation of embankments or elsewhere as indicated or specified, or as directed by the Engineer. It shall be the responsibility of the Contractor to handle excavation in a manner such that suitable materials will be available when required. No additional compensation will be allowed for any special sequence of excavating, placing of materials, or any re-handling of materials.

Follow all OSHA safety regulations for sloping the sides of excavations and trenches, using shoring and bracing as required.

The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the pipe to be installed therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result. Discharge of water from dewatering operations shall conform to local and state stormwater pollution prevention regulations.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

Excavated materials in excess of the amount needed to complete the grading shall be considered as waste material, which shall be removed from the site by and at the expense of the Contractor.

Any additional fill material required which is not available from excavation within the construction limits shall be supplied by the Contractor at no expense to the Owner unless provided for in the proposal and Special Provisions. All such material brought to the site and incorporated in the work shall be subject to the approval of the Engineer.

During excavation and grading operations if materials are encountered which are determined as being unsuitable or unstable by the Engineer they shall be removed to the depth required to reach stable material. The area involved shall then be backfilled with suitable material as determined by the Engineer and compacted to obtain the required density. Suitable material may include suitable soils or aggregate materials such as KDOT AB-3 material.

All roadway excavation in rock or shale shall be undercut as indicated on the drawings or specified in the Special Provisions. If undercut is not included in the drawings or Special Provisions, remove material and backfill with suitable soil or granular material as directed by the Engineer.

1105 EXCAVATION – TRENCHING. The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. One block or four hundred (400) feet (whichever is the shorter) shall be the maximum length of open trench on any line under construction unless otherwise approved by the Engineer. The Contractor shall backfill all open trench by the end of the day's work, except that which is necessary for

inspection or immediate continuation of the following day's work. All open areas shall be fenced.

The alignment, depth, width and grade of all trenches shall be in accordance with the drawings. Boulders and large stones shall be removed to provide a minimum clearance of six (6) inches below and on each side of all pipes.

1106 EMBANKMENT - FILL. Embankments shall be formed with suitable materials, as herein defined, procured from excavations made on the project site, or from Contractor furnished borrow pits as required to complete the grading work. Embankment construction shall not be performed when material contains frost, is frozen, or a blanket of snow prevents proper compaction.

The existing surface upon which embankment material is to be placed shall have all unstable and unsuitable material removed to the depths shown, or as directed by the Engineer, before starting the embankment work.

Earth embankment shall be placed in successive horizontal layers distributed uniformly over the full width of the embankment area. Each layer of material shall not exceed eight (8") inches in thickness (loose measurement) and shall be compacted as specified in paragraph 1108 before the next layer is placed thereon. As the compaction of each layer progresses, continuous blading will be required to level the surface and to ensure uniform compaction.

Successive horizontal layers of rock embankment not exceeding two (2') feet in depth shall be made by placing larger stones uniformly over the embankment area. Small stone fragments, sand, earth, or gravel shall be placed between the larger stones to fill all voids. Each layer shall be thoroughly compacted before the next layer is placed.

Large rocks shall be withheld from the top two (2) feet or more of the embankment and only earth used in this layer unless otherwise indicated or specified.

1107 EMBANKMENT- BACKFILL.

A. GENERAL. Backfill shall not be placed when material contains frost, is frozen, or a blanket of snow prevents proper compaction. Backfill shall not contain waste material, organic material, or debris of any kind. The method of placement and compaction, and the type of equipment used shall be at the discretion of the Contractor subject to being appropriate for the material and obtaining the specified densities for the location.

The top portion of the backfill within right-of-way areas shall be finished with at least six (6”) inches of topsoil.

B. TRENCHES. Trench backfill shall be flowable fill for 1) all trenches crossing existing or proposed streets shall be backfilled with flowable fill from two (2) feet behind the back of curb on each side of the street, and 2) all portions of trenches running parallel to and within two (2) feet of the back of curb. All other trench backfill shall be either flowable fill or compacted earth as indicated on the drawings and standard details, or as specified in the Special Provisions.

Earth backfill material to be placed above pipe embedment shall be free of brush, roots more than two (2) inches in diameter, debris, cinders, or other corrosive material, but may contain rubble and detritus from rock excavation, stones, and boulders in certain portions of the trench depth. No backfill material containing rocks, or rock excavation detritus material, shall be placed within two (2) feet of final surface. No stone larger than eight (8) inches in its greatest dimension shall be placed within three (3) feet of the top of pipe. Large stones may be placed in the remainder of the trench backfill only if well separated and arranged so that no backfill settlement will result due to voids.

Compact masses of stiff clay or other consolidated material more than one (1) cubic foot in volume, shall not be permitted to fall from a height of more than five (5’) feet into the trench.

C. FLOWABLE FILL. Flowable fill (flowable mortar) shall be placed so all voids in the excavation or around the structure are filled. Filling operations shall proceed simultaneously on both sides of pipe or conduit so that the two fills are kept at approximately the same elevation at all times. Place flowable fill around structures in lifts to prevent the buildup of excess hydrostatic pressure. Weather limitations for flowable fill shall be the same as for concrete.

D. STRUCTURES. Backfill around and outside of structures shall be deposited in layers not to exceed eight (8) inches in uncompacted thickness. Compaction of structure backfill by rolling will be permitted provided the desired compaction is obtained and damage to the structure is prevented. Compaction of structure backfill by inundation with water will not be permitted. No tamped, rolled, or otherwise mechanically compacted backfill shall be deposited or compacted in water.

1108 COMPACTION

A. Moisture Control Requirements. The moisture content of the soil at the time of compaction shall be as indicated on the drawings or in the Special Provisions. If no moisture content requirements are provided, moisture content shall be as necessary to obtain the density specified for the particular location unless it is determined by the Engineer that the soil is unstable at that moisture content.

When the moisture content of the soil is not satisfactory to the Engineer, water shall be added or the material aerated, whichever is needed to adjust the soil to the proper moisture content. Moisture content shall be distributed uniformly and water for correction of moisture content shall be added sufficiently in advance that proper moisture distribution and compaction will be obtained. In no case, shall water be added without the consent of the Engineer.

All work involved in either adding moisture to, or removing moisture from soils shall be considered incidental to the completion of the grading operation.

B. Compaction Control Requirements. Earth embankment/fill and backfill materials shall be placed in horizontal layers not exceeding eight (8”) inches unless otherwise specified or approved by the Engineer and compacted as specified below before the next layer is placed. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compaction.

1. Subgrade for Embankments: Compact to a minimum of 95% of standard proctor maximum density as determined by ASTM D698.
2. Embankments/Fills: Compact to a minimum of 95% of the standard proctor maximum density for the material used as determined by ASTM D698.
3. Backfill: Unless otherwise specified, compact to a minimum of 95% of the standard proctor maximum density for the material used as determined by ASTM D698.
4. All fill or backfill material placed behind the curb and gutter or beneath and either side of sidewalks within the right-of-way shall be compacted such that no further consolidation is evident after additional rolling or tamping.
5. Structure Backfill: Compact to a minimum of 90% of standard proctor maximum density as determined by ASTM D698. Backfill around and outside of structures that will ultimately lie under proposed pavements shall be compacted to the requirements of SECTION 1200 "Subgrade Preparation."

1109 FINAL GRADING. After embankments and backfills are completed, all areas on the site of the work, which are to be graded, shall be brought to

grade at the indicated elevations, slopes, and contours, including shoulder, berm, and sidewalk spaces. The graded surface shall be made free of rock, concrete, and brick, or fragments thereof, or rubbish. Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and conforming to the lines and grades shown on the plans. Grades on areas to receive topsoil shall be established and maintained as a part of the grading operations. The Contractor shall repair any damaged surface and shall not use any equipment that will leave a marred surface.

Topsoil shall be placed to a minimum depth of six (6) inches in all areas indicated or specified to be seeded or sodded. Immediately prior to dumping and spreading topsoil, the surface shall be loosened by scarifying to a depth of two (2") inches to permit bonding of the topsoil to the underlying surface. Placement of all topsoil should be done in a manner so that roadway surfaces, sidewalks, manholes, valve boxes, and other utility structures or facilities are not covered by material being placed.

1110 CLEANUP. Cleanup shall follow the work progressively and final cleanup shall follow immediately behind the finishing. The Contractor shall remove from the site of the work all debris, equipment, tools, discarded materials and other construction items. The entire right-of-way or easement shall be left in a finished and neat condition. Cleanup shall be considered a subsidiary obligation of the grading work.

In the event the Contractor does not promptly comply with the terms of such instructions, the city may have the defective work corrected or the rejected work removed and replaced. All direct and indirect costs of such removal and replacement, including compensation for additional professional services, shall be paid by the Contractor. The Contractor will also bear the expenses of repairing work of others destroyed or damaged by the correction, removal or replacement of defective work.

1111 SETTLEMENT. The Contractor shall be responsible for all settlement of backfill, fills, and embankments, which may occur within one year after final acceptance of the contract under which the work was performed. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from the Engineer.

SECTION 1200 - SUBGRADE PREPARATION

1201 SCOPE. This section governs the performance of all work connected with subgrade preparation, prior to constructing pavements, sidewalks, drive approaches and concrete curb and gutters. This section does not include the construction of any base courses.

1202 DEFINITIONS.

A. Subgrade. Subgrade is defined as a well-graded and compacted surface, constructed as specified herein to the grades, lines, and cross-section shown, bladed and compacted to the specified density, preparatory to constructing pavements, or other improvements thereon.

B. Subgrade Preparation. Subgrade preparation is the repeated operation of fine grading and compacting the subgrade until the specified lines, grades, and cross-sections have been obtained and the materials are compacted to the specified depth and density.

1203 CONSTRUCTION REQUIREMENTS.

A. General. All underground work contemplated, including clearing, grubbing, and demolition, shall be completed in accordance with the requirements of Sections 1000 *Site Preparation* and 1100 *Grading* prior to commencement of any subgrade preparation.

Unless otherwise specified, prior to beginning any work on street subgrade the Contractor shall secure the services of a qualified testing agency to acquire samples of the material to be used for subgrade construction. These samples shall be analyzed to determine Proctor values and Atterberg limits. Copies of the analysis shall be provided to the Engineer for review at least 48 hours prior to commencing subgrade preparation.

The subgrade surface shall be brought to the specified lines, grades and cross-sections by repeatedly adding or removing material and compacting to the specified density with equipment suitable to perform these operations.

When unstable or unsuitable subgrade materials are encountered they shall be removed to the depth required to reach stable material or as directed by the Engineer. The over-excavated area shall be backfilled with suitable soil material, as defined in Section 1100 – *Grading*, or KDOT AB-3 aggregate material, as approved by the Engineer.

Backfilled subgrade shall be compacted in accordance with requirements of this Section.

B. Foundation Treatment. All subgrade in rock shall be undercut as indicated on the drawings or specified in the Special Provisions. If undercut is not included in the drawings or Special Provisions, remove material and backfill with suitable soil or granular material as directed by the Engineer.

1204 FLY ASH SUBGRADE TREATMENT

A. GENERAL: Fly ash shall be used for treatment of the subgrade section to a depth of 9 inches, unless otherwise indicated or specified. The addition of fly ash applies to natural ground, fills or cuts and shall be constructed as specified and to the lines, grades and typical sections as indicated on the plans or established by the Engineer. It shall be the responsibility of the Contractor to regulate the sequence of work, to process a sufficient quantity of material to provide a full depth layer as shown on the plans, to use the proper amounts of fly ash, to maintain the work, and to rework areas as necessary to meet the requirements**.**

When specified or indicated on the plans, the Contractor shall secure the services of a qualified testing agency to perform on site testing. A qualified field technician shall monitor placement, mixing, moisture content and in-place density. Copies of the test results shall be provided to the Engineer for review at least 48 hours prior to pavement placement. All costs incurred through the use of the testing agency shall be included in the Contractor's bid for fly ash subgrade.

B. MATERIALS

1. Fly ash shall be Class C complying with the physical requirements of ASTM D5239 Section 6.4 maintaining a minimum compressive strength of 500 psi at 7 days and the chemical requirements of ASTM C618 Section 3.3, when sampled and tested in accordance with Sections 5,6 and 8, unless otherwise indicated on the plans. The minimum calcium oxide (CaO) content of the fly ash shall be 25%. Fly ash that has been partially caked or set shall not be used.

2. A certification indicating compliance to these specifications shall be attached to or be part of the scale ticket for each load delivered. The producer's representative shall sign the certification. The Contractor shall provide weigh tickets from a certified public scale to the Inspector for each load of fly ash delivered to the site.

3. Potable water shall be used in the stabilized mixture.

4. The subgrade soil shall be uniform in quality and gradation, and shall be approved by the Engineer. The soil shall be free of roots, sod, weeds, and stones larger than three (3”) inches.

C. CONSTRUCTION REQUIREMENTS

1. Preparation of Roadbed: The subgrade shall be trimmed to finish subgrade elevations as shown on the plans. The Contractor shall allow for potential swell of material to minimize waste during final trimming. This may require the subgrade to be trimmed to slightly below proposed finished grade depending on the soil characteristics.

2. Equipment: The machinery, tools, and equipment appropriate and necessary for proper execution of the work shall be on the project prior to beginning of construction operations. Pulveration of existing subgrade and blending of the mixture shall be accomplished by use of a drum-rotary type tiller equipped with an adjustable water proportioning system. Initial compaction shall be achieved using a self-propelled sheepsfoot compactor having an operating weight adequate to achieve the required results. Rubber-tired or smooth-wheeled rollers shall be used for final compaction of the stabilized section. All machinery, tools and equipment used shall be maintained in satisfactory and workmanlike manner.

3. Storage: Fly ash shall be stored and handled in closed weatherproof containers until immediately before distribution. Fly ash exposed to moisture prior to mixing with recycled material shall be discarded. Temporary storage (less than 12 hours) of fly ash in open pits will be allowed provided fly ash is protected from rain and groundwater.

4. Application: Fly ash shall be added to the subgrade at a rate of 16% based on dry unit weight unless approved geotechnical studies indicate different rates. The fly ash shall be spread in an approved manner. Care shall be taken to prevent the fly ash from flowing off the area to be treated. The fly ash shall be distributed at a uniform rate in such a manner as to minimize the scattering of fly ash by wind. Fly ash shall not be applied when wind conditions, in the opinion of the Engineer, are such that blowing fly ash becomes objectionable to adjacent property owners or significantly reduces the amount of fly ash incorporated into the work.

   Mixing operations shall commence within one (1) hour after distribution of the fly ash and will proceed until all material has been mixed. No fly ash shall be placed on roadway that can not be incorporated within the weather limitation.

5. Moisture Control: The required moisture content will be established by the Contractor's testing agency based on laboratory tests on the materials and specific fly ash content to be used for the treatment. Water shall be introduced directly into the rotary mixing drum during the tilling procedure. Final moisture content of the mix, immediately prior to compaction shall be uniform. If the moisture content is too high or low to achieve required compaction results, additional fly ash may be added to lower the moisture content or additional water shall be added and uniformly blended with the mixture. Additional fly ash added to lower the moisture content shall be at the expense of the Contractor.

6. Mixing: The pulverized subgrade material and fly ash shall be thoroughly mixed and the mixing continued until a homogenous, friable mixture of pulverized subgrade material and flyash meeting the specified size requirements is obtained. The subgrade material shall be pulverized through use of the specified equipment. Depth of pulverization shall be as designated on the plans. All clods shall be reduced in size by mixing until the pulverized subgrade material-fly ash mixture meets the following size requirement when tested.

Sieve Size	Percent Retained
1"	0
½"	50

7. Compaction

   Compaction of the mixture shall begin immediately after mixing and confirmation that the moisture content is within the specified range. The specified compaction shall be obtained within 1 hour after the incorporation of the fly ash. Compaction of the mixture shall continue until the entire depth of mixture is uniformly compacted to the specified density.

   All non-uniform (too-wet, too dry or insufficiently treated) areas, which appear, shall be corrected immediately by scarifying the areas affected, adding material as required and reshaping and recompacting.

   The stabilized section shall be compacted in compliance with Section 1108.

