CITY OF OVERLAND PARK

151ST STREET, QUIVIRA ROAD TO ANTIOCH ROAD
KDOT PROJECT NO. 46 N-0282-01

SPECIFICATIONS

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SPECIFICATIONS

S-1 SCOPE OF WORK

The work provided for in these Specifications shall consist of furnishing all labor, materials, appliances, and equipment, and performing all work and operations in connection with the construction of items and all other incidental and related work as set forth in these Specifications and as directed by the Engineer to make a complete and finished job.

S-2 SPECIFICATIONS

The work shall conform to these Specifications and to the "Standard Specifications" where reference is made herein. Where reference is made in the Specifications and Contract Documents to "Standard Specifications," it shall mean that the reference is made to the current edition of the Standard Specifications for State Road and Bridge Construction, Kansas Department of Transportation and the Overland Park Municipal Code, with such revisions, amendments, and supplements as are contained herein.

Sanitary Sewer construction shall be in accordance with the “Construction and Materials Specification” as prepared by the Johnson County Unified Wastewater Districts, and on file with the State of Kansas, Department of Health and Environment, Permit No. 20969.

All sanitary sewer service line work shall conform to requirements of the Johnson County Unified Wastewater Districts Service Line Design and Construction Standards, and the most recent edition of the BOCA National Plumbing Code.

S-3 METHOD OF MEASUREMENT

The completed work shall be measured by the units described in the Proposal under each bid item that is satisfactorily completed by the Contractor. At monthly intervals, beginning one month after the Notice to Proceed, the Contractor shall submit to the City Engineer an accurate record of the work completed.

S-4 BASIS OF PAYMENT

The amount of completed work, measured as set forth above, shall be paid for at the contract unit price bid per item described in the Proposal and shall be full compensation for furnishing all materials, labor, equipment, tools, supplies and incidental related items necessary to complete the work in accordance with the Specifications. Work not measured separately for payment is subsidiary to the item to which it pertains.

S-5 EQUIPMENT REQUIREMENTS

S-5.1 Paver Machine

A self-propelled bituminous paver machine shall be used for the asphalt paving operations. The bituminous paver shall be equipped with automatic screed controls as set forth in Section 151.20 of the Standard Specifications. Asphalt Concrete paving equipment shall also conform to specification section “Asphaltic Concrete Surface and Intermediate Course”.

In no case shall longitudinal joints be left exposed overnight on the main line paving operations except at side streets.

S-5.2 Forms

Forms shall be of steel or wood, free from warp and shall be sufficiently strong and rigid and securely staked and braced to obtain a finished product correct to the dimensions, lines and grades required. All forms must be cleaned and oiled before each use.

S-5.3 Transportation Equipment

All equipment used by the Contractor having metal tracks shall not be driven over City streets other than those streets being constructed. Such equipment must be transported from one milling area to the next milling area.

S-5.4 Milling Machine and Equipment

The milling machine to be used in this contract shall be designed and built for cold milling work; shall be self-propelled; and shall have a means of milling the old pavement surface. The drum patterns shall leave a grooved surface finish. The milling machine drum shall have its teeth in a triple turn type pattern. The drum shall be totally enclosed to prevent discharge of any loosened material on adjacent work areas. A dust suppression system must be part of the equipment. Maximum width of the milling machine shall be 12'-6"; drum widths shall be minimum to maximum. Smaller machines may be used for auxiliary purposes only. A milling machine attached and powered by a uniloader capable of a 3-1/2" to 4" deep cut shall be used for asphalt repair work.

The cold milling machine shall have adequate power to force the cutting edge(s) of the drum teeth to the desired depth below the surface of the pavement without causing undue irregularities in the surface of the planned pavement.

The surface shall be milled flush to all curbs, inlets, manholes or other similar obstruction within the paved area.

S-6 SAMPLING AND TESTING

All sampling and testing deemed necessary by the Engineer shall be performed by a Testing Laboratory selected by the City. All Asphaltic Concrete mix design and test shall be as stated in specification section “Asphaltic Concrete Surface and Intermediate Course”. The costs of all such tests, showing compliance with the Specifications, shall be paid by the City. However, in

the event that any test indicates non-compliance with the Specifications, additional testing will be paid for by the Contractor to determine acceptability of the material or methods.

S-7 FORCE ACCOUNT

This work shall cover miscellaneous extra work covered during the course of construction.

S-7.1 Measurement and Payment

Payment for work under this item shall be paid for on an extra work basis not to exceed the contract set price for “Force Account (SET)”. Before the extra work is performed, the Contractor shall submit his proposed price for approval by the Engineer, and shall have received the written approval of the Engineer for the proposed extra work.

S-8 CLEARING AND GRUBBING

Clearing shall consist of the felling and cutting up of trees, stumps, roots, shrubs, hedges and other protruding obstructions not designated to remain and disposal of trees and other vegetation designated for removal, together with downed timber, rubbish, snags, mowing, and brush occurring within the areas to be graded. Trees and other vegetation within the areas to be cleared shall be completely removed, including roots as specified herein after. Except in areas to be excavated, stump holes and other holes from which obstructions are removed, shall be backfilled with suitable material and compacted in accordance with the best standard practice for the area and type of soil encountered. The method of disposal shall be accomplished in accordance with all applicable Federal, State and local ordinances.

S-8.1 Payment

This work shall include the felling and cutting all trees within the limits of the project designated to be removed, as shown on the plans or directed by the engineer. Payment for this work shall be made at the contract lump sum price bid for "Clearing and Grubbing".

S-9 REMOVAL OF EXISTING STRUCTURES

This work shall conform to Section 206 of the Standard Specifications and shall include the removal of subsurface structures such as all existing drainage structures, head walls, pipe, inlets, manholes, retaining walls, conduits, foundations, cables, and other obstructions which are encountered during construction. This item shall include any items which may not be specifically listed in the Plans but are in conflict with the new construction and which would normally be encountered upon a careful examination of the site of the work. This includes repair, plugging, or removal of existing pipe after removal of structures.

S-9.1 Measurement and Payment

Payment for this work shall be made at the contract lump sum price bid for "Removal of Existing Structures".

S-10 EXCAVATION

Excavation for construction shall be considered unclassified excavation and shall be done in accordance with Section 204 of the Standard Specifications and the following requirements:

At the direction of the Engineer, unstable and unsuitable materials such as organic substances, soft clays, etc. encountered in the subgrade during construction shall be removed, wasted, and suitable backfill placed. All waste sites shall be provided by the Contractor and approved by the Engineer.

This item shall also include removal and wasting of surface structures such as concrete curb, pavement of all types, sidewalk, signs and markers.

No separate payment will be made for undercutting and overbreakage in rock excavation and for backfilling and compacting this area with the materials as shown in the plans. No separate payment shall be made for removal and wasting of unsuitable material in the subgrade, removal and disposal of miscellaneous dumped fill, and backfilling and compacting these areas with suitable material.

S-10.1 Undercutting

Where excavation to the finished graded section results in a subgrade or slopes of unsuitable soil, the Engineer may require the Contractor to remove the unstable material and backfill to the finished grade section with approved material. The Contractor shall conduct his operation in such a way that the Engineer can take the necessary cross sectional measurements before the backfill is placed. Unsuitable material removed in areas not designated on the plans and encountered during construction shall be paid at two times the Contract unit price bid for "Unclassified Excavation". No additional payment will be made for backfilling and compacting these areas with suitable material.

S-10.2 Boring Logs

The logs of the soil borings are included in the Appendix section of these specifications. The logs are furnished by the Owner for information only and are not guaranteed to be accurate or representative of all subsurface materials and conditions that will be encountered.

S-10.3 Measurement and Payment

Payment for this work shall be based on plan quantity and will be paid for at the contract unit price bid per cubic yard for "Unclassified Excavation".

S-11 EXCAVATION FOR STRUCTURES

S-1.1 General

Work under this item shall consist of all necessary excavation for structures including the removal and disposal of all excess excavated materials, concrete for seal course, backfill around the completed structural element and related work. All work shall be done in accordance with Section 207 of the Standard Specifications and the following requirements.

S-1.2 Excavation and Removals

All removal work which might endanger the new structure shall be completed before any work on the new structure is started. Partial removals of any structure or adjustments of any utility shall be made with care to preserve the value of the retained portions. Work around any live utility shall be done in such a manner that uninterrupted service can be maintained, or relocated. Excavated material which is unsuitable for backfill and excess material not required for backfill shall be disposed of off-site at an approved disposal site in compliance with local, federal and state regulations.

S-1.3 Backfill

Backfill material shall be free from large or frozen lumps greater than 3 inches, wood, or other extraneous material. All spaces excavated and not occupied by the new structure or by porous backfill shall be refilled with earth to the original ground surface or to the finished ground lines shown on the plans. No measurement will be made of backfill or compaction of backfill around structures except that portion above the original ground line which is situated within an embankment designated to be compacted. All backfill shall be thoroughly compacted and its top surface neatly graded. The backfill at abutments which fall within the limits of the roadbed, shall be placed in successive 6 inch lifts and uniformly compacted to a minimum of Type AA, MR 3-3 in accordance with Section 210 of the Standard Specifications. Backfill placed adjacent to walls shall be compacted with light equipment to prevent over stressing the walls. Backfill placed around piers shall be kept at approximately the same elevation on opposing sides. Areas to receive fill shall be stripped of all vegetation and topsoil prior to placement of till. Existing slopes greater than 4 horizontal to 1 vertical shall be benched to assure adequate bonding between existing slope and the fill.

S-1.4 Measurement and Payment

Excavation around any curb inlet, drive entrance, and/or other structure will not be paid for directly, but shall be considered subsidiary to other bid items in the contract.

Concrete for Seal Course shall be paid for at the contract unit price bid per cubic yard for “Concrete for Seal Course”.

S-12 EMBANKMENT (CONTRACTOR FURNISHED)

If required borrow is needed to complete the earthwork or select soil, the Contractor shall furnish from an off-site source as approved by the Engineer.

S-12.1 Measurement and Payment

Payment for borrow shall be made at the contract price bid per cubic yard for "Embankment (Contractor Furnished)" which shall be full compensation for obtaining and placing borrow to the lines and grades shown on the plans in accordance with the project compaction requirements.

S-13 COMPACTION OF EARTHWORK

Compaction of Earthwork includes the compaction of on-site available material for embankment, not the compaction of borrow material. Compaction of borrow material shall be considered subsidiary to the bid item “Embankment (Contractor Furnished)”.

All subgrade shall be uniformly compacted as indicated on the plans and in accordance with Section 210 of the Standard Specifications. The Contractor shall have available adequate hand or mechanical compaction equipment to accomplish the compaction as set forth in these Specifications. No separate payment will be made for water required for compaction of subgrade.

All fill areas outside the limits of pavement shall be uniformly compacted to a minimum of Type B, MR-90, in accordance with Section 210 of the Standard Specifications.

S-13.1 Measurement and Payment
The amount of completed and accepted work shall be paid for based on plan quantity at the contract unit price bid per cubic yard for "Compaction of Earthwork" of the specified type and moisture range.

S-14 ROCK EXCAVATION AND BLASTING
Where solid rock, shale, or similar material is found, the excavation shall be as shown in the plans or as directed by the Engineer. The excavated areas shall be backfilled to the subgrade and shoulder elevation with materials shown in the plans. **ABSOLUTELY NO BLASTING OF ANY KIND WILL BE ALLOWED ON THIS PROJECT**.

Based on the boring logs, rock excavation will be required in some areas of the project.

S-14.1 Methods of excavation
The Contractor shall excavate rock encountered by use of track propelled equipment equipped with ripping teeth or rock excavation buckets. The Contractor shall be prepared to provide equipment of sufficient capabilities to conduct rock excavation operations in this manner. Only in the event that this method is deemed inadequate, as determined by the Project Engineer, shall other methods of excavation be allowed. These methods may include rock splitting, operation of hydraulic "hoe ram" equipment, or other methods, at the sole discretion of the Engineer.

S-14.2 Payment
No separate payment will be made for rock excavation as it will be considered subsidiary to "Unclassified Excavation".

S-15 GRADING OF SWALES
Regrading of overflow swales and area grading shall be to the neat lines and grades indicated in the plans or as directed by the Engineer. All regraded areas shall have minimum topsoil as specified under the sodding specification. Final grading shall be rounded and blended into existing grades to produce a smooth interface suitable for homeowner maintenance.

S-15.1 Payment
No direct payment shall be made for this item as it shall be considered subsidiary to other bid items.

S-16 BRACING AND SHORING

It shall be the contractor's responsibility to brace and shore existing structures during construction. Any additional damage to or collapse of existing structures during the contract period shall be the sole responsibility of the Contractor.

The Contractor shall brace and shore all trenches in full accordance with Occupational Safety and Health Standards - Excavations; Final Rule 29 CFR Part 1926.

S-16.1 Payment

This work shall not be paid for directly but shall be considered subsidiary to other bid items. No additional payment shall be considered for increased quantities of earthwork, asphalt removal and replacement, or increases in other items as a result of compliance with this specification.

S-17 OVERLAND PARK SUPERPAVE ASPHALTIC CONCRETE SURFACE AND INTERMEDIATE COURSE

Revision Date: 10/28/05

S-17.1 General

The Standard Specifications, Sections 601, 602, and 603 shall govern the asphaltic concrete work except as otherwise modified herein. All testing required by this specification including mix design and field verification of the mix shall be the responsibility of the Contractor. The mix design shall be modified or redesigned whenever a material source changes or a quarry starts producing from a different geological unit or a major change is made to the asphalt plant. This work shall be subsidiary to other bid items.

S-17.2 Asphalt Cement

Asphalt cement shall conform to the requirements of AASHTO-MP 1a-04[1,2] Performance Graded Asphalt Binder PG 64-22. The grade of the asphaltic binder shall not be changed without a laboratory remix design. It shall also comply with KDOT Special Provisions 90M-197-R6 or Later Revision and 90M-0196 – R6 or Later Revision. **Each shipment of asphalt to the asphalt plant shall have a bill of lading stating the asphalt cement meets the specifications referenced above. Copies of the bill of lading shall be submitted to the City Engineer.** Asphalt cement shall not be paid for directly but shall be considered a subsidiary bid item.

S-17.2.1 Anti-Stripping Agent

All bituminous mixtures shall contain an anti-stripping agent. AD-here® LOF 65-00 LS as manufactured by ARR-MAZ Products, L.P. shall be added to the asphalt cement at the rate of 0.75% by weight of the asphalt cement. Other asphalt anti-stripping additives and their application rate may be used when proven equal after testing as specified in Paragraph "Resistance of Compacted Bituminous Mixture to Moisture Induced Damage AASHTO T 283-03" and approved by the City Engineer.

S-17.3 Aggregates General

The total aggregate (coarse aggregate, fine aggregate, and the material passing the 75um (No. 200 sieve) shall contain not less than 85 percent crushed material for intermediate course and surface course. The job mix formula (JMF) shall be within the control points shown below. It shall be noted that when the gradation of extracted plant produced mix varies appreciably from JMF, the test properties of the mix will be out of specifications.

S-17.3.1 Aggregate for Asphaltic Concrete Surface Course

The exact gradation shall be determined by the contractor's laboratory.

Sieve Size	Percent Passing 12.5 mm Nominal Size Control Points	
19mm (3/4 inch)	____	100%
12.5 mm (1/2 inch)	90	100%
9.5 mm (3/8 inch)	80	95%
4.75 mm (No. 4)	____	____
2.36 mm (No. 8)	36	48%
1.18 mm (No. 16)	____	____
600 um (No. 30)	____	____
300 um (No. 50)	____	____
150 um (No. 100)	____	____
75 um (No. 200)	2	8%

Surface mixtures for streets designated thoroughfares by the city shall contain the following:

Fifteen percent of the minus 4.75 mm (No. 4) sieve material and 15 percent of the total aggregate shall be chat, crushed sandstone, crushed gravel, crushed steel slag, or crushed porphyry (rhyolite, basalt, granite, and Iron Mountain Trap Rock are examples of crushed porphyry).

S-17.3.2 Aggregate for Asphalt Concrete Intermediate or Leveling Course

The exact gradation shall be determined by the contractor's laboratory.

Sieve Size	Percent Passing 12.5 mm Nominal Size Control Points	
19 mm (3/4 inch)	____	100%
12.5 mm (1/2 inch)	85	100%
9.5 mm (3/8 inch)	75	90%
4.75 mm (No. 4)	____	____
2.36 mm (No. 8)	34	44%
1.18 mm (No. 16)	____	____
600 um (No. 30)	____	____
300 um (No. 50)	____	____
150 um (No. 100)	____	____
75 um (No. 200)	2	8%

S-17.4 Superpave Asphaltic Concrete Mix Design Method

The finished mixture shall meet the requirements described below when prepared in accordance with AASHTO T 312-04 (using 6 inch nominal size molds) and the volumetric properties of compacted paving mixtures as calculated using Chapter 4 of Superpave Mix Design, Superpave Series No. 2 (SP-2), Third Edition 2001 Printing, Published by the Asphalt Institute referred hereafter as "SP-2", unless otherwise specified. The procedure shall be as specified in Chapter 5 and 6 of the SP-2. The Theoretical Specific Gravity (Gmm) shall be determined following AASHTO T 209-99 (2004) and the Bulk Specific Gravity of the Compacted Asphalt Mixture (Gmb) shall be determined following AASHTO T166-00. The material for the theoretical specific gravity (Gmm) and the material for the Gyratory Compactor specimens (pucks) shall be cured at 140+/-3º C (285+/-5º F) for four hours in a closed oven after the mix is produced in the laboratory. Also, the plant-produced mixture shall be tested when the mix is four hours old. The mixture shall be transported to the laboratory in an insulated container and then stored in a laboratory oven at 140 +/-3° C (285 +/-5° F) minimum temperature for the remainder of the curing period. The curing oven shall be the forced air type and may be operated at a temperature not to exceed the maximum temperature at which the mixture may be discharged from the plant as specified in paragraph "Mixing Plants". This procedure shall be used when the water-absorption as determined by ASTM C 127-04 and ASTM C 128-04a of any aggregate in the mixture exceeds 1.25 percent. The mixture shall be compacted at 140 +/-3° C (285 +/-5° F). The theoretical specific gravity (Gmm) shall be preformed using the Type E-A 4500ml metal vacuum pycnometer with a clear polymethyl methacylate PMMA lid. The vacuum shall be applied for 15 minutes to gradually reduce the residual pressure in the vacuum vessel to 28 mm Hg. The bulk specific gravity of the Fine Sand Chat shall be determined using the standard Cone Test for Surface Moisture as stated in ASTM C-128-04a unless otherwise directed by the City Engineer**. The AASHTO Specification shall be used when this specification references the AASHTO number.**

S-17.5 Superpave Design and Testing Properties

		Required Density (% of Theoretical Maximum Specific Gravity (Gmm) Number of Gyrations (Average of 2-6 inch specimens)
$N_{initial}$ 6		85 - 91%
N_{design} 60	(Mix Design Only)	96%
N_{max} 90		$\leq$ 98%
Percent Air Voids, in compacted mixture	(Mix Design Only)	4.0%
Percent VMA in compacted mixture	12.5mm Nominal Size (Mix Design Only)	14.0%
Voids filled with asphalt; percent (VFA)		65-75
The ratio of minus 75µm (No. 200) material to % effective asphalt control (Pbc)based on the weight of the aggregate from the extraction test	Mix Design Field	0.6-1.2 0.6-1.6

When the aggregate absorption is high, the produced mixture will be tender until the asphalt is absorbed into the aggregate. Therefore, it may be beneficial to silo the mixture at the plant for a time before delivering to the project site. This is more important when the truck haul is short.

S-17.6 Resistance of Compacted Bituminous Mixture to Moisture Induced Damage
AASHTO T 283-03
The index of retained strength must be greater than 80 percent as determined by AASHTO T 283-03 (using a 4 inch nominal size mold). Specimens shall be conditioned by freezing and thawing. When the index of retained strength is less than 80 the amount of anti strip may have to be adjusted, the aggregate stripping tendencies may be countered by the use of an approved anti-stripping agent. No additional payment will be made to the Contractor for addition of anti-stripping agent required. The mix shall contain the anti-stripping agent specified in paragraph "Anti-Stripping Agent" and tested by AASHTO T 283.

S-17.6.1 Method of determining the retained strength of plant-produced mixtures. Sample the plant produced mixture at the plant site in accordance with ASTM D 979 or behind the paver using the procedure specified herein. Transport the mixture to the laboratory and determine the theoretical specific gravity as specified in paragraph "Asphaltic Concrete Mix Design Method". Prepare the specimens for the AASHTO T 283 test using the same four-hour cured material and compact to 7 ± 0.5 percent air voids. Allow the samples to cool and cure overnight at room temperature and proceed with testing by determining the thickness and bulk specific gravity, then separating the specimens into subsets and preconditioning as specified herein. Then proceed with the testing as specified in AASHTO T 283.

S-17.6.2 Test for AASHTO T 283
One set of tests for each mix design from each plant shall be made as the final verification of the plant produced mix design by the contractor's laboratory.

S-17.6.2.1 One set of tests for each mix produced for Public Works Department Contracts shall be taken during the initial production each year and one set of tests for each 10,000 tons produced that year. Sampling frequency shall be adjusted when the Contractor has multiple contracts with the Public Works Department so that tests are taken every 10,000 tons of production. The City Engineer may take an additional test at his expense. Any test that fails will require the contractor to adjust the JMF and take additional test at the contractor's expense.

S-17.6.2.2 One set of tests shall be made and approved by the City Engineer at contractor's expense when any of the material sources change or when requested by the City Engineer.

S-17.7 Contractor's Laboratory
Asphaltic Concrete Mix Design shall be the responsibility of the Contractor's Laboratory. The laboratory shall be a commercial testing laboratory meeting the requirements of ASTM D 3666-05a. The manager of the laboratory shall submit a signed certificate stating that the laboratory has a current certificate stating that the laboratory meets the ASTM D 3666-05a requirements. The laboratory shall have past experience in testing materials and making Superpave Asphaltic Concrete mix designs. The laboratory shall be approved by the City Engineer. The laboratory shall establish the mix design using the criteria specified herein. Certified test results of the mix

design and materials shall be submitted 30 days prior to commencing construction for review by the City Engineer. The test results shall include all detailed raw calculations for the composition of the mix design and shall include all specific gravity calculations. The calculations must be legible but not necessarily typed.

S-17.8 Verification of the Plant Produced Mix Design by the Contractor's Laboratory
All test properties of the mix shall be verified by sampling and testing the uncompacted mix placed behind the paver. The test shall be performed in accordance with paragraph "Superpave Asphaltic Concrete Mix Design Method" and shall indicate the test properties of the mix shown in paragraph "Superpave Design and Testing Properties". Also, an extraction and gradation test shall be made using the ignition oven. The contractor's laboratory shall adjust the mix design entering the plant to obtain the test properties behind the paver.

S-17.8.1 The properties of the plant produced mix shall be determined using uncompacted mix sampled behind the paver. The properties shall be determined at Ndesign from the average of 2-6 inch nominal size samples gyrated to Nmax.

S-17.8.2 Material for the sample shall be from the following locations
One from each side of the placed bituminous mat and one from the center of the mat. A square, pointed shovel shall be used for taking the sample and for evenly laying material back into the disturbed mat. Care shall be taken not to get foreign material or tack oil into the sample.

S-17.8.3 A test shall be taken at least daily, or as directed by the engineer when the plant has produced a **minimum** of 180 metric tons (200 tons).

S-17.8.3.1 The test shall also consist of one gradation test ASTM C-136-96a of hot bin material for conventional plants, or total aggregate material from the final feed belt for dryer-drum plants.

S-17.8.3.2

NOTE: The result of the gradation test is very important in determining how to adjust the mix. After the gradation or the bitumen content has been adjusted to obtain the properties of the mix, this verified mix design becomes the Job Mix Formula (JMF). The plant settings may have to be adjusted again whenever the gradation of the materials change. When a change is made it shall be reported on the Superpave Asphaltic Concrete Test Report form.

S-17.8.3.3 Gradation and asphalt content of the mix shall be performed using ASTM D-6307-05 Standard Test Methods for Asphalt Content of Hot Mix Asphalt by the Ignition Method and ASTM D 5444-05. The initial temperature setting of the Ignition Oven shall not exceed 525° C.

S-17.8.3.4 Laboratory test results shall be shown on the test report form "Asphaltic Concrete Test" shown at the end of this specification section. Test results shall be received by the contractor and the City Engineer field representatives within approximately 7 hours after the samples are taken. The laboratory shall determine the Percent Voids and VMA as soon as possible and evaluate in accordance with paragraph below: **"Corrective action to be taken when Asphaltic Concrete Test indicates the mix is out of specification." Whenever the**

Percent Voids or VMA is out of specification the laboratory shall contact the Contractor and the City Engineer immediately. The Contractors testing laboratory shall send the test results directly to the Contractor and the City immediately upon completion of the test. Signed checked copies may be sent later. The Contractors laboratory shall furnish the City's laboratory other items such as the JMF mix gradation, plant setting, the bulk specific gravity of the aggregate G_{sb} and the specific gravity of the asphalt G_b. Laboratories shall compare final test results when the mix is out of specification. The test results shall indicate whether the plant needs adjusting and recommendations shall be provided on correcting the problem.

S-17.8.3.5 The most recent Asphalt Concrete Test that indicates the mixture meets the specifications is the current mix design.

S-17.8.4 Corrective action to be taken when Asphaltic Concrete Test indicates the mix is out of specification.

S-17.8.4.1 Asphaltic Concrete Surface and Asphaltic Concrete Intermediate or Leveling Course The mix should be adjusted when consecutive tests show the percent voids in the compacted mix are getting close to being the minimum of 3.0 percent or the maximum of 5.0 percent. Paving shall stop and the mixture shall be redesigned whenever any of the following occurs: three consecutive sets of tests show the percent voids in the compacted mix are less than 3.0 percent or more than 5.0 percent; or two consecutive sets of tests show the percent voids in the compacted mix are less than 2.5 percent or greater than 5.5 percent.

S-17.8.4.2 Also paving shall stop and the mix shall be redesigned whenever three consecutive sets of tests show the VMA of the specified mix is more than 1.0% greater or 1.5% less than the specified VMA.

S-17.8.4.3 Asphaltic Concrete mixtures with a test indicating the voids filled with asphalt is 81 percent or more shall be removed unless directed otherwise by the City Engineer.

S-17.8.5 Pre-Construction test strips
Test strips shall be constructed by the Contractor off city property at the contractor's expense. However, the city shall observe the sampling and testing. The contractor may negotiate the construction of a test strip on the project with the engineer. In that event, asphalt not meeting specification shall be removed at contractor's expense. Asphalt meeting specifications will be paid for at unit prices.

S-17.8.5.1 The Contractor's laboratory shall test the final belt gradation if the plant is a dryer-drum plant or the hot bin material if the plant is a conventional plant, and adjust the feeds to insure the plant is producing the gradation of the mix design, before hot mix production begins for the tested strip.

S-17.8.5.2 Test strips shall contain at least 75 metric tons (83 tons) of asphaltic concrete. A test sample shall be taken behind the paver at 73 metric tons (80 tons). The paver shall be set 3.7 meters (12 feet) wide and at plan depth when the sample is taken. Care shall be taken not to get foreign material or tack oil into the sample.

S-17.8.5.3 If the laboratory test results indicate the mix can be adjusted to meet the properties stated in paragraph “Superpave Design and Testing Properties”, project paving may begin. However, this has to be agreed upon by the Contractor's laboratory, the Contractor, and the City Engineer. Otherwise, another test strip shall be constructed. Test strips will not be required on other projects which use this mix design. However, all materials have to be from the same sources and geological units. Also, the mix has to be produced by the same plant.

S-17.9 Verification testing of the plant produced asphaltic concrete by the city.
The City Engineer will take verification tests at random times, at the City’s expense.

S-17.10 Mixing Plants
Mixing plants shall meet the requirements of KDOT’s latest specification in effect when this project’s bids are received by the City, except the mixture discharged from the plant shall not exceed 157.2°C (315°F).

S-17.11 Asphalt mixtures having temperatures less than 113°C (235°F), when dumped into the mechanical spreader will be rejected.

S-17.11.1 All bituminous mixtures shall be delivered to the paver at a temperature sufficient to allow the material to be placed and compacted to the specified density and surface tolerance.

S-17.11.2 All delivery trucks shall be totally covered with a water proof tarpaulin at the asphalt plant and shall not be uncovered until they are next in line to unload.

S-17.12 Placing
Asphaltic concrete intermediate and surface courses shall not be placed in compacted lifts greater than 75 mm (3 inches) deep except when otherwise indicated on maintenance project plans. Asphaltic concrete surface course shall not be placed thinner than 50mm (2 inches) deep. Asphaltic concrete intermediate course used as surface shall not be placed thinner than 50mm (2 inches). Interim layers of intermediate course shall not be left uncovered by the subsequent course for more than 5 days, weather permitting. Material trucks hauling materials other than asphaltic concrete or tack coat shall not travel on previously constructed layers of asphaltic intermediate course until the final course of the intermediate is constructed.

S-17.12.1 The Contractor shall schedule and route his hauling operation to minimize hauling over a final course as much as feasible.

S-17.12.2 Bituminous-Materials Spreaders
Bituminous-materials spreaders shall be the self-propelled type equipped with hoppers, tamping, or vibrating devices, distributing screws (augers), adjustable screeds operated either manually or automatically, equipment for heating the screeds and equalizing devices. The spreader shall be capable of spreading hot bituminous mixtures without leaving indented areas, tearing, shoving, or gouging and capable of confining edge of strips to true lines without use of stationary side forms and capable of placing the course to the required thickness. It shall also be capable of producing a finished surface conforming to the smoothness requirements specified. Spreaders shall be designed to operate forward at variable speeds and in reverse at traveling speeds of not less than 100 feet per minute. If an automatic grade control device is used on the spreader for

two-lane paving operations, it shall consist of sensing device for control of one end of the screed and a slope-control mechanism for control of the other end of the screed, or a sensing device on each side of the paving machine. Where the paver is used on multiple paving lanes (more than two paving lanes), sensing devices shall be used on each side of the spreader for control of the screed. The slope-control mechanism shall not be used for grade control in multiple paving lane operations.

S-17.12.2.1 When the contractor chooses to pave lanes through the project wider than 3.65 m (12 ft.) the spreader (paver) shall be equipped with auger extensions.

S-17.12.2.2 Through lanes shall be paved before left turn lanes and side street intersections. Through lane pavers shall not stop for other areas to be paved.

S-17.12.3 Special Procedures to Prevent Segregation
The wings of the spreader hopper shall not be emptied (flipped) between truck loads. The depth of the material in the screed auger champer shall be kept approximately three-fourths (3/4) full - all the way out to the end gate. The augers should be running automatically and the vibrating screed turned on. The hopper conveyor shall always have approximately 6 inches of material covering it and not be allowed to run out of material. Whenever the paver is run empty (conveyor exposed) the area behind the paver should be checked for a segregated spot. If a spot exists the paver should be stopped and the segregated spot repaired before it is rolled.

S-17.12.4 Joints General
Joints between old and new pavements or between successive day's work shall be cut back vertical with a saw. Other joints shall be sawed vertical as directed by the City Engineer. All joints shall be tacked and shall be made carefully to insure continuous bond between old and new sections of the course. All joints shall have the same texture, density, and smoothness as other sections of the course. The tack shall be overlapped onto the previous pavement 25 mm (1 inch) to 50 mm (2 inches). Contact surfaces of previously constructed pavements, curbs, gutters, manholes, etc., shall be tacked. Surfaces that have become coated with dust, sand, or other objectionable material shall be cleaned by brushing or cut back with an approved power saw, as directed. The surface against which new material is to be placed shall be sprayed with a thin, uniform coat of bituminous material conforming to the requirements of paragraph TACK COAT stated hereinafter. The material shall be applied far enough in advance of placement of the fresh mixture to insure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

S-17.12.4.1 Edges of previously placed pavement that have cooled and are irregular, honeycombed, poorly compacted, damaged, or otherwise defective unsatisfactory sections shall be cut back to expose a clean, sound surface for the full thickness of the course as directed by the City Engineer.

S-17.12.4.2 Transverse Joints
The roller shall pass over the unprotected end of freshly placed mixture only when placing of the course is discontinued or when delivery of mixture is interrupted to the extent that unrolled material may become cold. In all cases, the edge of the previously placed course shall be cut back to expose an even, vertical surface the full thickness of the course. In continuing placement

of the strip, the mechanical spreader shall be positioned on the transverse joint so that sufficient hot mixture will be spread to obtain a joint after rolling which conforms to the required density and smoothness specified herein.

A string line shall be used to set pavement elevations twenty-five feet after a beginning at a transverse joint or twenty-five feet before an ending at a transverse joint.

S-17.12.4.3 Offsetting Joints in Intermediate and Surface Courses
The surface course shall be placed so that longitudinal joints of the surface course will not coincide with joints in the intermediate course by approximately 230 mm (9 inches). Care shall be taken when possible to offset longitudinal joints in a manner that the final surface course joint is in the center of the pavement or at the location shown on the plans. Transverse joints in the surface course shall be offset by at least two feet from transverse joints in the intermediate course.

S-17.12.4.4 Special Requirements for Placing Paving Lanes Succeeding Initial Lanes
In placing each succeeding lane after the initial lane has been placed and compacted as specified hereafter, the screed endgate of the mechanical paver shall overlap the previously placed lane slightly and shall be approximately 1.25 times thicker than the existing compacted lane to allow for compaction roll down and produce a smooth compacted joint with the specified density. Mixture placed on the edge of the previously placed lane by the mechanical paver shall be pushed back (tucked) to the edge of the lane being placed by use of a lute (rake). The pushed back material shall form a ridge on the uncompacted lane along the edge of the previously placed lane. The height of the ridge above the uncompacted lane should be approximately equal to the thickness being allowed for roll down during compaction. These procedures shall be used to facilitate getting a smooth joint with density. Excess mixture shall be removed and wasted. Excess material shall not be spread over the uncompacted mat.

S-17.12.5 Steel-Drum Rollers
Steel-drum rollers shall be self-propelled, tandem (two-axle) with both drums the same size, powered by both drums, vibratory types, weighing not less than 9071.8 kg (20,000 pounds) static weight and not less than 26.8 kg/cm (150 lb/in) of drum. Drums shall be equipped with adjustable scrapers, water tanks, and sprinkling apparatus for keeping the drums wet, thereby preventing the bituminous mixture from sticking to the wheels. Rollers shall be capable of reversing without backlash and free from worn parts. Roller drums with flat and pitted areas or projections that leave marks in the pavement will not be permitted.

S-17.12.6 Heavy Pneumatic-Tired Rollers
Heavy pneumatic-tired rollers shall be self-propelled and shall consist of two axles on which are mounted an odd number of pneumatic-tired wheels. The roller shall have at least nine pneumatic-tired wheels in such manner that the rear group of wheels will not follow in the tracks of the forward group, but spaced to give essentially uniform coverage with each pass. Axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. Tires shall be smooth, inflated to 620 kPa (90 p.s.i.). Construction of the roller shall be such that each wheel can be loaded to a minimum of 1043 kg (2,300 pounds).

S-17.12.7 Blowers and Brooms
Blowers and brooms shall be power type and suitable for cleaning the surface to be paved. Open faced brooms may only be used when approved by the City Engineer.

S-17.13 Compaction of Mixture
The contractor is responsible for the development of a compaction procedure that will obtain the required density. The following paragraphs describe a procedure that generally obtains density. **The contractor shall determine the exact amount of rolling (coverages needed) to obtain a density meeting paragraph: "Density and Density Test". The ideal density is an average density between 92% and 94%.**

S-17.13.1 General
The surface of the placed material shall be corrected if necessary before compaction begins. Compaction of the mixture shall be accomplished using a minimum of two steel-drum rollers and a pneumatic-tired roller as specified above. Breakdown rolling shall be as close behind the paver as possible. The break down roller shall be a steel-drum and operated in the vibratory mode on the first forward pass and may be operated in vibratory made on subsequent passes either forward or back. Delays in rolling freshly spread mixture will not be permitted. The pneumatic-tired roller shall be used as an intermediate roller; however, it shall also roll closely behind the break down roller. The pneumatic-tired roller shall always be kept moving in order to keep its tires warm. The second steel-drum roller shall be used as a final finish roller. Rollers shall not travel faster than 4.8 km/hr (3 mph). Steel-drum rollers shall not be used in the vibratory mode except for initial breakdown rolling. When steel-drum rollers are used in the vibratory mode they shall be operated at maximum frequency and minimum amplitude. Rolling shall be continued until density is obtained in all portions of each course.

The speed of rollers shall be slow enough at all times to avoid displacement of the hot mixture. Displacement of the mixture resulting from reversing the direction of the roller or from any other cause shall be corrected at once by raking or removing and replacing fresh mixture when necessary. Alternate passes of the roller shall be varied slightly in length. During rolling, the wheels of steel-drum rollers and plates of vibro plate compactors shall be moistened to prevent adhesion of the mixture to the drums or plates, but excess water will not be permitted. Tires of heavy pneumatic roller shall be moistened with soapy water when required to prevent mixture from sticking to tires during rolling. Rollers shall not be permitted to stand on finished courses until the courses have thoroughly cooled. The contractor shall supply ample rollers to obtain the specified density. Places inaccessible to rollers shall be thoroughly compacted with hot hand-tampers or vibro plate compactors.

S-17.13.2 Break Down Rolling
Rollers shall be operated as specified above. The unconfined edge or low side edge of the paving lane shall be broken down first. The other edge shall be broken down second and the middle broken down last. **This is considered one coverage**. Steel-drum break down rollers shall not hang over the free edge of the mat or stay back from it even though they are going to back up for the adjoining lane. The entire lane shall be broken down at the same temperature.

S-17.13.2.1 Intermediate Rolling
The rubber tired roller shall be close behind the break down roller after the mat has cooled a few degrees. The rubber tired roller shall roll the same pattern making the same coverage as the breakdown. The rubber tired roller should stay the thickness of the lift from the free edge.

The number of coverages shall be determined by the contractor. This will change with temperature, humidity and thickness of the lift.

S-17.13.2.2 Longitudinal Joint Break Down Rolling of Paving Lanes Succeeding Initial Lanes
The break down roller in the vibratory mode shall lap over the tucked joint approximately six inches (6") on to the previously placed compacted lane.

As part of the break-down rolling and immediately after the break-down roller completes its first passes, the longitudinal joint shall be pinched to ensure compaction with the pneumatic-tired roller. The rubber tired roller shall make at least one complete pass (forward and backward) operated on the hot lane with the outside tire pinching the joint.

After the rubber tired roller rolls the joint, it shall make at least one pass over the rest of the mat and then drop back to its intermediate rolling. The steel drum roller in static mode shall immediately smooth out the rubber tired marks.

S-17.13.2.3 Finish Rolling
Finish rolling should start when the mat has cooled down 20°F to 40°F below the intermediate rolling (This could be approximately 225°F). The steel wheeled roller in static mode shall immediately smooth out the rubber tired marks using the same pattern making the same type coverages as the breakdown roller. Do not roll until cracks appear, let it cool. Finish rolling can continue until the temperature reaches 175°F to 150°F.

The finish rolling shall continue until the pavement is smooth and has the density specified above.

S-17.14 Sampling Pavements for Density
Samples of finished pavement shall be obtained by the contractor or the contractor's laboratory. A minimum of one test (three cores) shall be taken for each tonnage lot represented by a Superpave Asphaltic Concrete test. Lots larger than 1200 tons shall have one set of (three cores) for each 1000 tons placed or as directed by the Engineer. The cores samples shall be taken at locations throughout the tonnage lot. The locations shall not be previously marked. The core locations shall be marked by the City Engineer after each tonnage lot placement is completed. Cores shall be at least 4 inches in diameter. Sample holes shall be backfilled by the contractor using Quikrete, Rapid Road Repair manufactured by The Quikrete Companies, Atlanta Georgia, 30329, Crystex manufactured by L&M Construction Chemicals Inc., Omaha Nebraska, 68152 or approved equal. The top of the patch shall be sprayed black with paint. The samples shall be tested by the contractor's laboratory to determine conformance to density and thickness. The City Engineer may require the contractor to take more samples at the contractor's expense if the density is marginal.

S-17.15 Density and Density Test

Density of the compacted mixture of the surface or intermediate course shall be determined by tests made on specimens taken from the compacted course in accordance with the requirements of the previous paragraph: SAMPLING PAVEMENTS FOR DENSITY. The density shall be the average of the three cores 92% to 96% of max theoretical specific gravity of the Superpave Asphaltic Concrete test for the lot. No core shall be less than 90%.

S-17.16 Weather Limitations

Weather limitations in Section 603.06 of the Standard Specifications shall apply except that 1) bituminous mixtures may only be placed when both the ambient air temperature and the road surface temperature are equal to or greater than that shown in Table 3 of Section 603.06, and 2) surface temperatures listed in Table 3 of Section 603.06 shall be increased by 3°C (5°F).

S-17.17 Road Surface Preparation

When the bituminous mixture is placed on an existing bituminous surface, Section 603.03 (b) (2) of the Standard Specifications shall apply, except that in addition to brooming, a high pressure type water truck, capable of washing all fines, dirt, and debris from the surface, may be required prior to overlaying as directed by the City Engineer. Equipment compliance with this specification shall be visual observation by the City Engineer at the commencement of washing operations. Unless specified, no direct payment shall be made for this item, as it shall be considered subsidiary to other bid items.

S-17.18 Tack Coat

Emulsified Asphalt CSS-1h meeting the requirements of Section 1202 of the Standard Specifications shall be used for tack coat. All existing asphaltic concrete surfaces shall receive a tack coat not more than six hours prior to placing the asphaltic concrete. Surfaces previously tack coated and not covered with new asphaltic concrete for more than six hours shall be retacked. The rate of application shall be 0.25 L/sq m to (0.05 gal./sy) to 0.50 L/sq m (0.12 gal./sy), or as otherwise directed by the City Engineer. At locations where asphalt is being placed on top of existing concrete pavement, or for night work where temperatures warrant, the emulsified asphalt shall be diluted 10 percent with water versus the normal 50 percent dilution with water. Tack coat shall not be paid for directly but shall be considered subsidiary to other bid items.

S-17.19 Surface Smoothness

The surface course, upon completion of final rolling, shall be smooth and true to grade and cross-section. When a 3.66 meters (12-foot) straightedge is laid on the surface parallel with the centerline, the surface shall not vary more than 3.2 mm (1/8 inch) from the straightedge. When the 3.66 meters (12-foot) straightedge is laid on the surface transverse to the centerline between the crown and edge of pavement, the surface shall not vary more than 6.4 mm (1/4 inch) from the straightedge. Low or defective areas shall be immediately corrected by cutting out the faulty areas and replacing with fresh hot mixture and compacting the area to conform to the remainder of the pavement. Testing for plan grade conformance and surface smoothness shall be preformed by the Contractor in the presence of a representative of the City Engineer. Tests shall be made at intervals as directed by the City Engineer. The City Engineer may direct the contractor to diamond grind areas that are out of tolerance in lieu of above replacement.

S-17.20 Measurement

Measurement shall be in accordance with Section 109.01 of the Standard Specifications and as modified herein after. The asphalt mixture shall be weighed on approved, certified scales at the contractor's expense. Scales shall be inspected and sealed at least annually by an approved calibration laboratory. The City Engineer will verify the weights at random times, at the City's expense.

S-17.21 Payment

Payment will be made at the contract unit price bid per ton for "Asphaltic Concrete Intermediate Course" and "Asphaltic Concrete Surface Course". This shall be considered payment for all items of work specified in this section. No separate payment will be made for tack coat and asphalt cement.

SUPERPAVE ASPHALTIC CONCRETE TEST (Verified Mix Design)

Description:			
LAB I.D.:		**TIME**	**TONS**
Sample Date:		Belt	
Sample I.D.:		Hot Mix	
Supplier:			

GRAIN SIZE DATA – ASTM D5444, C136, C117

Sieve Size	Belt Sample	Hot-Mix Sample*	JMF
19mm (3/4")			
12.5mm (1/2")			
9.5mm (3/8")			
4.75mm (No. 4)			
2.36mm (No. 8)			
1.18mm (No. 16)			
600µm (No 30)			
300µm (No 50)			
15 µm (No 100)			
75µm (No 200)			

*from uncompacted mat

EXTRACTION DATA-ASTM D6307

		Sample	Plant Setting
%AC, total mix basis			

Aggregate Type	%**	Aggregate Type	%**

**total aggregate basis

VOLUMETRIC DATA 6" NOMINAL SIZE Gyratory Specimens

Gyrations (average of 2 specimens) @ 280-290 deg F – AASHTO T312 - 01

Nmax = 90 | Ndes = 60 | Nini = 6

	Sample*	Specifications	
Mix bulk specific gravity @ Ndes, Gmb		--	
Density @ Ndes, pcf		--	AASHTO T 166-00
%Voids @ Ndes		3-5	AASHTO T 166-00
%VMA @ Ndes, Gsb basis		12.5-15	As Per Spec
%VFA @ Ndes		65-75	Max 81%
%Gmm @ Nmax		98 maximum	AASHTO T 166-00
%Gmm @ Nini		85-91	AASHTO T 166-00
Ratio (-) 75µm (No. 200) to % Eff Binder		0.6-1.6	
Tensile Strength Ratio, %		80 minimum	AASHTO T 283-03
Max Theoretical Specific Gravity Gmm		--	AASHTO T 209-99(04)
Max Theo. Density, pcf		--	
Effective specific gravity Agg. Gse		--	
Bulk Specific Gravity of Total Agg., Gsb		--	ASTM C128, C127
Specific Gravity of Asphalt, Gb		--	

COMMENTS:

S-18 METHODS OF MILLING OPERATIONS

This work will consist of the removal of the existing surface to the depth and limits shown on the Plans or established by the Engineer. It shall also include the loading and stockpiling, if required, of the milled material.

S-18.1 Milling Operations

The nature and condition of the milling equipment and the manner of performance of the work shall be such that the finished milled surface of the pavement is not torn, gouged, shoved, broken, oil coated or otherwise injured by the milling operation.

The milling operation shall provide for a windrowing of cuttings, pick-up and elevation into dump trucks, all in a single lane operation. Use of front-end loaders as the primary means of pick-up will not be construed as a single lane operation, nor will side loading of dump trucks be permitted.

All side streets shall have a butt joint of 1" unless otherwise specified on the plans. All driveways greater than 1" after milling shall be ramped.

S-18.2 Milling (Total Width Cut)

Sufficient passes or cuts shall be made at a depth and width as shown on the plans. The milling operation shall provide a smooth profile and cross section that does not require a leveling course prior to the overlay operation. Prior to opening to two-lane traffic, no unevenness within a lane shall exist. The maximum tolerance for Milling (Total Width Cut) in a longitudinal direction shall be 1/2" under a 10' straight edge and shall be 3/8" under an 8' straight edge in a transverse direction. “Milling (Total Width Cut)” shall be paid for at the contract unit price per square yard, for the depths indicated on the plans.

S-19 METHODS OF ASPHALTIC CONCRETE OPERATIONS

S-19.1 Base Replacement

Asphalt base shall be laid at those locations shown on the plans or as specified in the specifications. The base material shall be laid on compacted subgrade. A bituminous paving machine shall be used where applicable to maintain the required grade. Asphaltic base replacement shall consist of removing the existing asphalt along with any rock base or subgrade, recompacting the subgrade and laying an asphaltic concrete base (Intermediate). Compaction shall be as specified in Section 603 of the Standard Specifications. The base repairs shall be performed after the curb work has been completed. All traffic control required for this work as shown on the plans shall be part of the traffic control lump sum bid.

Subbase shall be completely clean, and the surface tack coat applied as specified prior to placing the asphaltic base material. The asphaltic base shall be laid with a bituminous paving machine not to exceed 4" lifts in depth unless sufficient compaction equipment is used and then not to exceed 6" lifts in depth. The base material shall match the asphalt surface. All areas with 1" in depth or greater not replaced within the work day limitations, or as directed by the Engineer, shall have temporary material placed to allow traffic full access. All temporary materials used shall be removed prior to placing asphaltic base. Placing and removing temporary material shall

be subsidiary to other bid items. Asphaltic base material shall be paid for at the contract unit price bid per ton.

S-19.2 Surface Overlay Operation

Base shall be completely clean, and a surface tack coat applied as specified prior to placing the asphaltic surface material. During overlay operations no reference grade will be established by the Engineer, except where deemed necessary by the Engineer to maintain satisfactory grade. A mobile grade line shall be used as the reference guide on all paving operations, except where otherwise directed by the Engineer. The mobile grade line shall be either a rigid ski, a matching shoe, or a string line on wheels as directed by the Engineer.

On all curbed streets, the asphaltic overlay shall be laid 1/4" above the lip of the curb. All asphaltic and/or concrete materials remaining within the gutter and require removing shall be subsidiary to other bid items. Where catch basins are located along or are part of the curb, special care shall be taken to keep the asphalt out of the catch basins. Where catch basins have a side opening and no opening in the gutter line, the Contractor shall not fill up or restrict any portion of this side opening with the overlay, but shall wedge the overlay to meet the existing dimensions. Longitudinal joints shall be rolled as directed by the Engineer, along with providing proper traffic control.

Contractor shall provide a smooth transition from the new overlay to the existing pavement at intersections and driveways, as directed by the Engineer in the field. The Contractor shall overlay around all radii and curb returns as directed by the Engineer. Asphaltic surface material shall be paid for at the contract unit price bid per ton.

S-20 STREET SWEEPING

During the cold planing operation, the Contractor shall remove all cuttings and debris from the street by use of a self-propelled street sweeper with hopper. Recompacted planing materials and all other materials not picked up the street sweeper shall be removed by other means by the Contractor. No material shall remain that would recompact or leave an unsuitable surface for subsequent overlay operations. Open faced brooms shall only be used when approved by the City Engineer.

At all other times the project site shall be kept clean, neat and orderly. The contractor shall keep all streets in a dust free condition. At any time the engineer may require additional sweeping to maintain the required dust free surface. Stockpiling of debris and unsuitable materials beyond normal working hours shall not be permitted. Immediately after construction operations are complete, all equipment, debris and unsuitable materials shall be completely removed from the site in order to minimize the damage to finished work and inconvenience to the public and adjoining property owners.

S-20.1 Measurement and Payment

Street Sweeping shall not be paid for directly, but shall be subsidiary to “Milling”.

S-21 STREET WASHING

A high pressure type water truck, capable of washing all fines from the planed surface may be required prior to overlaying as directed by the Engineer. Equipment compliance with this specification shall be by visual observation by the Engineer at the commencement of washing operations.

S-21.1 Measurement and Payment

Street washing shall not be paid for directly, but shall be subsidiary to “Milling”.

S-22 TEMPORARY SURFACING MATERIAL

Access to private drive entrances shall be maintained whenever possible.

During various stages of the construction, it may become necessary to provide commercial mix asphaltic concrete, meeting the requirements of Section 816 of the Standard Specifications, and/or gravel, at drive entrances or across intersections to provide suitable access. The asphaltic concrete shall then be removed when the temporary fill interferes with a later stage of construction just prior to commencing that stage of construction. The Contractor shall furnish, place and remove the asphaltic concrete or gravel from the drive entrances as directed by the Engineer.

S-22.1 Measurement and Payment

Payment will be made at the contract unit price bid per ton for "Temporary Surfacing Material" of the specified type. No payment will be made for material placed that was not requested by the Engineer.

S-23 AGGREGATE BASE COURSE (OP SPECIAL)

Revision Date:
11/12/01

S-23.1 General

This work shall consist of furnishing and placing aggregate base course in accordance with the following specifications and as shown on the plans.

S-23.2 Compaction

Compaction requirements shall be based on the results of a test section constructed by the Contractor, using the materials, methods, and equipment proposed for use in the work. The test section shall meet the requirements of paragraph “Test Section” and shall be observed by the City Engineer.

S-23.2.1 Compaction Equipment

A dual or single smooth drum roller with vibratory capability and static weight not less than 26.8 kg/cm (150 lbs/in) width of drum.

S-23.3 Sampling and Testing

S-23.3.1 Samples
Samples for material gradation, liquid limit, and plastic limit tests shall be taken in conformance with ASTM D 75.

S-23.3.2 Initial Test
One of each of the following tests shall be performed on the proposed material, prior to commencing construction for each source (geological unit) of material: Sieve analysis, wear test, soundness, absorption, specific gravity, liquid limit and plasticity index, and moisture-density relationships. Certified test results shall be submitted to the City Engineer prior to commencing construction.

S-23.3.3 Sieve Analyses
Sieve analyses shall be made in conformance with ASTM C 117 and C 136. Sieves shall conform to ASTM E 11.

S-23.3.4 Liquid Limit and Plasticity Index:
Liquid Limit and plasticity index shall be determined in accordance with ASTM D 4318.

S-23.3.5 Testing Frequency
Testing frequency for sieve analysis, liquid limit and plasticity index -- Results shall verify that the material complies with the specifications. After the initial test, a minimum of one analysis shall be performed for each 1,000 megagrams (835 tons) of material placed, with a minimum of one analysis for each day's placement until the base course is completed. When the source of materials is changed or deficiencies are found, the initial analysis shall be repeated and the material already placed shall be re-tested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced.

S-23.3.6 Density
Density will be determined by roller pattern. The City Engineer may perform check density test as specified herein at random times.

S-23.3.7 Soundness, Wear, Absorption, and Specific Gravity Test shall conform to the requirements of Subsection 1105 of the standard specifications. The above test shall be performed in accordance with test methods stated in Subsection 1117 of the standard specifications.

S-23.4 Approval of Material

S-23.4.1 Aggregates
Aggregates shall consist of clean, sound, durable particles of crushed limestone stone. The Contractor shall obtain materials that meet the specification and can be used to meet the grade and smoothness requirements specified herein, after all compaction operations have been completed. The aggregates shall be free of silt and clay as defined by ASTM D 2487, vegetable matter, and other objectionable materials or coatings. The portion retained on the 4.75 mm (No. 4) sieve shall be known as coarse aggregate; that portion passing the 4.75 mm (No. 4) sieve shall be known as fine aggregate.

S-23.4.2 Coarse Aggregates
Coarse aggregates shall be angular particles of uniform density. The percentage of flat and/or elongated particles shall not exceed 20 in the fraction retained on the 12.5 mm (1/2 inch) sieve and in the fraction passing the 12.5 mm (1/2 inch) sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the requirements set forth herein.

S-23.4.3 Fine Aggregate
Fine aggregate shall be natural sand or angular particles produced by crushing stone or gravel that meets the requirements for wear and soundness specified for coarse aggregate.

S-23.4.4 Gradation Requirements
Gradation requirements specified herein shall apply to the completed <u>compacted</u> base course. The aggregates shall have a maximum size of 50 mm (2 inch) and be graded continuously well within the limits specified in Table I. Sieves shall conform to ASTM E 11.

TABLE I. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve:

Sieve Designation	Percent Passing
50 mm (2 inches)	100
37.5 mm (1 ½ inches)	70-100
25 mm (1 inch)	45-80
12.5 mm (1/2 inch)	30-60
4.75 mm (No. 4)	10-35
2.36 mm (No. 8)	5-25
425 um (No. 40)	4-18
75 um (No. 200)	0-10

Liquid limit and plasticity index requirements stated herein shall apply to any aggregate component that is blended to meet the required gradation and also to the aggregate in the completed base course. The portion of the aggregate passing the 425 um (No. 40) sieve shall be either non-plastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

S-23.4.5 Stockpiling Material
Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. Aggregates shall be stockpiled on the cleared and leveled areas designated by the City Engineer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

S-23.5 Preparation Of Surface
Immediately prior to placing aggregate base course, the previously constructed underlying surface course shall be cleaned of all foreign substances; if the surface of the underlying material has been damaged after placement or has inadequate compaction or other deviations from this

contract specification requirements, such defects shall be repaired immediately prior to placement of this course.

S-23.6 Grade Control
During construction, the lines and grades including crown and cross slope indicated for the base course shall be maintained by means of line and grade stakes placed by the Contractor.

S-23.7 Weather Limitation
Base courses shall be placed when the atmospheric temperature is above 2 degrees C (36° F). Areas of completed base course that are damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirement.

S-23.8 Mixing of Materials
The coarse and fine aggregates shall be mixed in a stationary plant. **Water shall also be added to the aggregate prior to placement at a stationary mixing plant. The amount of water added shall be considerably above optimum moisture.** The Contractor shall make such adjustments in mixing procedures or in equipment as may be directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory base course meeting all requirements of this specification.

S-23.9 Placing
The mixed material shall be placed on the prepared sub-grade or sub-base in layers of uniform thickness with an approved spreader box when possible as directed by City Engineer. Tracked equipment operated on base course material shall have street tracks. When a compacted layer 150 mm (6 inches) or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 150 mm (6 inches) is required, the material shall be placed in layers of equal thickness. No layer shall exceed 150 mm (6 inches) or be less than 75 mm (3 inches) when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, content, and to insure an acceptable base course. Mixed material shall not be placed on or above frozen material.

S-23.10 Test Section

S-23.10.1 General
A test section shall be constructed to evaluate placement and compaction procedures. Test section data will be used by the City Engineer to determine the required number of passes and the field dry density requirements for full scale production. The test section shall be located with the limits of the base course construction area at a location approved by the City Engineer. The underlying courses shall be completed, inspected and approved in the test section prior to constructing the base course. The test section shall be 12 feet wide and contain approximately 100 tons of completed base course. Whenever the quarry starts producing the base course material from a different geological unit, a new test section shall be constructed.

S-23.10.2 Mixing, Placement, and Compaction
Mixing, placement, and compaction shall be accomplished using equipment meeting the requirements stated hereinbefore. Compaction equipment speed shall be no greater than 2.4 km/hour (1.5 miles/hour).

S-23.10.2.1 Procedure
The test section shall be constructed with aggregate in a moist state so as to establish a correlation between number of roller passes and dry density achievable during field production. Density and moisture content tests shall be conducted at the surface and at intervals of 2 inches of depth down for the total layer thickness, in accordance with ASTM D 2922 and ASTM D 3017. Sieve analysis tests shall be conducted on composite samples, taken adjacent to the density test locations, which represent the total layer thickness. One set of tests (i.e. density, moisture, and sieve analysis) shall be taken before compaction and after each subsequent compaction pass at three separate locations as directed by the City Engineer. Compaction passes and density readings shall continue until the difference between the average dry densities of any two consecutive passes is less than or equal to 0.5 pcf.

S-23.10.3 Evaluation
Within 5 working days of completion of the test section, the Contractor shall submit to the City Engineer a Test Section Construction Report complete with all required test data and correlations. The City Engineer will evaluate the data and provide to the Contractor the required number of passes of the roller, the dry density for field density control during construction, the depth at which to check the density, and the need for a final static pass of the roller.

S-23.11 Compaction
Compaction shall be accomplished using rollers meeting the requirements of paragraph "Compaction Equipment" and operating at a rolling speed of no greater than 1.5 miles per hour. Each lift of material, including shoulders, shall be compacted with the number of passes of the roller as specified by the City Engineer. In addition, a minimum field dry density, as specified by the City Engineer, shall be maintained. If the required field dry density is not obtained, the number of roller passes shall be adjusted. Excessive rolling resulting in crushing of aggregate particles shall be avoided. In all places not accessible to the rollers, the material shall be compacted with mechanical hand operated tampers.

S-23.12 Finishing
The surface of top layer of base course shall be finished after final compaction, by cutting any overbuild to grade and rolling with a steel-wheeled roller. In no case will thin layers of material be added to the top layer of base course to meet grade. If the elevation of top layer of base course is 12.5-mm (1/2 inch) or more below the grade, the top layer of base shall be scarified to a depth of at least 75-mm, new material shall be added, and the layer shall be blended and recompacted to bring to grade. Adjustments in rolling and finishing procedures shall be made as may be directed to obtain grades, to minimize segregation and degradation of base course material, to adjust the water content, and to insure an acceptable base course. Material found unacceptable shall be removed and replaced, as directed, with acceptable material. As stated here in before the gradation applies to the completed compacted base.

S-23.13 Edges of Base Course
Acceptable material shall be placed along the edges of the base course in such quantity as will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least a 0.30-m (1 foot) width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the base course, as directed.

S-23.14 Smoothness Test
The surface of the top layer shall not deviate more than 12.5 mm (1/2 inch) when tested with a 3.05 m (10 feet) straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding 12.5 mm (1/2 inch) shall be corrected as directed. Measurements taken at right angles to the centerline shall be taken at a minimum of 15.24 m (50 feet) intervals.

S-23.15 Thickness Control
The completed thickness of the base course shall be within 12.5 mm (1/2 inch) of the thickness indicated. The thickness of the base course shall be measured at intervals providing at least one measurement for at least each 418 square meters (500 sq. yd) of base course. The depth measurement shall be made by test holes at least 75 mm (3 inches) in diameter. Where the measured thickness of the base course is more than 12.5 mm (1/2 inch) deficient, such areas shall be corrected by excavating to the required depth and replacing with new material. Where the measured thickness of the base course is 12.5 mm (1/2 inch) more than indicated, it will be considered as conforming with the requirements plus 12.5 mm (1/2 inch), provided the surface of the base course is within 12.5 mm (1/2 inch) below established grade and not above the established grade. The average job thickness shall be the average of the job measurements as specified above but within 6.25 mm (1/4 inch) of the thickness indicated.

S-23.16 Maintenance
The base course shall be maintained in a condition that will meet all specification requirements until accepted.

S-23.17 S-1.17
Within 15 days after completion of the aggregate base course it shall be covered with asphaltic concrete intermediate course. The aggregate base course shall not be used as a haul road except for curb construction.

S-23.18 S-1.18 Measurement and Payment
Payment for aggregate base course shall be at the contract unit price bid per square yard for "Aggregate Base Course (OP Special)" which includes all tools, materials, labor, equipment and incidentals necessary to complete the work specified above.

S-24 FLY ASH MODIFIED SUBGRADE
This work shall consist of constructing one or more courses of a mixture of soil, fly ash, and water, in accordance with Section 310 of the Standard Specifications. All fly ash materials shall conform to Section 2005 of the Standard Specifications, and water used for fly ash modified subgrade shall conform to Section 2400 of the Standard Specifications.

The Contractor shall make every reasonable attempt to utilize the most suitable on site, as designated by the Engineer, for preparation of the areas to receive fly ash modification. Prior to constructing grades in these areas the Contractor shall inform the Engineer of the materials to be used, in order that tests to determine the suitability of the materials may be conducted.

The amount of fly ash to be used for modification shall be established by the Engineer based on laboratory tests on the site materials and specific fly ash to be supplied by the Contractor. The required moisture content shall be established by the Engineer based on laboratory tests on the site materials and specific fly ash content to be used for the treatment.

S-24.1 Measurement and Payment
The amount of completed and accepted work shall be paid for at the contract unit price per ton for "Fly Ash", and at the contract unit price per square yard for "Manipulation for Fly Ash Treated Subgrade". No separate payment will be made for water required for fly ash modification.

S-25 CONCRETE CONSTRUCTION

Revision Date:
05/18/2004

S-25.1 General
All concrete construction shall meet the requirements of Section 701 of the Standard Specifications and as hereafter presented.

S-25.2 Mix Designs
The mix designs shall be approved by the Kansas City Metro Materials Board as meeting the designation “KCMMB 4K “ or “KCMMB 5K”.

S-25.3 Ready-mixed Concrete
Ready-mixed concrete shall be mixed and placed in accordance with the requirements of the Standard Specifications, except that ready-mixed concrete shall be transported with agitation, and such concrete shall not be used when the cement has been in contact with the aggregate more than one hour before it is placed. All concrete shall meet the slump requirements specified, and the Engineer will require additional slump tests if, in his opinion, it appears that excessive water has been added. Concrete which does not meet this requirement will be rejected.

A diligent effort shall be made by the Contractor and the ready-mix concrete producer to deliver concrete at regular intervals, and to maintain a uniform mix throughout each concrete pour. Concrete shall be delivered at intervals frequent enough to prevent any cold joints.

S-25.4 Placement and Curing
The Contractor shall provide 24 hours notice of his intention to place concrete to allow for adequate supervision.

Apply a waterborne monomolecular evaporation retarder to concrete surfaces, as recommended by ACI 305R, ACI 308, and ACI 345R if hot, dry, or windy weather conditions cause moisture

loss approaching 0.1 lb/sf/hr as determined using the Menzel Evaporation Rate chart. Apply according to the manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before final finishing operations. The engineer will confirm evaporation rate calculations. Failure to use an evaporation retarder will be grounds for rejection of concrete. The engineer shall approve all evaporation retarding materials. Evaporation retarders are not required where water-fogging equipment is in use.

Curing of all concrete shall meet the requirements of the Municipal Code.

S-25.5 Forms
Forms shall be of steel or wood, free from warp and shall be sufficiently strong and rigid and securely staked and braced to obtain a finished product correct to the dimensions, lines and grades required. All forms must be cleaned and oiled before each use. In no case shall forms obstruct the waterways of the storm sewer system.

S-25.6 Structural Concrete Construction
All concrete used in construction of reinforced box culverts, retaining walls and culvert aprons shall be classified as KCMMB 5K. The actual mixed proportions of cement, aggregates and water shall be determined by the Contractor.

S-25.7 KCMMB 4K Construction
All concrete used in construction of concrete pavement, curbs and gutters, sidewalks, and integral sidewalk retaining walls shall be classified as KCMMB 4K. The actual mixed proportions of cement, aggregates and water shall be determined by the Contractor.

S-25.8 Measurement and Payment
Structural concrete shall be paid for at the contract unit price per cubic yard for "KCMMB 5K Concrete". No direct payment will be made for KCMMB 4K construction as it shall be considered subsidiary to other bid items.

S-26 SAWING
All required sawing including curb and gutter, removal and replacement, and any other sawing shall be subsidiary to other bid items.

S-27 REINFORCING STEEL
All fabrication and placement of reinforcing steel shall be in conformance with Section 703 of the Standard Specifications and Special Provision 90M-165-R7. All reinforcing shall be as shown on the drawings and shall be held in place and positioned by pins or bar chairs or other approved devices or methods. Reinforcement shall be new billet ASTM A615 Grade 60 for KCMMB 5K concrete construction, as shown on the plans. Reinforcing shall be new billet ASTM A615 Grade 40 for all other construction.

S-27.1 Payment
No direct payment shall be made for reinforcing steel, as it shall be considered subsidiary to other bid items.

S-28 STEEL PILES

This work shall consist of furnishing and driving of steel piles at the locations and to the elevations shown on the plans. Steel piles shall be furnished and driven in accordance with Sections 704 and 1607 of the Standard Specifications except as noted herein.

S-28.1 Subsurface Data

The geotechnical investigations were prepared for the guidance of the Contractor as to what soil and water conditions may be expected at the site. They are not guaranteed as representing all the conditions which may be encountered. Each bidder is cautioned that it is your responsibility to examine the boring logs and to determine if the information provided in the report is adequate for your method of construction The Owner will not assume responsibility for variations in soil and water conditions at locations or times other than indicated.

S-28.2 Measurement and Payment

No direct payment shall be made for steel piles, as it shall be considered subsidiary to the bid item “Unclassified Excavation”.

S-29 GRANULAR BACKFILL (WINGWALLS)

This work shall be done in accordance with the plans and applicable portions of the Standard Specifications. It shall consist of the excavation of unstable or other unsuitable material from the designated locations behind the wingwalls, and placement of granular backfill material as shown on the plans.

S-29.1 Measurement and Payment

Payment for this work shall be made at the contract unit price bid per cubic yard for "Granular Backfill (Wingwalls)", measured to the theoretical limits as shown on the plans. Excavation, and installation of drainage pipe and rodent screens shall be considered subsidiary to this item.

S-30 FOUNDATION STABILIZATION

This work shall be done in accordance with Section 207 of the Standard Specifications. It shall consist of the excavation of unstable or other unsuitable material below foundation elevation of reinforced concrete box structures and replacement with suitable and stable granular backfill material.

S-30.1 Measurement and Payment

Payment for this work shall be made at the contract unit price bid per cubic yard for "Foundation Stabilization".

S-31 CURB CONSTRUCTION

S-31.1 Concrete Curb
Concrete curb shall be installed, or removed and replaced as shown on the plans and in accordance with the requirements of the Overland Park Municipal Code, and shall consist of KCMMB 4K concrete.

S-31.2 Equipment
A slip form curb machine shall be required on all continuous curb construction of lengths greater than 100 feet.

S-31.3 Construction

S-31.3.1 Concrete Placement
The concrete shall not be placed until the subgrade has been inspected for compaction and moisture. The concrete shall be compacted with an approved internal type vibrator, or by hand spudding and tamping. The surface shall be shaped by use of a steel tool to produce the sections shown on the drawings. The edges shall be rounded with edgers to form the radii indicated on the drawings.

The surfaces shall be finished with a wooden or metallic float and brushed. All concrete shall be cured in accordance with the Overland Park Municipal Code.

S-31.3.2 Inlets
Curbs constructed in front of existing inlets shall be paid for at the contract unit price bid per lineal foot of concrete curb. (See Standard Curb Inlet Detail).

S-31.3.3 Line and Grade
The new concrete curb and gutter shall be accurately placed in accordance with the line and grade as established by the Engineer.

S-31.4 Removal and Replacement

S-31.4.1 Removal
Excavation, removal of concrete, concrete curbing, sidewalks, pavement material, or any other items required to be removed for the completion of this project shall be removed from the construction site and disposed of by the Contractor. The pavement shall be saw cut full depth in a true line a minimum of 2 inches in front of the section of curb marked to be removed. The concrete curb shall be sawed at each end of the section of curb marked to be removed. The curb shall be removed as not to disturb the adjacent pavement and adjacent curb. The Contractor will be responsible for repairing all damage to the pavement and curb and gutter resulting from his operations beyond the limits marked for repair.

S-31.4.2 Replacement
The subgrade shall be compacted as required by the plans and specifications, but not less than Type AA (MR-5), clean of any foreign material, and moistened prior to placing concrete. If additional fill is required for subgrade, aggregate designated as AB-3 shall be used in accordance with Section 1104 of the Standard Specifications, or as approved by the Engineer, and 95% compacted. The Contractor shall have available adequate hand or mechanical compaction

equipment to accomplish the compaction as set forth in these Specifications. Concrete, as a base material, shall be placed in front of the new curb and shall be in place five days, or shall have obtained 70% design strength prior to placement of asphalt surface. The concrete shall be left below the existing surface by the surface thickness, and an asphaltic concrete surface shall be placed over the concrete and compacted. Concrete and asphalt in front of the new curb shall not be paid for directly but shall be considered subsidiary to the contract price bid per lineal foot of the concrete curb type.

S-31.5 Measurement and Payment
Payment will be made at the contract unit price bid per lineal foot for "Curb and Gutter, Combined", of the specified type, or "Curb", of the specified type. Curb in front of handicapped ramps, curb transitions, Type C curbs, and other locations not a standard width or section, will be paid for as "Curb and Gutter, Combined" of the more prevalent type unless otherwise specified.

S-32 CONCRETE MEDIAN NOSE
This item includes construction of median nose at locations shown on the plans. Median nose shall be constructed of KCMMB 4K concrete, and shall conform to the requirements of "Concrete Construction" and "Reinforcing Steel".

S-32.1 Measurement and Payment
Payment will be made at the contract unit price bid per each for "Concrete Median Nose", which shall include gravel base, concrete, pipe sleeves and any other incidental materials required for this construction.

S-33 CONCRETE PAVER STONES
Solid concrete paver stones shall be used in the medians as shown on the plans.

S-33.1 Work Included

1. Supply and place sand laying course.
2. Supply and install interlocking concrete paver stones in quality, shape, thickness and color as specified.
3. Supply and place all accessory items as required by the contract.

S-33.2 Product Handling
Paver stones shall be delivered and unloaded at jobsite on pallets and bound in such manner that no damage occurs to the product during handling, hauling and unloading.

S-33.3 Interlocking Concrete Paver Stones (ASTM Designation C936-82)
Paver stones shall be red, cobblestone style consisting of full stones, (4 5/8" X 7" X 2 3/8"); two thirds stones, (4 5/8" X 4 5/8" X 2 3/8"); and one third stones, (4 5/8" X 2 5/16" X 2 3/8"). The mix of stones sizes shall be approximately 28% full size, 57% two thirds size and 15% one third size.

S-33.4 Cementatous Materials
Materials shall conform to the following ASTM specifications as they apply

1. Portland Cements - Specification C150
2. Blended Cements - Specification C595
3. Hydrated Lime Type S - Specification C207
4. Pozzolans - Specification C618

S-33.5 Aggregates
Aggregates shall conform to ASTM Specifications C33 for Normal Weight Concrete Aggregate.

S-33.6 Other Constituents
Air-entraining agents, coloring pigments, integral water repellents, finely ground silica, etc. shall conform to ASTM standards where applicable, or shall be previously established as suitable for use in concrete.

S-33.7 Physical Requirements

S-33.7.1 Compressive Strength
At the time of delivery to the work site, the average compressive strength shall be not less than 8,000 psi with no individual unit strength less than 7,200 psi, with testing procedures in accordance with ASTM Standard C140.