   After each section is completed, tests will be made by the Engineer or authorized representative. If the material fails to meet the density requirements, the Engineer may require it be reworked as necessary to meet those requirements and/or require the Contractor to change his construction methods to obtain required

density on the next section. Additional fly ash will be added to the areas that are reworked at no additional cost to the owner, and the Engineer or authorized representative shall determine the amount required. Should the section, due to any reason or cause, lose the required stability, density and finish before the surface is placed or the work is accepted, it shall be reprocessed, recompacted and refinished at the sole expense of the Contractor. Reprocessing shall follow the same patterns as the initial stabilization including the addition of fly ash**.**

8. Finishing and Curing
   Following the compaction of the stabilized section the surface shall be protected from rapid drying by maintaining a continuous moist condition by sprinkling for a period of not less than seventy-two (72) hours or until overlying pavement is placed. Prior to paving, the treated section will be trimmed to the required lines and grade by means of equipment, which is automatically controlled with regard to grade. The surface shall then be compacted with a smooth wheel or pneumatic tired roller and proof rolled. If ruts or other damage to the treated section is apparent during trimming, compaction and proof rolling operations, all work will cease and not recommence for at least 24 hours.

   The Engineer may waive the use of automatically controlled equipment on projects containing narrow or irregular dimensions where operation of the automated equipment is impractical. Finishing of these areas may be as set forth above or the surface will be lightly scarified during finishing operations and bladed to a uniform grade and cross section to eliminate and imprints left by the equipment.

9. Weather Limitations
   Fly ash mixing operations shall not be performed when the subgrade is frozen. Mixing operation shall not be allowed until the ambient air temperature and surface temperature is forty (40) degrees F and rising. The Contractor shall be responsible for protection and quality of the fly ash modified subgrade mixture under any weather conditions.

1205 MOISTURE AND COMPACTION CONTROL REQUIREMENTS. The moisture content of the soil at the time of compaction and compaction control requirements shall conform to the requirements of Section 1108.

1206 COMPACTION REQUIREMENTS.

A. Beneath Street Pavements and Commercial Drives. The subgrade shall be compacted to a minimum density of 95% of standard Proctor maximum density for the material used as determined by ASTM D698. Material shall be compacted to a depth of nine (9") inches below the finished subgrade elevation or as indicated on the plans, whichever is greater.

B. Beneath Residential Drives, Sidewalks and Multi-Use Paths. The top six (6") inches of the subgrade for sidewalks and recreational paths shall be compacted such that no further consolidation is evident after additional rolling or tamping.

C. Beneath Curb or Curb and Gutter. For curb or curb and gutter installed directly on the subgrade rather than on a lift of pavement, the subgrade shall be compacted to the same density as the subgrade for the adjacent pavement.

1207 PROTECTION AND MAINTENANCE OF SUBGRADE. The newly finished subgrade shall be protected from action of the elements. Any settlement or washing that occurs prior to the acceptance of the work shall be repaired and the specific lines, grades, and cross-section reestablished.

1208 COMPACTION TESTING AND PROOF ROLLING. Compaction testing will be required prior to placement of pavements. The subgrade must successfully pass compaction testing by a nuclear density/moisture measuring device or other accepted method and proof rolling. Proof rolling shall be accomplished with a loaded tandem dump truck carrying a minimum loaded weight of twenty five (25) tons (gross weight) with three cycles of loading over three separate paths. Proof rolling must be completed a minimum of 24 hours before paving operations. If as a result of the testing/proof rolling the Engineer determines that further compaction is required, the Contractor shall revise methods or procedures as necessary to obtain density and stability.

SECTION 1300 - ASPHALTIC CONCRETE PAVEMENT

1301 SCOPE. This section covers asphaltic concrete (AC) pavement for roadways and parking areas.

1302 GENERAL. Pavement shall be constructed to the lines, grades, dimensions, and details as shown on the plans. Allowable mixes for AC pavements shall be the following:

Surface Course Mix – KDOT HMA-Commercial Grade 12.5A
Base Course Mix – KDOT HMA-Commercial Grade 12.5A,
BM-2B, or BM-2
Leveling Course Mix – KDOT BM-1

Alternative mix designs may be used only where approved by the Engineer prior to bidding a project.

Materials.

A. Asphalt cement shall conform to the Performance Graded (PG) system. The asphalt oil used for residential, collector, and arterial streets shall be PG 64-22 for all types of AC mixes. PG 64-22 oil shall also meet the additional testing requirements:

	PG 64-22
Separation Test (AASHTO PP-5)	$\leq$ 10
Elastic Recovery Test (ASTM D6084)	$\geq$ 45

B. The quality of individual aggregates and mineral filler supplements shall meet the requirements of the current KDOT Standards for aggregates for hot mix asphalt.

C. Recycled asphalt pavement (RAP) shall be processed such that 100% will pass the 1-1/2 inch sieve and shall be free of debris and foreign material.

D. Tack oil shall be SS-1, SS-1H, CSS-1 or CSS-1H grade oil. Alternative materials must be submitted for approval by the Engineer prior to submitting a bid on a project. Certification shall be submitted to Engineer.

Composition of Mix. Immediately prior to the addition of the asphalt, the combined virgin aggregate shall meet the following requirements:

SIEVE SIZE	PERCENT MASTER GRADING LIMITS (PERCENT RETAINED)				RETAINED DESIGN JOB-MIX TOLERANCES			
	12.5A	BM-2	BM-2B	BM-1	12.5A	BM-2	BM-2B	BM-1
1”			0					
¾”	0	0	0-5					
½”	0-10							
3/8”	10 Min	8-30	10-30	0-8	+/-6	+/-6	+/-6	
4				18-39	+/-6	+/-6	+/-6	+/-5
8	42-61	42-72	42-72	35-53	+/-5	+/-6	+/-6	+/-5
16				50-68	+/-5	+/-5	+/-5	+/-5
30		64-88	64-88	60-80	+/-4	+/-5	+/-5	+/-5
50				70-90	+/-4	+/-4	+/-4	+/-4
100				82-95	+/-3	+/-4	+/-4	+/-3
200 (wash&Scr)	90-98	92-98	92-98	92-98	+/-2	+/-2	+/-2	+/-2
Plastic Index = 6 max.								
Moisture in Final Mix: = 0.5% max.								

In addition, there shall not be less than three (3%) percent nor more than twenty-three (23%) percent material between any two of the following successive sieves: Numbers 4, 8, 16, 30, and 50.

The asphalt content for each mix shall be the optimum content plus or minus one-half (1/2%) percent, based on the approved mix design for the project. Mix design shall be submitted to the Engineer by the Contractor a minimum of ten (10) days in advance of the paving operation.

The Contractor may use virgin materials or a blend of virgin materials in combination with a maximum of 15% reclaimed asphalt pavement (RAP) in the surface course and 25% in the base course. No RAP will be allowed in the leveling course mix. The use of recycled roofing materials will not be allowed in asphaltic mixes.

1303 SUBGRADE PREPARATION. Subgrade preparation for pavement shall be as specified in Section 1200 *Subgrade Preparation*.

1304 TRANSPORTATION OF MIX. The mix shall be transported to the jobsite in vehicles cleaned of all foreign material including asphalt left from previous loads. The inside of the truck beds shall be lubricated with a thin non-petroleum based oil to prevent the mix from adhering to the bed, but an excess of lubricant will not be permitted. Vehicles shall be provided with covers of sufficient size and design to protect the load and to prevent cooling of the mix during transportation to the site. The Contractor shall

provide a sufficient number of haul vehicles of the proper size, speed, and condition to ensure an orderly and continuous nonstop paving operation. Contractor must have a minimum of 3 loaded trucks onsite before paving will be allowed to commence.

No diesel or petroleum base solvents will be permitted on tools or on equipment that comes in contact with asphalt, or to clean equipment on the job site.

1305 PLACING REQUIREMENTS. The bituminous mixture shall be spread and finished true to crown and grade by a mechanical, self-propelled paving machine. AC mixture may be spread and finished by other methods only where machine methods are impractical as determined by the Engineer.

All construction activities shall be completed during daylight hours. **Nighttime work on projects will not be permitted unless approved in advance by the Engineer.**

All AC mixtures shall be delivered to the paver at a temperature between 250°F and 325°F. Delivery of the material to the paver shall be at a continuous rate and in an amount well within the capacity of the paving and compacting equipment. If asphalt plant or trucks cannot keep up with the paver, the speed of the laydown operation shall be reduced to match the supply of material to the job site and avoid “stop-and-start” operations.

The maximum depth of any individual lift shall be four (4) inches for base course and two (2) inches for surface course.

When AC pavement is being placed, the surface of all structures, driveways, entrances, curb and gutters, and other roadway appurtenances shall be protected in a satisfactory manner to prevent them from being splattered with paving materials or marred by equipment operation. In the event that any appurtenances become splattered or marred, the Contractor shall, at his own expense, remove all traces of material and repair all damage, and leave the appurtenances in the same condition as before the work began and to the satisfaction of the Engineer.

Pavement may be placed only when either the ambient air temperature or the road surface temperature is equal to or greater than the temperatures in the table below. No pavement shall be placed when there is frost in the subgrade, on wet subgrade, or at any other time when weather conditions are unsuitable without the expressed consent of the Engineer.

Paving Course	Thickness (inches)	Air Temperature (Degrees F)	Road Surface Temperature (Degrees F)
Surface	All	50	55
Base	Less than 3	40	45
Base	3 or more	30	35

When the ambient temperature falls below 55°F, precautions shall be taken to compact the mix before it cools below 175°F to obtain the required density. In no case shall successive lifts of asphalt be placed until the previous lift has cooled to 150°F or less.

During placement, excess material raked from the surface shall not be placed back onto the new pavement surface prior to rolling.

1306 MECHANICAL PAVING MACHINES. Mechanical pavers shall be capable of spreading the mix, within the specified tolerances, true to the line, grade, and crown indicated on the contract drawings.

Pavers shall be equipped with quick and efficient steering devices and shall be capable of traveling both forward and in reverse. They shall be equipped with hoppers and distributing screws, which place the mix evenly in front of adjustable screeds. They shall be equipped with a vibrating screed.

The screed shall include any strike-off device operated by cutting, crowding, or other action which is effective on mixes at workable temperatures without tearing, shoving, or gouging them and which produces a finished surface of an even and uniform texture. The screed shall be adjustable as to height and crown and shall be equipped with a controlled heating device for use when required.

Pavers shall be capable of spreading mixes without segregation or tearing. They shall also be capable of placing courses in varying thicknesses and from widths of eight (8') feet to at least thirteen (13') feet.

1307 COMPACTION REQUIREMENTS. Compacting equipment shall conform to the requirements of the KDOT Standards. Rollers and other compaction devices shall be operated by competent and experienced roller personnel and shall be kept in operation continuously so that all parts of the pavement will receive substantially equal compaction. The Engineer shall order the paver to cease operations at any time proper rolling is not being performed.

After spreading and strike-off and as soon as the temperature and mix conditions permit the compacting to be performed without excessive

shoving or tearing, the mixture shall be thoroughly and uniformly compacted.

The selection of the type of roller to be utilized in breakdown rolling may be varied to suit mix characteristics and shall be acceptable to the Engineer. The final rolling of the top or surface course shall be accomplished with a steel roller unless otherwise approved by the Engineer. In the event a vibratory roller is used for finish rolling, it shall be operated with the vibratory unit in its off position.

During rolling, the roller wheels shall be kept moist with only sufficient water to avoid picking up the material.

The line of rolling shall not be changed suddenly or the direction of rolling reversed suddenly. If rolling causes displacement of the material, the affected areas shall be loosened at once with lutes or shovels and restored to the original grade of the loose material before being re-rolled. Rollers shall not be permitted to stand on the finished surface before it has been compacted and has thoroughly cooled.

In laying a surface mix adjacent to any finished area, it shall be placed sufficiently high so that, when compacted, the finished surface will be true and uniform and match the existing surface.

Any mixture that does not comply in all respects with the requirements set forth herein, shall be removed, replaced with suitable material, and finished, by and at the expense of the Contractor, in accordance with these specifications.

1308 TACK COAT. Tack coat shall be placed on all contact surfaces such as existing or previously placed pavement, curb and/or gutter, manholes, and other structures. Contact surfaces shall be adequately coated so as to ensure a thorough and continuous bond between the existing surface and the new AC mixture.

Prior to the distribution of the tack coat, the Contractor shall remove all debris, trash and loose materials from the surface by means of preapproved enclosed mechanical sweepers with watering systems, hand brooms and/or other approved equipment as required, until it is as free from dust and other foreign materials as is practicable. Extra care will be used to ensure dust control. If dust is found to be in excess as determined by the Engineer, work will be stopped until dust can be controlled.

Tack coat shall be placed on only one lane of the roadway at a time. Place tack coat just enough in advance of paving operations to allow the tack to

cure before overlying pavement is placed. No traffic shall be allowed on tacked surfaces.

The tack coat shall be applied to areas to be surfaced at the rate of from 0.05 to 0.15 gallons/square yard at application temperature. It shall be applied by means of approved pressure distributors operated by skilled workmen. The spray nozzles and spray bar shall be so adjusted and frequently checked that uniform distribution is ensured. The distribution shall cease immediately upon any clogging or interference of any nozzle and corrective measures taken before distribution is resumed. Hand sprays shall be used only in tacking small patches or inaccessible areas that have been missed by the distributor.

The tack coat shall be entirely fogged over the surface to be paved and require no sand blot. If, however, it has not been uniformly distributed, sufficient sand shall be spread over the surface to blot up the excess asphalt and prevent it from picking up. Prior to laying an intermediate or surface course, all loose or excess sand shall be swept from the base.

The Contractor shall maintain the tack coat and the surface to be paved intact until it has been covered by the overlying course. Areas that have been damaged shall be repaired and shall receive additional applications of tack coat material in compliance with these specifications. The maintenance and repair of the tack coat shall be at the Contractor's expense.

The Contractor shall be responsible for protecting adjacent streets and other surfaces from tracking of tack material. Protection of surfaces and tack material tracking removal shall be performed at the Contractor's expense.

1309 DENSITY AND SURFACE REQUIREMENTS. Both density and thickness shall be carefully controlled during construction and shall be in full compliance with plans and specifications. During compaction, 4-inch diameter cores will typically be taken to determine in-place densities and as an aid for verifying thickness. Contractor shall obtain cores by means approved by the Engineer. Core locations shall be repaired using epoxy concrete, high-strength non-shrink grout, or other approved product.

Unless otherwise specified, the completed asphaltic concrete pavement shall have a density greater than or equal to ninety-two (92%) percent of Theoretical Maximum Specific Gravity. Upon request by the Engineer, representative samples of the compacted asphalt paving shall be obtained by the Contractor under the supervision of the Engineer and shall be tested by a suitable independent or municipal testing laboratory as necessary to verify compliance with respective density requirements.

The testing laboratory shall be selected and compensated by the Owner, unless otherwise specified. The Engineer will establish the number, timing, location and testing procedures for the representative samples. Copies of each report covering the details and results of the tests shall be provided to the Contractor.

The surface of the final course shall be of a uniform texture, without segregation, and conform to lines and grades shown on the plans. It shall not vary from a ten (10') foot straight edge, applied parallel to the centerline, by more than one-fourth (1/4") inch. Segregation checks, in accordance with KDOT procedures, may be run in areas that appear to be segregated.

Correct all surface irregularities exceeding the specified tolerances using equipment and methods approved by the Engineer. Method for correction shall be approved by the Engineer and may include:

- Diamond grinding
- Remove and replace the entire pavement thickness
- Mill the surface and replace the specified surface course
- Other methods proposed by the Contractor as approved by the Engineer.

When specified densities are not achieved payment for the material will be reduced, or the pavement shall be removed and replaced, as follows:

% GMM	% of Payment
≥ 92	100
90-91.9	98
88-89.9	96
86-87.9	94
< 86	50 OR remove & replace at Contractors option

Reduced payment will apply only to the amount of material represented by each test but no more than 500 tons. If a test indicates a density below the minimum required, additional tests will be performed to better define the extent of the area subject to reduced payment. No more than one test per 150 tons will be performed.

1310 PROTECTION OF PAVEMENT. The Contractor shall protect all sections of newly compacted base and surface courses from traffic until they have hardened properly, or as directed by the Engineer.

1311 ROLLING PROCEDURE. At the option of the Engineer, the effectiveness of the rolling procedure will be verified using a nuclear density-moisture

measuring device. The Contractor shall revise the rolling procedure as necessary to obtain the specified density.

1312 CLEANUP. Cleanup shall follow the work progressively and final cleanup shall follow immediately behind the finishing. The contractor shall remove from the site of work all equipment, tools, discarded material, and other construction items. The entire right-of-way shall be left in a finished and neat condition. Clean up shall be considered a subsidiary obligation.

SECTION 1400 - CONCRETE PAVEMENT

1401 SCOPE. This section governs the furnishing of all labor, equipment, tools, and materials and the performance of all work necessary to construct concrete pavement.