S-33.7.2 Absorption
The average absorption shall not be greater than 5% with no individual unit absorption greater than 7%.

S-33.7.3 Durability
The manufacturer shall satisfy the purchaser either by proven field performance or the laboratory freeze-thaw test that the paving units have adequate durability.

S-33.7.4 Proven Field Performance
Satisfactory field performance is indicated when units similar in composition, and made with the same manufacturing processes those to be supplied to the purchaser, do not exhibit objectionable deterioration after at least three years. The units used as the basis for proven field performance shall have been exposed to the same environmental factors as is contemplated for the units supplied to the purchaser.

S-33.7.5 Freeze-Thaw Test
When tested in accordance with Section 8 of ASTM C67-83, Specimens shall have no breakage and not greater than 1.0% loss in dry weight of any individual unit when subjected to 50 freeze-thaw cycles. This test shall be conducted not more than 12 months prior to delivery of units.

S-33.7.6 Abrasion Resistance
When tested by sandblasting in accordance with ASTM C418-76, Specimens shall not have greater volume loss than 15 cubic cm per 50 square cm. The average thickness loss shall not exceed 3mm.

S-33.7.7 Permissible Variations in Dimensions
Length or width of units shall not differ by more than 1.5mm (1/16") from approved samples. Heights of units shall not differ by more than 3mm (1/8") from the specified standard.

S-33.7.8 Visual Inspection
All units shall be sound and free of defects that would interfere with the proper placing of unit or impair the strength or permanence of the construction. Minor cracks incidental to the usual methods of manufacturer, or minor chipping resulting from customary methods of handling in shipment and delivery, shall not be deemed grounds for rejection.

S-33.7.9 Sampling and Testing
The purchaser or his authorized representative shall be accorded proper facilities to inspect and sample the units at the place of manufacture from the lot ready for delivery. Sampling and testing of units shall be in accordance with ASTM Methods C140 except as required.

S-33.7.10 Rejection
In case the shipment fails to conform to the specified requirements, the manufacturer may sort it, and new test units shall be selected at random by the purchaser from the retained lot and tested at the expense of the manufacturer. In case the second set of test units fails to conform to specified requirements, the entire lot shall be rejected.

S-33.7.11 Expense of Tests
The expense of inspection and testing shall be borne by the purchaser unless otherwise agreed.

S-33.7.12 Concrete Base Course
The concrete base course shall be KCMMB 4K concrete. The concrete base course shall be the responsibility of the paver stone installer.

S-33.7.13 Sand Laying Course
The sand laying course shall be a well graded, clean washed, sharp sand with 100% passing a 3/8" sieve size and a maximum of 3% passing a No. 200 sieve size. This is commonly known as manufactured concrete sand, limestone screening, or similar. Mason Sand will not be permitted. The sand laying course should be the responsibility of the paver stone installer.

S-33.7.14 Edge Restraint
All edges of the installed paver stone shall be restrained by the concrete curb, concrete sidewalk, or suitable method of preventing movement of edge stones.

S-33.8 Execution

S-33.8.1 Installer
The paver stone installer/contractor must have related experience in the installation of interlocking concrete paver stones.

S-33.8.2 Concrete Base Course
The concrete base course shall be shaped to the grade and cross section as shown on the plans with an allowable tolerance of 1/4" (5mm). The base course shall be 3-3/8" (86mm) below finish grade for 2-3/8" (6cm) pavers.

S-33.8.3 Construction of the Sand Laying Course
The finished base course shall be approved before the placement of the sand laying course. The uncompacted sand laying course shall be spread evenly over the area to be paved and then screened to a level that will produce 1" (25mm) thickness when the paver stones have been placed and vibrated. Once screened and leveled to the desired elevation, the sand laying course shall not be disturbed in any way.

S-33.8.4 Laying of Concrete Paver Stones
The paver stones shall be installed in rows perpendicular to the major axis of the median being paved. Within each row the stone sizes shall be randomly mixed so that joints between stones are not normally aligned with joints between stones in adjacent rows. No joints shall be aligned for more than three consecutive rows. The paver stones shall be laid in such a manner that the desired pattern is maintained and the joints between the stones are as tight as possible. For maximum interlock it is recommended that joints between stones do not exceed 1/8" (3mm). String lines should be used to hold all pattern lines true.

The gaps at the edge of the paver surface shall be filled with standard edge stones or with stones cut to fit. Curing shall be accomplished to leave a clean edge to the traffic surface using a double-headed breaker or a masonry saw. However, when cutting precision designed areas, a masonry saw is recommended. Whenever possible, no cuts should result with a paver less than 1/3 of original dimension.

Paver stones shall be vibrated to their final level in the sand laying course by two or three passed of a vibrating compactor capable of 3,000 to 5,000 pounds compaction force with the surface clean and joints open. After vibration, clean concrete sand containing at least 30% of 1/8" (3mm) particles shall be spread over the paver stone surface, allowed to dry, and vibrated into the joints with additional passes of the plate vibrator so as to completely fill the joints. Surplus material shall then be swept from the surface. Upon completion of work covered in this Section, the Contractor shall clean up all work areas by removing all debris, surplus material and equipment from the site.

After final vibrating, the surface shall be true to grade and shall not vary by more than 5mm (1/4") when tested with a 3m (10') board at any location on the surface.

S-33.9 Measurement and Payment
Payment for concrete paver stones shall be at the contract unit price bid per square foot for "Concrete Paver Stones" which includes subgrade preparation, concrete base course, tools, materials and equipment necessary to complete the work.

For removal and resetting of existing paver stones, any extra materials needed to complete the work including concrete base course and sand laying course shall be considered subsidiary. Payment for removing and resetting paver stones shall be at the contract unit price bid per square foot for “Concrete Paver Stones (Remove and Reset)”.

S-34 DRIVEWAYS

All concrete, asphalt, or gravel driveways that are damaged or removed shall be constructed to the same widths and with the same material that existed prior to construction, unless noted otherwise on the plans. All driveways of every material shall be constructed on a prepared subgrade, compacted to 95% for a depth of 6" in cut sections, and to a depth of 18" in fill sections.

S-34.1 Concrete Driveways

Where construction requires the removal and replacement of existing concrete driveways, such removal shall be accomplished by first sawing the existing driveway as shown on the plans, and removing all material to be replaced. A one-half inch (1/2") premolded expansion joint shall be installed at the sawed joint, and the driveway and drive apron replaced with concrete. Concrete driveways shall be replaced to a minimum thickness of 6", except that in no case shall it be less than the section being replaced, and it shall include wire mesh if the existing driveway is so reinforced. If wire mesh is used, it shall be 6" x 6" #6 WWF provided in sheet form. Rolled wire mesh shall not be allowed. All concrete shall conform to KCMMB 4K concrete as defined in these Specifications. Driveways shall receive a nonslip finish obtained by a wood float and hair brush or broom applied transverse to the centerline of the driveway.

All joints in concrete driveways shall be tooled. Joints shall be tooled after brooming to provide a "picture frame" appearance.

S-34.2 Asphalt Driveways

Where roadway construction requires the removal and replacement of existing asphalt driveways, such driveways will be sawed and all material removed as shown on the plans. The driveway shall be replaced with a minimum of 6" of asphaltic concrete intermediate course upon the prepared subgrade, but in no case shall it be less than that section being replaced. Placing and compaction of the asphalt driveway pavement shall be in accordance with the Standard Specifications and in 4" maximum lifts.

S-34.3 Gravel Driveways

Where construction requires the removal and replacement of existing gravel driveways, such driveways shall be removed as shown on the plans. The minimum pavement section for gravel replacement shall be 6" of AB-3, which shall be laid watered, manipulated and compacted in lifts not to exceed 3".

S-34.4 Temporary Access

The Contractor shall not prohibit access to the property owner without providing temporary access. Temporary access shall consist of AB-3 aggregate, wood planks, or any other means of

providing access to the property. This work shall not be paid for directly but shall be subsidiary to other bid items.

S-34.5 Measurement and Payment
Concrete driveway replacement shall be paid for at the contract unit price bid per square yard for "Concrete Pavement" of the specified thickness. Asphalt driveway replacement shall be paid for at the contract unit price bid per ton for "Plant Mix Bituminous Mixture – Commercial Grade (Intermediate Course)".

Gravel driveway replacement shall be paid for at the contract unit price bid per ton for "Aggregate for Base (AB-3)".

S-35 FLOWABLE FILL
The contractor shall use low strength flowable fill as shown in the Plans and according to the applicable sections of Special Provision 90M-188-R2. The flowable fill mix design shall be submitted to the Engineer for approval and shall be such that it can be pumped.

S-35.1 Measurement and Payment
No direct payment shall be made for this item as it shall be considered subsidiary to other bid items.

S-36 CONCRETE SIDEWALK CONSTRUCTION
All sidewalk construction shall comply with the City of Overland Park Municipal Code.

S-36.1 Subgrade Preparation
The subgrade shall be uniformly compacted and evenly graded to the required subgrade elevation. All loose or extraneous material shall be removed from the subgrade and soft spots shall be uniformly recompacted prior to placement of concrete. The Contractor shall have available adequate hand or mechanical compaction equipment to accomplish the compaction as set forth in these specifications.

S-36.2 Dimensions
The width of any sidewalk repair shall be the same as that being replaced. The width of new sidewalk construction shall be as indicated on the plans. The minimum allowable thickness shall be 4", except within a driveway approach area, where the minimum allowable thickness shall be 6".

S-36.3 Reinforcing
Reinforcing of sidewalks will not be required except in unusual conditions where the City Engineer may require reinforcing or welded wire fabric. When welded wire fabric is used it shall be placed two inches (2") from the finished surface of the sidewalk. There will be no direct payment for this item, and it shall be subsidiary to the unit price bid for sidewalk replacement.

S-36.4 Measurement and Payment
Payment shall be made for the construction of sidewalks at the contract unit price bid per square foot of "Sidewalk Construction" of the specified thickness.

S-37 SIDEWALK RAMPS

Revision Date: 6/1/05

This work shall be constructed in accordance with the Overland Park Municipal Code.

Sidewalk ramps shall consist of the construction of sidewalk ramps at locations shown on the plans. Ramps shall be constructed with or without a detectable warning surface as specified on the plans. Type M mortar shall be used for the setting bed and grouted joints for the detectable warning surface paver bricks in accordance with ASTM C270, Table 1 (Masonry Cement Type only).

S-37.1 Curb Return Verification

After the construction of the adjacent curb and gutter section, and not less than one week prior to the construction of all wheelchair ramps, the contractor shall verify that the curb return elevations and the location of the depressed section is constructed in conformance with the design drawings. If the absolute elevation of any of the control points shown in sidewalk ramp drawings is not within .5 inches, or if the relative difference between any two control points is not within .125 inches, or if the depression location is not within 1" of the design drawings, the contractor shall either 1) remove and replace the non-compliant curb, or 2) submit a shop drawing showing how the ramp can be constructed to be ADA compliant. In the event that the original design drawings showed a ramp with elements that were not ADA compliant, the shop drawing shall show that the proposed element is as or more ADA complaint than the original design drawing. If this cannot be accomplished, the curb shall be removed and replaced.

S-37.2 Method of Measurement

"Sidewalk Ramp (6")" shall be measured by the square foot of final exposed area of the entire ramp. "Sidewalk Ramp with Detectable Warning Surface" shall be measured by the square foot of final exposed area of the entire ramp including any detectable warning areas. "Detectable Warning Surface" shall be measured by the square foot of final exposed area of the detectable warning surface. Final exposed area shall be that area exposed after installation of detectable warning surfaces and backfill operations are complete.

S-37.3 Basis of Payment

Payment shall be made for sidewalk ramps at the contract unit price bid per square foot for "Sidewalk Ramp (6")" or "Sidewalk Ramp with Detectable Warning Surface". Payment shall be made for detectable warning surface at the contract unit price bid per square foot for "Detectable Warning Surface".

S-38 ASPHALT SIDEWALK CONSTRUCTION

At the locations shown on the plans the Contractor shall construct an asphalt sidewalk. The asphaltic mix to be used for this construction shall conform to the requirements for mix designation Plant Mix Bituminous Mixture - Commercial Grade in Section 605 of the Standard Specifications.

S-38.1 Subgrade Preparation
The subgrade shall be uniformly compacted and evenly graded to the required subgrade elevation. All loose or extraneous material shall be removed from the subgrade and soft spots shall be uniformly recompacted prior to placement of concrete. Asphalt sidewalks shall be constructed on a prepared subgrade, compacted to Type AA MR-3 standards for a minimum depth of 6". The Contractor shall have available adequate hand or mechanical compaction equipment to accomplish the compaction as set forth in these specifications.

S-38.2 Dimensions
The width of the asphalt sidewalk shall be as indicated on the plans, and the thickness shall be 4".

S-38.3 Finish
The Contractor shall provide adequate paving equipment and tools to produce quality workmanship in placing and compacting asphalt. Compaction shall be as specified in Section 603 of the Standard Specifications.

S-38.4 Measurement and Payment
Payment shall be made for the construction of sidewalks at the contract unit price bid per ton of "Plant Mix Bituminous Mixture - Commercial Grade (Intermediate Course)". This price shall include all excavation and compaction necessary to construct the sidewalk.

S-39 INTEGRAL SIDEWALK RETAINING WALL
Integral sidewalk retaining walls of reinforced concrete shall be constructed at location shown on the plans and in accordance with details shown on the plans, and the requirements of Section 701 of the Standard Specifications. Concrete and reinforcing steel shall meet the requirements herein under "Concrete Construction", and "Reinforcing Steel".

All form ties used for construction of retaining walls shall be of an approved type so as to have a minimum breakback of 1/2". All tie holes shall be grouted and all form marks shall be removed with a diamond bit grinder or approved equal. The finish wall surface shall be fully rubbed with cement grout to provide a smooth, uniform appearance.

S-39.1 Measurement and Payment
Payment for integral sidewalk retaining wall shall be made at the contract unit price bid per cubic yard for “KCMMB 4K Concrete (Integral Sidewalk Retaining Wall)”, which price shall include sidewalk adjacent to retaining wall.

Payment for retaining wall underdrains shall be made at the contract unit price bid per lineal foot for "Underdrain” of the specified size and type.

S-40 RIGHT-OF-WAY LIMITS
All sidewalks to be replaced are located within the public street right-of-way and generally not closer than one foot from the right-of-way line. The Contractor shall confine his work to the right-of-way limits unless express approval of the property owner has been granted to the

Contractor. The Engineer shall be informed as to any such arrangements that the Contractor makes on his behalf in these matters. The Contractor shall contact the Engineer or his authorized representative in the case there is any question as to right-of-way width.

S-41 STORM SEWERS

Revision Date:
05/24/2005

S-41.1 Location and Grade of Sewers

All storm sewer construction shall be in accordance with the Overland Park Municipal Code. All storm sewers, structures and appurtenances shall be located as shown on the plans and as determined by the Engineer. The grade and alignment of the pipe shall be determined and maintained from tacked offset stakes located alongside the trench upon which cuts and elevations have been established by the Contractor. Pipe alignment during construction shall be maintained by the use of laser alignment equipment. A minimum of one foot of cover shall be maintained over the storm sewer pipe.

S-41.2 Pipe Materials

All storm sewer pipe specified in the plans shall be in accordance with the Standard Specifications. The type of bedding materials to be used to construct this project shall be Class "C" in all areas except under pavement or where noted otherwise on the plans. Unless otherwise noted on the plans, all storm sewer pipe shall be Class III reinforced concrete pipe in accordance with Section 1902 of the Standard Specifications.

S-41.3 Pipe Joints

The engineer reserves the right to require joint testing on pipe sections, either at the plant or in place, as designated by the Engineer to demonstrate compliance.

Lift holes are prohibited for all concrete storm sewer pipes.

S-41.4 Post Construction Video

Once installation and backfill of the proposed storm sewer has been completed and all grading over and around the storm sewer is completed, the Contractor shall be responsible for video taping each run of storm sewer pipe to verify that the segment of pipe is in sound, stable condition and that no failures have occurred during construction. This video shall be delivered to the Engineer for approval prior to any permanent pavement being placed over any said storm sewer. The development and delivery of this video shall be considered subsidiary to other bid items.

S-41.5 C.S.P. and Steel Pipe

All Corrugated Steel Pipe shall be constructed and installed in accordance with Sections 712 and 1905 of the Standard Specifications. All Corrugated Steel pipe shall be 2 2/3" X 1/2" corrugations, riveted or lock seam fabrication, consisting of minimum 16 gauge (0.64) steel. All C.S.P. flared end sections shall have extra length toe plates furnished. All helical C.S.P. pipe ends shall be rerolled with annular corrugations a minimum of four corrugations from the end, and all connecting bands shall be "HUGGER" type bands. All pipe shall be measured by the

lineal foot along the centerline of the various pipe sizes. 6" X 4" X 5/16" steel pipe shall be located within the sidewalk where drainage is impaired and as directed by the engineer.

S-41.6 Special Pipe
All special pipe sections necessary to complete the storm sewer system as shown on the plans shall be furnished by the Contractor. These sections shall include, but not be limited to, drop joint or radius pipe, bends, tees, and Type III end sections. The pipe manufacturer shall provide shop drawings indicating the exact methods to be used to achieve the lines and grades indicated on the plans, including a pipe laying schedule, and the configuration and number of any special pipe sections. All special pipe sections used shall be subsidiary to other bid items.

S-41.7 Measurement and Payment
Storm sewer pipe shall be measured by the lineal foot of the various sizes of storm sewers. Payment shall be made on the amount of completed and accepted work at the contract unit price bid per lineal foot for “Storm Sewer” of the specified size and type, with the lengths determined from center to center of structure, unless otherwise noted on the plans. Payment for storm sewer end section will be made at the contract unit priced bid per each for “End Section” of the specified size and type. Concrete toe walls and/or bar grates shall be considered subsidiary to end sections.

Prices shall be full compensation for excavation (including rock, if necessary), bedding, backfill, asphalt repair, sawing, and for furnishing all materials necessary to complete the work and shall include all costs in modifying the existing damaged pipes or structures affected by the work.

S-42 STORM SEWER INLETS AND MANHOLES
Storm sewer inlets and manholes shall be constructed in accordance with the Overland Park Municipal Code.

All storm sewer structures used on this project shall be of precast concrete, or poured in place concrete type. If precast concrete structures are used, the tops shall be poured in place, and a minimum of 6" of the wall steel shall be left exposed, and poured into the tops. Precast shop drawings shall be submitted and approved by the Engineer. All pipes entering or exiting precast structures shall be encased in a minimum of 6" of concrete all around the pipe for a distance of 2' adjacent to each structure.

S-42.1 Measurement and Payment
Payment shall be made at the contract unit price bid per each for "Inlet", "Junction Box", "Manhole" of the specified size and type. The price shall be full compensation for excavation (including rock if necessary), backfill, steps, castings, concrete, reinforcing steel, and other materials necessary to complete the work. The welded steel frames and grates for curb inlets and area inlets shall be thoroughly cleaned and hot dip zinc galvanized in accordance with ASTM A 123. Reinforcing steel used in inlets and manholes shall be ASTM A 615 grade 40.

Reconstruction of existing structure walls or tops to match proposed elevations or for connection to proposed storm sewer systems shall be paid for at the contract unit price bid per each for "Modification of Structure" of the specified type.

S-43 CONCRETE COLLAR

Storm sewer joints shall be encased in a concrete collar at locations shown on the plans. This encasement shall be constructed in accordance with the detail indicated on the plans. Minimum encasement, if none is detailed, shall consist of 6" KCMMB 4K concrete, which shall extend a minimum of 1.5' past each side of the joint. Reinforcement shall consist of a cage of #4 bars at 6" centers longitudinally, and 3-#4 bars transverse to the pipe centerline.

S-43.1 Measurement and Payment

Concrete Collar construction shall be paid for at the contract unit price bid per each for “Concrete Collar”.

S-44 STONE RIPRAP

This work shall consist of furnishing and placing a layer of stone riprap on properly compacted subgrade for protection of the channel slopes. Riprap shall be placed to reasonably conform to the lines and grades shown on the plans.

S-44.1 Materials

Stone for riprap shall be sound durable limestone free from cracks, seams, shale partings, and overburden spoil. Deleterious substances which include soft friable particles, objectionable materials, and other foreign matter shall not exceed 5 percent by weight. Geotextile, if specified, shall meet the requirements of Subsection 1710 of the Standard Specifications, unless modified on the plans.

S-44.2 Gradation

Stone for riprap shall conform to the requirements of Section 1116, for the designation as indicated on the plans.

S-44.3 Placement

Slope protection work shall not begin until all construction within the channel and all channel grading is complete and approved.

Riprap shall be placed to its full layer thickness in one operation and in such a manner as to minimize segregation and avoid displacing the underlying material. The finished surface of riprap shall blend smoothly into surrounding slope lines.

Riprap placing procedures shall result in a reasonable distribution of the stone from the largest to the smallest sizes, free from clusters of the large stones and pockets of the small stones. Placement shall begin at the bottom and proceed up the slope in a progressive manner. Dumping of stone at the top of the slope and rolling into place will not be permitted. Moving stone by drifting and pounding of rock into place will not be permitted. Final finishing of the slope shall

be done as the material is being placed. Hand placing shall be employed to the extent necessary to secure the results specified herein.

The contractor shall maintain the riprap protection until accepted by the Engineer and any material displaced by any cause shall be replaced at his expense to the requirements specified herein.

S-44.4 Measurement and Payment
Riprap shall be measured by the square yard of materials acceptably placed as computed from the neat lines and grades shown on the plans. No measurement will be made of any excavation, backfill, filter fabric, or other appurtenances necessary to complete the work. Riprap shall be paid for at the contract unit price bid per square yard for “Riprap" of the specified series and thickness.

S-45 STONE MASONRY RETAINING WALL

S-45.1 Description
Stone masonry, as here specified, shall include the classes commonly known as coursed, random, and random range work and shall consist of roughly squared and dressed stone laid in cement mortar.

S-45.2 Materials

S-45.2.1 Rubble Stone
Stone for mortar rubble or dry rubble masonry shall be of approved quality, sound and durable, and free from segregations, seams, cracks, and other structural defects or imperfections tending to destroy its resistance to the weather. It shall be free from rounded, worn, or weathered surfaces. All weathered stone shall be rejected.

All stone used in this work shall be obtained from quarries and beds in the Manhattan, Kansas area and designated by the Kansas Department of Transportation as meeting durability requirements of Class 1 or Class 6 and so shown on the current listing on file in the office of the City Engineer.

The stone shall be kept free from dirt, oil, or any other injurious material that may prevent the proper adhesion of the mortar.

S-45.2.2 Mortar
The mortar used shall be composed of one part of portland cement and three parts of sand.

S-45.3 Size
The size of the stone shall closely match the stone size of the existing stone masonry retaining wall. Stone size shall be approved by the Engineer prior to construction. Individual stones shall have a thickness of not less than 8 inches and a width of not less than 1 ½ times the thickness. No stones, except headers, shall have a length less than 1 ½ times their width. Stones shall decrease in thickness from bottom to top of wall.

S-45.4 Headers
Headers shall hold in the heart of the wall the same size shown in the face and shall extend not less than 12 inches into the core or backing. They shall occupy not less than one-fifth of the face area of the wall and shall be evenly distributed. Headers in walls 2 feet or less in thickness shall extend entirely through the wall.

S-45.5 Shaping Stone
The stones shall be roughly squared on joints, beds, and faces. Selected stone, roughly squared and pitched to line, shall be used at all angles and ends of walls. If specified, all corners or angles in exterior surfaces shall be finished with a chisel draft.

All shaping or dressing of stone shall be done before the stone is laid in the wall, and no dressing or hammering which will loosen the stone will be permitted after it is placed.

S-45.6 Laying Stone
Stone masonry shall not be constructed in freezing weather or when the stone contains frost, except by written permission of the Engineer and subject to such conditions as he may require.

The masonry shall be laid to line and in courses roughly leveled up. The bottom or foundation courses shall be composed of large, selected stones and all courses shall be laid with bearing beds parallel to the natural bed of the material.

Each stone shall be cleaned and thoroughly saturated with water before being set and the bed which is to receive it shall be clean and well moistened. All stones shall be well bedded in freshly made mortar. The mortar joints shall be full and the stones carefully settled in place before the mortar has set. No spalls will be permitted in the beds. Joints and beds shall have an average thickness of not more than 1 inch.

Whenever possible the face joints shall be properly pointed before the mortar becomes set. Joints which cannot be so pointed shall be prepared for pointing by raking them out to a depth of 2 inches before the mortar has set. The face surfaces of stones shall not be smeared with the mortar forced out of the joints or that used in pointing.

The vertical joints in each course shall break with those in adjoining courses at least 6 inches. In no case shall a vertical joint be so located as to occur directly above or below a header.

S-45.7 Pointing
Pointing shall not be done in freezing weather or when the stone contains frost.

Joints not pointed at the time the stone is laid shall be thoroughly wet with clean water and filled with mortar. The mortar shall be well driven into the joints and finished with an approved pointing tool. The wall shall be kept wet while pointing is being done and in hot or dry weather the pointed masonry shall be protected from the sun and kept wet for a period of at least 3 days after completion.

After the pointing is completed and the mortar set, the wall shall be thoroughly cleaned and left in a neat and workmanlike condition.

S-45.8 Measurement and Payment

Payment for stone wall shall be at the contract lump sum price bid for “Stone Masonry Retaining Wall”. The footing, reinforcing, excavation, backfill, geotextile fabric, underdrain pipe, cohesive soil and granular base shall be considered subsidiary to the installation of the wall. The contract price shall include all labor, tools, materials, and other items incidental to the satisfactory completion of the work.

S-46 PRECAST CONCRETE BOX CULVERT OPTION

The Contractor may, at the same bid price as cast-in-place, construct the culverts using precast reinforced concrete box barrels and cast in place wing walls and soil savers. Precast reinforced concrete culvert barrels shall be furnished in accordance with the requirements of ASTM C 1433. Design shall be based on AASHTO HS-20 loading and a 28 day compressive strength of 5,000 p.s.i.. In addition, specific design requirements for culvert barrels shall be as indicated on the plans. Reinforcing steel shall be Grade 60 in accordance with Section 704 of the Standard Specifications. Concrete and reinforcing steel shall meet the requirements of these specifications as described in "CONCRETE CONSTRUCTION", and "REINFORCING STEEL". Shop drawings shall be required for precast sections and for required modifications to wing walls, toe walls, and hub guards.

A minimum length section of the R.C.B. adjacent to the wing walls shall be poured in place with hub guards and toe walls shown on the plans. This section length shall be as indicted on the plans or as determined by the project engineer. The end barrel segments of the precast R.C.B. will be constructed with a key and tie steel of an adequate length and bar size for a lap with the toe wall and hub guard reinforcing steel in the poured in place section.

Pipe blockouts shall be cast into the R.C.B. barrel sections at the locations shown on the plans, with the reinforcing steel running through the blockout to be cut out in the field. Extra reinforcement as per the plans shall be installed around the blockout and shall be so indicated on the shop drawings.

Embedded lifting inserts shall provide a watertight lift point, which does not require patching or grouting. The insert type, size, and location shall be shown on the shop drawings. Inserts and their accessories shall be supplied by the same manufacturer. Rigging and installation guidelines shall be based on the insert manufacturer’s recommendations.

Barrel segments will be connected with a minimum of four tie bolts per joint. Barrel segments will have weep holes constructed as per the plans to utilize the drainage system as indicated, with weep hole spacing to be approved by the Engineer.

Excavation and backfill for precast culverts shall be in accordance with the requirements of these specifications as described in "EXCAVATION", and in accordance with Section 207 of the Standard Specifications. A granular bedding shall be placed to provide an even surface of

uniform density. The placing of precast barrel segments shall be started at the outlet end, with barrel segments placed with ends tightly abutting and true to line and grade. Barrel segments shall be match cast to each other or shall be otherwise formed at the joints with such precision as to limit joint openings in the installed position to not more than 3/4 inch wide. The completed barrel shall form a smooth uniform invert. The space between parallel segments in a multiple R.C.B. shall be filled with grout or aggregate backfill, as indicated on the plans. An approved mastic joint filler shall be applied to the joints prior to placement of the barrel segments. All precast barrel joints shall be wrapped in an external sealing band meeting the requirements of ASTM C 877 latest revision and installed in accordance with the manufacturers requirements.

S-46.1 Measurement and Payment
If the Contractor chooses to use the Precast Concrete Box Culvert Option, payment for this work shall be made at the contract unit price bid per cubic yard for "KCMMB 5K Concrete (R.C.B)" for precast barrels and poured in place end sections, toe walls, hubguards, and wing walls.

S-47 DRAIN TILE CONNECTION
Existing foundation drains, roof drains, and sump pump drains shall be connected to the proposed storm sewer system or ditch liner at locations indicated on the plans or as directed by the engineer. Extensions of the existing tile shall be made with a compatible material and all joints shall be watertight. Connections to an underground system shall be made at a structure when possible. Connection to the storm sewer pipe by coring a clean hole in the upper 1/3 of the pipe and grouting the drain securely into the pipe shall be acceptable with prior approval of the Engineer.

Cleanouts shall be provided at all bends in the drain tile systems. Cleanouts shall extend to grade and shall use no greater than 45 degrees bends.

Flapgates or backflow preventors shall be installed at locations where directed by the Engineer.

S-47.1 Payment
No direct payment shall be made for drain tile connections as they shall be considered subsidiary to other bid items.

S-48 PIPE UNDERDRAIN
At the locations determined by the engineer, underdrain shall be constructed in accordance with the plans and Section 818 of the Standard Specifications. All materials shall meet the requirements of Section 1900 of the Standard Specifications, except as modified herein. Under no circumstance shall Type H Pipe be installed within the same underdrain system as Type L Pipe or Prefabricated Edge Drain.

S-48.1 Pipe Underdrain
Pipe underdrain shall be Type H, PVC Corrugated Sewer Pipe with smooth interior and fittings in accordance with ASTM F 949, or, Type L, Corrugated Polyethylene Drainage Pipe in accordance with AASHTO M 252M.

S-48.2 Outlet Pipe
Outlet pipe shall be Type K, PVC Corrugated Sewer Pipe with smooth interior and fittings in accordance with ASTM F 949, or, Type E, Corrugated Polyethylene Drainage Pipe in accordance with AASHTO M 252M.

S-48.3 Joints
All joints shall be installed in accordance with the manufacturer's instructions. The contractor shall submit certified test results that the mechanical joints with elastomeric seals meet the requirements of ASTM D 3212 and ASTM F 477.

S-48.4 Perforations
Type H pipe shall be perforated in accordance with ASTM F 949. Type L pipe shall be perforated in accordance with AASHTO M 252M.

S-48.5 Prefabricated Edge Underdrain
The Contractor may, at his option, use prefabricated edge drain for "Pipe Underdrain " at locations not shown on the plans as being under paved areas. Prefabricated edge drain shall be corrugated polyethylene panel type pipe consisting of supporting drainage core encased in a geotextile.

S-48.5.1 Materials
Drainage core material shall be manufactured from polymers having a high resistance to deterioration by pavement deicing salts, petroleum based materials and naturally occurring soil chemicals. The core shall have sufficient flexibility to withstand bending and handling without damage or significant weakening.

Polyethylene edge drain materials shall conform to the requirements of the minimum cell classification of 323410C or 333410C as defined and described in ASTM D3350. The compound ingredients may consist of lubricants, stabilizers, nonpoly (ethylene) resin modifiers, and pigments essential for processing, property control, and coloring.

S-48.5.2 Workmanship and Visible Defects
The panel type pipe and fittings shall be free of foreign inclusions and visible defects. Ends shall be cut squarely and cleanly so as not to adversely affect joining. Cracks, creases, unpigmented or non uniformly pigmented pipe are not permissible.

S-48.5.3 Dimensions
The nominal sizes of the panel type pipe shall be 12 inches or 18 inches wide and 1 inch thick. The inside and outside dimensions and tolerances for the pipe are as follows:

Outside Dimensions:

Nominal Size	Width	Thickness
12 inchs	13 inches $\pm$ 3%	1.5 inches $\pm$ 3%
18 inchs	18 inches $\pm$ 3%	1.6 inches $\pm$ 3%

Inside Dimensions:

Nominal Size	Width	Thickness

12 inchs	12 inches ± 3%	0.750 inches + 3%/- 1.5%
18 inchs	17.25 inches ± 3%	0.830 inches + 3%/- 1.5%

Length shall be as approved by the Engineer, and shall not be less than 99 percent of the stated quantity.

S-48.5.4 Perforations
When perforated, the perforations shall be cleanly cut so as not to restrict the inflow of water and uniformly spaced on each long side of the panel type pipe. For 12 inch wide panels, four (4) rows of slots shall be uniformly spaced in every corrugation valley on each face. For 18 inch wide panels, six (6) rows of slots shall be uniformly spaced in every corrugation valley of each face. The length of slots shall not exceed 1 inch. The width of slots shall not exceed 0.150 inches. The water inlet area shall be a minimum of 5 square inches per foot per side for 12 inch panel; 7.5 square inches per foot per side for 18 inch panel.

Conditioning
S-48.5.5 Condition the specimen prior to test at 21 to 25º C for not less than 40 hours in accordance with procedure A in ASTM D618 for those tests where conditioning is required, and unless otherwise specified.
S-48.5.6
S-48.5.7 Conditions: Conduct all tests at a laboratory temperature of 21 to 25º C
S-48.5.8 unless otherwise specified herein.
S-48.5.9
S-48.5.10
S-48.5.11 Compressive Strength
The panel type pipe shall have a minimum of 40 psi. at 20% deflection when tested in accordance with these specifications. Further, the panel type pipe shall retain 50% of the minimum compressive strength when tested at 50 degrees from the normal plane.

To test for compressive strength, select a minimum of three (3) specimens and test for compressive strength as described in ASTM D2412, except for the following: (1) the test specimens shall be a minimum length equal to the nominal size of the panel type pipe; (2) the sample must lie flat on the plate within 1/8 inch and may be straightened by hand bending at room temperature to accomplish this; (3) crosshead speed shall be 0.50 +/- 0.02 inches per minute; (4) loading plates must be larger than the sample size; (5) the deflection indicator shall be readable and accurate to +/- 0.001 inch; (6) project the linear portion of the load/deflection curve between 0 and 10% deflection until it intersects the deflection axis. The point shall be considered as the origin of the load deflection curve. This test must be repeated using loading plates at 50 degrees from vertical and the results reported as above.

S-48.5.12 Environmental Stress Cracking
There shall be no cracking of the pipe when tested in accordance with these specifications.

Sections shall be tested for environmental stress cracking in accordance with ASTM D1693, except for the following modifications: (1) Three samples shall be tested; (2) each specimen

shall consist of a 180 degree arc length taken from the ends of the panel type pipe; (3) Bend the specimens to shorten the inside radius length 20 +/- 1 percent and retain in this position using a suitable holding device; (4) Place the bent specimen in a container of suitable size and cover completely with a preheated wetting agent at 122 degrees F +/- 3.6 degrees F. Maintain this temperature for 24 hours, and then remove the sample and inspect immediately. The wetting agent used in this test is 100 percent Igepal CO-630, a trade name for Nonylphenoxy Poly (Ethyleneoxy) Ethanol.

S-48.5.13 Brittleness
Samples shall not crack or split when tested accordance with these specifications. Five non-failures out of six impacts will be acceptable.

Test sections shall be tested in accordance with ASTM D2444. There shall be a minimum of three test specimens, each having a minimum length of 3 feet. The specimens shall be conditioned at a temperature of 25 degrees F for a period of 24 hours. Conduct the test within 60 seconds of removal from this environment. Use Tup B weighing 5.5 lbs. and drop height of 1.8 feet. The center of the falling tup shall strike on a corrugation crown on the narrow ends of the drain panel.

S-48.5.14 In-Plane Flow
The panel type pipe shall have minimum hydraulic transmissivity of 17.5 gallons per minute per foot when tested in accordance with these specifications.

In-plane flow tests shall be performed in accordance with ASTM D4716 with the following exceptions: (1) test samples shall be full width and 12 inches long; (2) a hydraulic gradient of 0.1 shall be used; (3) samples shall be loaded to a minimum applied load of 10 psi. for 100 consecutive hours prior to testing; (4) transmissivity shall be recorded in gallons per minute per foot of sample width.

S-48.5.15 Fittings
The fittings shall not reduce or impair the overall integrity or function of the pipe line. Standard fittings include in-line couplings, end outlets, side outlets, and end caps. Fittings shall not reduce the inside open flow area of the panel type pipe. Couplings shall be corrugated to match corrugations of the panel type pipe and shall provide sufficient longitudinal strength to assure alignment and prevent separation at the joints. Couplings shall not depend on tape or staples to maintain closure.

Joint integrity shall be tested by assembling in-line coupling fittings to panel type pipe sections in accordance with the manufacturer's recommendations. Using pipe sections at least 6 inches in length, an assembled test sample shall be suspended with its longitudinal axis vertical. A load consisting of a tare weight of 100 lbs shall be hung from the lower end of the specimen, without separating.

Alignment shall be tested by assuring that the assembly or joint is correct and complete. Lay the assembly on join on a flat surface and verify that it will accommodate straight line flow.

S-48.5.16 Marking
All panel type pipe shall be clearly marked at intervals of not more than 10 feet, and fittings shall be clearly marked with (1) the manufacturer's name or trademark, and (2) nominal size.

S-48.5.17 Quality Assurance
A manufacturer's certification that the product was manufactured, tested, and supplied in accordance with this specification, together with a report of the test results, and the date each test was completed, shall be signed by a person authorized by the manufacturer.

S-48.5.18 Geotextile Wrap
The geotextile shall be tightly stretched over the core in such a manner that sagging of the geotextile will not reduce the core flow area more than 15% under a test with a compressive load of 6,000 psf applied through 6 inches of a No. 30 - 50 sieve size sand.

Sewing of the geotextile will be allowed provided it conforms to the following: (1) Seams shall be either "J" or "butterfly" type and shall utilize a lock stitch; (2) Seams shall conform to the tensile strength requirements for the geotextile when tested across the seam; (3) The thread for seaming shall be of equal or greater durability than the geotextile itself.

S-48.6 Measurement and Payment
Payment for this work shall be made at the contract unit price bid per lineal foot for "Pipe Underdrain" of the specified type. Outlet pipe shall be paid for at the contract unit price bid per lineal foot for “Pipe Underdrain” of the specified type. Damages and subsequent costs to the underdrain system during construction shall be the responsibility of the general contractor and shall be subsidiary to all other items.

No measurement shall be made of excavation, disposal of surplus excavated materials, aggregate for underdrain, geotextile, or connections to structures. Such work shall be considered subsidiary to the bid item "Pipe Underdrain".

S-49 GEOTEXTILE

Date:
10/30/2001

The work shall consist of furnishing all equipment, labor and material for placing geotextile as specified herein and shown on the contract drawings and maintaining the geotextile until placement of the base course, curb and gutter and select soil backfill is completed and accepted.

Geotextile shall meet the requirements of AASHTO M-288-00 except as modified herein.

The geotextile shall be a nonwoven sheet of plastic yarn as defined by ASTM D 123 and conform to the criteria presented in Table 1. These requirements shall be based on the Minimum Average Roll Value (MARV) which is defined as the value that can be expected, with 95 percent confidence, to be the minimum test average obtained on a roll sampled and tested in accordance with ASTM D 4759.

TABLE 1 PHYSICAL REQUIREMENTS

Geotextile Class 1

Physical Property	ASTM Test Procedure	Minimum Acceptance Criteria	
		English	Metric
Grab strength tensile	D 4632	200 lbs	890 N
Grab Elongation at Break	D 4632	50%	50%
Puncture Strength	D 4833	80 lbs	355 N
Mullen Burst Strength	D 3786	260 psi	1790 Kpa
Trapezoidal Tear	D 4533	80 lbs	355 N
Apparent Opening Size (AOS)	D 4551	70-100 US Std. Sieve	150-212 um

Geotextile Class 2

Grab strength tensile	D 4632	120 lbs	530 N
Grab Elongation at Break	D 4632	60%	60%
Mullen Burst Strength	D 3786	90 psi	620 Kpa
Apparent Opening Size (AOS)	D 4551	60/70 US Std Sieve	250/212 um

S-49.1 Measurement and Payment
Geotextile will not be paid for directly, but shall be considered subsidiary to other bid items in the contract.

S-50 SANITARY SEWERS

S-50.1 Location and Grade of Sewers
All sewer construction shall be in accordance with the Overland Park Municipal Code, and shall additionally be in accordance with requirements of the jurisdiction listed herein. All sewers, structures and appurtenances shall be located as shown on the plans and as determined by the Engineer. The grade and alignment of the pipe shall be determined and maintained from tacked offset stakes located alongside the trench upon which cuts and elevations have been established by the Contractor. Pipe alignment during construction shall be maintained by the use of laser alignment equipment.

S-50.2 Pipe Materials
All sanitary sewer pipe specified in the plans shall be PVC sewer pipe in accordance with the requirements of ASTM D 3034, classified as SDR-26, or ABS sewer pipe in accordance with the requirements of ASTM D-1527-77, classified as Schedule 40. All PVC joints shall be mechanical joints with elastomeric seals conforming to ASTM D 3212. All ABS joints shall be solvent-cemented in accordance with ASTM D 2235. All joints shall be installed in accordance with the manufacturer's instructions.

Ductile iron pipe shall be minimum thickness Class 50 in accordance with ASTM A 746 and ASTM D 1248. All D.I.P. joints shall be push on joints in accordance with ANSI A-21.11.

S-50.3 Maintenance

The Contractor shall be responsible for keeping all debris and waste material out of sewers during sanitary sewer construction. Should any waste material, debris, earth or other foreign material enter sewers during adjustments or other construction operations, the Contractor shall be responsible for removal of such material and shall maintain sewer flow at all times.

S-50.4 Cleanouts

The Contractor shall install cleanouts at all bends in sanitary lateral relocations. Cleanouts shall be of the same size pipe as the lateral, and shall extend to grade. No fittings with a greater bend than 45 degrees shall be used in construction of the cleanout system. This item shall be considered subsidiary to “Sanitary Lateral Relocation”.

S-50.5 Jurisdiction

Sanitary Sewer construction shall be in accordance with the “Construction and Materials Specification” as prepared by the Johnson County Unified Wastewater Districts, and on file with the State of Kansas, Department of Health and Environment, Permit No. 20969.

All sanitary sewer service line work shall conform to requirements of the Johnson County Unified Wastewater Districts Service Line Design and Construction Standards, and the most recent edition of the BOCA National Plumbing Code.

S-50.6 Casing Pipe

The casing pipe shall be made of steel, meeting the requirements of ASTM A 139, grade B, with a minimum yield strength of 35,000 psi. Installation, support, and end treatments shall conform to requirements of the Johnson County Unified Wastewater Districts Service Line Design and Construction Standards, and the most recent edition of the BOCA National Plumbing Code.

S-50.7 Measurement and Payment

Sanitary sewer pipe and casings shall be measured by the lineal foot of the specified size. Payment shall be made on the amount of completed and accepted work at the contract unit price bid per lineal foot for "Sanitary Sewer" or "Sanitary Lateral Relocation", of the specified size and type, with the lengths noted on the plans. Payment shall be made at the contract unit price bid per lineal foot for "Sanitary Sewer Casing Pipe" of the specified size and type. Payment shall be made at the contract unit price bid per each for "Manhole (Sanitary)" of the specified size. Prices shall be full compensation for excavating (including rock if necessary), bedding, backfill, construction of ground water interruption barriers, cleanouts, and for furnishing all materials and fittings necessary to complete the work and shall include all costs in modifying the existing structures affected by this work.

S-51 SANITARY SEWER ENCASEMENT

Revision Date:
11/9/2004

Sanitary sewers at locations shown on the plans shall be encased with a minimum of 6" KCMMB 4K concrete. This encasement shall extend a minimum of 5' past each side of the storm sewer, and shall terminate within 6" of a joint in the sanitary sewer line, as approved by the Engineer.

All encasement of the sanitary sewer lines shall be in accordance with the requirements of the Johnson County Unified Wastewater Districts.

S-51.1 Measurement and Payment

Payment for sanitary encasement shall be made at the contract unit price bid per lineal foot for "Sanitary Sewer Encasement".

S-52 ADJUSTMENT OF MANHOLE AND VALVES

This item includes raising or lowering of existing manholes as required due to construction under this contract. Construction shall be in accordance with Section 809 of the Standard Specifications and applies to both sanitary sewer and to storm sewer manholes, of both brick masonry and concrete type construction.

Where existing sanitary sewer manhole frames and covers require raising or lowering due to construction under this contract, such adjustment shall be accomplished in accordance with the requirements of the owner.

S-52.1 Brick Manholes

Brick masonry manholes may be adjusted upward to accommodate construction by adding brick to obtain the proper dimension to match finish grade or surface as approved by the owner; adjustments downward will be limited to the removal of courses of brick to the top of the existing manhole cone. When greater adjustments are required, the manholes shall be reconed as indicated in the plans.

S-52.2 Precast Concrete Manholes

Precast concrete manholes may be adjusted upward by a combination of adding barrel sections and/or a maximum of 1' of concrete riser rings. Adjustments downward may be accomplished by a combination of removing barrel sections and/or a maximum of 1' of concrete riser rings.

All sanitary sewer manhole wall sections to be over 16' in depth shall meet the requirements of the owner for deep manholes. The Contractor shall be responsible for inspection of existing manholes to determine the extent of reconstruction necessary to meet these requirements.

S-52.3 Materials

S-52.3.1 Brick

Brick for manholes shall be of uniform texture, handburned throughout, and free from lime, gypsum, or other substance which would affect the brick under wet or freezing conditions.

S-52.3.2 Mortar
Mortar for all manholes shall be mixed in the proportions of 1 part by volume of Portland Cement, 1/4 part by volume of hydrated lime, and 3 parts by volume of sand. The cement, lime and sand shall be thoroughly mixed dry and only enough water added to form a mortar of proper consistency for its intended use. All mortar shall be used within 40 minutes after mixing. Mortar which has begun to take on initial set shall be discarded and shall not be mixed with additional cement or new mortar.

S-52.3.3 Rings and Covers
The Contractor shall furnish new manhole frames with O-ring gasket and bolted cover (Clay & Bailey No. 2014 or approved equal) for all sanitary manholes located within limits of ditch liners, and as noted on the plans. Removed rings and covers shall become the property of the Johnson County Unified Wastewater Districts.

S-52.3.4 Steps
The existing steps may be reused except when they have been found to be unacceptable as determined by the Engineer. If required, replacement steps will be Clay & Bailey No. 2102 or approved equal.

S-52.3.5 Manholes in Pavement
If the manhole lid is within the pavement, manhole lid shall be adjusted to grade and placed in concrete.

S-52.3.6 Maintenance
The Contractor shall be responsible for keeping all debris and waste material out of sewers during manhole adjustments. Should any waste material, debris, earth or other foreign material enter sewers during adjustments or other construction operations, the Contractor shall be responsible for removal of such material and shall maintain sewer flow at all times.

S-52.3.7 Manhole Spraying
All manhole covers shall be sprayed with diesel fuel prior to the overlay by the Contractor. Diesel spraying and asphalt removal around manholes shall be subsidiary to other bid items.

S-52.4 Measurement and Payment
Payment shall be made at the unit price bid per each for "Adjustment of Manholes".

S-53 SEPTIC TANK REMOVAL

S-53.1 All septic tank removals shall be in accordance with the requirements of the applicable Overland Park and Johnson County codes. The Contractor shall provide documentation of the completed sanitary sewer service connection to City Hall to obtain a special permit and instructions for the demolition of the septic tank. The septic tank shall be emptied and removed according to City of Overland Park and Johnson County codes. Prior to removal of the septic tank, the Contractor shall contact Suzy Fisher at 913-895-6272 to be on-site during the removal of the tank.

S-53.2 Measurement and Payment
All work related to the septic tank removal shall be subsidiary to the bid item "Removal of Existing Structures."

S-54 FENCING

At the locations shown on the plans or directed by the Engineer, woven wire, chain link, wood privacy, or other types of fence shall be removed and replaced or installed in accordance with Section 806 of the Standard Specifications.

All corner posts assemblies, line post assemblies and connectors shall be considered incidental to the fence construction.

All fences and gates within the construction easements and necessary to be removed for construction of the project shall be disposed of by the Contractor. After construction is completed, fences and gates of the type that existed prior to removal shall be constructed with new materials by the Contractor as designated by the Engineer.

All material used for fencing shall be brand new and meet minimum standards in accordance with Section 806 and KDOT standard details. In addition, all fence replacement shall be of a quality at least equal to that fence being replaced when it was new.

S-54.1 Breakaway Sections
At all locations where fences cross overflow swales, the Contractor shall install breakaway fence sections. The bottom of the swale shall be spanned by a section of chain link or woven wire not integral with the other fence sections. This section shall be supported on each end by posts separate from the remainder of the fencing, and shall be placed on the downstream side of the posts. The breakaway section shall be attached to the posts separately from the remainder of the fence, and minimal ties shall be used on the bottom one half of the section. This item shall be considered incidental to the fence construction.

S-54.2 Gates
Gate construction shall follow the details as set forth in the plans. The material used for gates shall be in accordance with Section 1619 of the Standard Specifications. Gate posts shall be 3 inch outside diameter with a minimum weight of 5.79 lb./ft. All gates shall have heavy duty gate hinges, and all hinges and latch designs shall be submitted for approval by the Engineer. Single

gates shall have standard gate latches, and double gates shall have standard double drive gate drop rod assemblies with center stop and concrete footings.

S-54.3 Privacy Fence
All material used for construction of wood privacy fencing shall be brand new, and shall be of a quality at least equal to that fence being replaced when it was new. As a minimum requirement, all line posts shall 4" square, corner posts shall be 6" square, and all posts and rails shall be CCA treated. All posts shall be set in concrete, the concrete shall be left 4" below grade, and the top of the concrete base shall be sloped away from the post. Rails shall be 2" x 4" dimension CCA treated lumber. Facing material shall be as shown on the plans or as directed by the Engineer. Typical facing shall be 4" wide dog eared cedar planks, except that facing shall be 6" wide if the existing fence facing was 6" wide. All privacy fencing shall be constructed with galvanized ring shank nails, staples are not permitted.

S-54.4 Wrought Iron Fence
All material used for construction of wrought iron fencing shall be brand new, and shall be of a quality at least equal to that fence being replaced when it was new. Wrought iron fence design and shop drawings shall be submitted to the Engineer for approval.

S-54.5 Picket Fence, 3-Strand Barbless Wire Fence, Wood Rail Fence, and Split Rail Fence
All material used for construction of fencing shall be brand new, and shall be of a quality at least equal to that fence being replaced when it was new. Contractor shall document condition, materials, and dimensions of existing fence, posts, gates, and footings prior to removal. Photo documentation and sketches shall be required to document the existing fences. Contractor shall submit documentation of existing fence and shop drawings of proposed replacement fence to the Engineer for approval prior to removal of existing fence. New fencing shall be of equal or better material, construction, and dimensions as existing fence. All work shall be considered incidental to the fence construction.

S-54.6 Temporary Fencing
The Contractor shall install temporary fencing wherever existing fencing is removed for construction, or where requested by the Engineer. The temporary fencing shall skirt the edge of the construction area and tie into existing fencing. Temporary fencing shall not extend outside the indicated easements.

Increased length of reinstalled fence indicated on the plans or directed by the Engineer shall be paid for at the contract unit price bid per linear foot of "Fence" as applicable.

S-54.7 Measurement and Payment
Payment for this work shall be made at the contract unit price bid per lineal foot for "Fence" of the specified size and type.

All temporary fence installation shall paid for at the unit price bid per lineal foot for "Temporary Fence".

Payment for gates shall not be paid for directly, but shall be considered subsidiary to other bid items.

Payment for fence removal shall not be paid for directly, but shall be considered subsidiary to “Removal of Existing Structures”.

S-55 HANDRAIL

At the locations shown on the plans the Contractor shall furnish and install Handrail. All handrail is to be constructed in accordance with Section 709 of the Standard Specifications and as indicated on the plans.

S-55.1 Measurement and Payment

Payment for handrail shall be made at the contract unit price bid per lineal foot for completely fabricated sections of "Handrail" of the specified size and type. Posts, fabrication, and painting of the handrail shall be considered subsidiary to the price of the handrail. Handrail quantity shall be determined by measuring from the base of the end posts.

S-56 STREET LIGHTING REMOVAL AND RELOCATION

This item shall include the removal and relocation of existing street lights as shown on the plans.

S-56.1 Measurement and Payment

Payment for street lighting removal and relocation shall not be made directly but shall be considered subsidiary to "Street Lighting Installation".

S-57 STREET LIGHTING SYSTEM

The specifications for this item are included herein. This item shall include the installation of a fully operational street light system. See LS-1 through LS-14 following the KDOT Special Provisions for technical specifications.

S-57.1 Measurement and Payment

The street lighting installation as indicated on the plans, complete-in-place and accepted, will be measured as unit lump sum quantities for all work necessary. Payment for the street light system will be made at the contract lump sum unit price bid for "Street Lighting Installation". This installation shall include all materials, equipment, tools and labor necessary to complete the improvements.

S-58 TRAFFIC SIGNAL INSTALLATION

The Specifications for this item are included herein. This item shall include the installation of a fully operational traffic signal installation. See SS-1 through SS-13 following the KDOT Special Provisions for technical specifications.

S-58.1 Measurement and Payment
Payment for the traffic signal installation shall be made at the contract lump sum price bid for "Traffic Signal Installation" at the locations indicated on the plans. This shall include all materials, equipment, tools and labor necessary to complete the improvements.

S-59 TRAFFIC SIGNAL MODIFICATION
The specifications for this item are included herein. This item shall include modifications of a fully operational traffic signal system. See SS-1 through SS-13 following the KDOT Special Provisions for technical specifications.

S-59.1 Measurement and Payment
The traffic signal modifications as indicated on the plans, complete-in-place and accepted, will be measured as unit lump sum quantities for all work necessary. Payment for the traffic signal system modifications will be made at the contract lump sum unit price bid for "Traffic Signal Modification". These modifications shall include all materials, equipment, tools and labor necessary to complete the improvements.

S-60 FIBER OPTIC SYSTEM INSTALLATION

The specifications for this item are included herein. This item shall include the installation of a fully operational fiber optic system. See FO-1 through FO-21 following the KDOT Special Provisions for technical specifications.

S-60.1 Measurement and Payment
The fiber optic system installation as indicated on the plans, complete-in-place and accepted, will be measured as unit lump sum quantities for all work necessary. Payment for the Fiber Optic System Installation will be made at the contract lump sum price bid for “Fiber Optic System Installation”. This shall include all materials, equipment, tools and labor necessary to complete the work.

S-61 SUBDIVISION AND ENTRANCE MONUMENT RECONSTRUCTION

This item includes the removal and replacement of monuments as shown on the plans. The relocated monument condition shall be as good or better than the original monument. Documentation and color photography of the original monument’s condition, size, and dimensions shall be performed and approved by the Engineer prior to demolition of the monuments. All materials to be used for the installation shall be approved by the Engineer. The completed relocation shall be a fully operational "turn-key" system including all necessary power supplies, underground wiring, mechanical equipment, sprinkler systems, and actuation devices.

All electrical wiring (if applicable) and installation shall be in full conformance with applicable building codes, and the Contractor shall be responsible for obtaining permits from and scheduling inspections by the City of Overland Park Codes Administration Division.

S-61.1 Measurement and Payment
Payment for monument relocation will be made at the contract unit price per each for "Subdivision Monument Reconstruction" or "Entrance Monument Reconstruction" shall include all materials and labor necessary to complete the reconstruction to the City's satisfaction.

S-62 PERMANENT TRAFFIC CONTROL SIGNING

Rev 8/17/05

S-62.1 General
The Contractor shall furnish and install permanent traffic control signing materials at the locations shown on the plans, in conformance with the details, and the material specifications included herein. Permanent traffic control signing materials shall include, but not be limited to, sign sheeting, aluminum sign blanks, sign posts, breakaway base assemblies, mounting brackets and hardware.

The permanent traffic control signing shall be installed before the roadway is open to construction unless prior approval is received by the Engineer or City Inspector. The installation of all regulatory signs is the first priority. If the permanent signs cannot be installed and thus the roadway would be unsigned overnight, temporary regulatory signs shall be installed and remain until the permanent signs can be installed. The contractor shall make every possible effort to remove the temporary signs and install permanent signs within 48 hours. Only under extreme circumstances and at the approval of the signing inspector or the engineer, will the duration of the temporary signs be extended. All temporary and permanent traffic control signs shall be in conformance with the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD) Part II. The temporary signs shall be removed prior to installation of the permanent signs.

S-62.2 Material
The material for permanent traffic control signs shall be in accordance with this specification.

S-62.2.1 Applicable Documents
The following documents form a part of this specification to the extent specified herein:
ASTM B209 Specification for Aluminum and Aluminum Alloy Sheet and Plate
ASTM D523 Standard Method for Test for Specular Gloss
ASTM D4956 Standard Specification for Retroreflective Sheeting for Traffic Control
ASTM E284 Standard Definition of Terms Relating to Appearance of Materials
ASTM E308 Computing the Colors of Objects by Using the CIE System
ASTM E810 Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting
ASTM E1164 Standard Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation
CIE Publication Number 39-2 Recommendation for Surface Colours for Visual Signaling
FP-03 Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects

S-62.2.2 Approved Manufacturer's List
All material for permanent traffic control signs used by the Contractor shall be from the City's approved list of vendors. It is important that users be completely knowledgeable of all application requirements and procedures prior to product application. It is the responsibility of the installer to contact the supplier of all permanent traffic control sign materials if questions regarding application procedures or conditions arise.

S-62.2.3 Super-High Efficiency Full Cube Retroreflective Sign Sheeting
This specification covers flexible white or colored, Super-High Efficiency Full Cube Retroreflective Sheeting, tape and related processing materials designed to enhance nighttime visibility of traffic control signs and objects. The sheeting shall consist of full cube prismatic lens elements with a distinctive interlocking diamond seal pattern visible from the face of a smooth surface. The sheeting shall have a pre-coated adhesive protected by an easily removable liner. This sheeting shall be used for all permanent traffic control signs as listed in the "Sign Information Table" on the Overland Park Standard Details.

S-62.2.3.1 Classification and Conformance
The sheeting shall conform to ASTM D 4956-04 as modified by this specification and proposed amendments to include Type XI.

S-62.2.3.2 Process Colors
The manufacturer of the sheeting shall manufacture and offer process colors in standard traffic colors, clears and thinners recommended for the sheeting to meet the performance requirements of this specification.

The process colors shall be a single line of traffic colors which may be applied before and after sheeting is applied to a substrate, require no component premixing, and will air dry for packing in 3 hours or less and require no clear coating.

S-62.2.3.3 Test Panels and Test Conditions
Unless otherwise specified herein, sheeting shall be applied to test panels in accordance with ASTM D 4956-04, section 7.2 and test conditions shall conform to ASTM D 4956-04 section 7.1.

S-62.2.3.4 Color Requirements
Color shall be as specified and shall conform to the requirements of ASTM D 4956-04, Table 17. Luminance factors shall conform to proposed ASTM Type XI.

S-62.2.3.5 Color Processing
The retroreflective sheeting shall be designed to work in concert with recommended imaging systems. Color processing with compatible transparent and opaque process colors shall be possible in accordance with the sheeting manufacturer's recommendation at temperatures of 60º to 100ºF (16º to 38ºC) and relative humidity of 20% to 80%. The sheeting shall be heat resistant and permit force curing without staining of applied or unapplied sheeting at temperatures recommended by the sheeting manufacturer.

S-62.2.3.6 Shrinkage

The retroreflective sheeting shall comply with the shrinkage requirements contained in ASTM D 4956-04 section 6.6.

S-62.2.3.7 Adhesive
The retroreflective sheeting shall comply with the liner removal and adhesion requirements contained in ASTM D 4956-04 sections 6.8 and 6.9 respectively.

S-62.2.3.8 Coefficient of Retroreflection
Conformance to minimum requirements for Retroreflectance is determined as follows:

Three 8 in. x 8 in. samples spaced evenly across and down a representative piece of sheeting shall be taken. The Coefficient of Retroreflection shall be determined for each of the three samples per ASTM E810. The average of the three values shall comply with the stated minimum table value and no single sample shall be less than 80% of the table value.

The observation angles shall be 0.2°, 0.5°, 1.0°. The entrance angles shall be -4° and 30°. For screen printed transparent colored areas or transparent colored overlay films on white sheeting, the coefficients of retroreflection shall not be less than 70% of the values for corresponding color in Table I.

White	-4°	30°	Blue	-4°	30°
0.2°	570	215	0.2°	26	10
0.5°	400	150	0.5°	18	6.8
1.0°	120	45	1.0°	5.4	2
Yellow	-4°	30°	FYG	-4°	30°
0.2°	425	160	0.2°	455	170
0.5°	300	112	0.5°	320	120
1.0°	90	34	1.0°	96	36
Red	-4°	30°	FY	-4°	30°
0.2°	114	43	0.2°	340	130
0.5°	80	30	0.5°	240	90
1.0°	24	9	1.0°	72	27
Green	-4°	30°	FO	-4°	30°
0.2°	57	21	0.2°	200	75
0.5°	40	15	0.5°	140	52
1.0°	12	4.5	1.0°	42	16

Table I – Extracted from ASTM D 4956 Proposed Type XI
Minimum Coefficient of Retroreflection
(cd/lux/m^2)

S-62.2.3.9 Fungus resistance
The retroreflective sheeting shall comply with the supplementary requirements contained in section S1 of ASTM D 4956-04.

S-62.2.3.10 General Characteristics and Packaging
The retroreflective sheeting as supplied shall be of good appearance, free from ragged edges, cracks and extraneous materials and shall be furnished in either rolls or sheets.

When furnished in continuous rolls, the number of splices shall not be more than two per 50 yards (45.7 m) of material, with a maximum of three pieces in any 50-yard (45.7 m) length. Splices shall be butted or overlapped and shall be suitable for continuous application as furnished.

The sheeting shall be packaged in accordance with commercially accepted standards. Each carton shall clearly stipulate the brand, quantity, size, lot or run number, color and type adhesive. Stored under normal conditions the retroreflective sheeting as furnished shall be suitable for use for a minimum period of one year.

S-62.2.3.11 Optical Stability
Three samples of retroreflective sheeting applied to test panels and conditioned as in Section S-1.2.3.3 shall each first have their photometric properties characterized by measuring the coefficients of retroreflection in accordance with ASTM E 810 at all test geometries shown in Table I. These panels shall then be exposed in an air circulating oven at 160 ± 5°F (71± 3°C) for a period of 24 hours. After exposure the panels shall be allowed to condition according to the provisions of Section S-1.2.3.3. These panels will again be characterized for photometric properties by measuring the coefficients of retroreflection at all test geometries measured before exposure.

The coefficients of retroreflection measured after exposure shall be between 85% and 115% of the values measured before exposure for each of the three samples.

S-62.2.3.12 Certifications
The sheeting manufacturer shall submit with each lot or shipment, a certification that states the material supplied will meet all the requirements listed herein.

S-62.2.3.13 Field Performance Requirements for Permanent Signing – Ordinary Colors
Sheeting manufactured of standard colors and processed and applied to sign blank materials in accordance with sheeting manufacturer's recommendations, shall perform effectively for at least 12 years. The retroreflective sheeting will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that: (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions; or (2) the coefficient of retroreflection is less than the minimum specified for that sheeting during that period listed as follows:

80% of values listed in Table I up to 7 years and
70% of values listed in Table I up to 12 years

Failure of process colors or overlay films provided and/or sold for use on recommended sheeting shall constitute a failure of entire sign and shall be replaced.
For screen printed transparent colored areas or transparent colored overlay films on white sheeting, the coefficients of retroreflection shall not be less than 70% of the values for the

corresponding integral color. All measurements shall be made after sign cleaning according to sheeting manufacturer's recommendations.

Natural causes include effects of exposure to weather. Natural causes exclude (without limitation) damage from exposure to chemicals, abrasion and other mechanical damage (such as from fasteners used to mount the sign, collisions or mishandling), vandalism, or malicious mischief.

S-62.2.3.14 Field Performance Requirements for Permanent Signing – Fluorescent Colors
Fluorescent colored sheeting processed and applied to sign blank materials in accordance with sheeting manufacturer's recommendations shall perform effectively for at least 10 years. The retroreflective sheeting will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that: (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions; or (2) the coefficient of retroreflection is less than the minimum specified for that sheeting during that period listed as follows:

80% of values listed in Table I up to 7 years and
70% of values listed in Table I up to 10 years

Failure of process colors or overlay films provided and/or sold for use on recommended sheeting shall constitute a failure of entire sign and shall be replaced. All measurements shall be made after sign cleaning according to sheeting manufacturer's recommendations.

Natural causes include effects of exposure to weather. Natural causes exclude (without limitation) damage from exposure to chemicals, abrasion and other mechanical damage (such as from fasteners used to mount the sign, collisions or mishandling), vandalism, or malicious mischief.

S-62.2.3.15 Sheeting Manufacturer's Replacement Obligation for Ordinary Colors
Where it can be shown that retroreflective signs, supplied and used according to the sheeting manufacturer's recommendations, have not met the field performance requirements as indicated above, the sheeting manufacturer shall cover restoration costs as follows for sheetings shown to be unsatisfactory:

> For the entire 12 years, the sheeting manufacturer will replace the sheeting required to restore the sign surface to its original effectiveness. In addition, during the first seven years the sheeting manufacturer will cover the cost of restoration of the sign surface to its original effectiveness at no cost to the City of Overland Park for materials and labor. Replacement sheeting shall carry the unexpired warranty of the sheeting it replaces.

S-62.2.3.16 Sheeting Manufacturer's Replacement Obligation for Fluorescent Colors
Where it can be shown that retroreflective signs, supplied and used according to the sheeting manufacturer's recommendations, have not met the field performance requirements as indicated above, the sheeting manufacturer shall cover restoration costs as follows for sheetings shown to be unsatisfactory:

> If the failure occurs within the first 7 years from the date of fabrication, the sheeting manufacturer shall, at its expense, restore the sign surface to its original effectiveness. If the failure occurs in the 8^{th} through the 10^{th} year from the date of fabrication, the sheeting manufacturer will furnish the necessary amount of sheeting to restore the sign surface to its original effectiveness. Replacement sheeting shall carry the unexpired warranty of the sheeting it replaces.

S-62.2.3.17 City of Overland Park Obligation
The City of Overland Park shall be responsible for requiring the dating of all signs at the time of application. That date constitutes the start of the field performance obligation period.

S-62.2.4 Electronic Cuttable Film
This specification covers flexible, transparent, durable films designed to be applied to retroreflective materials for the creation of traffic control signs and devices.

S-62.2.4.1 Description
Electronic Cuttable films shall consist of durable, transparent, colored films coated with a transparent pressure sensitive adhesive protected by a removable liner. The films are designed to be cut on knife over roll (sprocket fed or friction fed) and flat bed electronic cutting machines. The films shall be available in standard traffic colors, be dimensionally stable, and be designed to optimally cut, weed, lift, and transfer. Use of electronic cuttable films will not release any volatile organic compounds.

S-62.2.4.2 Test Conditions
Unless otherwise specified herein, all applied and unapplied test samples and specimens shall be conditioned at the standard conditions of 73º $\pm$ 3ºF (23º $\pm$ 1.5ºC) and 50 $\pm$ 5% relative humidity for 24 hours prior to testing.

S-62.2.4.3 Test Panels
Unless otherwise specified herein, when tests are to be performed using test panels, the specimens of retroreflective and / or overlay films shall be applied to smooth aluminum cut from ASTM B-209 Alloy 5052-H36, 5052-H38, 5154-H38, or 6061-T6 sheets on 0.020 inch (0.051cm), 0.040 inch (0.102cm) or 0.063 inch (0.160cm) thicknesses. The aluminum shall be degreased and lightly acid etched before the specimens are applied. The specimens shall be applied in accordance with the recommendations of the reflective sheeting and electronic cuttable film manufacturer.

S-62.2.4.4 Color Requirements
When electronic cuttable film is applied to retroreflective sheeting, the resulting color of the composite sheeting will conform to Federal Specification FP-03, Section 718.01 and ASTM D 4956.

S-62.2.4.5 Color Test
Conformance to color requirements shall be determined by instrumental method in accordance with ASTM E1164 on sheeting applied to aluminum test panels. The values shall be determined on a HunterLab Labscan 6000 0/45 Spectrocolorimeter with option CMR 559. Computations shall be done in accordance with ASTM E308 for the 2 degree observer

S-62.2.4.6 Coefficient of Retroreflection
When electronic cuttable film is applied to retroreflective sheeting, the composite will conform to the percentage retained of the minimum coefficient of retroreflection specified by these specifications and the manufacturer for the retroreflective sheeting when the retroreflective sheeting is screen processed. The coefficient of retroreflection shall be determined in accordance with ASTM E810.

Coefficients of retroreflection shall be specified in units of candelas per foot candle per square foot (candelas per lux per square meter). The observation angles shall be 0.2º and 0.5º unless otherwise specified. The entrance angles shall be -4° and 30° unless otherwise specified. Retroreflective sheetings with datum marks shall be tested in the orientation specified by the manufacturer. If no datum mark is supplied, the sheeting shall be rotated to determine the minimum coefficient of retroreflection which shall be reported without averaging.

S-62.2.4.7 Specular Gloss
The electronic cuttable film shall have an 85° specular gloss of not less than 50 when tested in accordance with ASTM D523.

S-62.2.4.8 Processing and Cuttability
The electronic cuttable film shall permit cutting, weeding, masking with transfer tape, lifting, and application to retroreflective sheeting when used in accordance with manufacturer's recommendations at temperatures between 65° and 95°F (18.3° and 35.0°C) and relative humidities between 30% and 70%. The film shall lay flat with minimal edge curl and be dimensionally stable.

S-62.2.4.9 Adhesive Liner
The protective liner attached to the adhesive shall be removable by peeling without soaking in water or other solutions, without breaking, tearing, or removing any adhesive from the electronic cuttable film. The liner shall have a controlled release from the adhesive coated film sufficient to allow cutting without the film popping off from the liner while still allowing the liner to easily be peeled from the film. Film with punched edges for use on sprocket fed knife over roll cutters shall be edge scored and weeded to remove film in the punched area as a means of eliminating adhesive build up on the sprockets.

S-62.2.4.10 Resistance to Accelerated Outdoor Weathering
When electronic cuttable film is applied to retroreflective sheeting, the surface of the film shall be weather resistant and show no appreciable cracking, blistering, crazing, or dimensional change after 2 years unprotected outdoor exposure, facing the equator and inclined 45° from the vertical. Following weather exposure, panels shall be washed in a 5% HCl solution for 45 seconds, rinsed thoroughly with clean water, blotted dry with a soft clean cloth and brought to

equilibrium at standard conditions. After cleaning, the coefficient of retroreflection shall not be less than the value specified for the retroreflective sheeting when the retroreflective sheeting is screen processed.

It shall show no appreciable evidence of cracking, scaling, pitting, blistering, edge lifting or curling or more than 1/32" (0.08cm) shrinkage or expansion. It shall show good color fastness or better when tested as in S-1.2.4.11. The retained reflectivity shall be the same as that specified for screen processed retroreflective sheeting of the type being tested. The film shall not be removable from the retroreflective sheeting without damage.

Retroreflective performance measurements made after weather exposure shall be made only at angles of 0.2° observation and -4° entrance. Where more than one panel of a color is measured, the coefficient of retroreflection shall be the average of all determinations.

S-62.2.4.11 Colorfastness

One specimen, exposed and prepared as specified herein shall be wet cut with a mild detergent and water solution and compared with a similarly treated unexposed specimen under natural daylight or artificial daylight having a color temperature of 7600°K. The colorfastness shall be evaluated as follows:

Excellent	- No perceptible change in color
Good	- Perceptible but no appreciable change in color
Fair	- Appreciable change in color

Appreciable change in color means a change that is immediately noticeable in comparing the exposed specimen with the original comparison specimen. If closer inspection or a change of angle of light is required to make apparent a slight change in color, the change is not appreciable.

S-62.2.4.12 General Characteristics and Packaging

When supplied as roll goods, the electronic cuttable film shall be of good appearance, free from ragged edges, cracks and extraneous materials. The maximum number of splices in each roll shall be three per 50 yards of material. Splices shall be butted. The sheeting shall be packed snugly in corrugated fiberboard cartons, in accordance with commercially accepted standards. Each carton shall clearly stipulate the brand, quantity, size, lot or run number, and color. Stored under normal conditions, the film shall be suitable for use for a minimum period of one year.

When supplied as a finished sign face or mounted sign, the sign face, made of electronic cuttable film and retroreflective sheeting, shall comply with the appearance, specification, and good workmanship for sign faces constructed of a screen processed retroreflective sheeting of the same type.

S-62.2.4.13 Certification

The film manufacturer shall, upon request, submit with each lot or shipment, a certification which states that the material supplied will meet all of the requirements listed herein.