1402 MATERIALS.

A. Concrete. Concrete for pavement shall be air-entrained as specified in Section 2000 *Concrete* unless otherwise specified or approved by the Engineer.

B. Reinforcing. Materials shall be as specified in Section 2000 *Concrete* or as indicated on the plans.

C. Isolation Joint Fillers. Isolation joint fillers shall conform to ASTM D1751.

D. Joint Sealing Compound. Joint sealing compounds shall conform to the following.

Joint Seals and Sealants	AASHTO	ASTM
Hot-poured, Polymeric Asphalt Based	M 301	D 3405
Hot-poured, Elastomeric Type	M 282	D 3406
Preformed Polychloroprene Elastomeric	M 220	D 2628
Lubricant for Installation of Preformed Seal	--	D 2835

E. Curing Membrane. All material to be used or employed in curing concrete must be approved by the Engineer prior to its use. It shall be of the liquid membrane type and shall conform to ASTM C1315, Type II, Class A – white pigmented cure.

1403 CONSTRUCTION DETAILS. The Portland cement concrete pavement shall be constructed to the configuration, lines and grades shown on the plans.

A. Grading and Subgrade Preparation. All excavation or embankment required shall be completed in accordance with Sections 1100 *Grading* and 1200 *Subgrade Preparation*.

B. Forms. All forms shall be in good condition, clean, and free from imperfections. Each form shall not vary more than one fourth (1/4) inch in horizontal and vertical alignment for each ten (10) feet in length. Forms may be wood or steel. No aluminum forms shall be allowed.

1. Size. Forms shall have a height equal to or greater than the prescribed edge thickness of the pavement slab unless otherwise approved by the Engineer.

2. Strength. Forms shall be of such cross-section and strength, and so secured as to resist the pressure of the concrete when struck off, vibrated, and finished, and the impact and vibration of any equipment, which they may support.

3. Installation. Forms shall be set true to line and grade, supported through their length and, joined neatly in such a manner that the joints are free from movement in any direction.

4. Preparation. Forms shall be cleaned and lubricated with a release agent prior to each use and shall be so designed to permit their removal without damage to the new concrete.

5. Paving Machine. A slip-form paving machine may be used in lieu of forms. The machine shall be capable of placing the concrete pavement to the correct cross-section, thickness, line and grade within the allowable tolerances as approved by the Engineer. The machine must be equipped with mechanical internal vibrators of the same type and size, mounted with a maximum spacing of 12 inches centers. Vibrators shall be mounted so that they enter the concrete in a vertical position under the influence of their own weight, with enough flexibility to work themselves around the reinforcing steel.

1404 JOINTS. Generally joints shall be formed at right angles to the true alignment of the pavement, and to the depths and configuration specified by the standard drawings or as modified by the plans and project specifications.

A. Isolation Joints. Isolation joints shall extend from the subgrade to one inch below the surface of the pavement or the material will have a suitable tear strip provided to allow for the application of the joint sealer. Under no circumstances shall any concrete be left across the isolation joint at any point.

1. Location: Isolation joints shall be placed at all locations where shown on the plans and standard details or as directed by the Engineer.

2. Material. Isolation joints shall be formed by a one-piece, preformed joint filler cut to the configuration of the correct section. For pavement the filler shall be three fourths (3/4) inch thick.

3. Stability. Isolation joints shall be secured in such a manner that they will not be disturbed during the placement, consolidation and finishing of the concrete.

4. Dowels. If isolation joints are to be equipped with dowels they shall be of the size and type specified, and shall be firmly supported in place by means of a dowel basket which shall remain in place. The basket shall be installed in such a position that the center line of the joint assembly is perpendicular to the center line of the slab and the dowels lie parallel to the slab surface and parallel the center line of the slab. One half of each dowel shall be lightly painted or greased with an approved lubricant.

B. Contraction Joints. Contraction joints shall be of the type and dimensions and at the spacing shown on the plans or standard drawings or as directed by the Engineer. Contraction joints shall be sawed to produce a controlled crack in the proper location unless other methods are approved by the Engineer.

1. Configuration: The standard contraction joint is a one eighth (1/8) inch wide joint to a depth of one third of the slab thickness plus one fourth inch (D/3 + ¼") unless otherwise indicated or specified.

2. Sawing. Sawed contraction joints shall be cut as soon as the concrete has hardened sufficiently to prevent excessive tearing and raveling regardless of the time or weather. Joints shall be sawed and finished before conditions induce uncontrolled cracks. Material created by sawing shall be removed from the pavement surface before it has had time to dry or set.

3. Spacing: The spacing shall be as shown on the plans or as directed by the Engineer.

C. Longitudinal and Construction Joints. Longitudinal joints or construction joints shall be placed as shown on the plans or where the Contractor's construction procedure may require them to be placed.

1. Center Joints. Longitudinal center joints shall be constructed using the methods specified in Section 1404B "Contraction Joints" or as specified for longitudinal construction joints as required.

2. Longitudinal Construction Joints. Longitudinal construction joints (joints between constructions lanes) shall be constructed with tie-bars. Joint configuration shall conform to the dimensions shown on the plans or standard drawings.

3. Transverse Construction Joints. Transverse construction joints shall be constructed with tie-bars and placed wherever concrete placement is suspended for such a time that the concrete has begun to take its initial set.

4. Tie-bars. Tie-bars shall be of deformed steel of the dimensions specified by the plans or standard drawings. Tie-bars shall be installed at the specified spacing and be firmly secured so as not to be disturbed by the construction procedure. They shall be free from dirt, oil, paint, grease, loose mill scale, and thick rust, which could impair bond of the steel with the concrete.

5. Sawing and Sealing. All construction joints shall be sawed and sealed.

1405 PLACING, FINISHING, CURING, AND PROTECTION. Concrete shall be furnished in quantities required for immediate use and shall be placed in accordance with the requirements of Section 2000--*Concrete* of these technical specifications and as specified herein.

A. Concrete Placement. Prior to placement of the concrete pavement, all debris and foreign material shall be removed from the inner surfaces of the forms and all forms and subgrade properly moistened. All required reinforcement shall be properly and firmly set into position to preclude movement during placement of the concrete.

The concrete shall be deposited over the entire width of the prepared subgrade between the forms in such a manner to prevent segregation and to require as little rehandling as possible. The pour shall be made to the required depth and width of the construction lane in successive batches and in a continuous operation without the use of intermediate forms or bulkheads. Concrete shall be thoroughly vibrated. Attachments on finishing machines to vibrate the concrete will be permitted provided satisfactory results are attained. Care shall be taken that the vibrator does not penetrate the subgrade or dislodge or move the joints. The vibrating shall be sufficient to produce a smooth pavement. Under no circumstances shall the vibrator be used to move concrete. Honeycomb in the edge may be cause for rejection of the pavement.

When the forward motion of the vibrating screed is stopped, the vibrator shall be shut off; it shall not be allowed to idle on the concrete. Internal mechanical vibration shall be used along all formed surfaces.

No concrete shall be placed around manholes or other structures until they have been brought to the required grade, alignment, and cross slope. All utility appurtenances shall be boxed out or otherwise isolated using isolation joint material as indicated or as directed by the Engineer. Concrete shall not be allowed to extrude below the forms.

B. Concrete Finishing. The pavement shall be finished to the elevations as shown on the drawings by either mechanical or hand-finishing methods.

Misting the concrete by means of a spray nozzle is acceptable. No brushes will be allowed.

1. Floating. All surfaces shall be consolidated and floated after strike-off, within 15 minutes of initial concrete placement, and prior to final surface finish. Use of a “fresno” steel trowel/ float (or walking trowel) will not be allowed for floating concrete pavement.

2. Final Surface Finish. A burlap drag or a broom finish shall be used as the final finishing method. When a drag is used it shall be at least three (3’) feet in width and long enough to cover the entire pavement width. It shall be kept clean and saturated while in use. It shall be laid on the surface of the pavement and dragged in the direction in which the pavement is being laid. When broom finishing, a hard bristle broom shall be used. The broom shall be kept clean and used in such a manner as to provide a uniform textured surface.

   The final surface of the concrete pavement shall have a uniform gritty texture free from excessive harshness and true to the grades and cross section shown on the plans. The Engineer may require changes in the final finishing procedure as required to produce the desired final surface texture.

C. Curing. Curing shall conform to the requirements set forth in Section 2000 – *Concrete.*

D. Protection. The Contractor shall, at his own expense, protect the concrete work against damage or defacement of any kind until it has been accepted by the city.

All vehicular traffic, including construction vehicles, shall be prohibited from using the new concrete pavement for a period of seven (7) days unless approved otherwise by the Engineer.

When approved or designated for use, high strength gain concrete (KCMMB 5k mix or a high early strength type mix approved by the Engineer) may be opened to vehicular traffic after ninety-six (96) hours. If a Contractor wishes to open the concrete pavement to traffic earlier than ninety-six (96) hours, material test results indicating the concrete has reached a

minimum compressive strength of 3,500 psi or a minimum flexural strength of 450 psi must be provided.

Concrete pavement, which is damaged or defaced, shall be removed and replaced, or repaired, to the satisfaction of the Engineer. All costs for replacement or repairs shall be the responsibility of the Contractor.

Pavement that develops uncontrolled or undesirable cracks shall be removed and replaced at the Contractor's expense. If approved by the Engineer, the Contractor may be allowed to make repairs to cracked pavement and/or a reduction in payment for the concrete pavement will be negotiated. All damaged sections to be removed shall be sawed a minimum of three (3) feet from a joint or removed to the nearest joint.

E. Temperature Limitation. Concrete work shall proceed in accordance with the requirements established in Section 2000-*Concrete*.

1406 BACKFILL. A minimum of twenty four (24) hours shall elapse before forms are removed and a minimum of five (5) days shall elapse before pavement shall be backfilled unless otherwise approved by the Engineer.

1407 JOINT SEALING. All sawed joints shall be sealed with an approved joint sealer applied in accordance with the manufacturer's recommendations. The joints shall be sealed after seven (7) days following placement of the concrete and prior to the opening of the pavement to traffic.

1408 CLEANUP. The Contractor shall be responsible for the removal of excess dirt, rock, broken concrete, concrete splatters and overspray from the area of the construction.

1409 SURFACE TOLERANCES. Concrete pavement shall have a surface tolerance in all directions of one fourth (1/4) inch in ten (10) feet when checked with a ten (10) foot straightedge. Pavement surface must drain when complete. No low areas, which allow water to pond, shall be left on the surface.

When surface tolerances are not met, use one of the following methods for corrections:

- Diamond grinding
- Remove and replace the entire pavement thickness
- Other methods proposed by the Contractor as approved by the Engineer.

The corrected areas shall have uniform texture and appearance.

1410 THICKNESS TOLERANCES. It is the intent of these specifications that pavement shall be constructed strictly in accordance with the thickness shown on the plans. The thickness of the pavement may be measured by

coring. If any pavement is found deficient in thickness, it may be compensated for at an adjusted unit price or shall be removed and replaced. In removing pavement, it shall be removed from the outside edge of the curb and gutter (curb and gutter with tie-bars may remain if in good condition) to a longitudinal joint and on each side of the deficient measurement until no portion of the exposed cross sections are more than two tenths (2/10) inch deficient.

SECTION 1500- CONCRETE CURB, CURB AND GUTTER, SIDEWALK, AND DRIVEWAY ENTRANCES

1501 SCOPE. This section covers concrete curb, curb and gutter, concrete sidewalk, concrete driveway entrances, and exposed aggregate concrete work, including reinforcing steel, forms, joints, finishing, curing, and other appurtenant work.

1502 GENERAL. All construction covered in this section shall conform to the requirements of Section 2000 *Concrete*. All forms shall be in good condition with not more than one-fourth (1/4") inch variation in horizontal and vertical alignment for each ten (10') feet in length.

1503 MATERIALS.

A. Concrete, Exposed Aggregate Concrete, and Reinforcing Steel: Conform to the requirements of Section 2000 *Concrete.*

B. Isolation Joint Filler: Isolation joints shall be formed with pre-formed isolation joint filler of the non-extruding and resilient type which shall meet the requirements of ASTM D1751 or D1752.

C. Detectable Material for Ramps: The material used to provide contrast shall be an integral part of the walking surface. The material for detectable surface shall consist of either tiles or panels. Surface applied retrofit tiles shall not be allowed.

1. Tiles or Panels: Acceptable products include Detectable Warning System's E-Z-Set Ceramic Composite Detectable Warning Panels, Armor Tile's Cast In Place System, ADA Solution's Composite Paver, CASTinTACT Detectable Warning Panel, TufTile Surface-Applied (Replaceable), TufTile Wet-Set (Replaceable), any KDOT prequalified ADA-compliant ramp panels, or approved equal.

2. Color for all surfaces options shall be 'brick red'. Any color variation to meet contrast requirements must be approved by Engineer.

D. Concrete Sealant: Material for sealing exposed aggregate concrete shall be W.R. Meadows' *Decra-Seal* or similar non-yellowing, acrylic-based sealing product.

1504 GRADING AND SUBGRADE PREPARATION. All grading and preparation shall be done in conformance with Sections 1100 *Grading* and 1200 *Subgrade Preparation*.

1505 JOINTS.

A. Isolation joints in concrete sidewalks shall be placed adjacent to existing concrete structures, as indicated in the standard details, or as directed by the Engineer. Material shall be one half (½) inch thick and extend for the full depth and width of the walk.

B. Isolation joints in curbs and curb and gutter shall be placed at each end of curves, curb inlets, or other locations as indicated on the plans or as directed by the Engineer. Material shall be one half (½) inch thick and extend for the full depth and width of the joint.

C. Contraction joints shall consist of planes of weakness created by sawing the surface of the concrete. Sawed joints shall be constructed by sawing through the surface of the concrete with an approved concrete saw. Sawing of the joints shall begin as soon as the concrete has hardened sufficiently to prevent excessive raveling.

D. For sidewalks only, contraction joints may be tooled rather than sawed. The edges of tooled joints shall be rounded with a one fourth (¼) inch radius.

E. Contraction joints in curb/curb and gutter shall be placed at maximum intervals of 10 feet except as specified for curb and gutter with concrete pavement. Transverse joints in sidewalk shall be spaced at a distance equal to the width of the sidewalk.

F. Contraction joints in separate curb and gutter shall be located to coincide with contraction joints in concrete pavement. They shall extend through the entire curb section from the top of curb to a depth of two (2) inches below pavement surface. Contraction joints shall be sawed.

1506 CONCRETE CURB. Concrete curb will be constructed as shown on the plans unless otherwise approved by the Engineer. Curb may be either integral with or separate from concrete pavement. Concrete in curbs and gutter shall be vibrated. If curbs are hand-poured, a strap shall be used for shaping. All excess material below, in front of, or behind forms shall be removed before the concrete hardens.

A. Integral curb Integral curb shall be constructed during or immediately following the finishing operation unless otherwise shown on the plans. Special care shall be taken so that the curb construction does not lag behind the pavement construction and form a "cold joint."

Curb forms or integral slipforming shall be required to form the backs of all curbs except where impractical because of small radii street returns or other special sections or as otherwise approved by the Engineer.

In placing curb concrete, sufficient spading shall be done to secure adequate bond with the paving slab and eliminate all voids in the curb.

Curbs shall be formed to the cross section as shown on the drawings with a mule or templates supported on the side forms and with a float not less than four (4) feet in length.

The finished surface of the curb and gutter shall be checked by the use of a ten (10) foot straightedge and corrected if necessary. Where grades are less than one percent (1%) and while the concrete is still plastic, the drainage of the gutter should be checked with a four (4) foot level to ensure positive drainage is provided.

B. Separate Curb and Gutter with Tie-bars for Concrete Pavement. Separate curb and gutter may be poured prior to the remaining pavement. Tie-bars one half (½) inch in diameter and eighteen (18) inches long shall be cast in the curb and gutter at thirty (30) inch centers as shown on the standard details. Tie-bars may be placed in drilled holes after the curb is placed as long as the required embedment length can be obtained and the bars are epoxied in place.

C. Separate Curb and Gutter for Asphaltic Pavements. Contraction joints shall be spaced no more than 10 feet apart and shall extend through the entire curb section from the top of curb to a depth of two (2) inches below pavement surface. Contraction joints shall be sawed.

1507 FINISHING. Misting of concrete is allowed by spray nozzle only. Brushes are prohibited. Brooms for finishing concrete surfaces shall be periodically cleaned during finishing operations to remove excess concrete materials.