S-62.2.4.14 Field Performance Requirements

The electronic cuttable film applied to retroreflective sheeting, both materials applied in accordance with the manufacturer's recommendations, shall as a composite perform with the same effective performance life as specified for that type of retroreflective sheeting when screen

processed. The composite sign will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that: (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions; or (2) the coefficient of retroreflection is less than the minimum specified for that sheeting when screen processed.

S-62.2.5 Aluminum Sign Blanks
This specification covers aluminum sign blanks for flat sheet signs for permanent traffic control signs.

S-62.2.5.1 Material
Sign blanks shall be manufactured from aluminum ASTM B209(H) alloy 6061-T6 or 5052-H38. The aluminum blank shall be degreased and lightly acid etched.

S-62.2.5.2 Thickness
All sign blanks for overhead street name signs shall be 0.125" thick. All other traffic control signs shall be 0.08" thick unless otherwise specified in the standard details.

S-62.2.5.3 Mounting Holes
Mounting holes in the sign blanks shall be the size and location as stipulated in the standard detail drawings.

S-62.2.6 Steel Sign Posts
This specification covers steel sign posts, post anchors, and breakaway anchor sleeves in accordance with the standard details.

S-62.2.6.1 Material
Steel posts shall conform to the standard specification for hot rolled carbon sheet steel, structural quality, ASTM designation A570, Grade 50. Yield strength after cold-forming is 60,000 psi minimum.

S-62.2.6.2 Shape
The cross section of the sign post shall be square tube formed of 14 gauge (0.083 U.S.S. gauge) steel. The cross section of the post anchor and anchor sleeve shall be square tube formed of 12 gauge (0.105 U.S.S. gauge) steel. All posts, post anchors and anchor sleeves shall be carefully rolled to size and shall be welded directly in the corner by high frequency resistance welding and externally scarfed to agree with corner radii. All ends shall be cut square.

S-62.2.6.3 Finish
Sign posts, post anchors and anchor sleeves shall be manufactured from hot-dipped galvanized steel conforming to ASTM A653, G90, Structural Quality, Grade 50, Class 1. The corner weld is zinc coated after scarfing operation. The steel is also coated with a chromate conversion coating and a clear organic polymer topcoat. Both the interior and the exterior of the post shall be galvanized.

S-62.2.6.4 Cross Section
Perforated sign posts, post anchors and anchor sleeves shall be of the following sizes:

Description	Size	U.S.S. Gauge	Weight (lbs./foot)
Sign Post	1 ¾" x 1 ¾"	14	1.71
Post Anchor	2" x 2"	12	2.42
Anchor Sleeve	2 ¼" x 2 ¼"	12	2.77

S-62.2.6.5 Telescoping Properties
The finished posts, post anchor and anchor sleeve shall be straight and have a smooth, uniform finish. It shall be possible to telescope all consecutive sizes of square tubes freely and for not less than ten feet of their length without the necessity of matching any particular face to any other face.

S-62.2.6.6 Tolerances
Tolerances shall be as indicated in the following table:

Tolerance Description	1 ¾" x 1 ¾"	2" x 2"	2 ¼" x 2 ¼"
Outside Tolerances at Sides at Corners[1]	± 0.008"	± 0.008"	± 0.010"
Wall Thickness Tolerances	± 0.008"	+ 0.011", -0.005	+ 0.011", -0.005
Convexity and Concavity Tolerances[2]	± 0.010"	± 0.010"	± 0.010"
Squareness of Sides Tolerances[3]	± 0.010"	± 0.012"	± 0.014"
Permissible Twist in 3' Length	0.062"	0.062"	0.062"
Straightness Tolerances in 3' Length	1/16"	1/16"	1/16"
Corner Radii	5/32" ± 1/64"	5/32" ± 1/64"	5/32" ± 1/64"

Notes:
[1]Measurements from outside dimensions shall be made at least 2 inches from the end of tube.
[2]Measured in the center of the flat sides determined at the corner.
[3]A sample shall be considered to fail if its sides are not 90 degrees to each other within the squareness tolerance listed above.

S-62.2.6.7 Holes
Holes shall be 7/16" ± 1/64" in diameter on one inch centers on all four sides down the entire length of the post, post anchor and anchor sleeve. Holes shall be on centerline of each side in true alignment and opposite each other directly and diagonally. All holes shall be drilled or punched and all welds, cuts, burrs, and sharp edges are to be smoothed off before application of finish.

S-62.2.6.8 Breakaway Performance
The breakaway base design shall meet the requirements of the National Cooperative Highway Research Program Report (NCHRP) No. 350.

S-62.2.7 Mounting Brackets, Hardware and Banding
This specification covers various mounting brackets, hardware and banding for sign installation as indicated by the standard details.

S-62.2.7.1 Steel Banding, Brackets and Buckles on Tubular Supports
Banding for signs mounted on tubular posts shall be ¾" wide by 0.030" Type 201 stainless steel. Buckles shall also be Type 201 stainless steel with ear-lock design and teeth for maximum clamping strength.

The mounting bracket shall be stainless steel with a flared leg, supplied with 5/16” x 1” stainless steel hex head bolt and 5/16” washer. The bracket shall be fully threaded and shall require no nuts to fasten. A 5/16” flat, plastic washer shall be installed contacting the sign face prior to the installation of the stainless steel washer.

S-62.2.7.2 Hardware for Steel Post Mounted Signs
Bolts for fastening the telescoping sign post, post anchor and anchor sleeve shall be a 5/16” stainless steel corner bolt with 5/16” hex head jam nut and 5/16” zinc plated flat washers as dimensioned in the standard details. The corner bolt is designed to prevent distortion of the opposite wall of the sign posts which can occur when conventional through-bolts are over-tightened.

Bolts for fastening the sign to the 1 ¾” x 1 ¾” sign post shall be straight 2 ½” x 5/16” zinc plated hex head bolt with 5/16” zinc plated washer and hex head jam nut. A 5/16” flat, plastic washer shall be installed contacting the sign face prior to the installation of the zinc plated washer.

All bolts, nuts, and washers shall comply with subsection 1614b and 1614e of the Kansas Department of Transportation Standard Specifications for State Road and Bridge Construction (current edition).

S-62.2.7.3 Astro Sign-Brac
The Astro Sign-Brac cable mount system shall be used to mount R10 Series MUTCD designated signs to signal pole mast arms. It shall consist of a high tensile aluminum alloy clamp kit, 5/16”-18 U-bolts, 1 ½” Schedule 10 aluminum tube (length based on sign length) and saddle, and high strength galvanized aircraft cable and stainless steel swaged fittings. It shall be supplied complete with all necessary attaching hardware including 5/16”-18 x 1” stainless steel hex head bolt, hex nut, split lock washer and flat washer.

S-62.2.7.4 Tubular Support Street Name Sign Wing Bracket
The wing bracket shall be used to mount street name signs to tubular supports such as light poles. The bracket shall be a single piece L-shaped cantilever of T-beam frame made from 380-3 aluminum alloy construction as indicated in the standard details. It shall be nominally 16 ½” long with an 8 ¼” mounting plate with set screws for sign attachment.

S-62.3 Method Of Installation
The proposed permanent traffic control signs shall be fabricated and installed by the contractor in conformance to the plans, standard details and these specifications. The signs shall meet all applicable requirements of the "Manual on Uniform Traffic Control Devices for Streets and Highways," U.S. Department of Transportation, Federal Highway Administration, edition 2003 or latest revision, hereinafter referred to as "MUTCD", except as modified on the Plans and as described herein.

S-62.3.1 Preparation of Aluminum Sign Blanks
This specification covers the preparation of aluminum sign blanks prior to application of retroreflective sheeting.

S-62.3.1.1 Size and Tolerances
Signs shall be of the length and width as specified on the plans or standard details. The tolerance for the length and width of the sign blank shall be within ± 1/8" from that shown on the plans or standard details. The sign blanks shall be free from buckles, warp, dents, cockles, burrs and other defects caused by fabrication.

S-62.3.1.2 Cleaning
Following fabrication, the aluminum to which the sheeting is to be applied shall be cleaned of all aluminum oxide and prepared with a class 2 chromate conversion coating as outlined in ASTM B449, "Standard Recommended Practice for Chromate Treatments on Aluminum" to resist corrosion and aluminum oxide. It should be a consistent weight (nominally 10-35 mg/sq ft.) and no darker than pale yellow. The coating should be well bonded to the metal and coherent within itself showing no dusting of the surface.

S-62.3.1.3 Etching
Etching shall be performed using specially designed chemical conversion tanks and either an acidic or alkaline etch solution. Time, temperature, and concentration may vary depending on the type of solution. Contact the solution manufacturer for details. Always rinse thoroughly using a high pressure wash with clean water and allow complete drying.

S-62.3.1.4 Blank Handling
The aluminum shall not be handled except by a mechanical device or with clean canvas gloves between the cleaning and etching operation and the application of retroreflective sheeting. There shall be no opportunity for the aluminum to come in contact with greases, oils, or other contaminants prior to the application of sheeting or film. Immediately prior to the application of the sheeting, should it be necessary to remove any residue wipe the surface of the substrate with a solvent in the following manner

- Saturate a clean cloth with an alcohol based solvent, mineral spirits, or a similar commercial solvent making sure the solvent is absolutely clean. Continual use from the same solvent container can result in contamination.
- Wipe the surface thoroughly, including areas near the edges where handling occurs.
- With a dry, clean, lint-free cloth wipe the surface clean before the solvent evaporates.

S-62.3.1.5 Cleanliness Tests
There are two types of tests to verify that the aluminum substrate has not become soiled during handling prior to application of the sheeting. The tests should be conducted as follows:

- Tape Snap Test — Press onto the surface a 3"- 5" length of common transparent self-adhesive tape. After several seconds, lift it off quickly at a right angle and inspect for evidence of transferred material or indications of a contaminated surface for metal substrates.
- Water-Break Test — Minute traces of grease, oil or wax can be detected by pouring clean water onto the surface. On a clean surface, water tends to hold a uniform film. On a contaminated surface, the water beads up into many small droplets.

S-62.3.2 Application of Sheeting
Retroreflective sheeting shall not be applied when the ambient air temperature, the temperature of the aluminum sign blank and the sheeting is below 65º F (18.3ºC).

S-62.3.2.1 Pressure Sensitive Adhesive
The retroreflective sheeting material shall be applied according to the manufacturer's recommendations. The sheeting shall be applied to the sign substrate by mechanical squeeze roll applicator, hand squeeze roll applicator or hand application.

S-62.3.2.2 Screen Processing
The retroreflective sheeting may be screen processed into traffic signs before or after mounting on a sign substrate. Process colors shall be screen processed at 60º to 100º F at relative humidity of 20 to 50%. A PE 157 screen mesh with a fill pass is recommended. Process colors shall be of the type or series as recommended by the manufacturer of the retroreflective sheeting.

S-62.3.2.3 Electronic Cuttable Film
Cutting of film and fabrication of the sign shall conform to manufacturer's recommended practices. The film may be applied to the sheeting either before or after the sheeting has been applied to the substrate. Use of a hand squeeze roll laminator is recommended to ensure satisfactory results. Use the "split liner method" starting in the middle of the sheet and remove half the liner to ensure proper alignment.

S-62.3.3 Sign Installation
This specification covers the field installation of permanent traffic control signs, consisting of retroreflective sheeting mounted on an aluminum substrate. Signs will either be installed on a square, steel, breakaway sign post assembly as herein specified or streetlight or traffic signal pole or mast arm according to the plans.

S-62.3.3.1 General Requirements
The Contractor shall locate the signs in the field in accordance with the Plans, the Manual on Uniform Traffic Control Devices (latest edition), and subject to the approval of the Engineer. Dimensions on the detailed drawings on the Plans shall take precedence. The Contractor will be responsible for orientation, elevation, offset and level of all signs erected. All sign posts shall be plumb. Any post that is leaning shall be replaced. The Contractor shall verify, prior to erecting any sign, that underground utilities will not be damaged as a result of placing the sign post.

Ground mounted signs shall be erected so the sign face is truly vertical and at 93 degrees away from the center of the lane(s) which the sign serves, and the direction of travel unless otherwise shown on the Plans or directed by the Engineer. Signs mounted on the mast arm of a traffic signal pole shall be angled down 3 degrees toward the pavement surface.

The height of the sign, measured from the finished ground surface or pavement to the bottom of a single sign, shall be 7'-0" unless otherwise indicated in the standard details. Exceptions would be for object markers which should be mounted 4'-0" above the finished ground surface or pavement to the bottom of the sign. If a secondary sign is mounted below another sign, the height, measured from the finished ground surface to the bottom of the secondary sign may be 6'-0". In the case where a sign is located in a pedestrian walkway or the sign face extends more than 4'-0" into a pedestrian walkway, the height to the bottom of the lowest mounted sign shall not be less than 80" measured from the finished surface of the walkway.

S-62.3.3.2 Sign Installation on a Square, Steel, Breakaway Sign Post
The sign post anchor shall be driven partially into the ground using a drive cap with sledge hammer or power equipment. The method of driving shall not substantially alter the cross-sectional dimensions of the posts or materially damage the coating. All areas where the galvanizing has been removed or damaged shall be cleaned and painted with zinc rich paint. Battered tops will not be permitted. The anchor sleeve shall then be slipped over the anchor and driven into the ground together with the sign post anchor. The sign post should then be slipped into the post anchor and bolted in place using the corner bolt as indicated in the detail drawings. The first hole above the finished grade level in all three post components shall be lined up in order to correctly insert the corner bolt.

The sign shall generally be installed on the post with the top of the sign one inch above the top of the sign post. Exceptions to this would be when street name signs are installed above the traffic sign as indicated in the standard details. The mounting holes in the sign shall be located 3" in from the top and bottom of the sign face. Signs should be mounted on the square post with a hex head bolt extending through the entire post cross section and fastened with a hex head jam nut as indicated in the standard details. Signs measuring greater than 36" in either height or width shall require both a flat plastic washer and a zinc plated washer with the plastic washer being placed against the sign face. Signs measuring less than or equal to 36" in either height or width only require the flat plastic washer.

S-62.3.3.3 Sign Installation on Round Signal or Streetlight Poles
Signs located on signal poles or streetlight poles shall be attached with flared leg stand-off brackets and ¾" stainless steel banding and buckle as indicated in the standard details. The number of brackets and banding is based on the size of the sign. Refer to the standard details for more information. The mounting holes in the sign face for attachment to the mounting brackets shall be offset from the edge of the sign a minimum of 2". Exceptions for ground mounted street name signs and overhead mounted street name signs are indicated in the following section. Signs located on the mast arm of traffic signal poles shall have the holes in the sign face located such that the sign is level.

All R10 series signs as designated by the MUTCD shall be mounted to mast arms with cable mount AstroBrac sign brackets as detailed in the standard details and specified herein. Signs measuring greater than 36" in either height or width shall require both a flat plastic washer and a zinc plated washer with the plastic washer being placed against the sign face. Signs measuring less than or equal to 36" in either height or width only require the flat plastic washer.

S-62.3.3.4 Installation of Overhead Street Name Signs
Overhead street name signs shall be attached to traffic signal mast arms with two or three flared leg stand-off brackets depending on the length of sign. Overhead street name signs shall have mounting holes placed along the horizontal dimension of the sign blank. Holes should be located at least 12" in from the edge of the sign and placed such that the sign, when mounted on a mast arm with an upward rake, is level with the horizon. For signs longer than 60", an additional mounting hole shall be mounted along the horizontal dimension of the sign blank at the midpoint of the sign.

Overhead street name signs shall generally be located on the mast arm between the two through vehicle signal heads, according to the standard details. Where only one through signal head indication exists on the mast arm, the sign shall be placed between the through signal head and the signal pole. The location of the overhead street name sign and the vehicle pre-emption device shall be coordinated during construction such that the pre-emption device is not located behind the sign.

S-62.3.3.5 Installation of Ground Mounted Street Name Signs
Ground mounted street name signs shall be attached either to square steel tubular posts or round street light poles as indicated in the plans and according to the standard details. The street name sign for the major street shall be mounted above the street name sign for the minor street.

When installed on square, steel tubular posts, two signs shall be provided and mounted on opposite sides of the post and be fastened with a hex head bolt that extends through the post and both signs and terminated with a hex head jam nut. A zinc plated washer and a flat plastic washer shall be installed on each side of the post with the flat plastic washer installed adjacent to the finished sign face. The mounting holes shall be located at the center of the sign and placed 1" from the edge of the sign. Holes shall also be located on each end of the sign ½" in from the edge of the sign for a tubular PVC spacer and aluminum pop rivet to provide stability for the dual sign blanks. At skewed intersections, the contractor shall install two "round to square" post couplers and indicated in the standard details and orient the signs at the appropriate angle to match each street. The minimum mounting height, measured from the finished ground surface to the bottom of the lowest street name sign shall be 8'-0" or as indicated in the standard details.

When installed on a round street light pole, the sign blank shall be fabricated with sheeting on both sides and installed with a L-shaped wing bracket as indicated in the standard details. The wing bracket shall be mounted to the round pole by two ¾" stainless steel bands and buckles. One wing bracket shall be installed per each sign. Cross brackets shall not be permitted.

S-62.4 Existing Signs
The Contractor shall preserve all existing traffic control signs in useful condition so as to provide traffic control during construction. All existing traffic signs except those signs to be removed shall be reused and relocated, as shown on the plans, after construction. All existing signs that are to be removed after construction shall be carefully protected and shall be returned to the City according to the "Instructions for Disassembly and Return of Traffic Sign Equipment" as listed in the standard details. There will be no direct measurement or payment for this work.

S-62.5 Pre-Qualification
Manufacturers interested in pre-qualifying material under this specification shall submit a sample of the material along with a complete materials specification for each item to be considered. The sample will be reviewed for compliance with all requirements of this specification. No material shall be used unless the material has been pre-qualified. A complete list of pre-qualified materials is maintained by the Traffic Engineering Division of the Department of Public Works.

S-62.6 Method of Measurement

Measurement for Permanent Traffic Control Signing shall be based on plan quantities as listed in the bid proposal, which includes all labor, materials, tools and equipment necessary to fully complete the installation according to the plans and specifications. No separate measurement will be made for the removal of or reinstallation of existing signs to maintain traffic during construction prior to installing new signs in the same location.

Signs shall be measured per square foot of retroreflective sheeting, of the appropriate type as listed in the proposal and indicated in the plans, and installed on a properly prepared aluminum substrate.

Square, steel, tubular sign posts shall be measured per linear foot of 1 ¼" x 1 ¼" sign post according to the length as specified in the plans for each sign installation. No measurement will be made for excess post cut off of a standard length of post as supplied by the manufacturer.

Sign post anchors shall be measured per linear foot of 2" x 2" post anchor installed.

Anchor sleeves shall be measured per linear foot of 2 ¼" x 2 ¼" anchor sleeve installed.

No separate measurement will be made for any mounting brackets, banding or miscellaneous hardware. These items shall be included in other bid items as listed in the proposal

S-62.7 Basis of Payment

The amount of completed and accepted work, for "Permanent Traffic Control Signs", measured as provided, shall be paid for at the contract unit price bid per square foot of "Permanent Traffic Control Signs", of the appropriate type as listed in the proposal and indicated in the plans, installed on a properly prepared aluminum substrate and per lineal foot for "1 ¼" x 1 ¼" Sign Posts", per lineal foot for "2" x 2" Sign Post Anchors" and per lineal foot for "2 ¼" x 2 ¼" Anchor Sleeves". Delineators shall be paid for at the contract unit price per each of "Delineator" of the designated type. Such payment and price shall constitute full compensation for all labor, materials, tools and equipment necessary to complete the item. No separate payment will be made for any mounting brackets, banding or miscellaneous hardware.

S-63 TRAFFIC CONTROL

Traffic Control shall conform to the applicable requirements of Section 821 of the Standard Specifications, as modified herein. Construction operations shall be coordinated to result in the least practicable delay to traffic.

S-63.1 Requirements

The Contractor shall furnish and maintain adequate signs, barricades, concrete safety barriers, delineators, warning lights, and all other equipment necessary to direct and reroute traffic in a safe and effective movement for through traffic; through and around the work area. The Contractor shall furnish all flaggers and other personnel necessary to provide the required traffic control.

S-63.2 Placement
Traffic control devices, barricades, and signs shall be installed at the inception of construction. The traffic control devices, barricades, and signs shall be properly spaced and properly maintained and/or operated during the time construction and/or special conditions exist on the project. When construction requires machinery or men to be in an intersection, barricades shall be placed and a flagger shall control the intersection traffic. If the intersection has left turn lanes, the left turn lane shall be closed using the required signing and barricades.

S-63.3 Removal
No barricades and/or signs shall be removed from an overlaid street until the surface temperature has cooled such that no marks will occur in the street surface or with the approval of the Engineer, to remove the barricades and/or signs. New curbs, including driveways, shall be barricaded from all traffic until the concrete has attained sufficient strength to prevent damage.

S-63.4 Access
Streets with no other outlet shall be open to traffic at all times. Access to private driveways shall be maintained insofar as possible. Businesses with two driveways shall have only one driveway closed at one time. Contractor shall provide access to businesses and residents with only one driveway at all times.

S-63.5 Measurement and Payment
At any time the Engineer, at his discretion, can require additional barricades and/or signs be placed at designated areas to provide the necessary traffic control. Additions and/or reductions of signs, barricades, concrete safety barriers, delineators, warning lights, flaggers, and all other equipment necessary to direct and reroute traffic shall be subsidiary to other bid items. Payment for Traffic Control will be made at the contract lump sum price bid for "Traffic Control".

S-64 TRAFFIC SAFETY
When working in the traveled way, the Contractor shall provide adequate and suitable barriers, signs, warning lights, flaggers, and all other equipment necessary to direct and reroute traffic and protect the public from moving or stationary vehicles, equipment, and materials, and other obstructions. Also, adequate protective warning lights and signs shall be provided to warn of any obstruction or excavation in the street, and easement area. All barricades, signs, lights and other protective devices in public right-of-way and easements shall be installed and maintained in conformity with applicable statutory requirements, the latest edition of the "Manual on Uniform Traffic Control Devices", and the "Overland Park Traffic Control Handbook for Street Maintenance and Construction Operations".

The Police Department, Fire Department, and Med-Act shall be notified prior to closing a street with the approval of the City Engineer.

S-65 TEMPORARY PAVEMENT MARKINGS

Rev. 10/30/01

S-65.1 General

The Contractor shall furnish and install temporary longitudinal white and/or yellow pavement markings, and white legends ("ARROW" and "ONLY" markings), as shown in the plans, details, specifications and in accordance with Part VI of the Manual on Uniform Traffic Control Devices (latest revision) and shall maintain them for the duration of the project.

Temporary pavement markings shall be defined as markings that are required for long-term, stationary temporary traffic control work zones during the construction of the project. Long-term, stationary work is defined as that which occupies a location more than 3 days.

S-65.2 Material

The material for temporary pavement markings shall be in accordance with this specification.

S-65.2.1 Paint

The temporary pavement marking paint shall be a rapid dry. The traffic paint shall provide optimum adhesion for glass spheres when both binder and glass spheres are applied in the recommended quantities.

S-65.2.1.1 Drying Time

When applied at a wet film thickness of 0.38mm (15 mils) with a top dressing of 2.72 – 4.54 kg (6-10 pounds) of glass spheres per liter (per gallon) of paint and when the pavement temperature is between 4.4 degrees C and 48.9 degrees C (50 degrees F and 120 degrees F) and the relative humidity doesn't exceed 80%, the binder shall dry to a no-tracking condition in a minimum of 20 seconds and a maximum of 60 seconds.

These dry times shall not be exceeded when the paint is applied with specialized equipment so as to have the pigmented binder at a temperature of 65.5 degrees C to 76.7 degrees C (150 degrees F to 170 degrees F) at the spray gun.

The no-tracking condition shall be determined by passing over the applied line in a simulated passing maneuver with a passenger car traveling 56 KPH (35 MPH). There shall be no visual deposition of the paint to the pavement surface when viewed from a distance of 15.2 meters (50 feet). Furthermore, the pigmented binder, without glass spheres, shall dry to no-tracking condition in 180 seconds or less when tested in accordance with ASTM D-711-67.

S-65.2.1.2 Directional Reflectance

The daylight directional reflectance of white pigmented binder (without glass spheres) shall be not less than 85% relative to magnesium oxide when tested in accordance with Federal Test Method Standard No. 141a, Method 6121. If yellow, after drying shall suitably match color 33538 of Federal Standard 595.

S-65.2.1.3 Glass Beads

The glass spheres shall meet the requirements of AASHTO Specification M 247-81, Type I with flotation and moisture resistance properties.

S-65.2.2 Temporary Tape
Temporary pavement marking tape shall be in accordance with the Standard Specifications for State Road and Bridge Construction of the Kansas Department of Transportation (latest version), Subsection 2205 for “Removable” Type II tape.

S-65.3 Method of Installation
The temporary pavement markings shall be installed true to line according to the plans, details, Manual on Uniform Traffic Control Devices (latest edition) and this specification. Temporary pavement markings shall be installed the same day that the existing pavement markings are damaged, removed or covered up.

S-65.3.1 Paint
Temporary paint shall be used on all existing asphalt surfaces that are scheduled to be milled and overlaid or milled asphalt surfaces that are scheduled to be overlaid.

S-65.3.2 Glass Beads
The glass beads should be applied at the rate of 2.72 – 4.54 kg per liter (6-10 pounds per gallon) of paint. The glass beads shall be sprayed into the wet traffic paint through a pressurized glass gun set 25 mm to 100 mm (1" to 4") behind the paint spray gun.

S-65.3.3 Tape
Temporary reflective tape shall be used upon newly overlaid surfaces or existing surfaces that are not scheduled for milling and overlay.

S-65.4 Method of Removal
The method of pavement marking removal shall be by a high pressure water blast method, a low pressure water and sand blast method, a steel shot blast method, burning method, or a grinding method. Overlaying existing markings with black paint or asphalt shall not be allowed. However, the use of removable, nonreflective, preformed tape is permitted where markings need to be covered temporarily.

All pavement marking materials shall be removed without structurally damaging the pavement or scarring the surface, unless the surface is to be overlaid with the project.

Existing pavement markings shall be thoroughly removed as to be unidentifiable as pavement markings under day or night, wet or dry conditions to eliminate confusion with the temporary pavement markings.

All material deposited on the pavement, as a result of the removal operation shall be removed as the work progresses by methods approved by the inspector.

S-65.5 Measurement
No direct measurement will be made for temporary pavement markings installed in accordance with the plans and specifications nor for the removal of the existing pavement markings or temporary pavement markings.

S-65.6 Payment

The amount of completed and accepted work, for Temporary Pavement Markings, including symbols and legends, measured as provided, shall not be paid for directly but shall be subsidiary to the bid item “Traffic Control”. Such payment and price shall constitute full compensation for all labor, materials, tools and equipment necessary to complete the item.

No payment shall be made for "Removal of Existing Pavement Markings” nor for the “Removal of Temporary Pavement Markings”. Any work required to remove the existing pavement markings or temporary pavement markings shall be considered subsidiary to the bid item “Traffic Control”.

All traffic control necessary for installation and removal of the existing pavement markings and temporary markings shall be subsidiary to the bid item “Traffic Control”.

S-66 PERMANENT PAVEMENT MARKINGS

Rev 8/12/05

S-66.1 General

The Contractor shall furnish and install white and yellow permanent retro-reflectorized pavement marking materials at the locations shown on the plans, in conformance with the details, and the material specifications included herein.

The permanent pavement markings shall be installed immediately after overlaying unless prior approval is received by the Engineer or City Inspector. The installation of the yellow markings (as required) is the first priority. If the permanent markings cannot be installed and thus the roadway would be unmarked overnight, interim removable markings shall be installed and remain until the permanent markings can be installed. The contractor shall make every possible effort to remove the interim pavement markings and install permanent pavement markings within 48 hours. Only under extreme circumstances and at the approval of the pavement marking inspector or the engineer, will the duration of the interim pavement markings be extended. Under no circumstance should the interim pavement markings be in place for more than 2 weeks. If permanent markings cannot be installed within the specified time then temporary markings shall be installed following the guide lines as set forth in the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD) Part VI, Sections F6 and G6. The interim removable markings shall be removed prior to installation of the permanent markings.

S-66.2 MATERIAL

The material for permanent pavement markings shall be in accordance with this specification. All material for permanent pavement marking material used by the Contractor shall be from the City’s approved list of vendors. It is important that users be completely knowledgeable of all application requirements and procedures prior to product application. It is the responsibility of the installer to contact the supplier of all permanent pavement marking materials if questions regarding application procedures or conditions arise.

S-66.2.1 Pre-Mix Glass Spheres

Pre-mix glass spheres shall be uncoated and conform to AASHTO M247 Type 1. The glass spheres used in the formulation shall be lustrous, free from film, scratches, and pits. The glass spheres shall also meet the following requirements:

S-66.2.1.1 Roundness
The roundness of the spheres shall be minimum of 70% when tested in accordance with A.STM. D-1155.

S-66.2.1.2 Gradation
The gradation when tested in accordance with the method provided in A.S.T.M. D-1214 (by use of U.S. Standard Sieves) shall be:

Size of Sieve	Mass % Passing
1.00 mm (No. 18)	80-100
300 µm (No. 50)	20-50
180 µm (No. 80)	0-10

S-66.2.1.3 Refractive Index
When tested by a liquid immersion method at 25 degrees C (77 degrees F), the refractive index of the spheres shall be a minimum of 1.50.

S-66.2.2 Drop-On Glass Spheres
The spheres shall be manufactured from glass of a composition designed to be highly resistant to traffic wear and to the effects of weathering. The particles shall be spherical in shape, containing not more than thirty percent (30%) of irregularly shaped particles. They shall be essentially free of sharp angular particles, and particles showing milkiness or surface scoring or scratching. They shall meet the requirements of AASHTO M247 Type 1.

S-66.2.2.1 Gradation
The gradation when tested in accordance with the method provided in A.S.T.M. D-1214 (by use of U.S. Standard Sieves) shall be:

Size of Sieve	% Passing (by Weight)
850 µm (No. 20)	100
600 µm (No. 30)	80-100
300 µm (No. 50)	18-35
180 µm (No. 80)	0-10
150 µm (No. 100)	0-2

S-66.2.2.2 Refractive Index
When tested by a liquid immersion method at 25 degrees C (77 degrees F), the refractive index of the spheres shall be within the range of 1.50 to 1.60.

S-66.2.2.3 Moisture Proof Requirements
The spheres shall show no tendency to absorb moisture in storage and shall remain free of clusters and hard lumps. The spheres shall flow freely from dispensing equipment at any time when surface and atmospheric conditions are satisfactory for application.

S-66.2.3 Thermoplastic Pavement Markings Applied on New Asphalt
This specification covers a white and yellow thermoplastic reflectorized pavement marking material of a type that is either applied to new asphalt road surfaces and/or asphalt road surfaces that are not polished. The material shall be applied in a molten state by mechanical means to receive a surface application of glass spheres, and which upon cooling to normal pavement temperature, produces an adherent reflectorized stripe of specified thickness and width and is capable of resisting deformation.

S-66.2.3.1 Characteristics
The material shall not exude fumes that are toxic, obnoxious or injurious to person or property, when it is heated to the temperature range specified by the manufacturer for application. It shall remain stable when held for 4 hours at this temperature, or when subject to 3 reheatings after cooling to ambient temperature.

The temperature-viscosity characteristics of the plastic material shall remain constant throughout repeated reheatings, and shall show like characteristics from batch to batch. There shall be no obvious change in color of the material neither as a result of repeated reheatings nor from batch to batch.

The thermoplastic material shall easily extrude from the equipment to produce a cross-section of line 1.5 mm to 4.8 mm (90 to 125 mil) thick, which shall be continuous and uniform in shape, and have clear and sharp dimensions.

S-66.2.3.2 Serviceability
The compound shall resist deterioration by contact with sodium chloride, calcium chloride or other chemicals used to prevent roadway ice, or because of the oil content of pavement materials or from oil droppings or other effects of traffic. The markings shall remain intact under normal traffic conditions at temperatures below 60 degrees C (140 degrees F).

S-66.2.3.3 Specific Gravity
The material's specific gravity shall not be less than 1.8 nor exceed 2.3 referred to water at 25 degrees C (77 degrees F) when determined by a water displacement method at 25 degrees C (77 degrees F).

S-66.2.3.4 Set Time
When applied at the specified temperature and thickness, the material shall set to bear traffic in not more than 2 minutes when the air temperature is 10 degrees C (50 degrees F) and not more than 10 minutes when the air temperature is 32 degrees C (90 degrees F).

S-66.2.3.5 Composition
The thermoplastic pavement marking material shall be homogeneously composed of pigment, filler, resin binder and glass reflectorizing spheres. The solid resin shall be a "maleic-modified glycerol ester resin" (alkyd binder) comprising at least one-third of the binder compositions and be no less than eight (8) percent by weight of the entire material formulation. The alkyd binder shall consist of a mixture of synthetic resins (at least one of which is solid at room temperature), and high boiling point plasticizers. The material shall not contain any petroleum derived

ingredients. Yellow pigment shall be heat stabilized encapsulated lead chromate. The thermoplastic pavement marking material shall contain the following ingredients:

INGREDIENT (Percent by Weight)	WHITE	YELLOW
Binder (See Note A below)	18.0 min.	18.0 min.
Titanium Dioxide	10.0 min.	--
Glass Spheres	20.0-50.0	20.0-50.0.
Lead Chromate	--	2.0-4.5
Inert Fillers	42.0 max.	50.0 max.

The material shall be thoroughly mixed and furnished in a free flowing granular form. The material shall meet the requirements of this specification for a period of one year. The material shall readily melt in a uniform mixture. The material shall be free from all skins, dirt, and foreign objects. It shall be of such composition that it will not bleed, stain or discolor when applied to bituminous pavement. The manufacturer shall replace material not meeting the above requirements.

S-66.2.3.6 Color
The color of the thermoplastic material after heating for 4 hours ± 5 minutes at 218±1.4 degrees C (425 ± 3 degrees F) shall conform to the following when tested by Federal Test Method Standard 141 Method 4252:

White:	Federal Color Chip No. 37875 (Fed. Std. No. 595)
Yellow:	Federal Color Chip No. 13538 (Fed. Std. No. 595)

S-66.2.3.7 Reflectance
The daylight luminous reflectance of the white material shall be not less than 75% when tested according to A.S.T.M. E1347. The yellow shall have a minimum brightness of 45% relative to magnesium oxide, and shall be within the green and red tolerance of the "Standard Color Chips for Highway Signs (January 1939)" obtainable from the United States Bureau of Public Roads, Washington, D.C. (TT-P-115a).

S-66.2.3.8 Softening Point
After heating the thermoplastic material for 4 hours ± 5 minutes at 218 ± 1.4 degrees C (425 ± 3 degrees F) and testing in accordance with ASTM D36, the material shall have a softening point 102 ± 7.1 degrees C (215 ± 15 degrees F).

S-66.2.3.9 Flowability
After heating the thermoplastic material for 4 hours ± 5 minutes at 218 ± 1.4 degrees C (425 ± 3 degrees F) and testing for flowability, the white thermoplastic shall have a minimum percent residue of 18 percent and the yellow thermoplastic shall have a maximum residue of 21 percent.

After heating the thermoplastic material for 8.5 hours ± 5 minutes at 218 ± 1.4 degrees C (425 ± 3 degrees F) and testing for flowability, the thermoplastic shall have a maximum percent residue of 28 percent.

S-66.2.3.10 Indentation Resistance
Hardness shall be measured by a Shore Durometer, Type A2, as described in A.S.T.M. D-2240, except that the Durometer and the panel shall be at 25 degrees C (77 degrees F), and a 2 kg (4.4 lb.) load applied. After 15 seconds, the reading shall be not less than 55.

S-66.2.3.11 Abrasion Resistance
The material shall not show a maximum loss of 0.5 g (0.02 ounces) subjected to 200 revolutions on a Taber Abraser at 25 degrees C (77 degrees F), using H-22 calibrate wheels, weighted to 500 g (17.6 ounces). The wearing surface should be kept wet with distilled water throughout the test. The panel for this test shall be prepared by forming a representative lot of material at a thickness of 3 mm (125 mil) on a 100 mm (4") square panel (thickness 1.3 $\pm$ 0.025 mm) [thickness 0.050 $\pm$ 0.001 inch] on which a suitable primer has been previously applied.

S-66.2.3.12 Low Temperature Impact Resistance
The materials shall not fracture when subjected to an impact of 7.23 N-m at –20 degrees C (64 inch pounds at –4 degrees F), for at least 3 hours. The panel is then placed in an instrument also maintained at -20 degrees C (–4 degrees F), consisting of a 4.7 kg (10.5 pound) freely falling weight controlled to drop vertically for 150 mm (6") onto the surface of the panel, which it strikes with a hemispherical indentor having a radius of 7 mm (0.28 inches).

S-66.2.3.13 Water Absorption
Materials shall have a maximum of 0.5 percent by weight of retained water when tested by ASTM designation D-570, “Water Absorption of Plastics”, procedure (A).

S-66.2.3.14 Yellowness Index
The white thermoplastic material shall not exceed a yellowness index of 0.15.

S-66.2.3.15 Flash Point
The thermoplastic material shall have a flash point not less than 475 degrees F when tested in accordance with ASTM D92.

S-66.2.3.16 Cracking Resistance
After heating the thermoplastic material for 4 hours $\pm$ 5 minutes at 218 $\pm$ 1.4 degrees C (425 $\pm$ 3 degrees F); applying to concrete blocks, and cooling 7.1 $\pm$ 1.4 degrees C (15 $\pm$ 3 degrees F), the material shall show no cracks. Properly applied, the material shall show less than six stress cracks per three lineal meters (ten lineal feet) of markings independent of pavement fracturing and faulting, for at least six months.

S-66.2.4 Preformed Thermoplastic Pavement Markings
This specification is for the furnishing of retroreflective preformed thermoplastic pavement marking materials that can be adhered to asphalt or Portland cement concrete pavements by means of heat fusion. The applied markings shall be very durable, oil and grease impervious and provide immediate and continuing retroreflectivity.

S-66.2.4.1 Characteristics:
The preformed marking material shall consist of a resilient white and yellow polymer thermoplastic with uniformly distributed glass spheres 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 Manual on Uniform Traffic Control Devices for Streets and Highways.

The preformed markings shall be fusible to asphalt concrete and Portland cement concrete 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 concrete and Portland cement concrete 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 concrete 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 10 degrees C (50 degrees F) for one person to carry without the danger of fracturing the material prior to application.

S-66.2.4.2 Composition

The retroreflective pliant polymer thermoplastic pavement markings shall consist of a homogeneous mixture of high quality polymeric thermoplastic binders, pigments, fillers and glass spheres. The thermoplastic material must conform to AASHTO designation M249 with the exception of the relevant differences due to the material being supplied in a preformed state.

S-66.2.4.3 Glass Spheres

The markings shall contain 30% glass spheres which shall conform to AASHTO M247 Type 1, except that glass spheres shall have a minimum of 70% true spheres on each sieve and 80% true spheres overall.

The glass spheres must be homogeneously blended throughout the material with a securely bonded protruding exposed layer of spheres that provide immediate and continuous retroreflectivity; no additional glass spheres shall be dropped on the material during application. Curved arrows must be available without protruding glass spheres if reversibility is needed.

S-66.2.4.4 Retroreflectivity

The preformed marking shall upon application exhibit uniform adequate nighttime retroreflectivity when tested in accordance to ASTM E1710-97. The applied material must have an initial minimum intensity reading of 375 millicandelas for white and 175 millicandelas for yellow as measured with an LTL-2000 Retroreflectometer with a 1.05 degree observation angle, 88.76 degree entrance angle and 30 meter geometry (viewing distance).

S-66.2.4.5 Abrasion Resistance
Using a Taber Abraser with an H-18 wheel and a 125 g (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.

S-66.2.4.6 Color Characteristics
The thermoplastic material without glass spheres 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.

S-66.2.4.7 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.

S-66.2.4.8 Thickness
The width of the supplied material shall have a minimum average thickness of 2.3 mm (90 mils).

S-66.2.4.9 Flexibility
The preformed thermoplastic marking material shall have flexibility at 10 degrees C (50 degrees F) such that no cracking occurs in the test sample when a 25 mm by 150 mm (1" by 6") sample is bent through an arc of 90 degrees at a uniform rate in 10 seconds (9 seconds per degree) over a 25 mm (1") mandrel. The sample must be conditioned prior to testing at 10 $\pm$ 0.9 degrees C (50 $\pm$ 2 degrees F) for a minimum of four hours. At least two specimens tested must meet the flexibility requirements at 10 degrees C (50 degrees F) for a passing result.

S-66.2.4.10 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.

S-66.2.4.11 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.

S-66.2.5 Cold Plastic Pavement Markings
This specification covers a white and yellow pre-formed cold plastic reflectorized pavement marking material of a type that is applied only to a concrete 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.

S-66.2.5.1 Characteristics:
The material shall be manufactured without the use of lead-chromate pigments or other, similar, lead-containing chemicals.

Glass spheres 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 for Streets and Highways.

The preformed markings shall be capable of being adhered to Portland cement concrete 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.

S-66.2.5.2 Composition
The retroreflective pavement marking film shall consist of a mixture of high-quality polymeric materials, pigments and glass spheres distributed throughout its base cross-sectional area. A reflective layer of glass spheres 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 0.13 mm (0.005 inches). The film shall have a pre-coated, shear-resistant, pressure sensitive adhesive.

S-66.2.5.3 Color
The daytime color of the white film shall provide a minimum initial luminance factor, Y, of 80 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
.0310	0.295	0.491	0.435
0.330	0.360	0.512	0.486
0.350	0.340	0.536	0.463

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 above chromaticity requirements:

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

S-66.2.5.4 Reflectance

The white and yellow films shall have the following initial minimum reflectance values as measured in accordance with the testing procedures of ASTM D 4061. The photometric quantity to be measured shall be coefficient of retroreflected luminance (R_L) and shall be expressed as millicandelas per square meter per lux (mcd-m^{-2}-lux^{-1}) (millicandelas per square foot per foot-candle (mcd-ft^{-2}-fc^{-1})).

	WHITE			YELLOW		
Entrance Angle	86.0º	86.0º	86.5º	86.0º	86.0º	86.5º
Observation Angle	0.2º	0.5º	1.0º	0.2º	0.5º	1.0º
Retroreflected Luminance R_L (mcd-ft^{-2}-fc^{-1})	700	500	400	410	250	175

S-66.2.5.5 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 retroreflective 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 non-wheel track areas.

S-66.2.5.6 Tensile Strength and Elongation

The film shall have a minimum tensile strength of 7.18 kilopascals (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 D638-76, except that a sample 150 mm x 25 mm (6” x 1”) shall be tested at a temperature between 21.1 degrees and 26.7 degrees C (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.

S-66.2.5.7 Reflectivity Retention

The glass spheres must be strongly bonded and not be easily removed by traffic wear. Using a Taber Abraser with an H-18 wheel and a 125 g (4.4-ounce) load, the sample shall be inspected at 200 cycles, under a microscope, to observe the extent and type of sphere failure. No more that 15% of the spheres shall be lost due to popout and the predominant mode of failure shall be “wear down” of the spheres.

S-66.2.5.8 Glass Spheres

The size, quality and refractive index of the glass spheres shall be such that the performance requirements for the markings shall be met. The sphere adhesion shall be such that spheres are not easily removed when the material surface is scratched.

The film shall have glass sphere retention qualities such that when a 50 mm x 150 mm (2” x 6”) sample is bent over a 12.7 mm (½”) diameter mandrel, with the 50 mm (2”) dimension

perpendicular to the mandrel axis, microscopic examination of the area on the mandrel shall show no more than 10% of the spheres with entrapment by the binder of less than 40%.

S-66.2.5.9 Thickness
The film, without adhesive, shall have a minimum thickness of 1.55mm (60 mil).

S-66.2.6 Lead-Free, Water-Borne Emulsion Based White and Yellow Traffic Paint
The pavement marking paint shall be a rapid dry. The traffic paint shall provide optimum adhesion for glass spheres when both binder and glass spheres are applied in the recommended quantities. The paint shall be well ground and mixed, shall not settle badly or cake in the container or thicken in storage. It shall not change in consistency and shall be readily broken up with a stirrer to a smooth and uniform condition.

S-66.2.6.1 Characteristics
The paint shall consist of Dow DT 250NA acrylic resin lead-free pigments, dryers, and water as solvent and sufficient pigment suspending agents to insure soft settlement during storage.

S-66.2.6.2 Composition
The formulation for the waterborne paint shall be as follows:

Test Component	White	Yellow
TiO_2 % by Weight	8.5% @ 0.14 gm/cm^3 (1.17 lbs/gal)	1.35% @ 0.04 gm/cm^3 (0.36 lbs/gal)
Pigment – $Ti0_2$	Enamel Grade ASTM D-476 Type III	Clariant 11-2400 Yellow Pigment
Unit Weight	1.65 gm/cm^3 $\pm$ 0.02 (13.8 lbs/gal $\pm$ 0.2)	1.63 gm/cm^3 $\pm$ 0.02 (13.6 lbs/gal $\pm$ 0.2)
Vehicle Solids % by Weight	17%	17.5%
Extender Pigment % by Weight	52%	55%
Calcium Carbonate	ASTM D-1199 Ground and Classified – Dry Brightness 95	ASTM D-1199 Ground and Classified – Dry Brightness 95

S-66.2.6.3 Drying Time
When applied at a wet film thickness of 38mm (15 mils) with a top dressing of 0.70 – 1.20 kg (6-10 pounds) of glass spheres per liter (per gallon) of paint and when the pavement temperature is between 4.4 degrees C and 48.9 degrees C (50 degrees F and 120 degrees F) and the relative humidity doesn't exceed 50%, the binder shall dry to a no-tracking condition in a minimum of 20 seconds and a maximum of 60 seconds. Air flow across the surface of field applied material must be at least 23 meters/minute (75 feet/minute) to qualify material for this requirement.

These dry times shall not be exceeded when the paint is applied with specialized equipment so as to have the pigmented binder at a temperature of 65.5 degrees C to 76.7 degrees C (150 degrees F to 170 degrees F) at the spray gun.

The no-tracking condition shall be determined by passing over the applied line in a simulated passing maneuver with a passenger car traveling 56 KPH (35 MPH). There shall be no visual deposition of the paint to the pavement surface when viewed from a distance of 15.2 meters (50 feet). Furthermore, the pigmented binder, without glass spheres, shall dry to no-tracking condition in 180 seconds or less when tested in accordance with ASTM D-711.

S-66.2.6.4 Dry Opacity
The minimum contrast ratio shall be 0.96 when drawing down with a 0.005 bird film applicator on a 2A Leneta Chart or equal and air-dried for 24 hours. Contrast Ratio = Black/White. Dry Opacity will be determined according to Method 4121, Federal Test Method Standard No. 141a. Apply the paint with the above applicator to the chart specified in Section 1.1 of Method 4121.

S-66.2.6.5 Flexibility
Apply the paint to aluminum alloy 2024-0, 0.81 $\pm$ 0.08 mm (0.032 $\pm$ 0.003 inch) thick panels with a 0.005 inch Bird Film Applicator. Air dry 18 hours and bake for 5 hours at a temperature of 105 to 110 degrees C (220 to 230 degrees F). Cool for 15 minutes at 25 degrees C (77 degrees F) and bend over the conical mandrel as specified in ASTM D522. There shall be no cracking of the film at a mandrel diameter of 2.54 cm (1 inch) or larger when examined without magnification.

S-66.2.6.6 Abrasion Resistance
When subjected to the Falling Sand Abrasion Resistance Test, the amount of sand required to completely abrade the paint film from an area 4mm (5/32”) in diameter on the panel shall not be less than 70 liters (18.5 gal). The test shall be conducted according to Method 6191 of Federal Test Method Standard No. 141a with the following additions and exceptions:
Fresh, new unused sand shall be used for each test of three panels. Sand shall be measured by weight with 7.9 kg (17.5 lbs) of sand being counted as equivalent to 5 liters (1.3gal).

A test shall be the average liters (gallons) of sand required to abrade the 4mm (5/32”) spot on three separate panels. Panels for the test will be prepared as follows:
Apply the paint without reduction to a smooth glass panel with a 0.15mm (0.006 inch) Bird Film Applicator. Air dry for 24 hours and bake for 3 hours at a temperature of 105 to 110 degrees C (220 to 230 degrees F). Condition the panel for 24 hours at a temperature of 21 to 27 degrees C (70 to 80 degrees F) and a relative humidity of 50% to 70% before making the test. The glass panels shall not be less than 200mm (8 inches) long and the abrasion test shall be made on the middle third of the film on the panel.

S-66.2.6.7 Water Resistance
Apply a film of the paint with a 0.13mm (0.005 inch) Bird Film Applicator to a smooth glass panel approximately 250 mm (10 inches) long. Allow to dry for 48 to 72 hours and then immerse one end of the panel in a beaker of distilled water to a depth of approximately 125 mm (5 inches). After 24 hours of immersion, remove the panel and examine. After 24 hours of air drying the immersed portion of the film shall be equal in hardness, toughness, gloss, and color adhesion to the portion of the film that was not immersed in water. Adhesion shall be checked using knife blade or spatula on both ends of the film, comparing the ease with which the film can be removed from the glass.

S-66.2.6.8 Stability Test
Fill a 0.5 liter (one-pint) friction top paint can with a thoroughly mixed sample to within 25 mm (one inch of the top). Determine consistency in grams (pounds) according to Method 4281, Federal Test Method Standard No. 141a. Close the can with the lid and shake for 5 minutes. Place the can in an air oven at 60 degrees (140 degrees F) for 18 hours. Remove and cool to room temperature. Open the can and remove any skins and examine the contents. There shall be no livering or other deterioration. Thoroughly mix the paint and again determine the consistency in grams (pounds). The increase in consistency shall not be more than 17 grams (0.6 oz).

S-66.2.6.9 Fineness of Grind
When tested according to ASTM D1210, the fineness of grind shall not be less than 3 Hegman units.

S-66.2.6.10 Sphere Embedment
Paint shall be applied to a glass panel at a wet film thickness of 0.3mm (0.012 inch) followed immediately by an application of glass spheres dropped on the surface of the paint. After drying for at least 24 hours, observe the amount of sphere embedment with a 30-power microscope. At least 90% of the spheres shall be embedded between 50% and 65%. The glass spheres used for this test must be a moisture resistant silicone treated sphere suitable for use with a water base coating.

S-66.2.6.11 Directional Reflectance
The daylight directional reflectance of white pigmented binder (without glass spheres) shall be not less than 85% relative to magnesium oxide when tested in accordance with Federal Test Method Standard No. 141a, Method 6121. If yellow, after drying shall suitably match color 33538 of Federal Standard 595.

The paint for the pavement markings shall contain no lead and/or chromium and shall have volatile organic content conforming to the latest Environmental Protection Agency regulations.

In addition, the paint and/or components shall conform to the American Society for Testing Materials (ASTM) as follows:

ASTM D93 -Flash Point by Pensky Martens Closed Tester
ASTM D476 - Titanium Dioxide Pigments, Type II Rutile
ASTM D562 - Consistency of Paints Using Stormer Viscosimeter
ASTM D711 - No Pick-Up Time of Traffic Paint
ASTM D768 - Yellow Iron Oxide
ASTM D868 - Evaluating Degree of Bleeding of Traffic Paint
ASTM D969 - Laboratory Test for Degree of Bleeding of Traffic Paint
ASTM D1152 -Methyl Alcohol
ASTM D1199 -Calcium Carbonate
ASTM D1210 -Fineness of Dispersion of Pigment-Vehicle Systems
ASTM D1475 -Density of Paint, Varnish, Lacquer, and Related Products
ASTM D2243 -Freeze-Thaw Resistance of Waterborne Coatings
ASTM D2369 -Volatile Content of Coatings

ASTM D2805 -Hiding Power of Paints by Reflectometry
ASTM D3723 -Pigment Content of Water Emulsion by Low Temperature Ashing
ASTM D3960 -Volatile Organic Content (VOC) of Paints and Related Coatings
ASTM D4060 -Abrasion Resistance by Taber Abraser
ASTM D4366 -Hardness of Organic Coatings by Pendulum Damping Tests
ASTM E70 - pH of Paints and Related Material
ASTM E1347 - Standard Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry

The paint shall show no cracking, flaking, blistering, appreciable loss of adhesion, softening, coagulation, discoloration, and have a minimum bleeding ratio of 0.97 when tested in accordance with Federal Specification TT-P-1952B.

The paint shall be capable of dilution with water at all levels without curdling or precipitation such that the wet paint can be readily cleaned up with water only.

S-1.2.8 Epoxy Pavement Marking
This specification is for the application of epoxy resin and glass beads as reflective pavement markings on Portland cement concrete or aged asphalt pavements. The epoxy resin material shall be toxic heavy metal free, two–component, 100% solids, and shall be formulated and tested to perform as a pavement marking material with glass spheres applied to the surface. The two components are an epoxy resin and an amine curing agent. The contractor shall provide complete manufacturer's specifications and material safety data sheets to the Engineer for all material furnished.

S-1.2.8.1 Characteristics:
The material shall not exude toxic fumes when heated to application temperature. The material which, when mixed in the proper ratio and applied at 0.14 mil (500 µm) wet film thickness at 74.8 degrees F (23.8 degrees C) with the proper saturation of glass beads, has a no–tracking time of less than 40 minutes for slow curing material and less than 10 minutes for rapid curing material. The material shall be capable of fully curing under a constant surface temperature of 32 degrees F (0 degrees C) or above.

S-1.2.8.2 Color:
Provide white which complies with Federal Standard 595 17875. Provide yellow which matches the standard shade within the red and green tolerance limits when compared with the Highway Yellow Color Tolerance chart available from the U.S. Department of Transportation, Washington, D.C. (Federal Standard 595 13538).

S-1.2.8.3 Abrasion Resistance:
Maximum loss should be 0.0028 ounces (80 mg) when tested at 30 $\pm$ 1.5 mils (750 $\pm$ 38 µm) and a 72 hour cure and with a CS–17 wheel under a load of 2.2 lbs. (1000 grams) for 1000 cycles

S-1.2.8.4 Hardness:
Shore D hardness of 75 minimum.

S-1.2.8.5 Adhesion to Concrete:
When catalyzed, has such a high degree of adhesion to the specified concrete surface that there is a 100% concrete failure. Apply the material at a film thickness of 15 ± 1.5 mils (375µm + 38µm) to concrete with a minimum compressive strength of 4061 psi (28 MPa). Allow the material to cure for 72 hours at 77 degrees F (25 degrees C) before the test is performed.

S-1.2.8.5 Yellowness Index:
White only. Value after 72 hours in QUV – 30 maximum when tested at 15 ± 1.0 mils (375µm + 25µm) and a 72 hour cure.

S-1.2.8.6 Field Evaluation:
Field test materials at AASHTO NTPEP regional test facilities, which include both hot and cold weather conditions and are a minimum of six months in duration.

S-1.2.8.7 Glass Beads For Drop–On Application (double drop system):
For the first drop, furnish large beads, which are compatible with the epoxy system, and comply with AASHTO M 247 except with the following gradation (FP–96, Type 4):

Sieve Size	**Percent Passing**
No. 10 (2.00 mm)	100
No. 12 (1.70 mm)	95 – 100
No. 14 (1.40 mm)	80 – 95
No. 16 (1.18 mm)	10 – 40
No. 18 (1.00 mm)	0 – 5
No. 20 (850 µm)	0 – 2

For the second drop, furnish regular beads which are specifically manufactured to be compatible with the epoxy system, and which comply with the requirements of AASHTO M247, Type 1.

Both types of beads are to be coated with a moisture resistant coating and an adhesion promoting coating which is compatible with the epoxy system.

S-1.2.8.8 Test Methods:
ACI 503, Appendix A.1 Adhesion to Concrete
ASTM D2240 Hardness
ASTM C501 Abrasion Resistance

S-1.2.8.9 Prequalification:
Manufacturers interested in prequalifying material under this specification must provide a one liter sample of each color plus one liter of hardener to the Engineer for laboratory testing. Also include a copy of the quality control test report for each lot of material, an infrared spectroscopy analysis for each component if available, material safety data sheets and a complete set of installation recommendations and instructions. Forward an official copy of the AASHTO NTPEP test report along with evidence that the product in reference is identical to that submitted for prequalification.

The material will be evaluated for compliance with all requirements of this specification, and the manufacturer will be notified of the results. Both component A and component B will be analyzed and "fingerprinted" using infrared spectroscopy for use in screening future verification samples to ensure that materials submitted for use are of an identical formulation as originally approved.

Verification testing: The Engineer will take a one liter verification sample of Part A and Part B of the epoxy from one lot of each color per project. Send the samples to the engineer for testing and evaluation. Lots previously tested will be exempted from testing and may be exempted from sampling if coordinated with the engineer. Samples may be tested using infrared spectroscopy and testing as necessary. Deviations as determined by comparison with the prequalification sample will be cause for removal from the prequalified list. The Engineer may also take a 0.5 gallon (2 liter) sample of each type of glass bead used on the project. Forward all samples to the engineer for verification testing

S-66.3 METHOD OF INSTALLATION

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 City Inspector. 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 16.5 mm (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 and 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 City of Overland Park Traffic Control Handbook. 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.

S-66.3.1 Glass Spheres

The drop on glass spheres shall be applied at a rate of 3.6 to 4.5 kg per 9.3 square meters (eight to ten pounds per 100 square feet).

S-66.3.2 Thermoplastic Pavement Markings

Thermoplastic material shall readily apply to the pavement at temperatures of 204 – 218 degrees C (400 – 425 degrees F) from approved equipment to produce an extruded line that shall be continuous and uniform in shape having clear and sharp dimensions. Application temperatures shall not exceed 232 degrees C (450 degrees F).

Thermoplastic may be used for cross walks and stop bars as specified under the conditions described herein. The thermoplastic markings shall be applied to the pavement surface in a molten state by mechanical means with surface application of glass spheres, and upon cooling to

normal pavement temperature, produce an adherent retro-reflectorized stripe of specified thickness and width and capable of resisting deformation.

S-66.3.2.1 Equipment
The equipment used to install the thermoplastic shall be as follows:

A self-propelled machine is required in order to fulfill the timing needs of the marking installation for longitudinal lines.

If thermoplastic is used for transverse lines, i.e., crosswalks and stop lines, a push cart shall be used according to the following requirements: Only one pass with the thermoplastic pavement marking equipment shall be allowed in order to provide the required line width according to the plans. Multiple passes of narrower lines with overlaps to provide the required width shall not be allowed unless otherwise approved by the inspector after review of a test strip installation. If approved, the contractor shall be required to heat the seam with a torch and feather the overlapped material with a putty knife. Liquid thermoplastic shall not be used for word or symbol markings.

Constructed to provide mixing and agitation of the materials. Conveying parts between the main material reservoir and the shaping die shall be constructed as to prevent accumulation and clogging.

Constructed so that mixing and conveying parts up to and including the shaping die will maintain the materials at a temperature not less than 204 – 232 degrees C (400 – 450 degrees F). To assure that the material does not fall below the minimum temperature, the shaping die shall be heated by means of a gas-fired infrared heater or a heated, oil-jacketed system.

Constructed as to insure continuous uniformity in the dimensions of the stripe. The applicator shall provide a means for cleanly cutting off square stripe ends and shall provide a method of applying “skip” lines. The equipment shall be constructed to be able to provide for varying die widths and to produce varying widths of traffic markings. The use of pans, aprons, or similar appliances with die overruns will not be permitted.

All conditions apply as stated above for material temperatures, line definition and workmanship when a hand pushcart is used for cross walks. The Inspector will verify measurement.

Equipped with a special kettle for melting and heating the material shall be provided. The kettle shall be equipped with a thermostat so that heating can be done by controlled heat transfer liquid rather than by direct flame so as to provide positive temperature control and prevent overheating of the material.

Constructed for a nominal application of 2.3 – 3.2 mm (90 – 125 mil) thickness.

The heater and applicator shall be so equipped and arranged as to meet the requirements of the National Board of Fire Underwriters of the National Fire Protection Association, of the state, and of the local authorities.

Equipped with an automatic glass sphere dispenser attached to the striping machine in such a manner that the spheres are dispensed almost instantaneously upon the installed line. The glass sphere dispenser shall be equipped with an automatic cut-off control synchronized with the cut-off of the thermoplastic material.

The equipment shall be arranged as to permit preheating of the pavement immediately prior to application of the thermoplastic material, if preheating is recommended by the thermoplastic manufacturer.

The applicator shall be capable of containing a minimum of 453.6 kg (1000 pounds) of molten material (not applicable for hand-liner use).

The applicator shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

The Contractor's striper shall be equipped with electrical meter (foot) counters. The counters shall individually tabulate the length of line applied by each gun whether solid or dashed. The Contractor shall determine the accuracy of the meter (foot) counters and establish an adjustment factor as required to determine the pay item quantities. The meter (foot) counters shall be periodically checked to assure accurate measurements. No thermoplastic shall be applied without the accurate operation of the foot counters. The Contractor shall provide the Engineer with a certified document on these calibrations.

S-66.3.2.2 Application Over Existing Markings

Existing thermoplastic markings on asphalt road surfaces may be over laid with thermoplastic material providing that the existing markings (thermoplastic) are less than 0.75 mm (30 mils) thick, and are securely bonded to the substrate. If the thermoplastic is greater than 0.75 mm (30 mils), or not securely bonded to the substrate, then it shall be ground to 0.75 mm (30 mils), or removed completely if not securely bonded to the road.

Existing solvent based paint on asphalt road surfaces may be over laid with thermoplastic provided that more than 75% of the road surface is exposed, and there is no more than a single coat of paint on the remaining unexposed area. If more than one layer of paint exists, the paint is not securely anchored to the substrate, or there is less than 75% of the road surface exposed, then the paint must be thoroughly removed.

All existing polyester, epoxy, or other type pavement marking paints on asphalt or concrete road surfaces must be completely removed from all road surfaces prior to the installation of thermoplastic material.

S-66.3.2.3 Application Temperatures

To insure optimum adhesion, the pavement and ambient air temperature shall be 10 degrees C (50 degrees F) and rising for standard thermoplastic and 18 degrees C (65 degrees F) for durable thermoplastic. The thermoplastic material shall be applied in a melted state at a temperature of 204 – 218 degrees C (400 – 425 degrees F). The temperature of the material within the shaping dies shall be maintained at the manufacturer's recommendations for application temperatures,

but in no case shall the temperature fall below 204 degrees C (400 degrees F) or exceed 232 degrees C (450 degrees F).

Where manufacturer's application temperatures differ from those as specified, the manufacturer's temperatures shall apply upon approval of the Engineer.

S-66.3.2.4 Line Quality
The finished lines shall have well defined edges and be free of waviness. Pavement marking lines shall be straight or of uniform curvature and shall conform with the tangents, curves, and transitions as specified in the pavement marking standards and/or as directed by the Inspector.

S-66.3.2.5 Line Thickness
The minimum thickness of the lines as viewed from a lateral cross section shall be not less than 2.4 mm (90 mil). Drop-on glass spheres shall not be included in the measurement, or if so, then appropriate allowances shall be made for the added mil thickness. A device for gauging the installed material thickness shall be furnished to the City Inspector as requested for use on the project. The gauge shall be easy to read and shall readily indicate excessive variations.

S-66.3.2.6 Clean Up
The Contractor shall be responsible for removing all pavement markings material spilled upon the roadway surface or adjoining area. The Contractor shall use methods acceptable to the Engineer/Inspector for removing the spilled material.

S-66.3.2.7 Line Repair
Any pavement marking which is crossed by a vehicle and tracked shall be replaced and any subsequent marking made by the vehicle shall be removed by methods acceptable to the Inspector at NO additional cost to the City.

S-66.3.3 Preformed Thermoplastic Pavement Markings
The markings shall be applied in accordance with the manufacturer's recommendations on clean and dry surfaces.

S-66.3.3.1 Asphalt
The materials shall be applied using the propane torch method recommended by the manufacturer. The material must be able to be applied at ambient and road temperatures down to 0 degrees C (32 degrees F) without any preheating of the pavement to a specific temperature. The pavement shall be clean, dry and free of debris and oil or grease residue.

At temperatures below 10 degrees C (50 degrees F), the preformed thermoplastic pavement markings shall be kept as warm as possible to maintain flexibility.

Remove pavement surface moisture by holding a propane torch approximately 150 mm (6") above the section of asphalt using a continuous circular motion.

Heat the pavement with the torch upon placing the material to a temperature of 93 degrees C (200 degrees F) for 2.3 mm (90 mil), and up to 149 degrees C (300 degrees F) for 3.2 mm (125 mil) materials.

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

Position the torch approximately 305 mm (12”) 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.

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.

If installing reversible arrows, which do not contain a top coating of glass spheres, the glass spheres shall be hand applied on the molten material.

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.

After cooling, use a putty knife to attempt to remove a portion of the material. The material shall not pry off without asphalt embedded to the underside.

S-66.3.3.2 Concrete
New concrete surfaces must be sandblasted to entirely remove curing compound. The same application procedure shall be used as described for asphalt pavements. However, a compatible primer sealer shall be applied before application to assure proper adhesion.

S-66.3.3.3 Chip Seal Surfaces
The same application procedure shall be used as described for asphalt pavements. However, exposed aggregate should be removed where the preformed thermoplastic pavement marking is to be applied.

S-66.3.4 Cold Plastic Pavement Markings
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 only to concrete pavement surfaces by means of an approved inlaid grinding process with pre-coated adhesive and pressure.

S-66.3.4.1 Procedure
This procedure explains how to apply tape to concrete surfaces only. Apply the tape according to manufacturer’s instruction in conjunction with an approved inlaid grinding method.

S-66.3.4.2 Road conditions
It is recommended that the tape be installed as soon as practical following tape manufacturer instructions.

Cold plastic pavement markings shall be inlaid by an approved grooving process into concrete pavement surfaces. Cold plastic will not be allowed on asphalt pavement surfaces whether inlaid into hot asphalt or existing asphalt surfaces. Grooving the pavement surface allows preformed pavement marking tape to better adhere by creating a fresh surface. Grooving also produces a lower profile marking by embedding the tape into the pavement surface, which helps protect the tape from snowplow damage.

The cutting head shall consist of diamond tipped cutting blades "gang stacked" 6 mm to 13 mm (0.25" to 0.50") wide. The spacers between each blade must be such that there is less than a 10 mil raise in the finished groove between the blades. Water-cooling the blades may be necessary for long line grooving.

The groove width shall be equal to the tape width plus 25 mm + 3.2 mm (1" + 1/8"). The depth of the groove shall be 75% of the tape thickness $\pm$ 15%. For series 420, 60 mil tapes, the groove shall be 45 mils $\pm$ 10 mils or 1.25 mm $\pm$ 0.25 mm (0.05" $\pm$ 0.01"). 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. If water-cooling is used, flush the groove immediately after grooving to clean the surface.

Clean the surface of the road and the groove using a broom and/or high-pressure air blower. If either of these methods fail to clean the road surface, then high-pressure water wash shall be used. Road surface, including the surface of the groove must be dry and all dust, dirt, debris, oil, grease and foreign material removed before applying tape. If using water-cooling to groove, the groove must be completely dry prior to tape application.

S-66.3.4.3 Tape Application
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 one inch away from the crack or joint on each side. Apply the required surface preparation adhesive and allow to dry completely (5-10 minutes at 21 degrees C (70 degrees F), but not over 30 minutes.

S-66.3.4.4 Tamping
Tamp the tape thoroughly with a tamping cart with a minimum 90 kg (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 cart on the tape

Make six passes (three passes back and forth) over each part of the tape (tamping is very important)

Make sure all edges are firmly adhered

S-66.3.4.5 Application Conditions

Air temperature 15.5 degrees C (60 degrees F) and rising

Surface temperature 21.1 degrees C (70 degrees F) and rising

Overnight air temperature 4.4 degrees C (40 degrees F) the night before tape application

Pavement surface must be clean and dry. No rainfall should occur within 24 hours prior to application

Butt splices must be used; do not overlap tape ends

Traffic must be kept off of pavement surfaces coated with a surface preparation adhesive prior to tape application (follow manufacturer's instruction regarding the use of surface preparation adhesive)

S-66.3.4.6 Surface moisture
Cold preformed plastic tapes will not adhere if moisture is present. Therefore, road surfaces must be dry and above the minimum required temperature 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) must be performed and approval obtained from the inspector. The groove must be visibly dry for a minimum of two hours prior to application. A moisture test shall be completed after the two-hour drying time to ensure no presence of moisture.

S-66.3.5 Pavement Marking Paint
The Contractor shall furnish and install white and yellow retro-reflectorized pavement marking paint material at the location shown on the plans, in conformance with the details and material specifications included herein.

The wet thickness and dry thickness of the pavement marking paint shall not be less than 0.4 mm (15 mils) and 0.3 mm (12 mils), respectively without glass spheres.

Glass spheres shall be applied uniformly over the entire length of line at the rate of 0.70 – 1.20 kg per liter (6 to 10 lbs. per gallon) of paint.

The gun tip shall be oriented perpendicular to the centerline to ensure that the beginning and ends of all lines are perpendicular to the centerline and not skewed.

The equipment shall be maintained such that the needle can be fully closed when shut as to ensure square cut lines at the beginning and ends.

S-1.3.6 Epoxy Pavement Marking
The Contractor shall furnish and install white and yellow epoxy markings at the location shown on the plans, in conformance with the details and material specifications included herein.

S-1.3.6.1 Equipment:
Use equipment that is capable of spraying both yellow and white epoxy in the manufacturer's recommended proportions. Provide equipment that will place stripes on the left and right sides, and place two lines simultaneously with either line in a solid or intermittent pattern in yellow or white. All guns must be in full view of operators at all times. If words, symbols, crosswalks, cross–hatching and stop bars are to be of epoxy resin material, equip the truck with a hand spray wand for such application. Mount the equipment on a truck of sufficient size and stability, and with an adequate power source, to produce lines of uniform dimension and prevent application failure. Provide equipment with metering devices to register the accumulated volume dispensed for each material, each day. Additionally, provide individual pressure gauges, clearly visible to the operator, for each pump used.

Provide equipment with two glass bead dispensers (double drop system) that uniformly distributes the glass beads to the surface of the epoxy pavement marking at a rate of at least 25 pounds per gallon (3 kilograms per liter). Glass beads may be applied by a pressure gun or controlled free fall.

S-1.3.6.2 Contractor's Personnel:
Assure that at least one employee on the project when pavement markings are being applied holds an American Traffic Safety Services Association (ATSSA) pavement marking certification.

S-1.3.6.3 Surface Preparation:
On existing pavements, remove the existing pavement markings in accordance with these Specifications. Remove the existing markings and prepare the surface according to the manufacturer's recommendations (for the type of markings being installed).

On new Portland cement concrete pavement (PCCP), use shot blasting to remove curing compounds and laitance from the surfaces to which the pavement marking will be applied. Prepare the surfaces of new concrete bridge decks the same as new PCCP.

On aged asphalt pavements, THOROUGHLY remove all dirt, grit, grease, grime, vegetable matter, residue of prior pavement marking application (including such adhesives or primers that may have been used in their application), and any other foreign matter from the roadway surface prior to the application of epoxy pavement markings.

S-1.3.6.4 Alignment:
All layout required in the construction of the pavement marking is the responsibility of the Contractor. Lay out the pavement marking as detailed on the Plans. When the Plans do not provide details, submit a layout plan (conforming to the requirements of the Manual on Uniform Traffic Control Devices (MUTCD)) for the pavement markings to the Engineer for approval. Normally locate longitudinal pavement marking stripes 50 mm (2 inches) from existing longitudinal joints. Provide adequate guide marks (approximately 50 mm (2 inches) by 150 mm (6 inches) at approximately 10 to 15 m (30 to 50 ft) intervals) for the application of the pavement markings.

S-1.3.6.5 Pavement Marking Application:

When no traffic is present, and for edgelines under any condition of traffic, a slower curing epoxy material (40 minutes) may be used. When the application is taking place under traffic, use a fast setting (10 minutes) epoxy material for center lines and skip lines. Apply the epoxy material closely behind the cleaning procedure.

Provide the Project Engineer with a copy of the manufacturer's application instructions. Apply the epoxy pavement markings in accordance with the manufacturer's recommendations. In the absence of manufacturer's recommendations, apply the markings when the ambient and pavement surface temperatures are 4 degrees C (40 degrees F) and rising. Cease pavement marking operations when the ambient or the pavement surface temperature drops to 4 degrees C (40 degrees F).

Before mixing the components of the pavement marking material, heat the individual components to the temperature ranges recommended by the manufacturer of the material. Avoid exceeding the maximum recommended temperature at any time.

Apply the epoxy pavement marking material at a thickness of 500 µm ± 50 µm (20 mils ± 0.2 mils) on asphalt and PCCP. Immediately apply the glass beads to the epoxy pavement marking at the rate of 3 kilograms per liter (25 pounds per gallon) of epoxy, equally divided between the large and regular bead gradations. Apply the large beads on the first drop, and the regular beads on the second.