A. Curb and Curb and Gutter. In all cases the resulting surface shall be smooth and of uniform color with all rough spots, projections, and form stakes removed. No plastering of the concrete will be allowed on exposed surfaces. The finished curb shall have a true surface, free from sags, twists, or warps, and shall have a uniform appearance, and shall be true to the specified lines, grades, and configurations shown on the drawings. Curbs and gutter shall be broom finished with brush strokes parallel to the back of curb.

B. Sidewalk and Driveway Entrances. After the concrete has been thoroughly consolidated and leveled, and the initial set has taken

place, the surface shall be finished with a float and then broom finished with no other mortar than that contained in the placed concrete. The resulting surface shall be uniform in color and contain no imperfections. The edges shall be tooled with a one fourth (¼) inch radius. Special care shall be taken to ensure a straight, neat appearance along the edges of the sidewalk or driveway entrance and at the joints.

C. Surface Tolerances. Finished sidewalks, drives, and multi-use paths shall have a surface tolerance of one-fourth (1/4) inch in 10 feet when checked with a 10-ft straightedge. Vertical deflections at sidewalk joints shall not exceed one-fourth (1/4) inch. All surfaces must drain and no low spots, which allow water to pond, shall be left in the finished surface.

When surface tolerances are not met, use one of the following methods for corrections:

- Grinding
- Remove and replace the entire section as directed by the Engineer
- Other methods proposed by the Contractor as approved by the Engineer.

The corrected areas shall have uniform texture and appearance.

1508 REINFORCEMENT. Reinforcement shall be as shown on the contract drawings and/or standard details for the project.

1509 DETECTABLE WARNINGS IN SIDEWALK OR RAMPS. Detectable warnings shall extend across the full width of the walking surface of the sidewalk or ramp, and shall be 2 feet long in the direction of pedestrian travel. Detectable warning materials shall be installed in accordance with manufacturer's recommendations.

1510 EXPOSED AGGREGATE CONCRETE. Place as specified in Section 2000 *Concrete* and as follows:

After the mixture has been properly struck off, to the line and grade as shown on the plans or as directed by the Engineer, the surface shall be lightly finished as not to force the coarse aggregate too deep into the mix. As soon as the bleed water has dissipated apply a uniform coating of an approved surface retarder at the rate specified by the manufacturer. Once sufficient cure has been attained on the concrete the Contractor shall pressure wash and or broom surface exposing the coarse aggregate to the desired affect.

Once concrete surface has sufficiently dried so that surface water has completely disappeared, an approved clear sealant shall be applied in

accordance with the manufacturer's recommendations. Sealant shall be applied by rolling or by an approved sprayer and nozzle.

When the concrete has hardened enough so that excess raveling or spalling will not occur, and before random cracking occurs, the Contractor shall saw one-eighth (1/8) to one-fourth (1/4) inch wide relief joints to a depth equal to one-third the pavement thickness plus one-fourth inch (D/3 + ¼"). The contractor has the option to add an additional cut ¼" to 3/8" by ¼" to 3/8" to assist with hot type joint sealant. Joints shall be located as shown on the plans or as directed by the Engineer. For raised islands care should be taken to joint the exposed aggregate concrete to match the curb and gutter joints. Joints shall be sealed with a gray or beige silicone or polyurethane caulk approved by the Engineer.

1511 PROTECTION. The Contractor shall, at his own expense, protect the concrete work against damage or defacement of any kind until it has been accepted by the city.

All vehicular traffic, including construction vehicles, shall be prohibited from using new concrete pavement for a period of seven (7) days unless approved otherwise by the Engineer.

Concrete work, which is not acceptable to the Engineer because of damage or defacement, shall be removed and replaced, or repaired to the satisfaction of the Engineer. Sections of cracked curb and gutter, sidewalk or driveways shall be replaced joint-to-joint. Cracks identified during inspection at the end of the warranty period may be sawed and sealed if approved by the Engineer.

SECTION 1600 - PAVEMENT MARKING

1601 SCOPE. This section covers the work necessary to furnish and install permanent or temporary pavement marking materials.

1602 GENERAL. The permanent pavement markings shall be installed immediately after the roadway surface is complete. The installation of the yellow markings (as required) is the first priority.

Contractor's personnel must be completely knowledgeable of all application requirements and procedures prior to product application. It is the responsibility of the Contractor to contact the supplier of the cold plastic material if questions regarding application procedures or conditions arise.

1603 GENERAL INSTALLATION AND REMOVAL. The proposed permanent markings shall be laid out by the Contractor in advance of the marking installation. Markings shall not be applied until the layout and conditions of the surface have been approved by the Engineer. If a paint line is used for layout purposes, in lieu of a chalk line or string line, the paint line shall not be wider than ½ inch in width. If wider, the paint shall be removed following the application of the final permanent marking. New markings shall match existing markings as applicable in areas abutting existing road surfaces. The surface shall be dry. All dust, debris, oil, grease, dirt, temporary markings and other foreign matter shall be removed from the road surface prior to the application of the permanent marking material.

The Contractor shall be responsible for keeping traffic off freshly applied markings until they have set sufficiently to bear traffic. Traffic control is the responsibility of the contractor and shall conform to the Manual on Uniform Traffic Control Devices (MUTCD). Failure to comply with traffic control guidelines will result in the Pavement Marking Contractor being directed to stop operations and leave the site until proper and approved traffic control has arrived and put in place on site.

Removal: Temporary pavement markings on milled surfaces scheduled to be overlaid do not have to be removed prior to performing the overlay. Permanent pavement markings installed on new asphalt surfaces shall be removed without structurally damaging the pavement or scarring the surface. The method of pavement marking tape removal shall be by high-pressure water blast, low-pressure water and sand blast, steel shot blast, or burning. Grinding or black paint covering shall not be allowed on new pavement surfaces.

1604 PREFORMED THERMOPLASTIC PAVEMENT MARKING

A. Materials: This specification is for the furnishing of retroreflective preformed thermoplastic pavement marking materials that can be adhered to asphalt pavements by means of heat fusion. The applied markings shall be very durable, oil and grease impervious and provide immediate and continuing retroreflectivity.

1. Characteristics
   The preformed marking material shall consist of a resilient white and yellow polymer thermoplastic with uniformly distributed glass beads throughout its entire cross section.

   Preformed words and symbols shall conform to the applicable shapes and sizes as prescribed in the latest revision of the MUTCD.

   The preformed markings shall be fusible to asphalt pavements by means of the normal heat of a propane type of torch. Adhesives, primers or sealers shall not be used prior to the preformed marking application on asphalt pavements.

   The preformed markings shall conform to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures. The markings shall have resealing characteristics and be capable of fusing to itself and previously applied worn hydrocarbon and/or alkyd thermoplastic pavement markings.

   The preformed markings shall be capable of application on new, dense and open graded asphalt wearing courses during the paving operation in accordance with the manufacturer's instructions. After application, the markings shall be immediately ready for traffic. The preformed markings shall be suitable for use for one year after the date of receipt when stored in accordance with the manufacturer's recommendations.

   The preformed thermoplastic markings shall not be brittle and must be sufficiently cohesive and flexible at temperatures exceeding 50 degrees F for one person to carry without the danger of fracturing the material prior to application.

2. Composition: The retro-reflective pliant polymer thermoplastic pavement markings shall consist of a homogeneous mixture of high quality polymeric thermoplastic binders, pigments, fillers, and glass beads. The thermoplastic material must conform to AASHTO designation M 249 with the exception of the relevant differences due to the material being supplied in a preformed state.

3. Glass Beads: The markings shall contain thirty (30%) percent glass spheres, which shall conform to AASHTO M 247 Type 1, except that glass spheres shall have a minimum of seventy (70%) percent true spheres on each sieve and eighty (80%) percent true spheres overall. The glass beads must be homogeneously blended throughout the material with a securely bonded protruding exposed layer of beads that provide immediate and continuous retro-reflectivity. Curved arrows must be available without protruding glass beads if reversibility is needed.

4. Retro-reflectivity: The preformed marking shall upon application exhibit uniform adequate nighttime retro-reflectivity. At 86 degree thirty (30') feet incidence angle and 1 degree thirty (30') feet divergence angle, the markings shall have average minimum intensities of 350 millicandelas for white and 175 mill candelas for yellow as measured with a Mirolux retroreflectometer. Using a Taber Abraser with an H–18 wheel and a 4.4 ounce (125 g) load, the sample shall be inspected at 200 cycles, under a microscope, to observe the extent and type of bead failure. No more that fifteen (15%) percent of the beads shall be lost due to popout and the predominant mode of failure shall be "wear down" of the beads.

5. Color Characteristics: The thermoplastic material without glass beads shall meet the following:

   White: Daylight reflectance at 45-degree/0 degree of 80% minimum
   Yellow: Daylight reflectance at 45-degree/0 degree of 45% minimum

   The daylight reflectance shall not change significantly when the preformed thermoplastic is properly applied to the roadway surface.

   For highway use, the white markings shall contain a minimum of 8% by weight of titanium dioxide pigment to ensure a color similar to Federal Highway White, color No. 17886 Standard 595. Yellow color shall reasonably match color chip Number 13538 of Federal Standard number 595 and be lead free.

6. Skid Resistance: The surface of the preformed thermoplastic markings shall provide a minimum skid resistance value of 45 BPN when tested according to ASTM E303.

7. Thickness: The width of the supplied material shall have a minimum average thickness of 90 mils.

8. Flexibility**:** The preformed thermoplastic marking material shall have flexibility at 50 degrees F such that no cracking occurs in the test sample when a one (1”) inch by six (6”) inches sample is bent through an arc of 90 degrees at a uniform rate in 10 seconds (9 seconds per degree) over a one inch mandrel. The sample must be conditioned prior to testing at 50 + 2 degrees F for a minimum of four (4) hours. At least two specimens tested must meet the flexibility requirements at 50 degrees F for a passing result.

9. Environmental Resistance**:** The applied markings shall be resistant to deterioration due to exposure to sunlight, water, oil, diesel fuels, gasoline, pavement oil content, salt and adverse weather conditions.

10. Effective Performance Life**:** When properly applied, in accordance with the manufacturer’s instructions, the pavement markings shall be neat and durable. The markings shall remain retroreflective and show no fading, lifting, shrinkage, tearing, roll back or other signs of poor adhesion.

B. Installation: The markings shall be applied in accordance with the manufacturer’s recommendations on clean and dry surfaces.

1. Asphalt: The materials shall be applied using the propane torch method recommended by the manufacturer.

a. At temperatures below 50 degrees F, the preformed thermoplastic pavement markings shall be kept as warm as possible to maintain flexibility.

b. Remove pavement surface moisture by holding a propane torch approximately six (6”) inches above the section of asphalt using a continuous circular motion.

c. Heat the pavement with the torch upon placing the material to a temperature of 200 degrees F for 90 mil,and up to 300 degrees F for 125 mil materials.

d. Immediately after the road surface has been properly preheated, position the material with exposed bead side up and heat.

e. Position the torch approximately 12 inches over the marking so the flame is extended and heat is evenly applied moving the torch in a circular motion across the marking. When the correct temperature of the marking has been reached, it will turn slightly

darker or pale yellow if the material is white. Over heated or burned material shall be removed.

f. After the entire material section has been heated and bonded to the pavement, re–heat the perimeter of the marking and the road surface to bond the edges.
g. If installing reversible arrows, which do not contain a top coating of glass beads, the glass spheres shall be hand applied on the molten material.

h. Feather the leading edge of the pavement marking with a putty knife or bevel with the torch. Leading edges are any edge that would be susceptible to snow plow blades approaching from the direction of normal travel.

2. Concrete: Entirely remove curing compound from new concrete surfaces prior to applying marking material using a method approved by the Engineer. The same application procedure shall be used as described for asphalt pavements. However, a compatible primer sealer may be applied before application to assure proper adhesion

1605 COLD PLASTIC PAVEMENT MARKINGS

A. Materials: This specification covers a white and yellow pre–formed cold plastic reflectorized pavement marking material of a type that is applied to a road surface by an inlaid, pre–coated pressure sensitive adhesive that produces an adherent reflectorized stripe of specified thickness and width and is capable of resisting deformation.

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1. Characteristics: The material shall be manufactured without the use of lead-chromate pigments or other similar lead-containing chemicals.

Glass beads shall be incorporated to provide immediate and continuing retroreflection. Ceramic skid particles shall be bonded to the top layer to provide a skid-resistant surface.

Preformed word and symbol markings shall conform to the applicable shapes and sizes as outlined in the Manual on Uniform Traffic Control Devices.

The preformed markings shall be capable of being adhered to pavements by an inlaid, pre–coated pressure sensitive adhesive. A surface preparation adhesive may be used to precondition the inlay pavement surface.

The preformed marking film shall mold itself to pavement contours by the action of traffic. Following proper inlay application and tamping, the markings shall be immediately ready for traffic.

2. Composition: The retroreflective pavement marking film shall consist of a mixture of high–quality polymeric materials, pigments and glass beads distributed throughout its base cross–sectional area. A reflective layer of glass beads and a layer of skid–resistant ceramic particles shall be bonded to the top urethane-wearing surface. The urethane wear surface shall have a nominal thickness of five one thousands of (0.005") inches. The film shall have a pre–coated, shear–resistant, pressure sensitive adhesive.

3. Color: The daytime color the white film shall provide a minimum initial luminance factor, Y, of 80 and shall conform to the following chromaticity requirements. The daytime color of the yellow film shall provide an initial luminance factor, Y, in a range of 36 to 59 and shall conform to the following chromaticity requirements.

White		Yellow	
X Values	Y Values	X Values	Y Values
0.290	0.315	0.474	0.455
0.310	0.295	0.491	0.435
0.330	0.360	0.512	0.486
0.350	0.340	0.536	0.463

Measurements shall be made in accordance with ASTM #1349, using illuminant "C" and 0/45 (45/0) geometry. Calculations shall be in accordance with ASTM E308 for the 2-degree observer.

4. Reflectance: The white and yellow films shall have the following initial minimum reflectance values as measured in accordance with the testing procedures of ASTM D4061. The photometric quantity to be measured shall be coefficient of retroreflected luminance (R_L) and shall be expressed as millicandelas per square foot per foot-candle (mcd-ft^{-2}-fc^{-1}).

	White			Yellow		
Entrance Angle	86.0°	86.0°	86.5°	86.0°	86.0°	86.5°
Observation Angle	0.2°	0.5°	1.0°	0.2°	0.5°	1.0°
Retroreflected Luminance, R_L	700	500	400	410	250	175

5. Skid Resistance: The surface of the retroreflective films shall provide an initial minimum skid resistance value of 55 BPN as measured by the British Portable Skid Tester in accordance with ASTM E303.

   The surface of the retreoreflective film shall retain an average skid resistance value of 45 BPN when tested in accordance with ASTM E303, for a period of one year when installed in non-snow removal areas. The 45 BPN minimum value shall be an average of several readings taken in both the wheel track and the non-wheel track areas.

6. Tensile Strength and Elongation: The film shall have a minimum tensile strength of 150 lbs. per square inch of cross-section when measured in the direction of the length of the roll and tested in accordance to ASTM D638, except that a sample 6 inch x 1 inch shall be tested at a temperature between 70 degrees F and 80 degrees F using a jaw speed of 10 to 12 inches per minute. The sample shall have a maximum elongation of 50% at break when tested by this method.

7. Reflectivity Retention: The glass beads must be strongly bonded and not be easily removed by traffic wear. Using a Taber Abraser with an H-18 wheel and a 4.4 ounce load, the sample shall be inspected at 200 cycles, under a microscope, to observe the extent and type of bead failure. No more than 15% of the beads shall be lost due to popout and the predominant mode of failure shall be "wear down" of the beads.

8. Glass Beads: The size, quality and refractive index of the glass beads shall be such that the performance requirements for the markings shall be met. The bead adhesion shall be such that beads are not easily removed when the material surface is scratched.

   The film shall have glass bead retention qualities such that when a 2-inch x 6-inch sample is bent over a ½-inch diameter mandrel, with a 2-inch dimension perpendicular to the mandrel axis, microscopic examination of the area on the mandrel shall show no more than 10% of the beads with entrapment by the binder of less than 40%.

9. Thickness**:** The film, without adhesive, shall have a minimum thickness of 60 mils.

B. Installation: The Contractor shall furnish and install white and yellow permanent retro-reflectorized cold preformed plastic pavement marking

material at the location shown on the plans, in conformance with the details and material specifications included herein.