S-66.4 INSTALLATION PERFORMANCE MEASURES
To ensure total understanding of what is expected in the application of any permanent pavement marking material in the City of Overland Park, the following guidelines shall be followed:

S-66.4.1 Thermoplastic Installation Performance Measures
All thermoplastic lines shall be of uniform thickness, with well-defined edges and squared off beginnings and endings of all lines.

All thermoplastic lines will have minimal dribbles, runs and overlaps. In the event thermoplastic long lines must stop and then continue, the restart shall line up to within 13mm (½ inch) of the existing long line and maintain a totally straight line. Hand pushcarts shall be used when doing crosswalks and stop bars. When the crosswalk or stop bar cannot be laid continuous, the startup of the line shall be within 6mm (¼ inch) of the initial line. A maximum of two passes can be made in order to achieve the desired width of stop bars. When two passes are used, a maximum of 3mm (1/8”) gap shall be maintained between the two passes instead of a material overlap.

The application equipment shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

Thermoplastic pavement marking materials shall not be applied when pavement temperatures are below 10 degrees C (50 degrees F), or when the surface of the pavement shall show evidence of moisture. Temperatures should be at least 10 degrees C (50 degrees F) and rising.

Thermoplastic material will not properly adhere to pavement if moisture is present. Should rainfall occur within 24 hours prior to application, the surface moisture test (plastic wrap or

roofing paper method as approved by the inspector) must be performed, and approval obtained from the Inspector.

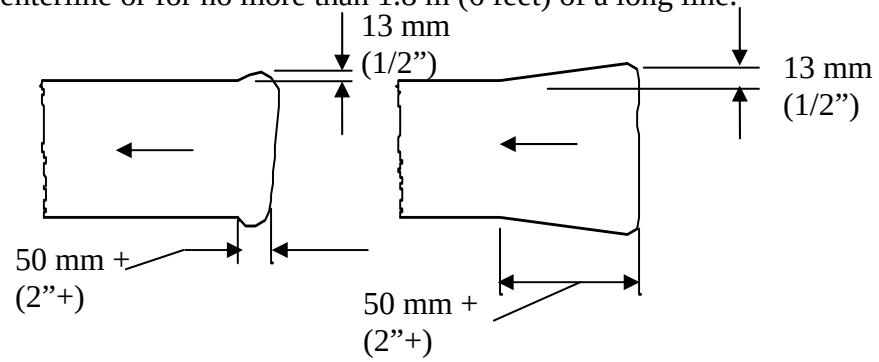
Lack of specified thickness: The full unit price bid per meter (foot) shall be withheld if lack of thickness is found more than three (3) times per 1.6 km (mile), or project if less than 1.6 km (1 mile) in length. Each line shall be checked a minimum of six (6) times per 1.6 km (mile), or project if less than 1.6 km (1 mile) in length, using the random number tables and method of sampling as set forth in section 5.17.06 of Part V of the KDOT Construction Manual.

Lack of specified width: Payment shall be made with penalty being equal to 25% of the unit price bid per meter (foot) for each 6.4 mm (¼") of width lacking not to exceed 100% of the unit price bid per meter (foot) for the length of the line less than specified width. Penalty shall be imposed upon the first occurrence and every occurrence thereafter.

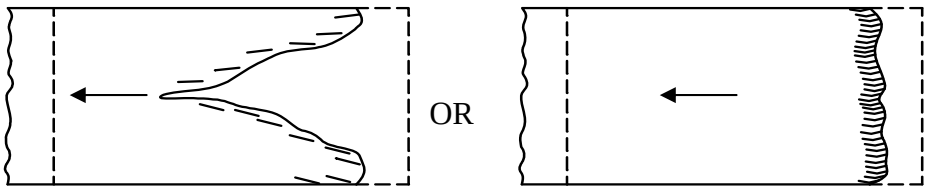
Lack of specified length/cycle: Payment shall be made with penalty being equal to 25% of the unit price bid per meter (foot) for each 50 mm (1") of length lacking or exceeding the specified length for broken lane line and/or broken center line not to exceed 100% of the unit price bid per meter (foot) for the length of the line less than specified length. Penalty shall be imposed upon the first occurrence and every occurrence thereafter.

Lack/Excess of Surface Spheres or Improper Application: The full unit price bid per meter (foot) shall be withheld for each lineal meter (foot) of material with inappropriate application rate of the surface glass spheres. The same penalty shall apply if the spheres are not evenly disbursed across and along a line or if the spheres imbed improperly. This penalty shall be imposed for each instance that the Contractor fails to take corrective action after one warning by the Engineer.

Bell ends: The full unit price bid per meter (foot) shall be withheld for wide "bell" ends greater in length than 50 mm (2 inches). This penalty shall be for the full 1.8 m (6 feet) of a lane line or broken centerline or for no more than 1.8 m (6 feet) of a long line.

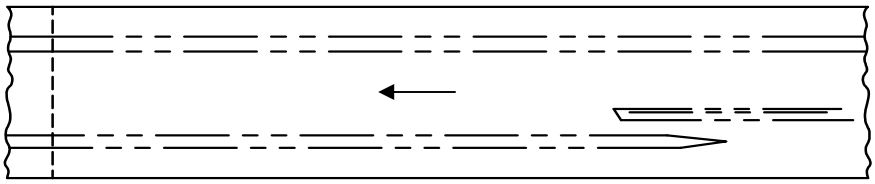


Lack of adhesion: The full unit price bid per meter (foot) shall be withheld for one meter (one foot) for each occurrence if found more than three (3) times per 1.6 km (1 mile), or project if less than 1.6 km (1 mile) in length.

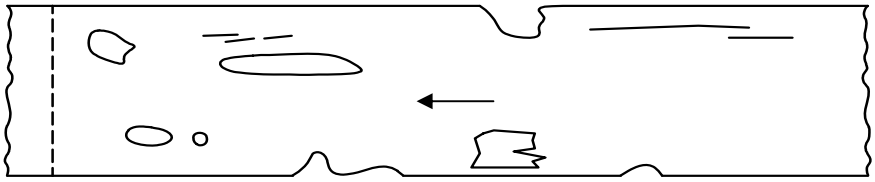


Line Deviation: A line that in the judgment of the Engineer deviates from the specified layout by an unreasonable amount shall be replaced. The Contractor shall be responsible for removal of the deviated marking material/repair of the pavement as designated by, and to the satisfaction of, the Engineer at no additional compensation.

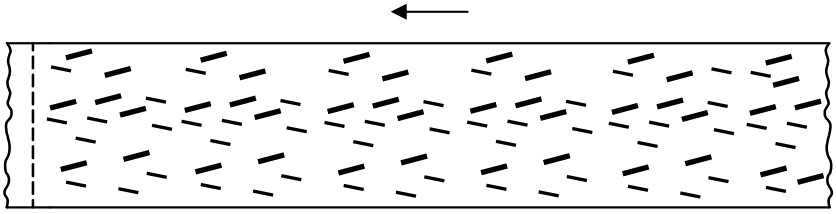
Pitted Line: The full unit price bid per meter (foot) shall be withheld for each pit greater than 3 m (10 feet) in length.



Gaps in Line or Crumbly Edges: The full unit price bid per meter (foot) shall be withheld for the entire length of the portion of any line receiving less than the required amount of thermoplastic material. This penalty shall be imposed when the Contractor fails to correct line quality after the second warning within 1.6 km (1 mile), or project if less than 1.6 km (1 mile) in length.



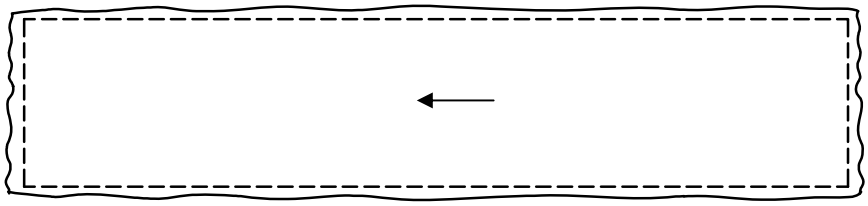
Rough Line Surface: The full unit price bid per meter (foot) shall be withheld for the entire length of the portion of any line with a rough or "burlap" surface. Penalty shall be imposed upon the first occurrence and every occurrence thereafter.



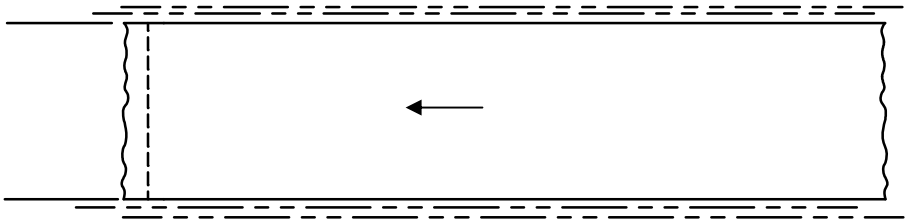
Excessive Dripping between Lines: The full unit price bid per meter (foot) shall be penalized for the length of any dribbled open space between broken lines that is not removed to the

satisfaction of the Engineer before leaving the project site that work day. Penalty shall be imposed upon the first occurrence and every occurrence thereafter.

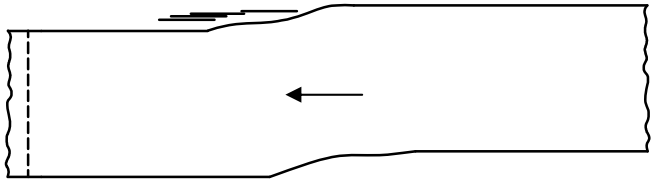
Swollen Line of Excessive Width: The full unit price bid per meter (foot) shall be penalized for swollen lines in excess of the specified width.



Smeared Line Edges: Fifty (50) percent of the unit price bid per meter (foot) shall be penalized for each occurrence of a length greater than 4.6 m (15 feet).



Wavy Line: The full unit price bid per meter (foot) shall be withheld for the entire length of waviness in a line caused by poor operation by the driver/operator of the application equipment. Penalty shall be imposed from the first occurrence.



Work Outside the Scope/Limits of Project: Payment for all pavement marking work performed shall be withheld in full until the Contractor (a) removes all pavement marking material placed outside the scope/limits of the project, and (b) repairs the pavement surface as directed by and to the satisfaction of the Engineer and the local entity, if different from the Engineer.

Timeliness: All thermoplastic material shall be completely installed within one (1) calendar week of the road surface material being laid. Failure to install markings on schedule shall result in liquidated damages of $1500 per day, separate from the project liquidated damages as stated elsewhere in the Contract Documents, until pavement markings are installed on schedule, or completion of the markings completes the project. These liquidated damages shall be imposed

each time the Contractor fails to install pavement markings within the one-week window as described above.

S-66.4.2 Preformed Thermoplastic Installation Performance Measures
Applied material must be from an approved manufacturer, of proper dimensions and composition. Material must be applied per manufacturer's instructions. No substitutions of materials will be allowed without prior approval of the Engineer.

Contractor is responsible for accurate layout and measurement. Preformed thermoplastic to be used only where specified or with approval of the Engineer.

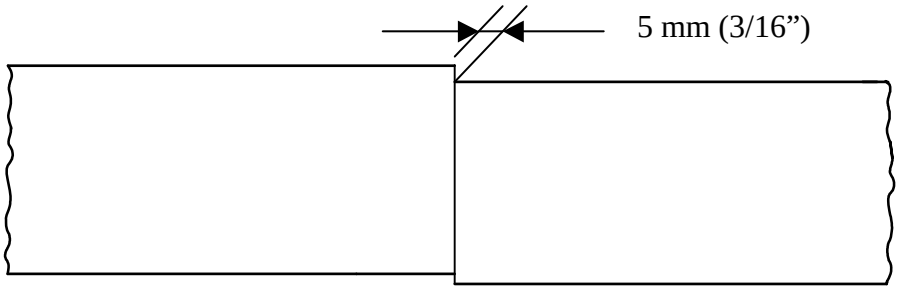
Applied material must adhere fully and completely to road surface, with straight edges and squared ends; lay smooth on surface with no warps, folds, creases, waves, bubbles or rips. Color and beading must be uniform and consistent.
No overlap of materials. Ends or sides matched to existing markings must not exceed 3mm (1/8") in separation. Applied material to be in alignment with existing markings and of consistent size.

Preformed thermoplastic pavement marking materials shall not be applied when pavement temperatures are below 0 degrees C (32 degrees F), or when the surface of the pavement shall show evidence of moisture.

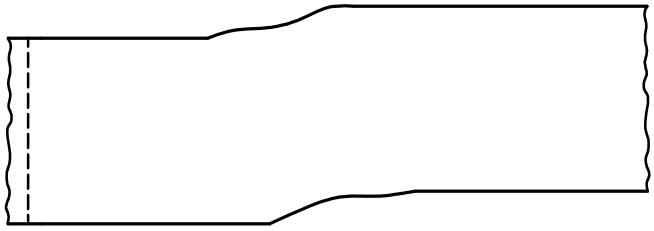
Lack/Excess of Surface Spheres or Improper Application: The full unit price bid per meter (foot) shall be withheld for each lineal meter (foot) of material or per each for symbol markings with inappropriate application rate of the surface glass spheres. The same penalty shall apply if the spheres are not evenly disbursed across and along a line or if the spheres imbed improperly. This penalty shall be imposed for each instance that the Contractor fails to take corrective action after one warning by the Engineer.

Lack of adhesion: The full unit price bid per meter (foot) or per each for symbol markings shall be withheld for one meter (one foot) for each occurrence if found more than three (3) times per 1.6 km (1 mile), or project if less than 1.6 km (1 mile) in length.

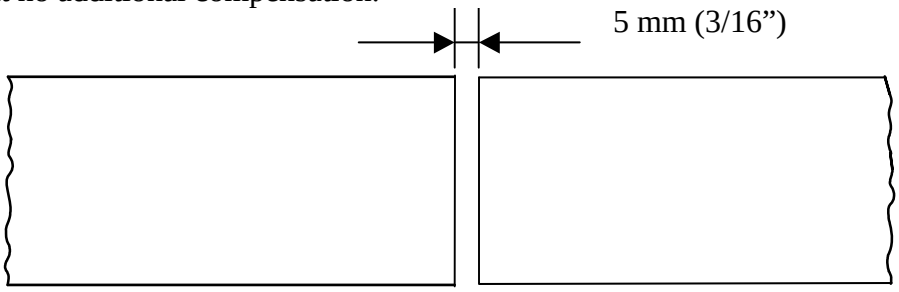
Line Deviation: A line that deviates from the specified layout by an unreasonable amount shall be replaced. The Contractor shall be responsible for removal of the deviated marking material/repair of the pavement as designated by, and to the satisfaction of, the Engineer at no additional compensation.



Wavy Line: The full unit price bid per meter (foot) shall be withheld for the entire length of waviness in a line caused by poor workmanship and/or application procedures. Penalty shall be imposed from the first occurrence.



Gaps Between Successive Lines: Successively placed lines that contain gaps as specified by an unreasonable amount shall be replaced. The Contractor shall be responsible for removal of the deviated marking material/repair of the pavement as designated by, and to the satisfaction of, the Engineer at no additional compensation.



Burned or Discolored Markings: Fifty (50) percent of the full unit price bid per meter (foot) shall be withheld for each lineal meter (foot) of material or per each for symbol markings which shows signs of burning or discoloration due to prolonged application of the torch. This penalty shall be imposed for each instance that the Contractor fails to take corrective action after one warning by the Engineer.

Work Outside the Scope/Limits of Project: Payment for all pavement marking work performed shall be withheld in full until the Contractor (a) removes all pavement marking material placed outside the scope/limits of the project, and (b) repairs the pavement surface as directed by and to the satisfaction of the Engineer and the local entity, if different from the Engineer.

Timeliness: All preformed thermoplastic material shall be completely installed within one (1) calendar week of the road surface material being laid. Failure to install markings on schedule shall result in liquidated damages of $1500 per day, separate from the project liquidated damages as stated elsewhere in the Contract Documents, until pavement markings are installed on schedule, or completion of the markings completes the project. These liquidated damages shall be imposed each time the Contractor fails to install pavement markings within the one-week window as described above.

S-66.4.3 Cold Plastic Installation Performance Measures
Applied material must be from an approved manufacturer, of proper dimensions and composition. Material must be applied per manufacturer's instructions. No substitutions of materials will be allowed without prior approval of the Engineer. Manufacturer-approved adhesive must be used and applied per instructions. No substitutions of materials will be allowed without prior approval of the Engineer.

Contractor is responsible for accurate layout and measurement. Cold plastic to be used only where specified or with approval of the Engineer.

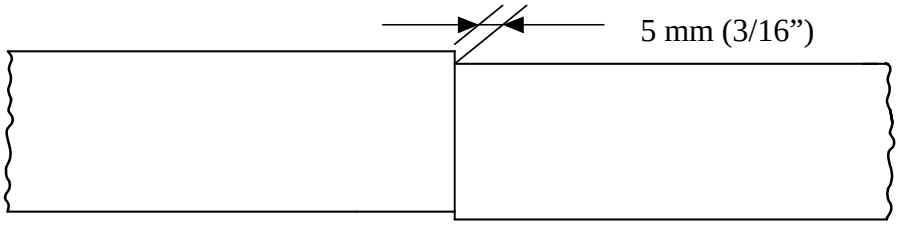
Applied material must adhere fully and completely to road surface, with straight edges and squared ends; lay smooth on surface with no warps, folds, creases, waves, bubbles or rips. Color and beading must be uniform and consistent.

No overlap of materials. Ends or sides matched to existing markings must not exceed 3mm (1/8") in separation. Applied material to be in alignment with existing markings and of consistent size.

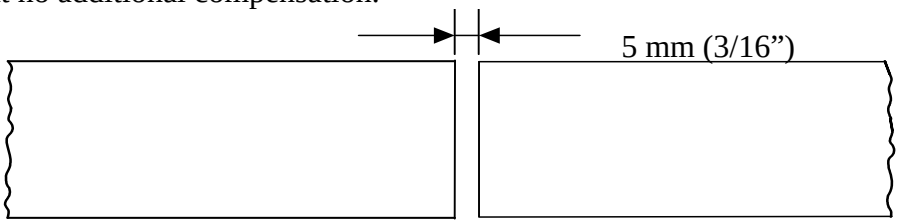
Cold plastic pavement marking materials shall not be applied when pavement temperatures are below 10 degrees C (50 degrees F), or when the surface of the pavement shall show evidence of moisture. Temperatures should be at least 10 degrees C (50 degrees F) and rising.

Lack of adhesion: The full unit price bid per meter (foot) shall be withheld for one meter (one foot) for each occurrence if found more than three (3) times per 1.6 km (1 mile), or project if less than 1.6 km (1 mile) in length.

Line Deviation: A line that in the judgment of the Engineer deviates from the specified layout by an unreasonable amount shall be replaced. The Contractor shall be responsible for removal of the deviated marking material/repair of the pavement as designated by, and to the satisfaction of, the Engineer at no additional compensation.



Gaps Between Successive Lines: Successively placed lines that contain gaps as specified by an unreasonable amount shall be replaced. The Contractor shall be responsible for removal of the deviated marking material/repair of the pavement as designated by, and to the satisfaction of, the Engineer at no additional compensation.



Inlaid Groove Quality: The full unit price bid per meter (foot) shall be withheld for the entire length of line that does not meet the requirements for depth of the inlaid material or for a groove that displays a coarse tooth pattern bottom that is not conducive to complete adhesion of the marking material. Penalty shall be imposed from the first occurrence.

Wavy or Misaligned Line: The full unit price bid per meter (foot) shall be withheld for the entire length of waviness caused by poor operation by the driver/operator of the grooving/installation equipment or for any misalignment in the material installed within the inlaid groove. Penalty shall be imposed from the first occurrence.

Work Outside the Scope/Limits of Project: Payment for all pavement marking work performed shall be withheld in full until the Contractor (a) removes all pavement marking material placed outside the scope/limits of the project, and (b) repairs the pavement surface as directed by and to the satisfaction of the Engineer and the local entity, if different from the Engineer.

Timeliness: All cold plastic material shall be completely installed within one (1) calendar week of the road surface material being laid. Failure to install markings on schedule shall result in liquidated damages of $1500 per day, separate from the project liquidated damages as stated elsewhere in the Contract Documents, until pavement markings are installed on schedule, or completion of the markings completes the project. These liquidated damages shall be imposed each time the Contractor fails to install pavement markings within the one-week window as described above.

S-66.4.4 Pavement Marking Paint and Epoxy Pavement Marking Installation Performance Measures
The line shall be uniform thickness across the entire cross section of the line with well-defined edges. Heavy inner thickness and thin edges or vice-versa will not be accepted.

Glass spheres shall be spread uniformly over the entire length of line.

Beginning and ends of lines shall be clean cut and perpendicular to the centerline of the street.

Pavement marking paint materials shall not be applied when pavement temperatures are below 10 degrees C (50 degrees F), or when the surface of the pavement shall show evidence of moisture. Temperatures should be at least 10 degrees C (50 degrees F) and rising.

Lack of specified thickness: The full unit price bid per meter (foot) shall be withheld if lack of thickness is found more than three (3) times per 1.6 km (mile), or project if less than 1.6 km (1 mile) in length. Each line shall be checked a minimum of six (6) times per 1.6 km (mile), or

project if less than 1.6 km (1 mile) in length, using the random number tables and method of sampling as set forth in section 5.17.06 of Part V of the KDOT Construction Manual.

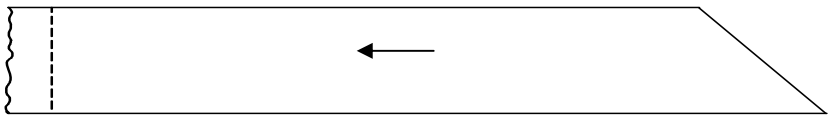
Lack of specified width: Payment shall be made with penalty being equal to 25% of the unit price bid per foot for each 6.4 mm (¼") of width lacking not to exceed 100% of the unit price bid per meter (foot) for the length of the line less than specified width. Penalty shall be imposed upon the first occurrence and every occurrence thereafter.

Lack of specified length/cycle: Payment shall be made with penalty being equal to 25% of the unit price bid per meter (foot) for each 50 mm (1") of length lacking or exceeding the specified length for broken lane line and/or broken center line not to exceed 100% of the unit price bid per meter (foot) for the length of the line less than specified length. Penalty shall be imposed upon the first occurrence and every occurrence thereafter.

Lack/Excess of Surface Spheres or Improper Application: The full unit price bid per meter (foot) shall be withheld for each lineal meter (foot) of material with inappropriate application rate of the surface glass spheres. The same penalty shall apply if the spheres are not evenly disbursed across and along a line or if the spheres imbed improperly. This penalty shall be imposed for each instance that the Contractor fails to take corrective action after one warning by the Engineer.

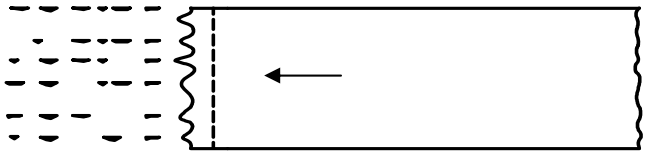
Pointed Ends: The full unit price bid per meter (foot) shall be withheld for pointed ends. This penalty shall be for the full 1.8 m (6 feet) of a lane line or broken centerline or for no more than 1.8 m (6 feet) of a long line.

Skewed Ends: The full unit price bid per meter (foot) shall be withheld for skewed ends. This penalty shall be for the full 1.8 m (6 feet) of a lane line or broken centerline or for no more than 1.8 m (6 feet) of a long line.

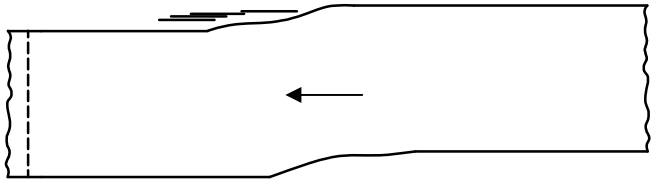


Line Deviation: A line that in the judgment of the Engineer deviates from the specified layout by an unreasonable amount shall be replaced. The Contractor shall be responsible for removal of the deviated marking material/repair of the pavement as designated by, and to the satisfaction of, the Engineer at no additional compensation.

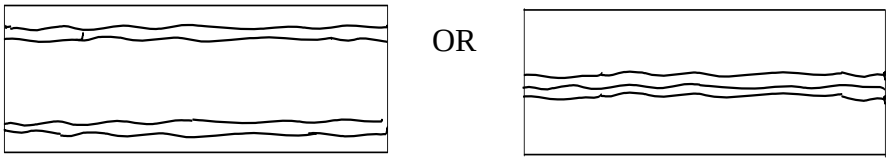
Excessive Dripping between Lines: The full unit price bid per meter (foot) shall be penalized for the length of any dribbled open space between broken lines that is not removed to the satisfaction of the Engineer before leaving the project site that work day. Penalty shall be imposed upon the first occurrence and every occurrence thereafter.



Wavy Line: The full unit price bid per meter (foot) shall be withheld for the entire length of waviness in a line caused by poor operation by the driver/operator of the application equipment. Penalty shall be imposed from the first occurrence.



Non-Uniform Thickness: The line shall be uniform thickness across the entire cross section of the line with well-defined edges. Heavy inner thickness and thin edges or vice-versa will not be accepted. The full unit price bid per meter (foot) shall be withheld for lines that are not of uniform thickness. Penalty shall be imposed from the first occurrence.



Work Outside the Scope/Limits of Project: Payment for all pavement marking work performed shall be withheld in full until the Contractor (a) removes all pavement marking material placed outside the scope/limits of the project, and (b) repairs the pavement surface as directed by and to the satisfaction of the Engineer and the local entity, if different from the Engineer.

Timeliness: All paint material shall be completely installed within one (1) calendar week of the road surface material being laid. Failure to install markings on schedule shall result in liquidated damages of $1500 per day, separate from the project liquidated damages as stated elsewhere in the Contract Documents, until pavement markings are installed on schedule, or completion of the markings completes the project. These liquidated damages shall be imposed each time the Contractor fails to install pavement markings within the one-week window as described above.

S-66.5 PRE-QUALIFICATION

Manufacturers interested in pre-qualifying material under this specification shall submit a sample of the material along with a complete materials specification for each color of marking material to be considered. The sample will be reviewed for compliance with all requirements of this specification. No material shall be used unless the material has been pre-qualified. A

complete list of pre-qualified materials is maintained by the Traffic Engineering Division of the Department of Public Works.

S-66.6 METHOD OF MEASUREMENT

Measurement for Permanent Pavement Markings shall be as listed in the bid proposal, which includes all labor, materials, tools and equipment necessary to fully complete the installation according to the plans and specifications. No measurement will be made for the removal of existing pavement markings prior to installing new markings in the same location.

Solid lines, composed of double median approach lines, double centerlines, crosshatch lines, chevron lines, crosswalk lines, solid lane lines, stop lines and edge lines, etc. shall be measured by the linear meter (foot), measured along the centerline of all markings. In the case of double, parallel line markings, the two lines shall be measured as one line, measured along the centerline between the two parallel lines.

Broken lines, composed of broken centerlines and broken lane lines, etc. shall be measured by the linear meter (foot) for the actual marked line only.

Solid and broken lines, composed of a solid line and a broken line parallel to each other, shall be measured as one, measured along the centerline between the two parallel lines.

Symbol markings, consisting of left and right turn arrows, “ONLY” markings and railroad crossing markings, etc. shall be measured per each for the complete symbol.

S-66.7 PAYMENT

The amount of completed and accepted work, for “Permanent Pavement Markings”, measured as provided, shall be paid for at the contract unit price bid per lineal foot for the various types of lines as listed in the proposal and at the contract unit price bid per each of the various symbol markings as listed in the proposal. Such payment and price shall constitute full compensation for all labor, materials, tools and equipment necessary to complete the item.

All traffic control necessary for installation of the Permanent Pavement Markings shall be subsidiary to the bid item “Traffic Control”. The removal of existing pavement markings prior to installing new markings in the same location shall be considered subsidiary to the bid item “Removal of Existing Structures”.

S-67 INTERIM PAVEMENT MARKINGS

Rev. 10/30/01

S-67.1 General

The Contractor shall furnish and install interim longitudinal white and/or yellow pavement markings, and white legends (“ARROW” and “ONLY” markings), as shown in the plans, details, specifications and Part VI of the Manual on Uniform Traffic Control Devices (latest revision)

and shall maintain them until the permanent pavement markings are installed, according to the plans and permanent pavement marking specifications.

Interim pavement markings shall be defined as markings that may be used until the earliest date when it is practical and possible to install permanent pavement markings that meet the full MUTCD standards for pavement markings. The contractor shall make every possible effort to remove the interim pavement markings and install permanent pavement markings within 48 hours. Only under extreme circumstances and at the approval of the pavement marking inspector or the engineer, will the duration of the interim pavement markings be extended. Under no circumstance should the interim pavement markings be in place for more than 2 weeks. If permanent markings cannot be installed within the specified time, then temporary pavement markings shall be installed following the guide lines as set forth in the MUTCD Part VI, Sections 6F and 6G. The interim markings shall be removed prior to installation of the permanent markings.

S-67.2 Material
The material for interim pavement markings shall be in accordance with this specification.

S-67.2.1 Paint
The interim pavement marking paint shall be a rapid dry. The traffic paint shall provide optimum adhesion for glass spheres when both binder and glass spheres are applied in the recommended quantities.

S-67.2.1.1 Drying Time
When applied at a wet film thickness of 15 mils with a top dressing of 6 - 10 pounds of glass spheres per gallon of paint and when the pavement temperature is between 50 degrees F and 120 degrees F and the relative humidity doesn't exceed 80%, the binder shall dry to a no-tracking condition in a minimum of 20 seconds and a maximum of 60 seconds.

These dry times shall not be exceeded when the paint is applied with specialized equipment so as to have the pigmented binder at a temperature of 150 degrees F to 170 degrees F at the spray gun.

The no-tracking condition shall be determined by passing over the applied line in a simulated passing maneuver with a passenger car traveling 35 MPH. There shall be no visual deposition of the paint to the pavement surface when viewed from a distance of 50 feet. Furthermore, the pigmented binder, without glass spheres, shall dry to no-tracking condition in 180 seconds or less when tested in accordance with ASTM D-711-67.

S-67.2.1.2 Directional Reflectance
The daylight directional reflectance of white pigmented binder (without glass spheres) shall be not less than 85% relative to magnesium oxide when tested in accordance with Federal Test Method Standard No. 141a, Method 6121. If yellow, after drying shall suitably match color 33538 of Federal Standard 595.

S-67.2.1.3 Glass Beads
The glass spheres shall meet the requirements of AASHTO Specification M 247-81, Type I with flotation and moisture resistance properties.

S-67.2.2 Temporary Tape
Temporary pavement marking tape shall be in accordance with the Standard Specifications for State Road and Bridge Construction of the Kansas Department of Transportation (latest version), Subsection 2205 for “Removable” Type I tape.

S-67.3 Method of Installation
The temporary pavement markings shall be installed true to line according to the plans, details, Manual on Uniform Traffic Control Devices (latest edition) and this specification.

Interim pavement markings shall be installed the same day that the existing pavement markings are damaged, removed or covered up prior to lane opening.

The interim pavement markings shall be installed using the same cycle length as the permanent markings and be at least 2 ft long. This equates to a line 2 ft long with a 22 ft gap. Double yellow markings shall be used for centerline and single white markings shall be used for lane lines on four lane roadways. Single yellow markings shall be used for centerline on two lane roadways as directed by the engineer.

Half-cycle lengths with a minimum of 2 ft stripe and 10 ft gap should be used on roadways with severe curvature.

Interim pavement markings should be used for centerlines, lane lines, channelization lines, edge lines, and lane reduction transitions.

S-67.3.1 Paint
Paint shall be used on all milled asphalt surfaces that are scheduled to be overlaid.

S-67.3.2 Glass Beads
The glass beads should be applied at the rate of 6 - 10 pounds per gallonof paint. The glass beads shall be sprayed into the wet traffic paint through a pressurized glass gun set 1 inch to 4 inch behind the paint spray gun.

S-67.3.3 Tape
Interim reflective tape shall be used upon newly overlaid surfaces.

S-67.4 Method of Removal
Interim pavement markings on milled surfaces scheduled to be overlaid do not have to be removed prior to performing the overlay. Interim 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 a high pressure water blast method, a low pressure water and sand blast method, a steel shot blast method, or burning method. Grinding or black paint coverings or asphalt covering shall not be allowed on new pavement surfaces.

S-67.5 Measurement
No direct measurement will be made for interim pavement markings installed in accordance with the plans and specifications nor for their removal.

S-67.6 Payment
The amount of completed and accepted work, for Interim Pavement Markings, including symbols and legends, measured as provided, shall be paid for at the contract lump sum price bid for “Interim Pavement Markings”. Such payment and price shall constitute full compensation for all labor, materials, tools and equipment necessary to complete the item.

No payment shall be made for the “Removal of Interim Pavement Markings”. Any work required to remove the interim pavement markings shall be considered subsidiary to the bid item “Interim Pavement Markings”.

All traffic control necessary for installation and removal of the interim pavement markings shall be subsidiary to the bid item “Interim Pavement Markings”.

S-68 CONCRETE SAFETY BARRIER
This work shall consist of erecting and removing concrete safety barriers, in accordance with the requirements of Section 828 of the Standard Specifications, as indicated on the construction plans or as directed by the Engineer.

S-68.1 Measurement and Payment
Payment for "Concrete Safety Barrier" of the various types designated on the plans shall not be paid for directly but shall be considered subsidiary to the bid item “Traffic Control”. Work shall include furnishing and placing all materials, moving of temporary barriers to alternate locations for various phases of construction when required, and all labor, equipment, tools, and incidentals to complete this work.

S-69 TREE AND PLANT PROTECTION
All trees and other vegetation which must be removed to perform the work shall be removed and disposed of by the Contractor; however, no trees or cultured plants shall be unnecessarily removed unless their removal is indicated on the drawings. All trees and plants not removed shall be protected against injury from construction operations.

The Contractor shall take extra measures to protect trees designated to be preserved, such as erecting barricades or fences around the drip line, and trimming low hanging branches to prevent damage from construction equipment. Barricade or fence shall not be removed without consent of the Engineer. When installing a pipe, or any other work that may damage the tree, hand excavating or tunneling methods shall be used. Where encroachment by vehicles or equipment is expected within the drip line of the tree, the contractor will be required to place at least a 6 inches layer of organic mulch on top of the affected area to offset possible compaction. Such trees shall not be endangered by stockpiling excavated material or storing equipment within the drip line of the tree. No backfill material exceeding 4 inches in depth shall be placed within the drip line area of any tree designated to be preserved without prior consent from the Engineer.

When excavation is required within the drip line of any protected tree, the contractor shall take extra measures to protect as many roots as possible. All roots to be cut or removed shall be "cut" with a chain saw, trencher, or other methods as approved by the engineer that will leave a smooth cut surface. All roots exposed during excavation shall be protected to prevent the roots from drying out by covering the exposed area with canvas or burlap, peat moss, or mulch, and kept damp until the area has been backfilled. Where shown on the plans, trees requiring root removal of one third or more of the circumference of the root system, may require the pruning of limbs on the opposite side of the root removal or thinning the entire tree equally as directed by the Engineer. All pruning, repair, and replacement of trees and plants shall be performed by qualified nurserymen or arborists. Trees requiring trimming are as noted on the plans. This work shall not be paid for directly but shall be considered subsidiary to other bid items.

When the injury or removal of trees designated to be preserved cannot be avoided; each tree injured beyond repair or removed shall be replaced with a similar tree, or provide compensation to the City as determined by the Engineer.

S-70 TEMPORARY EROSION AND POLLUTION CONTROL

The Contractor shall utilize temporary erosion control methods on the project site to prevent mud/debris from entering the portions of the roadway open to traffic, to prevent mud/debris from entering the completed storm sewer system, and to prevent damage to yards of existing occupied residences. Temporary Erosion Control shall conform to Section 904 of the Standard Specifications and Special Provision 90M-151-R7. The forms of temporary erosion control to be used shall include but not be limited to construction of silt fence, ditch checks, sediment basins, slope drains, sediment barriers, slope protection, and temporary berms.

S-70.1 Measurement and Payment

This work shall be paid for at the contract unit price bid for items as shown on the plans or in the Special Provision.

S-71 SEDIMENT RETENTION WATTLE

Revision Date: 11/11/04

This work shall consist of installation of sediment retention wattles at locations shown on the plans or as directed by the Engineer.

S-71.1 Description

Wattles shall be a straw-filled tube of flexible netting material exhibiting the following properties. It shall be a machine-produced tube of compacted rice straw that is Certified Weed Free Forage, by a manufacturer whose principle business is wattle manufacturing. The netting shall consist of seamless, high-density polyethylene and ethyl vinyl acetate and contain ultra violet inhibitors.

Light weight rolled erosion control straw or wood fiber blankets rolled up to create a wattle type device shall not be allowed under this specification.

S-71.2 Material
Erosion Control and Sediment Retention Wattles shall be Earth Saver® - Manufactured by R.H.Dyck Inc. and/or Greenfix America LLC or approved equal.

R. H. Dyck, Inc.
Earth Saver® Erosion Control Products
P.O. Box 665
Winters, CA. 95694 USA
1-866-WATTLES
1-530-795-4751
1-530-795-3972, Fax
www.earth-savers.com

Greenfix America LLC.
Worldscape Improvement Products
P.O. Box 1620
Calipatria, CA. USA 92233
1-800-929-2184
1-760-348-7600
1-760-348-3097, Fax
www.greenfix.com

S-71.2.1 Performance Requirements
The Erosion Control and Sediment Retention Wattle shall meet the minimum performance requirements of Table 1. The product must be guaranteed to meet all numeric performance values in Table 1 under the specific conditions as stated.

Table 1 - Temporary Erosion Control and Sediment Retention Wattle

Property	Test Method	Units	Min. Value
Mass per Unit Weight	Field Measured	(lbs/ft)	1.6
Dimension	Field Measured	(Dia/Inches)	8.0 - 9.0
Net Strand Thickness	Field Measured	(Inches)	0.030
Net Knot Thickness	Field Measured	(Inches)	0.055
Netting Unit Weight	Certified	(Ounces/ft)	0.35
Sediment Retention Capacity	Rainfall Sim. [1]	(lbs/ft)	30
Installed Free-Board Ht.	Field Measured	(Height/Inches)	6.0 — 7.0
Straw Fiber	Field Measured	Avg. Length (in)	3.0
Soil Loss[1]	Rainfall Sim. [1]	% Effectiveness	58[2]
De-Stabilizing Moisture	Rainfall Sim. [1]	% Retained (Max.)	11
Fiber Content	Certified	% Rice Straw	100

[1] Minimum of three 10 year predicted storm events on 1V:3H slope with Clayey Sand type soil.
[2] Minimum sediment yield reduction value.

S-71.3 Submittals

The contractor shall provide to the Engineer a certificate stating the name of the manufacturer, product name, style number, chemical composition of the fiber, netting and all other pertinent information to fully describe the Wattle composition. The Certification shall meet the performance requirements of this specification.

S-71.4 Delivery, Storage, and Handling

Wattle labeling, shipment, and storage shall follow the manufactures written storage and handling procedures. Product labels shall clearly show the manufacturer or supplier name, wattle diameter and length.

During storage, Wattles shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, excess temperatures, and any other environmental conditions that may damage the physical property values of the rolls.

S-71.5 Site Preparation

Proper site preparation is essential to ensure complete contact of the Wattle with the soil. The slope should be prepared to receive the surface mulching/re-vegetation treatment prior to installation of the Erosion control and sediment Retention Wattles. Remove all rocks, clods, vegetation or other obstructions so that the installed Wattles will have direct contact with the soil.

S-71.6 Installation

1. A small trench 2 - 3 inches in depth should be excavated on the slope contour and perpendicular to water flow. Soil from the excavation should be placed down-slope next to the trench.
2. Install the Wattles in the trench, insuring that no gaps exist between the soil and the bottom of the Wattle. The ends of adjacent Wattles should be tightly abutted so that no opening exists for water or sediment to pass through. Alternately, Wattles may be lapped, 6" minimum to prevent sediment passing through the field joint.
3. Wooden stakes should be used to fasten the Wattles to the soil. When conditions warrant, a straight metal bar can be used to drive a "pilot hole- through the Wattle and into the soil.
4. Wooden stakes should be placed 6" from the Wattle end angled towards the adjacent Wattle and spaced at 4 foot centers leaving less than 1 - 2 inches of stake exposed above the Wattle. Alternately, stakes may be placed on each side of the Wattle tying across with a natural fiber twine or staking in a crossing manner ensuring direct soil contact at all times. (see staking details).
5. Terminal ends of wattles may be dog legged up slope to ensure containment and prevent channeling of sedimentation.
6. Backfill the upslope length of the Wattle with the excavated soil and compact.

7. Care shall be taken during installation so as to avoid damage occurring to the Wattle as a result of the installation process. Should the Wattle be damaged during installation, a wooden stake shall be placed either side of the damaged area terminating the log segment.
8. Field monitoring shall be performed to verify that the placement does not damage the Wattle.
9. Any Wattle damaged during placement shall be replaced as directed by the Engineer, at the contractor's expense.

S-71.6.1 Installation with Erosion Control Blankets

1. Trench and prepare slope per blanket manufacturer's recommendations.
2. Prepare wattle installation trench at intermediate slope location (see entrenchment detail).
3. Install blankets using manufacturer's recommended anchoring procedure.
4. Anchor blanket in prepared wattle anchor trench.
5. After blanket installation is complete, install Wattles as recommended above.

S-71.6.2 Installation In Conjunction With Hydroseeding

1. Install Wattles as recommended above.
2. Hydroseed per manufacturer's recommendations after Wattle installation is complete.

S-71.7 Inspection and Maintenance

1. The Wattles shall be inspected after installation to insure that they are trenched-in and that no gaps exist under the wattles or between adjacent ends of the wattles.
2. Wattles shall be inspected after significant rainfall events. Rills or gullies upslope of the wattle and any undercutting is to be repaired.
3. Sediment deposits that impair the filtration capability of the wattle shall be removed when the sediment reaches one-third of the wattles functional freeboard height. Removed sediment shall be deposit within the project in such a way that the sediment is not subject to erosion by wind or water, or as directed by the Engineer.
4. Installed Wattles shall be removed and/or replaced as required to adapt to changing conditions.

S-71.8 Wattles in a Temporary Erosion Control Application

When no longer required for the intended purpose, as determined by the Engineer, temporary wattles shall be removed from the site. As an option, the straw wattles may be slit down the length of the netting, and the straw may be used on slopes or other areas, as designated by the Engineer. The netting shall be gathered and disposed of.

Trenches, depressions or any other ground disturbances caused by the removal of the temporary straw wattles shall be backfilled and repaired with the excess sediment captured by the wattle, prior to spreading the straw or other final erosion control protection.

S-71.9 Wattles in a Permanent Erosion Control Application

As shown on the plans or as directed by the Engineer, wattles as installed shall be left in place to photodegrade or biodegrade over time.

S-71.10 Method of Measurement
"Sediment Retention Wattle" shall be measured by the ton of final weight of installed product.

S-71.11 Basis of Payment
Payment shall be made for Sediment Retention Wattles at the contract unit price bid per ton for "Sediment Retention Wattle".

S-72 ROCK SEDIMENT BARRIER

Small temporary stone dams or diversions constructed in drainage ditches and swales to settle solids and reduce velocities. Barriers may also be used to redirect water when earthen berms or other measures are not sufficient.

S-72.1 Materials:

S-72.1.1 Rock: Shall be a clean aggregate of a 3" or 6" nominal diameter, having the following gradation *(per KDOT 1116 Aggregate for Ditch Lining)*

	% Passing, by Weight	
Sieve Size	3"	6"
12"	--	100%
9"	--	60-80%
6"	100%	30-70%
5"	70-100%	--
4"	50-85%	15-35%
3"	30-70%	0-20%
2"	10-50%	0-10%
1"	0-5%	0%

Rock shall be free of deleterious substances, including earth, chert, cracks, seams, soapstone, shale or other easily disintegrated materials. Rock shall conform to the following quality requirements:

Parameter	Criteria	Test Method
Specific Gravity, sat & surf dry, min.	2.40	ASTM
Soundness, min.	0.85	ASTM
Wear, max.	45%	ASTM
Absorption, max	6.0%	ASTM

S-72.1.2 Geotextile: Shall meet the requirements of AASHTO M-288-00 except as modified herein.

S-72.2 Construction Requirements: Rock barriers shall be placed as shown on the plans or Standard Details. When shown, depressions shall be excavated on the upstream side of rock barriers to increase available storage volume and create a sediment trap.

S-72.3 Maintenance: Remove silt when it accumulates 1/2 the height of the barrier. Reshape or replace rock where settlements or isolated breaches occur.

S-72.4 Measurement and Payment: "Rock Sediment Barrier" will be measured per ton placed and paid for at the contract unit price. Excavation of depressions on the upstream side of rock barriers will be subsidiary to “Rock Sediment Barrier”.

S-73 SEEDING

Revision Date: 6/2/04

This work shall consist of the furnishing and planting of seed at those locations indicated on the plans or as designated by the Engineer.

All materials, bed preparation, and planting shall conform to the applicable requirements of Sections 903, 907, and 908 of the Standard Specifications. In general, all disturbed areas should have a minimum of 6" of select topsoil uniformly placed. All disturbed areas shall be seeded as soon as practicable after construction. All areas to be seeded shall be disked, harrowed, or hand raked to a minimum of 2" to 6" before application of seed. The final seedbed shall be well mixed with no large clumps of any kind and shall have no foreign material in it. The seedbed should be uniform and well packed. **Approval of the seed bed shall be obtained from the Engineer before seeding is started.** Seed shall be applied with an acceptable seed drill or other equipment approved by the Engineer at a depth of 1/2 inch in a uniform manner at the prescribed rate. Broadcasting and hand raking to a depth of 1/2 inch will only be used on areas where it is impossible to operate a seed drill. Unless a cultipacker type seeder is used, the seed shall be covered to a depth of 1/4 to 1/2 inch with a shallow-set spike tooth harrow or other approved methods. After covering, the areas shall be firmed by rolling.

S-73.1 Mulching

Mulch shall be spread uniformly in a continuous blanket at the rates indicated on the plans or specified by the Engineer. The mulch shall be anchored in the soil to a depth of two to three inches by a mulch puncher or straight serrated coulter disk mulch anchor machine designed to force the mulch into the soil surface. The machine shall be weighted and operated in such manner to secure the mulch firmly in the ground to form a soil-binding mulch and prevent loss or bunching by wind. The coulters shall be at least ten inches in diameter. Two or more passes may be required to anchor the mulch to the satisfaction of the Engineer. No mulch shall be placed unless it can be anchored on the same day.

S-73.2 Fescue Seeding

The seed mixture shall be a 100% turf type Tall Fescue. The mix shall be composed of an equal mix of a minimum of three approved species. The exact species to be used and rate of application shall be submitted for approval by the Engineer prior to seeding operations. In no case shall the rate of seeding be less than 8 lb. per 1000 square feet.

S-73.3 Fescue Fertilizer

Starter fertilizer for fescue seeding shall be an approved commercial brand composed of a "Slow Release Nitrogen" fertilizer in the 1-2-1 range, such as 13-25-12, and shall conform to the State Fertilizer Laws. It shall be uniform in composition, dry and free flowing, and shall be delivered to the site guaranteed analysis. Certification shall be submitted to the city on both fertilizer and

seeding. Any fertilizer which becomes caked or otherwise damaged, making it unsatisfactory for use, will not be accepted. Fertilizer shall be placed prior to seeding at not less than 1 1/2 lbs. actual nitrogen per 1000 sq. ft. of planting area.

S-73.4 Buffalograss Seeding
The seed mixture shall be as follows:

> Buffalograss seed: NaTurf Certified Cody, KN03 Applied.
> Available through Stock Seed Co., Murdock , NE 1-800-759-1520, or approved equal.

The rate of application shall be a minimum of 1 lb. of Pure Live Seed per 1000 Square Feet of planting area. Certification shall be submitted to the city on the seeding.

S-73.5 Buffalograss Fertilizer
Starter fertilizer for buffalograss seeding shall be an approved commercial brand composed of a mixture of soluble and insoluble Nitrogen, with an even composition, such as 12-12-12, and shall conform to the State Fertilizer Laws. It shall be uniform in composition, dry and free flowing, and shall be delivered to the site guaranteed analysis. Certification shall be submitted to the city on the fertilizer. Any fertilizer which becomes caked or otherwise damaged, making it unsatisfactory for use, will not be accepted. Fertilizer shall be placed prior to seeding at a rate of application of 1 lb. of actual nitrogen per 1000 square feet of planting area.

S-73.6 Buffalograss Seeding Season
Buffalograss shall be seeded and fertilized during the period from April 20 to June 1. If seeding is required at other times of the year, temporary seed shall be used, and the areas shall be fertilized and reseeded with buffalograss during the above time period.

S-73.7 Temporary Seeding
The seed mixture shall be a 100% Annual Rye grass. The rate of application shall be a minimum of 5 lb. of Pure Live Seed per 1000 Square Feet of planting area. Certification shall be submitted to the city on the seeding.

S-73.8 Temporary Seeding Fertilizer
Starter fertilizer for temporary seeding shall be an approved commercial brand composed of a "Slow Release Nitrogen" fertilizer in the 1-2-1 range, such as 13-25-12, and shall conform to the State Fertilizer Laws. It shall be uniform in composition, dry and free flowing, and shall be delivered to the site guaranteed analysis. Certification shall be submitted to the city on both fertilizer and seeding. Any fertilizer which becomes caked or otherwise damaged, making it unsatisfactory for use, will not be accepted. Fertilizer shall be placed prior to seeding at not less than 1 1/2 lbs. actual nitrogen per 1000 sq. ft. of planting area.

S-73.9 Erosion Control Fabric
The Contractor shall place erosion control fabric at locations indicated on the plans. The type of fabric to be used shall be North American Green DS-150. The fabric shall be installed in accordance with the manufacturers instructions with a minimum of 1.5 staples per square yard. Staples shall be purchased from the manufacturer and shall be expressly designed for this purpose.

Any seeding done outside of the seeding season as specified in the Standard Specifications will be maintained by the Contractor until satisfactory growth is established or reseeding shall be done at the Contractor's expense if the growth is unsatisfactory.

S-73.10 Measurement and Payment
All seeding and fertilizer use shall be paid for at the contract unit price bid per acre for "Seed" of the specified type. No separate payment will be made for fertilizer, mulching or, if specified, erosion control fabric.

S-74 SODDING
This work shall consist of furnishing and placing sod at those locations indicated on the plans or as designated by the Engineer in accordance with Section 905 of the Standard Specifications except as modified herein. All equipment used in sodding shall be in accordance with Section 901 of the Standard Specifications except as modified herein.

S-74.1 Sod Types
The type of sod to be used will be Kentucky Bluegrass sod, except where Zoysia sod or Turf Type Fescue sod is identified under the property owners name and address on the plans, or designated by the Engineer. In the case of mixtures of Bluegrass and Zoysia sod, Zoysia shall be used unless otherwise directed by the Engineer.

S-74.2 Sod Material
All materials shall conform to the requirements of these Specifications and to Section 2107 of the Standard Specifications. The Contractor shall retain a person knowledgeable of the different types of sod to ascertain prior to bidding, the location and types of existing sods. Sod shall be of best quality Bluegrass, Zoysia, or Turf Type Fescue, not more than two years old, shall conform to the quality standards of Nursery Grown Sod as defined by the American Sod Producers Association, and shall meet the following standards:

a. Thickness of Cut: Sod shall be machine cut at a uniform soil thickness of 5/8 inch, plus or minus 1/4 inch, at the time of cutting. Measurement for thickness shall exclude top growth and thatch.

b. Pad Size: Individual pieces of sod shall be cut to the suppliers's standard width and length as approved by the Engineer. Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2 inch on width and plus or minus 5 percent on length. Broken pads and torn or uneven ends will not be acceptable.

c. Strength of Sod Sections: Standard size sections of sod shall be strong enough to support their own weight and should retain their size and shape when suspended vertically from a firm grasp on the upper 10 percent of the section.

d. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) will adversely affect its survival.

e. Mowing Height: Before stripping, sod shall be mowed uniformly at a height of 2 to 3 inches.

f. Thatch: Sod shall be relatively free of thatch, up to 1/2 inch allowable (uncompressed).

g. Diseases, Nematodes, and Insects: Sod shall be reasonably free of diseases, nematodes, and soil-borne insects. State nursery and/or plant materials' laws require that all sod entering inter-state commerce be inspected and approved for sale. The same applies to sod being shipped intra-state. The inspections and approval must be made by the state agricultural department, office of the state entomologist.

h. Weeds: Sod shall be free of objectionable grassy and broad leaf weeds. Sod shall be considered free of such weeds if less than 5 such plants are found per 200 square feet of area. Sod will not be acceptable if it contains any of the following weeds: quackgrass, Johnson grass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, wild garlic, ground ivy, perennial sorrel, bromegrass, bentgrass, and Bermuda grass.

S-74.3 Fertilizer

Fertilizer shall be of an approved commercial brand composed of "slow release nitrogen", 4-1-2 formula or similar, such as 18-5-9, for Kentucky Bluegrass and Fescue, 25-5-10 for Zoysia, shall conform to the State fertilizer laws, and shall conform to Section 2106 of the Standard Specifications.

Furnishing and placing fertilizer shall be in accordance with Section 907 of the Standard Specifications. Fertilizer shall be uniform in composition, dry and free flowing, and shall be delivered to the site in the original unopened containers, each bearing the manufacturer's guaranteed analysis. Any fertilizer which becomes caked or otherwise damaged, making it

unsuitable for use, will not be accepted. Fertilizer shall be placed prior to sodding at not less than 1 Lb. of pure nitrogen per 1000 square feet of sodding area. Fertilizer shall be subsidiary to sodding bid items.

S-74.4 Sod Season

Bluegrass and Fescue sod may be planted during the periods of March 1 to May 15 and September 1 to November 15. Bluegrass and Fescue sod may be planted during the period, November 15 to March 1, when the soil and sod is workable and with the approval of the Engineer. If sod is planted between November 15 and March 1, the Contractor will maintain the sod until 20 days after the beginning of the spring sodding season. The Engineer reserves the right to delay the sodding of all types of sod or to vary the permissible sodding seasons, due to weather, soil conditions, or for other causes.

Zoysia sod may be planted during the period April 1 to October 15.

S-74.5 Bed Preparation and Moisture Requirements

Where the width of the disturbed area to be sodded exceeds 18", the area shall be widened to a uniform size by removing enough existing turf from behind the disturbed area, creating an area whose width is a multiple of 18" (width of sod roll). A clean edge should be established at the outer limits of the area to be sodded, so that good contact can be made between the new sod and the established turf.

Where the width of the disturbed area is less than 18", enough existing turf shall be removed to create an area of uniform width, no less than six (6") inches.

All backfill shall consist of soil suitable for vegetation. The area shall be prepared such that sodding can be placed on bare soil. This will consist of cultivating, smoothing, removing of clods, surface stones 1" in diameter or larger, and weeds. All backfilling shall be subsidiary to other bid items.

Area to be sodded shall consist a minimum of 6"-8" of top soil, free from clods, rocks, trash, and other debris. If the area has been severely compacted by heavy trucks or other equipment, it shall be cultivated to a depth of 6"-8" by tilling or disking. Backfill areas shall be compacted to a sufficient density to prevent excessive settling after placement of sod. If footprints left by an adult walking across the area are more than 1/2" deep, the compaction is not sufficient.

Grade of the area shall be approximately 1" below desired final grade, to allow for the thickness of the sod.

S-74.6 Water

Water used in this work shall be furnished by the Contractor and will be suitable for irrigation and free from ingredients harmful to plant life. All watering equipment required for the work shall be furnished by the Contractor. Under no circumstances shall the Contractor use water except that metered from adjacent fire hydrants or public water lines.

S-74.7 Placing Sod

Sod strips shall be laid parallel with the ends staggered in a running bond pattern. Each successively laid strip shall be pressed firmly up against the one next to it or up against the edge of the existing turf, to ensure good contact with no overlapping. Sod shall be staked in places where the slope exceeds 3:1. Sod shall be staked with a minimum of two to four stakes per square yard or roll, as determined by the Engineer. Stakes shall be of lath or similar materials and shall be driven six inches into the ground, leaving approximately 1/2 inch of the top above the sod line.

After placing sod, the area shall be tamped with a hand tamp or rolled with a lawn roller half filled with water. Rolling shall be done in a direction perpendicular to the direction in which the sod lengths were laid.

S-74.8 Sod Watering and Maintenance

After each days sod is placed, it shall be watered sufficiently to wet the sod pads and at least 2 inches of the sod bed. Thereafter in the absence of adequate rainfall, watering shall be performed daily and as often as necessary to keep the sod pads moist at all times. Watering by the Contractor shall continue until the roots of the sod are anchored in placed, and the sod is growing and accepted.

All sodded areas shall be mowed immediately prior to the Engineer's inspection for acceptance. Mowing is required to facilitate visual assessment and acceptability of the work. Mowing shall not be attempted until the sod is firmly rooted and secure in place. Not more than 1/3 of the grass leaf shall be removed. Any debris that would interfere with mowing shall be collected and removed.

S-74.9 Sod Acceptance

All sodded areas shall be kept thoroughly watered by the Contractor for a period of 20 days after laying and as often as required thereafter, until completion of other items of work in the contract. If sodding is the last item of work to be performed, the Contractor shall continue watering until all sod is growing and accepted.

The Contractor shall be fully responsible for the condition of the sod work until written notification that his obligation to maintain the sod is terminated, and the sod has been accepted. At that time the property owners shall be notified by the Engineer that further maintenance of the sod is their responsibility.

S-74.10 Measurement and Payment

All sodding shall be paid for at the contract unit price bid per square yard for "Sod” of the specified type, which shall include full compensation for bed preparation, transporting, placing, firming, watering, cultivating, and maintaining the sod.

S-75 HYDRAULIC MULCHING

S-75.1 Description
Work included in this section consists of the hydraulic broadcast of tackified wood fiber matrix slurry.

S-75.2 Quality Assurance
Work shall be done according to the latest revisions of the State of Kansas Department of Agriculture Specification Reference # KSA 2-1415.

S-75.3 Job Conditions

S-75.3.1 Hydraulic Mulch Storage
Pallets shall be covered by the Contractor as suitable to protect the material from weather damage. Unused materials will be returned to the storage area at the end of the day.

S-75.3.2 Protection
The Contractor shall use all means necessary to protect all materials of this section before during and immediately after installation and to protect all materials designated to remain. In the event of damage the Contactor shall immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the City.

The Contractor shall be responsible for ensuring that the hydraulic mulch slurry has dried a minimum of 24 hours or as required by the Engineer. The Contractor shall schedule the application of the hydraulic mulch slurry in conjunction with suitable weather or as directed by the Engineer in order to ensure the adequacy of the cure.

S-75.3.3 Procurement of Water
The Contractor shall have the responsibility of procuring water from a source and shall adhere to all applicable local rules and regulations in the metering process. No direct payment will be made for procurement of water.

S-75.3.4 Equipment Condition/Project Inspector Access
The Contractor shall perform all hydraulic mulching with an asset designed to accommodate hydraulic mulch products. The mixing tank shall be clean of all previously used hydraulic materials, and the pump and piping shall be disassembled for inspection and consideration of approval as requested by the Engineer. The Engineer shall reserve the right to disallow the use of any particular hydraulic asset without additional cost to the City.

The Contractor shall submit the hydraulic tips for inspection by the Engineer. The selection of tips shall be directed by the Engineer throughout the hydraulic mulching processes.

The Engineer shall reserve the right to accompany the Contractor during all aspects of mixing, application, and cleanout. The Engineer shall reserve the right to direct a disassembly of the pump and piping at any time throughout the performance of the project. The Contractor at no additional expense to the City shall perform such inspections.

S-75.4 Submittals

S-75.4.1 Material Conformance
The Contractor must provide the City documentation from the manufacturer that each lot of tackified wood fiber mulch meets or exceeds the required specifications. The equivalence of the material shall be determined by the Engineer and will require approval prior to application.

S-75.5 Tackified Wood Fiber Mulch
The Contractor shall provide tackified wood fiber mulch per the following requirements;

Material	**Component**	**Requirement**
Tackified Wood Fiber	Type of Fiber	100% Virgin wood
	Type of Tackifier	Guar
	Fiber Length	25% averaging 0.4 inches
		50% or more retained on a Clark Classifier 24-mesh screen.
	Moisture Content (total weight basis)	12% +-3
	Organic Matter (oven dried basis, minimum)	99%
	Ash Content (oven dried basis, maximum)	1%
	pH (average at 3% aqueous consistency)	4.0 – 6.0
	Water Holding Capacity (oven dried weight basis)	108-112%
	Tackifier Content (w/w)	3% minimum
	Manufacturer	Mat Fiber Plus Conwed 2000 Or approved equal

S-75.5.1 Equipment Conformance
The Contractor shall field demonstrate to the Engineer the capability of the hydraulic broadcast implement to uniformly blend and apply the hydraulic mulch slurry over the specified area. The Engineer shall reserve the right to inspect the hydraulic asset prior to the start of construction and approve/reject the asset for use. The hydraulic asset shall be provided with suitable spray tips to ensure the even distribution of the hydraulic mulch slurry.

S-75.6 Hydraulic Broadcast
The Contractor shall hydraulically apply the slurry to the areas specified on the plans or as directed by the Engineer in a manner to ensure even coverage. Installation shall be by hose or as approved by the Engineer. Rate of application shall be no less than 2200 dry pounds of tackified wood fiber mulch per acre.

The performance of hydraulic mulching must proceed unabated until the designated area is completed. Any erosion of the area prior to drying shall be repaired by the Contractor at no additional cost to the City. Severe damage to any area caused by the Contractor's

activities shall be repaired by the Contractor at no additional cost to the City. The method of repair shall be directed by the Engineer.

S-75.7 Field Quality Control
The Contractor shall notify the Engineer prior to commencing mulching operations. If stages of construction have been established by the Engineer, the Contractor shall notify the Engineer upon completing a stage of construction and obtain approval prior to commencing with subsequent stages of construction.

S-75.8 Cleaning Up
Upon completion of the work of this section, the Contractor shall immediately remove all debris and excess materials from the site.

S-75.9 Measurement and Payment
All hydraulic mulching material and application shall be paid for at the Contract unit price bid per acre for “Hydraulic Mulching”.

S-76 TOPSOIL
Topsoil shall be furnished and placed at the locations shown on the plans, or as directed by the Engineer. Topsoil shall consist of suitable surface soil as stipulated in Section 2109 of the Standard Specifications and as approved by the Engineer. Furnishing topsoil shall be in accordance with Section 906 of the Standard Specifications.

The Contractor shall make every reasonable effort to stockpile existing top soil prior to deep excavations and reuse it in the same general locations. No payment will be made for topsoil furnishing and placement necessary due to excessive hauling off of existing top soil on the project site.

S-76.1 Measurement and Payment
This work shall be paid for at the contract unit price bid per cubic yard for "Topsoil", which shall be full compensation for furnishing, hauling, stockpiling if required, removing unsuitable soils, scarifying if required, and placement. No payment will be made for offsite topsoil acquisition and placement that was not specifically authorized and directed by the Engineer. This item does not include any topsoil that is obtained at the project site and reused, pertaining only to any additional soil furnished by the Contractor at the specific request of the Project Engineer.

S-77 PRUNING
Trees and shrubs within or overhanging into the easements that will be damaged during the construction operations shall be pruned in accordance with the requirements of Section 909 of the Standard Specifications. Pruning should be done only where absolutely necessary and no trees shall be pruned without prior approval of the Engineer. Where shown on the plans, trees requiring root removal of one third or more of the circumference of the root system, shall be pruned an equal amount. This pruning shall consist of removing limbs on the opposite side of the root removal or thinning the entire tree equally as directed by the Engineer. All pruning, repair, and replacement of trees and plants shall be performed by qualified nurserymen or arborists.

S-77.1 Payment
Pruning shall not be paid for directly but shall be considered subsidiary to other bid items.

S-78 LAND CORNER MONUMENT BOX

Revision Date: 10/29/04

This work shall be performed in accordance with Section 819 of the Specifications latest revision, as amended herein.

At locations shown on the plans, the Contractor shall reestablish and reset the land corner monument that is disturbed by construction operations under this contract. All land surveying shall be performed by land surveyors registered by the State of Kansas. The new reset monument shall be protected by an adjustable cast iron box similar and equal to Neenah Catalog No. R-1968 Type 36-B. Installation of the monument box shall be as shown on the plans.

S-78.1 Horizontal Control
Prior to construction Section Corner and quarter section corners shall be referenced to points outside construction and a Land Corner Endangerment Report submitted to the Kansas State Historical Society and the County Engineer within 30 days of the survey as required by state law. During construction the surveyor will coordinate with contractor on the placement of the monument box. After construction the surveyor shall use his previous reference ties and preliminarily mark the aluminum cap. This location shall be checked with coordinates from the design survey to insure that the ties match the previous coordinates. If within tolerance the aluminum cap shall be punched at the proper location. New Land Corner Reference Reports with updated references shall be submitted to the Kansas State Historical Society and the County Engineer within 30 days of the survey as required by state law.

S-78.2 Measurement and Payment
Payment for resetting monument including furnishing and placing cast iron box in place and accepted shall be made at the contract unit price per each for "Land Corner Monument Box".

S-79 WEATHER STATION RELOCATION

This item shall include the relocation of a weather station and appurtenances as indicated on the plans.

A metered 100 amp electrical service shall be provided at the weather station standpipe. All electrical wiring and installation shall be in full conformance with applicable building codes, and the Contractor shall be responsible for obtaining permits from and scheduling inspections by the City of Overland Park Codes Administration Division.

S-79.1 Measurement and Payment
Payment for the weather station relocation shall be made at the contract lump sum price bid for "Weather Station Relocation".

S-80 CONTRACTOR CONSTRUCTION STAKING

Revision Date: 10/29/04

This work shall be performed in accordance with Section 819 of the Specifications latest revision, as amended herein. The Contractor shall set construction stakes establishing all lines, slopes, continuous profile-grades, centerlines, and benchmarks necessary to control and perform the work.

S-80.1 Vertical Control

Prior to construction Johnson County Bench Marks that will be damaged or removed by construction shall be replaced by a benchmark outside of construction area. New benchmarks shall be an aluminum cap (caps will be furnished by the County) set in a rigid concrete structure. A hole shall be drilled into concrete and the cap grouted into place. The preferred locations are traffic signal bases, culvert headwalls and bridge handrails. A standard monument record sheet shall be completed for each permanent benchmark. Elevations shall be determined with a double rod level run using digital level and bar code rods and shall tie into Johnson County vertical control network at each end of the level run. Level runs shall close within 0.1 ft. per 4 miles. Level run data shall be furnished in digital and paper format. Mapping grade state plane coordinates shall also be provided. This effort shall be coordinated with the Johnson County Public Works Department County Surveyor.

S-80.2 Horizontal Control

Prior to construction Section Corner and quarter section corners shall be referenced to points outside construction and a Land Corner Endangerment Report submitted to the Kansas State Historical Society and the County Engineer within 30 days of the survey as required by state law. During construction the surveyor will coordinate with contractor on the placement of the monument box. After construction the surveyor shall use his previous reference ties and preliminarily mark the aluminum cap. This location shall be checked with coordinates from the design survey to insure that the ties match the previous coordinates. If within tolerance the aluminum cap shall be punched at the proper location. New Land Corner Reference Reports with updated references shall be submitted to the Kansas State Historical Society and the County Engineer within 30 days of the survey as required by state law.

S-80.3 Property Corners

The Contractor shall locate all existing property corners within the project limits prior to commencing construction. All property corners that can be saved shall be marked and protected. Property corners anticipated to be disturbed during construction shall be located by ties and shall be reset by the Contractor at the termination of construction activities. All property surveying shall be performed by a qualified land surveyor registered in the State of Kansas.

S-80.4 Swale Staking

The Contractor shall set cut stakes for all rough swale grading and shall maintain or reset such stakes for checking of the grade as required by the Engineer. Final grade for the swales and berms shall be established by "blue top" surveying or other approved method, and grade devices shall be maintained for inspection by the Engineer prior to sodding.

S-80.5 Basis of Payment

Payment for this work shall be made at the contract lump sum price bid for "Contractor Construction Staking", which shall include all staking, establishing vertical and horizontal control points and property corner resetting.

S-81 CONSTRUCTION AUDIO AND VIDEO RECORDING

S-81.1 General

S-81.1.1 Scope of Work

A. Furnish all labor, materials and equipment and furnish high quality color audio/video tape recording of the Project site surface conditions as specified herein.

S-81.1.1.1

B. Furnish to the Owner an original and one copy of a continuous high quality color audio/video DVD recording of surface conditions along the entire route of the proposed Work. The recording(s) shall be taken:
    1. Prior to any construction activity.
    2. After completion of all construction activities.

C. The Owner reserves the right to reject the audio/video DVD recording because of poor quality, unintelligible audio, or uncontrolled pan or zoom. Any DVD recording rejected by the Owner shall be re-recorded at no cost to the Owner. Under no circumstances shall construction begin until the Owner has received and accepted the audio/video DVD(s).

S-81.1.1.2

D. A qualified, established audio/video recording firm knowledgeable in construction practices and experienced in audio/video recording of construction projects shall perform the video. If requested, the electrographer shall provide examples of prior work and/or references.

S-81.2 Payment

S-81.2.1.1 Compensation for the audio/video recordings shall be subsidiary to the other contract items.

S-81.3 Products (Not Used)

S-81.4 Execution

S-81.4.1 Color Audio/Video Survey

A. Coverage shall include, but not be limited to, all existing roadways, sidewalks, fences, curbings, driveways, buildings and structures, ditches, above ground utilities, traffic signal and street light cabinets, landscaping, trees, culverts, headwalls, retaining walls, signage and other physical features located within the zone of influence of the construction. Particular and detailed attention shall be given to any defects noted, such as cracks, disturbed areas, damaged items, or as Owner may direct. The coverage may be expanded if Owner so directs.
B. All filming will be done during daylight hours. No filming shall be performed if weather is not acceptable, such as rain, fog, snow, etc.
C. It is the intent of this coverage to accurately and clearly document and define pre-existing, post-construction and/or construction conditions to minimize potential construction claims. Physically mark the excavation areas with highly visible fluorescent paint prior to audio/video recording. The markings shall include stationing information.

S-81.4.2 Audio and Video

A. Audio/video DVDs shall be commercial grade in a standard format. Properly identify all DVDs by disk number, location, project name, Owner name, and other information that Owner deems appropriate.
B. A record of the contents of each disk shall be supplied by a run sheet identifying each segment in the DVD, including the track number, street or road viewed, filming start- and stop-times, side (of street) being viewed, point starting from, travelling direction and ending destination point.
C. Each film shall begin with a verbal description of the current date, the Owner's name, Project or Contract name and number, Contractor's name, and location information such as street name, direction of travel, viewing side, etc. Translucent information must appear on the video recording's viewing screen. This information will consist of the date and time of the recording. The date information must contain the month, day, and year of the recording.
D. The zone of influence shall be defined as an area within the temporary construction easement or public right-of-way as Drawings indicate, or within 35 feet of the proposed Work. The Contractor shall obtain permission from the owners of private property prior to entering private property for the purpose of filming.
E. Identify houses and buildings visually by house number, when visible, in such a manner that structures of the proposed construction, (i.e. manholes, etc.) can be located by reference.

F. Adequate lighting, to produce the proper detail and perspective, will be required to fill in the shadow area caused by trees, structures, utility poles, road signs, and other such objects in residential areas, or as directed by the Owner's Representative.
G. Information appearing on the DVD must be continuous and run simultaneously by computer generated translucent digital information. No editing or overlaying of information at a later date will be acceptable.
H. Digital information will be as follows:
    1. Time
    2. Date, showing month, day and year
I. The rate of speed in the general direction of travel during the recording shall not exceed 100 feet per minute. Panning rates and zoom-in and zoom-out rates shall be controlled sufficiently such that during playback, the picture shall be in focus and maintain clarity at all times.
J. Engineering station numbers recorded, if applicable, must be continuous, be accurate and correspond to Project stationing. The symbols should be the standard engineering symbols (i.e. 16+64).
K. Written documentation must coincide with the information on the disk so as to make easy retrieval of locations sought for at a later date.
L. Video system shall have capability of producing hard copy prints of selected individual still frames.
M. Audio shall be recorded at the same time as the video recording and provide the same information as on the video log sheet. Special commentary will be given for unusual conditions of buildings, sidewalks and curbing, foundations, trees and shrubbery, etc.
N. All DVDs and cases shall bear labels with the following information:
    1. Disk Number
    2. Owner's Name
    3. Date of Recording
    4. Project Name and Number
    5. Location of Recording
O. The Owner will have the opportunity to accompany the videographer.
P. Sufficient time will be allowed for the Owner to review the DVD prior to construction.
Q. All original DVDs plus one (1) duplicate of each shall be provided to the Owner. The Contractor may keep a copy for his/her own records.

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