The cold plastic markings shall consist of a homogeneous, extruded, prefabricated material of specified thickness and width which shall contain reflective glass spheres uniformly distributed through–out the cross–section, and shall be applied to pavement surfaces by means of an approved inlaid process with pre–coated adhesive and pressure.

1. Procedure**:** Apply the tape according to manufacturer's instruction in conjunction with an approved method. Cold plastic pavement markings shall be installed as soon as practical.

2. Road conditions**:** Clean the surface of the road using a broom and/or high–pressure air blower. If either of these methods fails to clean the road surface, then high–pressure water wash shall be used. Road surface must be dry and all dust, dirt, debris, oil, grease and foreign material removed before applying tape.

3. Application Conditions: Road surfaces must be clean and dry, and temperatures must be above the minimum required for application of all tapes. If rainfall occurs within 24 hours prior to application, a surface moisture test (plastic wrap or roofing paper method as approved by the inspector) may be performed and approval obtained from the inspector.

    a. Air temperature 60 degrees F and rising.
    b. Surface temperature 70 degrees and rising.
    c. Overnight air temperature 40 degrees F (minimum) the night before tape application.
    d. Butt splices must be used. Do not overlap tape ends.

4. Tape Application:
    a. Cold plastic shall be inlaid into hot asphalt and rolled in to asphalt surfaces.
    b. Groove the pavement surface on concrete pavements prior to installation. Grooving shall be performed using a cutting head with diamond-tipped cutting blades. The groove width shall be equal to the tape width plus a maximum of two (2) inches. The depth of the groove shall be the tape thickness plus 10 mils. The bottom of the groove should have a smooth, flat surface. If a coarse tooth pattern is present, increase the number of blades and decrease the thickness of the spacers between the blades on the cutting head. Water-cool the blades as necessary on long lines. If water–cooling is used, flush the groove immediately after grooving to clean the surface.

c. If there is a crack in the pavement, or if the tape is to be applied over a bridge expansion joint, manhole or utility box, lay the tape over the crack, joint or fitting, then cut the tape 1 inch away from the crack or joint on each side.
d. Apply the required surface preparation adhesive and allow to dry completely, but not over 30 minutes, before tape is applied.
e. Traffic must be kept off of pavement surfaces coated with a surface preparation adhesive prior to tape application. Follow manufacturer's instructions regarding the use of surface preparation adhesive.

5. Tamping: Tamp the tape thoroughly with a tamping cart with a minimum 200 pound load, three times back and forth (six passes) over each part of the tape. Start in the center of the marking and work out to the edges removing any trapped air. Do not twist or turn the tamper on the tape. Make sure all edges are firmly adhered.

1606 TEMPORARY TAPE

A. Materials: This material shall be a pavement striping tape designed to provide reflective delineation under both dry and moderate rainfall conditions. It shall be white or yellow, and either Type I – Regular or Type II – Removable, as indicated on the drawings or specified in the Special Provisions.

The tape shall consist of glass spheres tightly embedded to a binder on a conformable backing precoated with a pressure sensitive adhesive. The striping material shall be thin, flexible, formable and following application shall remain conformed to the texture of the pavement surface. The tape shall be furnished in the color and type designated on the Plans or in the contract. The markings shall be capable of being adhered to asphalt concrete or Portland cement concrete in accordance with manufacturer's instructions without the use of heat, solvents or other additional adhesive means, and shall be immediately ready for traffic after application. The adhesive shall not require a liner or release paper. The striping material shall have a uniform appearance, free from cracks and the edges shall be true, straight and unbroken. The material shall be weather resistant and show no appreciable fading, lifting or shrinkage when applied in accordance with the manufacturer's recommendations.

1. Color and Daylight Reflectance: The daylight reflectance (ASTM E1347) of white shall be not less than 70%. The color of yellow shall be within the red and green tolerance limits of the Highway Yellow Color Tolerance Chart issued by the U.S. Department of Transportation.

2. Dimensions: The width and length shall be as shown on the Plans or in the contract. The material shall be available in rolls and there shall be no more than three splices per 50 yards of length.

3. Packaging: The material shall be packaged in accordance with accepted commercial standards and, when stored under normal conditions, shall be suitable for use for a period of at least one year after purchase.

4. Adhesion: The material shall adhere to asphalt and concrete surfaces when applied according to manufacturer's recommendations at surface temperatures above 50 degrees F and shall be immediately ready for traffic following application.

5. Removability: Type II tape shall be removable from asphalt and Portland cement concrete intact or in large pieces, either manually or with a roll-up devise, at temperatures above 40 degrees F without use of heat, solvent, grinding or blasting.

6. Reflection: The white and yellow material shall be retroreflective, reflecting white or yellow respectively and shall be readily visible at night when viewed with automobile headlamps using high beams from a distance of at least 300 feet.

7. Durability: Type II material shall maintain adhesion, show no alligatoring, show no signs of pulling apart, and shall suffer no more than a 25% loss of beads, sand and grit when subjected to 30,000 revolutions on a small-wheel circular track as described in ASTM E660, with the following variations or exception:

    a. Two opposite wheels mounted with Goodyear 3.40-5 NHS Industrial Rib tires shall be used with a total load of 51.5 lbs. on each tire. Tire air pressure shall be maintained at 25 lbs. The wheels shall be mounted perpendicular to the specimens and toed out 2° to produce a slight abrading action.

    b. Specimens shall be applied to 6-inch diameter dense-graded bituminous concrete surface which has been compacted at 3000 psi for two minutes. After application, the specimens shall be allowed to cure at least 16 hours before beginning the test.

B. Installation: Temporary pavement markings shall be installed the same day that the existing pavement markings are damaged, removed or covered up prior to lane opening. Temporary pavement markings shall be installed using the same cycle length as the permanent markings

and be at least 2 feet long. Double yellow marking shall be used for temporary centerline and single white markings shall be used for temporary lane lines on four lane roadways. Single yellow markings shall be used for temporary centerline on two lane roadways as directed by the Engineer. Contractor shall maintain temporary markings in good condition until overlying pavement or permanent markings are installed, or project completion if required.

SECTION 1800- PAVEMENT MAINTENANCE

1801 CRACK REPAIR

A. Materials.

1. Material for sealing cracks up to one inch in width shall be Deery Super Stretch Hot applied DF sealant or Crafco, Inc. Superflex.

2. Material for filling cracks greater than one inch and up to two inches in width shall be Crafco PolyPatch Fine Mix – Type 2.

3. For cracks greater than two inches in width material shall be Crafco PolyPatch Type 2.

4. Glensoil 20 Plus or Crafco DETACK shall be used to remove surface tackiness of the sealant.

5. Alternative materials may be acceptable if submitted prior to the bid and approved by the Engineer.

B. Installation.

1. All cracks up to one inch in width are to be sealed including transverse, longitudinal, block, reflective cracks and the longitudinal joints/crack between the edge of pavement and toe of the gutter. Wider cracks shall be filled if specified in the Project Special Provisions or indicated on the plans. Where alligator cracking is found, the Engineer will determine if sealing is to be completed.

2. Cracks shall be cleaned to a minimum depth of 2 inches with an air compressor followed by the use of a hot air lance or other approved equipment immediately ahead of the sealant placement. Contractor shall control dust from cleaning and remove blown debris from adjacent properties.

3. Sealant shall be placed in the clean, dry crack using the methods and equipment recommended by the sealant manufacturer. The crack shall be slightly overfilled and immediately squeegeed to provide a band-aid type effect approximately two (2) inches wide, flush with the pavement surface, and with the edges feathered out.

4. Hot asphalt sealer shall be continuously, mechanically agitated during heating so that localized heating does not occur. Crack sealer shall not be placed when the air temperature in the shade is

less than forty (40) degrees F. No sealant shall be installed when the air temperature exceeds 90 degrees F.

5. Apply a de-tack product on freshly installed sealant in accordance with manufacturer's instructions to prevent tracking of material by traffic.

6. Contractor shall cleanup all excess material from the pavement or other adjacent surfaces.

1802 PAVEMENT PATCHING

A. General: Areas where base failure of the roadway has occurred, or where the surface is broken out, shall be repaired prior to surfacing operations. The failed sections will be marked by the Engineer.

B. Materials.
1. Hot-mix asphaltic patching material shall conform to the requirements of Section 1300 – *Asphaltic Concrete Pavement*.

2. Concrete patch mixes shall conform to the requirements of Section 2000 – *Concrete.*

C. Removal.
1. For surface and full-depth patches, the failed material shall be removed by sawing and/or milling a neat rectangular section into the pavement creating clean vertical sidewalls.

2. Over-excavate areas where unsuitable subgrade material is encountered then backfill and compact to bottom of pavement with approved material.

3. Do not remove more area than can be fully patched or plated and reopened to traffic by the end of the work day. Do not leave excavated areas in roadways that are open to traffic unless approved by the Engineer.

4. All failed asphalt material shall be removed without damage to the adjacent pavement. When existing pavement designated to remain is damaged during the patching process, the pavement shall be repaired by the Contractor at Contractor's expense.

D. Repair: Patching shall conform to standard city details and as follows.

1. Prior to placing patch material, all loose material and debris shall be removed.

2. For asphalt patching, all surfaces shall be properly tacked.

3. Asphaltic material shall be placed in layers not to exceed 3 inches and thoroughly compacted before the next layer is placed.

4. The vertical sidewalls of the patch shall be well bonded with the existing pavement and the surface shall be level with the existing pavement.

5. For concrete patching, see Section 1400 – *Concrete Pavement* for placing, finishing, curing, and protection of concrete. Small areas may also be temporarily plated with the approval of the Engineer.

1803 CHIP AND SEAL

A. General. Single asphalt surface treatment (chip and seal) shall be completed in accordance with KDOT Standards Section 609.

B. Materials. Cutback asphalt shall be RC-800 conforming to requirements of KDOT Section 1204. Cover material shall be type CM-K conforming to requirements of KDOT Section 1108.

C. Procedures. Conform to requirements of KDOT Standards. The Contractor shall include in the unit price the cost of cleaning or sweeping all streets to be sealed.

1804 MICRO-SURFACING AND SLURRY SEAL

A. General. The work shall consist of the application of micro-surfacing or slurry seal on existing paved surfaces. Each process shall consist of spreading a properly proportioned mixture of emulsified asphalt, mineral aggregate and water on a prepared surface in accordance with this specification and as directed by the Engineer. Micro-surfacing shall be a polymer modified asphalt emulsion.

1. Phasing Plan. A minimum of two weeks prior to beginning surfacing work, Contractor shall submit a phasing plan identifying specific lane closures and sequencing of streets and subdivisions. No work shall be performed until the phasing plan has been reviewed and accepted by the Engineer. Work shall not begin before 8:00 a.m. and must be completed and streets open to traffic by 6:00 p.m.

Changes to the phasing plan must be requested in writing a minimum of three (3) business days in advance of implementation.

2. Property Owner Notification. Contractor shall supply and place door tags on doors of all residences and/or businesses affected by micro-surfacing operations 48 hours prior to beginning work. Submit a sample door tag for approval at the pre-construction conference.

3. Maintenance of Traffic. All streets shall have one thru-lane open to traffic at all times. Cul-de-sacs may be completely closed until the material has cured adequately to allow traffic. The Contractor shall provide adequate advance signing, barricades, and/or flaggers to control traffic around and through the construction area. Directions for allowable travel paths shall be clearly indicated. Adequate trained personnel shall be available on-site to oversee traffic control. Any damage done by traffic to the surfacing shall be repaired by the Contractor at the Contractor's expense.

B. Materials.

1. Emulsified Asphalt.
   a. For micro-surfacing, the emulsified asphalt shall be a quick polymer modified cationic type CSS-1H emulsion and shall conform to the requirements specified in ASTM D2397. The cement mixing test shall be waived for this emulsion. The polymer materials shall be milled or blended into the asphalt or emulsifier solution prior to the emulsification process.

      The emulsified asphalt shall have not less than 62% residue after distillation when tested in accordance with ASTM D244 at a temperature below 280º F. Emulsified asphalt shall have a penetration of between 40 and 90 when tested in accordance with ASTM D2397 at 77º F and shall have a minimum softening point of 135º F when tested in accordance with ASTM D36. Contractor shall submit to Engineer a certificate of analysis/compliance matching the material used in the mix design for each load of emulsified asphalt delivered to the project.

   b. For slurry seal, emulsified asphalt shall be either Grade SS-1h conforming to ASTM D977, or CSS-1h conforming to ASTM D2397.

2. Aggregate. The aggregate shall be natural or manufactured crushed granite, slag or chat which is a by-product from the milling

of lead and zinc ores and shall conform to one of the following gradations for the specific surfacing method. The percent passing shall not go from the high end to the low end of the range for any two consecutive screens. Unless otherwise specified in the Project Special Provisions, aggregate shall be Type II for micro-surfacing and Type I for slurry seal.

	Amount Passing Sieves, % by Weight		
Sieve Size	Type I – For Slurry Seal	Type II – For Microsurfacing	Tolerance
3/8 inch	100	100	
No. 4	100	90-100	±5%
No. 8	90-100	65-90	±5%
No. 16	65-90	45-70	±5%
No. 30	40-65	30-50	±5%
No. 50	25-42	18-30	±4%
No. 100	15-30	10-21	±3%
No. 200	10-20	5-15	±2%

a. Aggregate quality shall meet the following requirements.

Quality	Required	Test No.
Sand Equivalent	65 min.	ASTM D2419
Soundness	15% max. w/NA_2SO_4 or 15% max. w/ $MgSO_4$	ASTM C88
Abrasion Resistance	30% max.	ASTM C131

b. Engineer may obtain samples for gradation testing from aggregate stockpiles designated by the Contractor for use. Samples for asphalt content may be taken from the completed mix. The frequency of sampling and testing will be established by the Engineer. Precautions shall be taken to insure that stockpiles do not become contaminated. The mineral aggregate shall be screened to remove any over-sized aggregate or foreign material at the Contractor's stockpile.

3. Mineral Filler. Mineral filler shall be any recognized brand of non-air/entrained Portland cement that is free from lumps and accepted upon visual inspection.

4. Water. Water shall be potable and shall be free from harmful soluble salts or contaminants.

5. Latex or Polymer Modifier. For micro-surfacing, natural rubber or polymer, certified from an approved source, shall be milled or blended into the asphalt or emulsifier solution prior to the emulsification process.

6. Other Additives. Additives may be added to the emulsion mixture or any of the component materials for micro-surfacing to provide the specified properties. Additives must be included as part of the mix design and be compatible with the other components of the mix.

C. Mix Design. The Engineer shall approve the mix design and all materials prior to use. The component materials shall be within the following limits. The mix design shall be made with the same materials the Contractor will be using on the project.

1. Micro-surfacing

Mineral Aggregate	10.0-20.0 lbs. per sq. yd. minimum weight of dry aggregate
Residual Asphalt	5.5% to 10.5% by dry weight of aggregate
Mineral Filler	0.0 to 3.0% by dry weight of aggregate
Latex or Polymer Based Modifier	Minimum of 3.0% solids based on asphalt weight
Water	As required to provide proper consistency
Additives	As needed

2. Slurry Seal

Mineral Aggregate	8.0 - 12.0 lbs. per sq. yd. minimum weight of dry aggregate
Residual Asphalt	10.0% to 16.0% by weight of dry aggregate
Mineral Filler	1.5% to 3.0% by weight of dry aggregate
Water	As required to provide proper consistency

D. Construction.

1. Weather Limitations. The material shall be spread only when either the ambient air temperature or the pavement temperature is at least fifty (50°) degrees F and rising, the weather is not foggy or rainy, and there is no forecast of temperatures below thirty-two (32°)

degrees F within twenty four (24) hours from the time of placement of the mixture.

2. Surface Preparation. The area to be sealed shall be thoroughly cleaned of all debris, trash, vegetation, loose aggregate and soil. Sweep pavement just prior to surfacing. Water used in pre-wetting the surface shall be applied at a rate to dampen the entire surface without any free flowing water ahead of the spreader box.

3. Equipment.
Each mixing unit used on the project shall be calibrated prior to construction. Contractor shall submit calibration documentation indicating individual calibration for each material at various settings, which can be related to the machine metering devices. No mixing machine will be allowed on the project until a calibration has been completed. Final calibration sheets shall be submitted to the Engineer.

Individual volume or weight controls for proportioning each material to be added to the mix shall be provided and properly marked.

Appropriate hand tools, which will provide the required results, shall be used to spread the mixture where machine spreading is not possible.

Power brooms, pickup sweepers, power blowers, air compressors and hand brooms may be used to provide a clean surface; however, care must be taken with power equipment to minimize dust and minimize debris blown onto adjacent properties. All debris from cleaning the surface must be removed from the project site.

a. Micro-surfacing. The mixing machine shall be specifically designed and manufactured to lay micro-surfacing. The machine shall be a self-propelled, continuous flow mixing unit able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, additives and water to a revolving multi-blade double shafted mixer and discharge the mixed product on a continuous flow basis. The machine shall have sufficient storage capacity for aggregate, emulsified asphalt, mineral filler, additives and water to maintain adequate supply to the proportioning controls.

Spreading equipment shall include a surfacing box with twin-shafted paddles or spiral augers fixed in the spreading box. A flexible front seal shall be provided to insure no loss of mixture at the road surface contact point. The rear flexible seal shall act

as a final strike-off and shall be adjustable in width. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off box. The box shall have suitable means provided to side-shift the box to compensate for variations in pavement geometry. A secondary strike-off shall be provided to improve the surface texture. It shall have the same leveling adjustments as the spreader box.

b. Slurry Seal. The mixing machine shall be a continuous flow mixing unit and shall be capable of accurately delivering a predetermined proportion of aggregate, water and asphalt emulsion to the mixing chamber and to discharge the thoroughly mixed product on a continuous basis. The equipment shall be capable of pre-wetting the aggregate immediately prior to mixing with the emulsion. The mixing unit of the mixing chamber shall be capable of thoroughly mixing all components together without violent mixing. The mixing machine shall be equipped with an approved fines feeder that includes an accurate metering device or method to introduce a predetermined proportion of mineral filler into the mixer. The mineral filler shall be fed at the same time and location as the aggregate. The fines feeder shall be required whenever added mineral aggregate is a part of the aggregate blend. The mixing machine shall be equipped with a water pressure system and fog-type spray bar, adequate for completing fogging of the surface receiving slurry treatment.

   Attached to the mixer shall be a mechanical-type squeegee distributor, equipped with flexible material in contact with the surface of the pavement to prevent loss of slurry from the distributor. It shall be maintained so as to prevent loss of slurry on varying grades and crown by adjustments to insure uniform spread. There shall be a steering device and a flexible strike-off. The spreader box shall have an adjustable width. The box shall be kept clean and build-up of asphalt and aggregate on the box or in the corners shall not be permitted. Use of burlap drags or other drags shall be approved by the Engineer.

   Slurry seal mixing machine may be either truck mounted or continuous run design and shall be able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, and water to a revolving mixer and to discharge the mixed product on a continuous flow basis.

The spreader box shall have suitable means provided to side shift the box to compensate for variations in the pavement geometry. A burlap drag or other approved screed may be attached to the rear of the spreader box to provide a uniform, highly textured mat.

4. Application.
   a. The aggregate shall be weighed before delivery to the job site. Emulsified asphalt shall be weighed or measured by volume. Individual volume or weight controls for proportioning each item to be added shall be provided. Each material control device shall be calibrated and properly marked as such. They shall be readily accessible for ready calibration and placed so that the Engineer may determine the amount of material used at all times.

   b. The mixture shall be spread to fill cracks and minor surface irregularities and leave a uniform skid resistant application of aggregate and asphalt on the surface.

   c. All longitudinal and transverse joints shall be uniform and neat in appearance.

   d. All excess material shall be removed immediately from the end of each run. All excess material that overruns in gutters shall be removed or squeegeed back onto the surface and burlap mopped as directed by the Engineer.

   e. All drag material shall be changed as required to prevent streaks or slick spots. No streaks or slick spots shall be left in the uncured pavement surfacing.

   f. When needed, all joints, radii, ends and returns will be squeegeed and burlap mopped as required to provide complete and uniform coverage.

   g. All discolored curbs and sidewalks shall be cleaned immediately before material sets up and all material tracked or lost past ends of job site shall be cleaned up before sealing crew leaves for next location. All removed material shall disposed of properly at an off-site location.

   h. The surface of all structures, monument boxes, manhole and valve covers, and other roadway appurtenances shall be protected to prevent them from being damaged, splattered or covered with asphalt material. If damage occurs, the Contractor

shall restore and/or replace the appurtenances at their expense. After the mixture has been placed at the above mentioned locations, it shall be tapered by a squeegee to improve ride quality.

i. Test Strip for Micro-surfacing. The contractor shall construct a test strip one lane in width, 500 feet in length, to be evaluated by the Engineer. When multiple machines are used, each machine shall be required to lay a test strip that will be compared to the other machines for variance in surface texture and appearance. Test strip will not be acceptable if any of the conditions listed under Final Acceptance exist.

j. A sufficient amount of surfacing material shall be carried in the spreader box at all times to obtain complete, uniform coverage. No lumping, balling, or unmixed aggregate shall be permitted. The mixture shall be free of excess water and emulsion, and free of segregation of the emulsion and aggregate fines from the coarser aggregate.

k. Application Rates. Daily reports on yields shall be submitted to the Engineer to confirm the rate at which material was placed.
   1) Micro-surfacing. The mixture shall be applied at a minimum rate of 10.0 lbs. per square yard.
   2) The mixture shall be applied at a minimum rate of 8 lbs. per square yard.

5. Curing. Adequate means shall be provided to protect the slurry seal or micro-surfacing from damage by traffic until the mixture has cured sufficiently so that it will not adhere to or be picked up by the tires of vehicles. Any damage done by traffic to the slurry seal or micro-surfacing shall be repaired by the Contractor.

E. Final Acceptance. After the micro-surfacing or slurry seal has been completely cured, the roadway surface shall provide a uniform surface texture. It shall be free of objectionable longitudinal lines, and shall be free of any objectionable transverse lines or grooves. The surface will not be considered acceptable if any of the following conditions exist.
   - More than 1 surface irregularity that is 1/4 –inch or wider and 10 feet or longer in any 100 foot section of surfacing;
   - More than 3 surface irregularities that are ½-inch or wider and more than 6 inches long in any 100 foot section of surfacing; or
   - Any surface irregularity that is I inch or wider and more than 4 inches long.

Joints will not be considered acceptable if any of the following conditions exist.

- Buildup of surfacing material at the joints;
- Uncovered areas at the joints;
- Longitudinal joints with more than ½-inch vertical space between the surface and a 4 foot straightedge placed perpendicular to the joint; or
- Transverse joints with more than ¼-inch vertical space between the surface and a 4 foot straightedge placed perpendicular to the joint.

If determined by the Engineer that the final surface or joints do not provide an acceptable riding surface, the Contractor shall be required to correct the unacceptable area(s) at the Contractor's expense.

. The Contractor is responsible for maintaining all streets sealed for thirty (30) days after application. This includes removing or adding cover material as required by the Engineer or authorized representative.

1805 COLD MILLING

A. Equipment. Milling the surface of pavements shall be completed by the use of a milling machine conforming to the following:

1. The cold milling machine shall be self-propelled and shall have in combination the means of milling and cutting (without softening the old surface) and blading the cuttings into a single windrow, or depositing them directly into a truck.

2. The machine shall be equipped with a dust suppression system including water storage tanks and high-pressure spray bars. Additional measures for dust suppression may be required by the Engineer.

3. It is desirable that the cutting width be greater than six (6) feet. In the event the cutting width is less than six (6) feet a system of electronic grade control for consecutive passes will be required.

4. The cutting drum shall be totally enclosed to prevent discharge of any loosened material on adjacent work areas.

5. In localized areas where use of the milling machine is not feasible, other equipment may be used as approved by the Engineer.

B. Construction.

1. Utilities and Monuments. Street surfaces adjacent to manholes, water valves, other utility facilities and monument boxes shall be completely removed to the full depth of cut specified for the street unless otherwise specified by the Engineer.

2. Milling Depth. Sufficient passes, shall be made such that all irregularities or high spots are eliminated, and that 100% of the surface is milled to a depth of two (2) inches over the entire street section unless specified otherwise. Removal of additional material below the 2-inch milling depth shall be accomplished by methods acceptable to the Engineer within 2 working days of the initial milling operation. Payment for the additional removal shall be as indicated in the bid form.

3. Milling Area. Mill only the area that can be patched and paved within the specified time limits at any one time. Contractor must plan work accordingly to include adequate number of mobilizations for milling operations in the bid price for milling.

3. Surface Conditions. The drum lacing patterns shall produce a smooth surface finish after milling, with groove depths not to exceed one fourth (1/4) inch and groove spacing not to exceed one (1) inch unless otherwise approved by the Engineer.

4. Cleanup. The material windrowed by the machine shall be removed immediately from the surface of the pavement and properly disposed of by the Contractor. All trash, loose material from milling operations, and other debris shall be removed from the street surface and curb and gutter by the end of each day. Any material and debris that adheres to the curb and gutter shall be removed. Additional dust suppression measures may be required by the Engineer to minimize impacts on adjacent properties.

6. Maintenance of Milled Surface. It shall be the responsibility of the Contractor to maintain the street once the pavement surface is milled. Such responsibilities include, but are not limited to, the timely filling of potholes, removing rebar, correcting damaged areas that pose a hazard to the traveling public, and maintenance of temporary pavement markings where required, as deemed necessary by the Engineer to prevent further pavement damage. The Contractor shall be responsible for repairing damaged areas prior to the overlay at Contractor's expense.

1806 OVERLAY

1. Materials. Asphaltic concrete, leveling course and tack oil for overlay shall conform to Section 1300 – *Asphaltic Concrete Pavement.* Overlay pavement shall conform to the requirements for surface course materials and installation.

2. Construction.
   a. Conform to requirements of Section 1300 of these specifications for equipment, placement, compaction and finishing of pavement.

   b. All manholes and valves shall be accessible to the owning utility through all phases of the work.

   c. The surface of all structures, monument boxes, manhole and valve covers, and other roadway appurtenances shall be protected to prevent them from being damaged, splattered or covered with asphalt material. If damage occurs, the Contractor shall restore and/or replace the appurtenances at their expense. Hot mix asphalt, or other method or material approved by the Engineer, shall be used for wedging adjacent to all appurtenances to provide an acceptable temporary riding surface.

   d. Temporary patches applied to maintain milled surface shall be removed and replaced with permanent patches in accordance with the plans and specifications prior to placing the overlay.

   e. All milled surfaces shall be overlaid within five (5) working days of completion of milling. Streets that require pavement patching shall be overlaid within ten (10) working days. If the Contractor fails to adhere to this stipulation, the Engineer will direct the Contractor to place a hot mix asphalt leveling course over the entire milled area at the Contractor's expense. As directed by the Engineer, any additional full depth patching required, because the placement of the asphalt overlay was not achieved in the required time period, will be completed by the Contractor at the Contractor's expense. Additional liquidated damages may apply for failure to meet these deadlines if specified in the Project Special Provisions.

1807 CONCRETE CURB AND GUTTER REPLACEMENT

1. Materials.
   a. Concrete materials for curb and gutter shall conform to requirements of Section 2000 – *Concrete* of these specifications.

   b. Topsoil behind curb shall be free of all debris, roots, vegetation, foreign material, concrete, rocks, stones, and clods.

2. Construction.
   a. Curb and gutter to be removed shall be neatly sawed to the full depth of existing pavement. Use appropriate equipment to minimize removal of adjacent pavement with the curb and gutter. When existing pavement designated to remain is damaged during the removal and replacement of the curb and gutter, the pavement shall be repaired by the Contractor at Contractor's expense.

   b. Contractor shall provide temporary surfacing at drives for access.

   c. New curb and gutter shall be installed per plans.

   d. The new curb and gutter shall be constructed within five (5) working days of the removal of the existing curb and gutter. Contractor shall not remove more curb and gutter than can be replaced within the five (5) working day limit. As directed by the Engineer, any additional damage that occurs to the existing pavement, because the placement of the curb and gutter was not achieved in the required time period, will be repaired by the Contractor at the Contractor's expense. Additional liquidated damages may apply for failure to meet these deadlines if specified in the Project Special Provisions.

   e. All curb and gutter shall be backfilled with topsoil between 4 and 10 working days after the new curb and gutter has been constructed. Topsoil may be clean on-site material stockpiled for the purpose but shall be tilled before seeding to remove clods, breakup roots, etc. The topsoil shall be placed to a minimum of 1 foot wide, up to a maximum of 15 feet wide, behind the curb in order to achieve positive drainage.

   f. All disturbed ground shall be seeded, fertilized, and mulched. Mulch must be punched into the topsoil. All seeded and mulched areas shall be watered at least once after mulch is secured.

   g. New curb and gutter shall NOT be paid for until backfilling is complete, the area has been cleaned and prepared for seeding, and all debris taken off site.

SECTION 2000 - CONCRETE

2001 SCOPE. This section covers all cast-in-place concrete, including reinforcing steel, forms, finishing, curing, and other appurtenant work.

2002 GENERAL. All cast-in-place concrete shall be accurately formed, and properly placed and finished as shown on the drawings and specified herein.

The Contractor shall inform the Engineer at least twenty four (24) hours in advance of the times and places at which the concrete is to be placed.

2003 MATERIALS.

Concrete Materials: All concrete materials shall conform to the specifications of the Kansas City Metropolitan Materials Board (KCMMB). Information is available on the website ***www.kcmmb.org***.

Liquid Curing Membrane: Type 2-White Pigmented compound, AASHTO Designation M148.

Polyethylene Sheeting Curing Material: White, opaque polyethylene sheeting/film with a 4 mil nominal thickness.

Curing Mats: New or used burlap composed of jute, manila hemp or kenaf. Used burlap shall have been previously used for curing concrete. Burlap fabricated from bags shall not be used.

Reinforcing Steel: ASTM A615; Grade 60.

Fibers: Provide graded fibers that are one hundred (100%) percent virgin polypropylene, fibrillated, rough textured, interconnected fibers containing no reprocessed olefin materials and specifically manufactured as concrete reinforcement. Material shall conform to ASTM C1116, Type III.

2004 CONCRETE MIX DESIGNATIONS.

A. Concrete mixes for pavement, curbs, and curb and gutter shall conform to the specifications of and be approved by the Kansas City Metropolitan Materials Board (KCMMB). Approved suppliers, approved aggregates, and approved mixes are available on the website ***www.kcmmb.org***.

B. All City projects shall use durable aggregates in all concrete mixes as specified in this section. However, exception is given to concrete mixes for residential driveways and residential sidewalks which may

use Class 1 coarse aggregates, as specified in the current edition of the KDOT Standard Specifications, if the concrete work is not funded by the City. Proportions for the mix shall meet the same criteria as specified for alternative mixes.

C. Exposed aggregate concrete shall conform to the following mix design.

Proportions

Materials	One Cubic Yard
Cement, Type I/II	395 lbs
Slag	169 lbs
Coarse Aggregate (smooth river rock)	1816 lbs
Fine Aggregate	1211 lbs
Water	248 lbs
Air Entraining Agent	3 +/- oz

Properties

Cementations Material, sack/yard	6.00
Water/Cement Material Ratio	.44
Fine Aggregate percent of total (by absolute volume)	40%
Unit weight pcf	32 +/- 1
Air Content	7 +/- 1
Slump	4 +/- 1
Compression Strength (not determined)	-------

D. All concrete delivery tickets shall include the plant name, design w/c ratio, batch weights per cubic yard, total batched weight of all materials for quantity delivered, time batched, design slump, water withheld (2 gal/yd maximum), allowable slump range, moisture correction for aggregates, and dosages of all approved admixtures.

E. Water may not be added to concrete after initial mixing except when it is withheld at the batch plant. Up to 2 gallons/cubic yard may be added at the project site to adjust the slump to meet the specifications. **Concrete slump shall not exceed 5" unless otherwise specified or approved by the Engineer.** The need for additional water must be determined as soon as the load arrives at the site. Water must be added to the entire load using a calibrated measuring device. Do not add more water than was withheld at the batch plant. After adding water, turn the drum or blades an additional 20 to 30 revolutions at mixing speed. The Engineer will observe the addition of water and will allow the procedure only once per load.

2005 PLACEMENT. The limits of each concrete pour shall be predetermined by the Contractor and shall be acceptable to the Engineer. All concrete within such limits shall be placed in one continuous operation.

Before concrete is placed, forms, reinforcements, and embedments shall be rigidly secured in proper position and all dirt, mud, water and debris shall be removed from the space to be occupied by the concrete. Bonding surfaces shall be cleaned of all foreign material and shall be free from laitance. Concrete shall not be placed on frozen subgrade or in excavations, which have not been dewatered.

Placement of concrete shall conform to requirements of ACI 304. Concrete shall be placed within forty-five (45) minutes of mixing operations, with the exception that the Engineer may extend the period to ninety (90) minutes (maximum) dependent upon weather conditions. Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement. Concrete shall not be placed in horizontal layers exceeding eighteen (18") inches and shall not be deposited in large quantities at any point in the forms and then run or worked along the forms, thus causing segregation of the materials. During and immediately after placement, concrete shall be thoroughly consolidated and worked around all reinforcements and embedments and into the corners of the forms. The concrete shall be vibrated or spaded to produce a solid mass without honeycomb or surface air bubbles.

Concrete shall not be dropped in the forms a distance of more than five (5') feet, unless confined by chutes or pipes; and care shall be taken to fill each part of the form by depositing the concrete as near final position as possible. After initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the ends of projecting reinforcement.

2006 COLD WEATHER CONCRETE. Unless authorized in writing by the Engineer, mixing and concreting operations shall be discontinued when the descending air temperature in the shade and away from artificial heat reaches thirty-five (35°) degrees F. Concrete operations may be resumed when the ascending air temperature in the shade and away from artificial heat reaches thirty-five (35°) degrees F.

When concrete work is authorized during cold weather, the concrete may be heated in accordance with ACI specifications. The temperature of the concrete shall be not less than sixty (60°) degrees F and not more than eighty (80°) degrees F at the time of placement in the forms.

No concrete shall be placed on frozen subgrade. Sudden cooling of concrete shall not be permitted. Concrete exposed to frost action or freezing weather shall be removed and replaced at the Contractor's expense.

A sufficient supply of approved blanketing material shall be provided and placed on all concrete placed between November 1 and April 1 and at other times when the ambient air temperature is expected to drop below forty (40°) degrees F. Blanketing materials shall protect the concrete and maintain a minimum temperature of forty (40°) degrees F in the concrete as measured on the surface. Concrete shall be covered for at least four days.

2007 HOT WEATHER CONCRETE. The provisions of this section shall apply to all concrete work, which is done when the air temperature is above eighty (80°) degrees F at the time of placement. The temperature of the concrete, when placed, shall not be high enough to cause excessive loss of slump, flash set or cold joints. Forms, reinforcing and sub-grade surfaces against which the concrete is to be placed shall be wetted down immediately before placement. In no case shall the temperature of the concrete, when placed, exceed ninety (90°) degrees F.

When the air temperature exceeds ninety (90°) degrees F and as soon as practicable without causing damage to the surface finish, all exposed concrete shall be kept continuously moist by means of fog sprays, wet burlap, cotton mats, or other means acceptable to the Engineer at no expense to the Owner. This cooling with water shall be in addition to the initial sealing by membrane curing compound.

No concrete shall be placed when the air temperature is above ninety-five (95º) degrees F.

2008 CURING AND PROTECTION. Concrete shall be cured by protection against loss of moisture, rapid temperature changes and mechanical injury for at least four days after placement. Acceptable methods shall be moist curing, white polyethylene sheeting, liquid membrane-forming compounds, or a combination thereof, unless specified otherwise. After concrete finishing operations have been completed, the entire surface of the newly placed concrete shall be covered by the curing medium. The Contractor shall have the necessary equipment for adequate curing on hand and be ready to install prior to concrete placement.

Moist curing shall be accomplished by a covering of burlap or other approved fabric mat used singly or in combination. Curing mats shall be thoroughly wet when applied and kept continuously wet and in intimate contact with the surface for the duration of the moist-curing period. Burlap or fabric mats shall be long enough to cover the entire surface of the work and lapped at joints to prevent drying between adjacent sheets.

White polyethylene sheets shall be large enough to cover the entire surface of the work and shall be lapped not less than eighteen (18”)

inches. The sheets shall be adequately weighted to prevent displacement or billowing due to wind. Tear holes appearing in the material during the curing period shall be immediately repaired or replaced with material in acceptable condition.

White membrane curing compound shall be applied after finishing operations have been completed and immediately after the free water has left the surface. The surface of the work shall be completely coated and sealed with a uniform layer of the curing compound at a rate of not less than one (1) gallon per one hundred fifty (150) square feet. The compound shall not be thinned and shall be kept agitated to prevent settlement of pigment. On surfaces where forms are removed prior to the end of the specified curing period, the entire exposed surface shall be coated at the specified rate of coverage. If rain falls on the newly coated surface before the film dries sufficiently to resist damage, or if the film is damaged in any other way, the Contractor will be required to apply a new coat of compound to the affected area.

2009 FORMS. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions shown on the drawings. They shall be sufficiently tight to prevent leakage of mortar and shall be braced or tied to maintain the desired position, shape, and alignment during and after concrete placement.

Forms may be of wood or non-aluminum metal and plastic shall be designed to permit easy removal without injury to the concrete. Forms for all exterior exposed surfaces which will be visible after backfilling shall be prefabricated plywood panel forms, job-built plywood forms, or forms that are lined with plywood or fiberboard. Forms shall be coated with an approved light oil to prevent concrete from adhering and shall be thoroughly cleaned and re-oiled before re-use.

Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

2010 REPAIRING DEFECTIVE AND DAMAGED CONCRETE. Any concrete found not to be formed as indicated on the plans, out of alignment or level, having a defective surface, or damaged prior to acceptance of the project by the city, shall be considered as not conforming to the intent of these specifications and may be ordered removed and replaced by the Contractor at his expense unless the Engineer authorizes patching of the defective or damaged area.

Concrete repair work shall conform to the current edition of ACI standards and shall be performed in a manner that will not interfere with thorough

curing of surrounding concrete. Repair work shall be adequately cured and protected from further damage.

Surface defects such as ridges and bulges shall be removed by grinding.

Honeycombed and other defective concrete that does not affect the structural integrity of the structure shall be filled. The methods used in this type of repair shall be approved by the Engineer. Material used for patching shall be a nonshrink, non-metallic grout with a minimum twenty-eight (28) day compressive strength of five thousand (5,000) psi or a similar material approved by the Engineer. Prior to placement of the repair filling, the contact surface of the affected area shall be thoroughly cleaned of all loose and foreign material.

2011 REINFORCEMENT. The metal reinforcement shall be protected by the thickness of concrete indicated on the construction drawings or as specified. Protect all metal reinforcement from weather while stored on-site.

Reinforcing steel shall be accurately placed and positioned on supports, spacers, hangers, or other reinforcing steel according to the plans or as approved by the Engineer and shall be secured in place with wire ties or suitable clips.

Metal reinforcement at the time concrete is placed shall be free from rust, scale, or other contaminants that will destroy or reduce the bond.

2012 CONSTRUCTION JOINTS. Construction joints shall be made at locations indicated on the drawings, as specified, or as approved by the Engineer and shall conform to the requirements of ACI 318.

2013 ISOLATION AND CONTRACTION JOINTS. Isolation and contraction joints shall be of the type and at locations as specified, as indicated on the drawings or as required by the Engineer.

SECTION 6000 – STORM SEWERS

6001 SCOPE. This section covers storm sewer pipe embedment, pipe installation, and other appurtenant work.

6002 REFERENCES. Trenching, backfill and flowable fill shall conform to the requirements of Section 1100 - *Grading*.

6003 MATERIALS

A. Bedding. Granular bedding material shall meet the requirements for SB-2 or CA-5 aggregate as specified in Division 1100 of the KDOT specifications. Recycled concrete may be approved if material meets the required gradation and is free of debris.

B. Reinforced Concrete Pipe.

1. Reinforced concrete pipe shall conform to the following ASTM Standards and be of the minimum strength designated herein or such higher strength as may be required by the Contract Drawings or Special Provisions:

   a. Round Pipe: ASTM C 76, Class III, Wall B.
   b. Elliptical Pipe: ASTM C 507, Class HE-III.
   c. Arch Culvert Pipe: ASTM C 506, Class A-III.

2. Joints
   a. Flexible Gasket: Flexible gaskets may be either flat gaskets cemented to the pipe tongue or spigot, O-ring gaskets, or roll-on gaskets. All gaskets shall conform to ASTM C 443.
   b. Plastic Compound: This compound shall be a homogeneous blend of bituminous material, inert filler and suitable solvents or plasticizing compounds roughly mixed at the factory to a uniform consistency suitable for sealing joints of concrete pipe. The compound shall conform to the following requirements:

      Bitumen, soluble in CS,
      Percent by weight, minimum 45%
      Ash, percent by weight 15-50%
      Penetration, standard cone, 15Og, 5 seconds, 2 5” C
      Trowel grade, bulk type 11 O-250mm
      Extruded rope or flat tape type 50-120mm

      The above penetration ranges include test tolerances.

   c. Preformed Plastic Compound: This compound shall be either rope form or flat tape form conforming to ASTM C 990. Primer,

as recommended by the manufacturer, shall be used to maintain the material in position while pipe sections are being joined.

C. Corrugated Steel Pipe. Pipe and coupling bands shall conform to the requirements of ASTM A 760/A 760M. Bituminous and/or other coatings shall be provided when required by the Special Provisions. All helical pipe shall have circumferential re-corrugated ends with a minimum of 4 re-corrugations on each pipe. Bituminous coating, if specified, shall conform to AASHTO M-190. Minimum thickness of the metal after galvanizing shall be as follows:

Circular Pipe					
2-$^{2}/_{3}$" x ½" corrugations			3" x 1" or 5" x 1" corrugations		
Diameter (in.)	Minimum Thickness (in.)	Gauge	Diameter (in.)	Minimum Thickness (in.)	Gauge
12-21"	0.079	14	36-54"	0.079	14
24-30"	0.079	14	60-84"	0.109	12
36-54"	0.109	12			
60-72"	0.138	10			
84"	0.168	8			

Arch Pipe 2-$^{2}/_{3}$" x ½" corrugations				
Equivalent Diameter (in.)	Minimum Thickness (in.)	Gauge	Span* (in.)	Rise* (in.)
15"	0.064	16	17"	13"
18"	0.064	16	21"	15"
21"	0.064	16	24"	18"
24"	0.079	14	28"	20"
30"	0.079	14	35"	24"
36"	0.109	121	42"	29"
42"	0.109	12	49"	33"
48"	0.109	12	57"	38"
54"	0.109	12	64"	43"
60"	0.138	10	71"	47"
* Subject to manufacturing tolerances				

D. High Density Polyethylene (HDPE) Pipe

1. Polyethylene (PE) pipe is acceptable for use in public right-of way of residential streets and in drainage easements outside the public right-of-way. PE pipe is not acceptable for use in the public right-of way of collector and larger streets.

2. Changes in pipe material shall occur only at manhole structures.

3. High density polyethylene pipe shall conform to AASHTO M294, type S (non-perforated circular cross section with corrugated outer surface and a smooth inner surface) for pipe diameters of 15 inches to 60 inches, inclusive.

4. Joints may be either bell and spigot, gasketed joints or made with external coupling bands. Joint integrity shall conform to the performance requirements of AASHTO M294.

5. Fittings and coupling bands shall be fabricated from the same material as the pipe and conform to AASHTO M294.

6. Coupling bands shall cover at least two full corrugations on each section of pipe and shall prevent the infiltration of soil into the pipe.

6004 INSTALLATION

A. Trenching. Excavation, grading, trenching, backfilling, compaction and density testing shall conform to requirements of Section 1100 of these Specifications.

B. Handling. All pipe and appurtenances shall be protected during installation from cracking, chipping, breaking, bending or other damage to pipe or coating materials. Damaged pipe materials shall be replaced with new materials unless otherwise approved by the Engineer.

C. Alignment And Grade. The alignment and grade or elevation of each pipe and appurtenant structure shall be maintained as shown on the drawings.

D. Laying. The laying of pipe in prepared trenches shall commence at the lowest point and continue upstream. Pipe shall be laid carefully centered to form a uniform flow line.

E. Pipe Bedding. Granular bedding material shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints.

Bedding shall be placed on each side of the pipe to the elevations indicated on the standard details. Bedding shall be compacted as necessary to provide firm uniform support for the pipe, and not subject the pipe to settlement or displacement.

F Reinforced Concrete Pipe. Core holes and handling holes in concrete pipe shall be repaired by cementing a properly-shaped concrete plug in place with epoxy cement or by other methods acceptable to the Engineer.

G Corrugated Steel Pipe. Before installing corrugated steel pipe, repair any damage to the metallic coating on the pipe. Clean the damaged area to bright metal by blast cleaning, power disk sanding or wire brushing. Apply zinc-rich paint over the cleaned area. Use zinc-rich paint to repair galvanized coatings.

H. HDPE Pipe. HDPE pipe shall be installed in accordance with ASTM Recommended Practice D2321. Trench and backfill specification for PE pipe shall be as follows:

a) No HDPE pipe shall be installed or backfilled without a City Engineering Inspector present. The inspector shall be notified of the installation schedule at least 48 hours prior to installation.

b) The minimum trench width = (1½ times the pipe diameter) + 12 inches.

c) The space between the pipe and the trench wall shall be wider that the compaction equipment used in the pipe zone.

d) The trench width in unsupported, unstable soils will depend on the size of the pipe, the stiffness of the backfill and in-situ soil, and the depth of cover.

e) Granular embedment shall be placed 6 inches minimum below the pipe and shall be shaped to fit the pipe to a depth of 0.25 time the pipe diameter. Where rock exist, the embedment shall be increased to 12 inches minimum below the pipe.

f) Where flowable mortar is required, granular backfill shall be placed to the spring line of the pipe. Where flowable mortar is not required, granular backfill shall be placed to a depth of 12" above the top of the pipe.

g) If the fill to the top of the subgrade is 3 feet or less, backfill with granular material to the top of the subgrade.

h) If the fill to the top of the subgrade is greater than 3 feet, backfill with granular material to a point 12 inches above the top of the pipe.

i) Granular embedment and backfill material shall comply with current City specifications.

j) The contractor shall not deform or damage the pipe during the placement of backfill.

k) The contractor shall be responsible to prevent floating the pipe during the backfilling operations. Do not deform or damage the pipe while compacting the granular backfill. Hand tamping may be necessary adjacent to the pipe to prevent distortion.

l) The maximum barrel deflection of all PE pipe (reduction of the barrel nominal base inside diameter) shall not exceed 5%. The contractor shall use a mandrel to measure the barrel deflection of the pipe. Take the measurement at least 30 days after the installation and backfilling. If oversized diameter pipes are installed, actual inside pipe diameters may need to be considered. The contractor shall remove, reinstall or replace any pipes deformed more than 5%.

I. Structure Connections. Pipes connected to structures shall be cut parallel with the inside face of the structure for plane walls and parallel with the spring line of the pipe for curved walls. Projection of the pipe beyond the inside face shall not exceed six (6) inches (measured at the spring line for curved walls).

J. Drainage Maintenance. Backfilling shall be performed so that water will not accumulate in unfilled or partially filled trenches. Surface drainage shall not be obstructed longer than necessary.

K. Protection Of Trench Backfill. Where trenches are constructed in ditches or other water courses, backfill shall be protected from surface erosion. Erosion control methods shall comply with the approved Stormwater Pollution Prevention Plan (SWP3) or as approved by the Engineer.

SECTION 7200 – SEEDING

7201 SCOPE. This section covers the furnishings of all labor, equipment, tools and materials, and the performance of all work for seeding, sodding and landscaping as designated on the contract drawings.

7202 GENERAL. The seeding work shall consist of furnishing and drilling in or sowing seed by an experienced seeding contractor having approved equipment manufactured expressly for the purpose, such as a seed drill with fertilizer attachment, mulch chopper and blower for the application of hay or straw mulch, mulch puncher or straight serrated disc for punching mulch into soil and a cultipacker that may be used for final compaction except as otherwise approved by the Engineer.

For public improvement projects seeding shall be required at all locations shown on the plans and for all grass covered areas that are disturbed by construction operations, either by grading, parking of equipment, temporary roads, or any other operation that has destroyed the existing grasses of the original site, and that is not designated on the drawings to be replaced with sod.

For all other types of construction, including that work done under a right-of-way permit, seeding shall be required where areas are disturbed by construction within the right-of-way in established yards or as directed by the Engineer.

7203 MATERIAL.
Seed shall be the kind and mixture specified herein. Seed shall be free of noxious weed seeds and shall not have more than one (1%) percent of weed seeds. Seed shall be delivered to the site in original containers, each fully labeled, bearing the name, or trademark and a warranty of the producer and a certificate of the percentage of the purity and germination of each kind of seed specified. The tags shall be made available to the Engineer for filing.

A. Temporary Seeding Establish fast-growing annual vegetation to provide erosion control for up to twelve (12) months and reduce the amount of sediment moving off the site. Annual plants, which sprout rapidly and survive for only one (1) growing season are suitable for establishing temporary vegetative cover. The Engineer may require mowing of temporary vegetation.

   This practice applies where short-lived vegetation can be established before final grading or in a season not suitable for permanent seeding.

Species*	Seeding Rate		Plant Characteristics
	lbs. per Acre	Lbs. per 1,000 ft.2	
Oats	80 lbs	2 lbs.	Not cold tolerant, height up to 2 feet
Cereals: Rye/Wheat	90 / 120	2.0 / 2.5	Cold tolerant, height up to 3 feet, low pH tolerant
Millets, Sudangrass	45 / 60	1.0 / 1.5	Warm season annual, aggressive growth, height up to 5 feet
Annual Ryegrass	75	2	May be added to mix, not heat tolerant, height up to 16 inches
Annual Lespedeza**Plus Tall Fescue	15 plus 45	0.5 plus 1.0	Warm season annual legume, makes own nitrogen, tolerates low pH

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B. Permanent. Permanent seeding shall match the existing grass type in established turf areas or as indicated or specified. In others areas seed shall be one of the following types. A mixture of seed types may be used if approved by the Engineer.

Seed Type	Planting Depth (inches)	Seeding Rate.	
		Lbs. PLS/ 1,000 SF	Lbs PLS/ Acre
Bermudagrass	1/8	1.5-3	20
Kentucky Bluegrass	1/8	2-3	50
Tall Fescue	1/8 – ¼	6-8	80
Perennial Rye	1/8 – ¼	6-8	80

Pure Live Seed (PLS) = Amount of Seed Guaranteed to Grow

Use the following equations to determine the amount of seed required.

$$\%PLS = \%Purity \times \%Germination$$

$$\text{Lbs. Bulk Seed Required} = \frac{\text{Lbs. PLS Recommended}}{\%PLS}$$

Nurse crops such as wheat (1 bushel/acre), annual rye (1 bushel/acre), or oats (1 ½ bushels/acres) shall also be used with all seeding mixtures. Small grain nurse crops should be planted about one (1) inch deep if planted separately and grasses and legumes one-half (1/2) inch deep. Nurse seed can be planted at shallower depths if mixed and planted with the permanent seed mix.

Native grass seed blends shall be used where indicated or specified. The seed mixture shall be as specified for the specific project and location.

C. Sod. Sod may be required, in lieu of seeding, if indicated on the plans. The sod shall be of the same type as removed or damaged and shall be of the best grade. If type is not indicated or unknown, sod shall be either Kentucky Blue Grass or tall fescue. The sod shall contain a growth of not more than ten (10%) percent of other grasses and clovers, shall be free from all prohibited and noxious weeds and shall be three-fourths (3/4") inch to one and one-fourth (1-1/4) inch thick. Sod shall be cut in strips not less than 18 inches wide and three (3) feet long.

D. Fertilizer. Commercial fertilizer for seeded areas shall consist of inorganic nitrogen only unless soil tests for the specific site indicate the need for other components.

It shall be uniform in composition, free flowing, and delivered to the site with certification showing weight, analysis, and name of manufacturer. It shall be stored until use in a weatherproof storage place in such a manner that it will be kept dry and its effectiveness will not be impaired.

E. Mulch. Mulch for application to seedbed areas shall include wheat straw, oat straw, smooth brome grass hay, Sudan grass hay or prairie hay. Mulch shall be free of prohibited and noxious weed seeds. Hydro mulching will be allowed at the Contractor's option.

7204 INSTALLATION

A. Time Of Seeding. Seeding and fertilizing shall be performed during periods shown in the following tables unless otherwise approved by the Engineer. Seeding and fertilizing shall not be done during periods of such severe drought, high winds, or excessive moisture, as determined by the Engineer, that satisfactory results are not likely to be obtained.

Temporary Seeding

Species	Acceptable Dates	Optimum Dates
Oats	Feb, May, Aug 1-15, Sep 16-30	Mar, Apr
Rye/Wheat	Jan thru May, Jul 16-Sep 15, Nov 1-15	Sep 16-Oct 31
Millet, Sudangrass	May 1-15, Jul 1-Aug 15	May 16-Jun 30
Annual Ryegrass	Jan, Feb, May, Jul 16-Aug 15, Sep 15-30	Mar, Apr, Aug 16-Sep 15
Annual Lespedeza plus Tall Fescue	Jan, Feb, May	Mar, Apr

Permanent Seeding

Species	Acceptable Dates	Optimum Dates
Bermudagrass	Jun, Jul	Apr 16-May 31
Kentucky Bluegrass, Tall Fescue, Perennial Rye	Feb 1 – Mar15, Apr 15-May 31, Aug 1-15, Sep 16-Oct 31	Mar 16-Apr 15 Aug 16-Sep 15

B. Application Of Fertilizer. Before tilling of the soil for seeded areas, the commercial fertilizer of the type specified shall be uniformly distributed over the entire site at the rate of 60 lbs./acre for quick release type or 90 lbs./acres for slow release type, and incorporated into the soil to a depth of at least two (2) inches by discing or harrowing methods or with a fertilizer drill. The fertilizer may be applied with the seeding operation only if a seed drill with a fertilizer attachment is used. Fertilizer may be broadcast in small areas not accessible to equipment.

The use of fertilizer shall not be allowed with native grass seed.

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C. Preparation Of The Seedbed. The area to be seeded shall be thoroughly tilled to a depth of at least three (3") inches by discing, harrowing or other approved methods until the soil is well pulverized. After completion of the tilling operation, the surface shall be cleared of all stones, stumps, or other objects larger than one and half (1-1/2) inches in thickness or diameter, and of roots, wire, grade stakes, and other objects that might be a hindrance to maintenance operations. Areas tilled shall then be brought to the desired line and grade and maintained until seeding and mulching is complete to ensure a smooth area with no gullies or depressions.

Any objectionable undulations or irregularities in the surface resulting from tillage or other operations shall be removed before planting operations are begun. Seedbed preparation shall be performed only during periods when satisfactory results are likely to be obtained. When results are not satisfactory because of drought, excessive moisture or other causes, the work shall be stopped until such conditions have been corrected to the satisfaction of the Engineer.

D. Placement Of Seed. Seeding may be accomplished by means of approved mechanical power-drawn drills followed by packer wheels, or by broadcast-type seeders or hydraulic type seeders in small areas not accessible to machine methods, or as approved by the city Engineer.

Mechanical power-drawn drills shall have depth bands set to maintain a planting depth of at least one-quarter (1/4") inch but not to exceed

one-half (1/2”) inch. Seed drills shall be set to space the rows not more than four (4”) inches apart. All seed sown by broadcast-type seeders shall be "raked in" or otherwise covered with soil to a depth of at least one-quarter inch. Water shall be applied when necessary.

Hydraulic seeding equipment shall include a pump capable of being operated at one hundred (100) gallons per minute and at one hundred (100) pounds per square inch pressure, unless otherwise directed. The equipment shall have an acceptable gauge and a nozzle adaptable to hydraulic seeding requirements. Storage tanks shall have a means of agitation and a means of estimation of the volume used, or remaining in the tank.

Seed shall not be drilled or sown during windy weather or when the ground is frozen or otherwise untillable.

E. Mulching. Straw or hay mulch shall be applied uniformly to seeded areas at a rate to provide coverage of 75% of the area. 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 twenty-four (24) hours after seeding, but not be done during windy or rainy weather or when such weather is imminent. Mulching shall be started at the windward side of relatively flat areas, or at the upper part of steep slopes and shall continue uniformly until each area is covered.

The mulching material shall be disced or punched into the soil so that it is partially covered. Several passes may be required, if a straight disc is used, in order to mix the mulching material with the topsoil sufficiently to ensure protection from erosion by either wind or water. The mulch tilling operation shall be performed parallel to the ground contours.

F. Maintenance. All seeded areas shall be protected against damage by vehicle and pedestrian traffic by the use of barriers and appropriate warning signs. If at any time before completion and acceptance of the seeding work any portion of the seeded area becomes gullied or otherwise damaged, Contractor shall repair such damaged areas with soil to original grade, re-seeding and re-mulching. All costs of repair work shall be borne by the Contractor.

SECTION 7300 - LANDSCAPING

7301 SCOPE Furnish materials, labor and equipment necessary to install landscaping as specified and as indicated on the plans.

7302 QUALITY ASSURANCE

A. Qualifications of Personnel: Provide at lest one (1) person who shall be present at all times during execution of this work that is thoroughly familiar with all materials and installation procedures included in the operations as specified herein.
B. Source Quality Control
   1. Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulation applicable to landscape materials. All plants shall be No. 1 grade. Type, size, and grading standards shall conform to those of the American Standards for Nursery Stock as adopted by the American Association of Nurserymen, unless otherwise specified.
   2. No substitutions shall be accepted before the contract is let and then only with written permission of the Parks and Recreation.
   3. Within 5 working days after award of contract, and before any materials are delivered to the job site, submit to the City a complete list of all plants including the sizes ordered, the type of equipment to be used on this project along with the sources and suppliers of plant materials and pesticides.

7303 MATERIALS AND PRODUCTS

A. Plant Materials
   1. Nomenclature: Scientific and common names used for plants are generally in conformity with “Standardized Plant Names.” The names of varieties are generally in conformity with the names accepted in nursery trade.
   2. Plant material size and measurements shall conform to the American Standard for Nursery Stock, ANSI Z60. 1-2004.
   3. Plants shall be container grown; vigorous stock, normally shaped, heavy and well branched foliage when in leaf, and shall have healthy, well-developed root systems.
   4. All plants furnished shall be free of any insect infestation, dead wood, bruises, or other root or branch injuries and shall have been grown under climatic conditions with temperature extremes similar to those of the project area for a minimum of two years prior to use on this project. All plants are to be naturalized to zone 5.
   5. Plants shall be measured when branches are in a normal position. The measurements specified are the minimum size acceptable. Plants that

meet the measurements specified, but do not possess a normal balance between height and spread will be rejected. Stock furnished shall be a fair average between the minimum and maximum size specified. All similar plants shall be matched in size and form.

6. All plant materials shall bear a tag providing full and legible identification of plant genus, species and variety.

B. Mulch: Use medium-grade Pine Bark mulch. After planting has been approved apply mulch. The mulch should not come into contact with plants.

C. Pre-emergent treatment: Surflan XL. Provide MSDS sheet and application records. Follow City of Lawrence's policy of posting signs before treatment. Pesticides shall be applied only by a State Certified Applicator.

D. Topsoil. Topsoil shall be soil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 1 1/2" in any dimension, and other extraneous or toxic matter harmful to plant growth.

7304 INSTALLATION

A. Ground Cover Plant Bed Preparation

1. Loosen subgrade of planting bed areas to a minimum depth of 6 inches. Remove stones larger then 1½ inches in any dimension sticks, roots, rubbish, and other extraneous materials.
2. Till soil in beds to a minimum depth of 8 inches, mix with specified soil amendments and fertilizers. Place topsoil as indicated.
3. Apply specified commercial starter fertilizer at rates specified; thoroughly mix into upper 2 inches of topsoil. Delay application of fertilizer if planting will not follow within a few days. Fertilizer shall be of the grade, type, and form specified below and shall comply with the rules of the Kansas Department of Agriculture and the following requirements:

    a. The grade of fertilizer will be identified according to the percent nitrogen (N), percent available phosphoric acid and percent water soluble potassium in that order and approval will be based on that identification.
    b. Fertilizer shall be of a type that can be uniformly distributed either by hand or application equipment.
    c. Fertilizer shall be furnished in a dry form.
    d. Fertilizer may be either homogenized or natural organic with at least 25 percent of the total nitrogen (N) in a slow-release form.
    e. Deliver fertilizer materials in original, unopened and undamaged containers showing weight, analysis, and name of manufacturer. Store in a manner to prevent wetting and deterioration.

4. Final grade plant beds to smooth, even surface with loose, uniformly, fine texture. Roll, rake, drag bed areas to remove ridges and fill depressions, as required to meet final grades. Limit final grading to areas which can be planted immediately after grading. No grading shall be done when the soil is in a muddy or frozen condition.

B. Planting
   1. Layout: Plantings shall be located where shown on the plan, or where locations have been flagged on site by the Parks and Recreation, except where overhead or below ground utilities are encountered and plants need to be relocated.
   2. Setting Plants: No planting holes shall be dug until proposed location been staked in the ground. Each plant shall be planted in an individual hole as specified. All plants will be removed from their containers.
   3. Backfilling Planting Beds: Existing topsoil is to be used as backfill. Soil amendments are not to be used. Planting pits shall be backfilled carefully to fill all voids and to avoid root injury. Following complete backfilling of the planting pit, plants shall be thoroughly irrigated by low volume, low pressure garden hose positioned at the bottom of the pit. After filling with water and soil settling has occurred planting mix shall be added to bring the pit to grade.
   4. Shrubs: All shrubs and roses shall be planted in holes at least one foot (1') greater in diameter than their ball of earth or spread of roots. The depth of the hole shall be as is necessary to accommodate the roots so that when the shrub is placed therein it will not be necessary to raise or lower it to bring it to finished grade.
   5. Watering: All plants shall be thoroughly deep watered within 24 hours of Pruning and Repair: planting and on a weekly basis during the growing season.
   6. All plants shall be neatly pruned only to remove broken or badly bruised branches.
   7. Apply pre-emergent chemicals to all areas to be mulched to control weeds and keep beds weed free during the growing season. Apply to the soil prior to mulching in accordance with the manufacturer's recommendations
   8. Apply mulch around plants after planting has been approved. The mulch should not come into contact with plants.

C. Special Utility Instructions: Any existing underground utility locations are to be determined by the contractor prior to any digging. Call "Dig Safe" (1-800-344-7233) prior to any digging. Perform work in a manner, which will avoid possible damage. Hand excavate, as required. Should any buried utilities be encountered during planting, consult the utility owner immediately for further directions. Full cooperation will be required in keeping respective services in operation. Repair for any damaged utilities will be full responsibility of the contractor.

7305 INSPECTION: Inspection of the planting work to determine its completion for beginning of the guarantee period will be made by a Parks and Recreation representative. The Contractor shall provide request for inspection at least seven (7) days prior to the anticipated date. All plant material must be labeled, alive, healthy and planted properly in order to be considered complete. Excess fill and waste material shall be removed from the site. Roads and walkways shall be swept clean and the site shall be left in a clean condition.

7306 MAINTENANCE, INSPECTION, GUARANTEES AND REPLACEMENTS

A. Warranty on Plant Material, for a period of one year after date of Substantial Completion, against defects including death and unsatisfactory growth, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond the Landscape contractor's control. The contractor shall be responsible for resetting of any plants to an upright position or to proper grade, and for the removal and replacement of any dead plant material, during the guarantee period.

B. Replacement of Plant Material: The Contractor shall replace once, without cost to the Owner, and as soon as weather conditions permit, and within a specified planting period, all dead plants and all plants not in a vigorous, thriving condition as determined by the Owner during and at the end of the warranty period. The plants shall be free of dead or dying branches and branch tips, and shall bear foliage of a normal density, size and color.

   Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in the Specifications. The contractor shall make all necessary repairs to other site and project features due to plant replacements. Such repairs shall be done at no cost to the Owner.

C. Maintenance: Unless specified otherwise, the contractor shall provide weekly maintenance for landscape services for a period of one year following the completion and acceptance of the original planting.

   New landscape plants should be watered weekly during the growing season or at an optimum rate depending on natural rainfall amounts, temperature, and demands of the plant materials to achieve an average of 1" rainfall per week. The contractor will be responsible for the weekly inspection of the landscape area to monitor watering, weeds, insects, and general plant health care. The landscape beds will be weeded once per week to be kept essentially weed free.

   Roses shall be pruned as needed to remove dead blooms once every month during the growing season. Roses shall be dormant pruned in early spring to reduce growth by 30%.

When significant portions of work are completed, including maintenance, Parks and Recreation will, upon request, make an observation to determine acceptability for compliance with requirements.

D. Final Inspection: Final inspection to determine acceptance will be made at the conclusion of the guarantee period by the Parks and Recreation Representative. No plants will be accepted unless they are alive and healthy. The Contractor shall replace any plants which are dead or, in the opinion of the Parks and Recreation representative, are in an unhealthy or unsightly condition. The cost of such replacement (s) shall be borne by the Contractor and shall be included in his bid price for the project.