

SECTION 3000 –TRAFFIC CONTROL

**CITY OF LEES SUMMIT, MISSOURI
STANDARD SPECIFICATIONS**

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3011 SIGNING GENERAL

3011.1 Scope

This work shall consist of furnishing of all material, equipment, and labor for the complete installation of permanent signs. Temporary signing shall conform to the temporary traffic control requirements in Section 3031.

3011.2 Codes and Standards

All work and material shall be in accordance with the latest requirements of the Manual on Uniform Traffic Control Devices (MUTCD), Standard Highway Signs (SHS), and all applicable local ordinances.

3011.3 Modification of Specifications

These Specifications may be modified or deleted by appropriate items in the Project Special Provisions or by written authorization by the City Engineer.

3011.4 Incidental Work and Parts

Work incidental to permanent signage that is not covered in these Specifications shall be performed in accordance with the City of Lee's Summit specifications and standards. All incidental parts, which are not shown on the Plans or specified in the Specifications and which are necessary to complete the installation of signage, shall be supplied and installed by the Contractor to the satisfaction of the City Engineer. No additional payments will be made for incidental work or parts.

3011.5 Existing Signing

The Contractor shall maintain all existing signs not shown on the Plans as to be removed. At the onset of the project, the Contractor should verify and document the condition of each sign that is to be re-used. The Contractor shall be responsible for the appropriate care of all existing signs that are to be re-used. Any signs that are damaged, lost or stolen shall be replaced by the Contractor at the Contractor's expense.

All Stop, Yield, or street name signs shall be maintained in a conspicuous location for the driving public. All Stop and Yield signs removed for construction purposes can be temporarily erected in reflectorized drums (no less than 7 feet above the pavement surface) until they can be reinstalled. Any temporary Stop or Yield sign installation to be left in place overnight will require prior approval from the City Inspector.

3011.6 Permits and Inspections

The Contractor shall contact the Public Works Department before any project work begins to notify the City Engineer of the construction schedule and to request project inspections. The Contractor is responsible for obtaining all necessary permits from the City, and is responsible for all associated costs, before any work can begin.

3011.7 Maintenance Work

The Contractor is responsible for making all repairs and replacements, including downed or damaged signs, regardless of the cause or responsible party, until the work is completed, inspected, and accepted by the City.

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3012 SIGNING MATERIALS AND EQUIPMENT

3012.1 Scope

This section governs the furnishing of all signs, posts, and other material and equipment supplied by the Contractor, as required to complete the installation of permanent signs as shown on the Plans, the Standard Drawings, and as specified in the Project Special Provisions. All signing material and equipment shall be of new stock unless the contract provides for relocation of existing units or use of units furnished by others. New material and equipment shall be of the best grade, and shall meet the approval of the City Traffic Engineer.

3012.2 Sign Blanks

Sign blanks shall be of aluminum, 6061-T6 alloy. Sign blanks shall be degreased and coated with an alodized finish to ensure that sign sheeting adheres to the surface. Sign blank thickness shall be 0.125 inches for signs with an area greater than nine square feet (9 sq. ft.). Sign blanks for overhead street name signs shall also have a thickness of 0.125 inches. Sign blanks for signs with an area less than or equal to 9 sq. ft. shall be 0.080 inches thick. Sign blanks shall have corner radii and holes punched according to the Federal Highway Administration's Standard Highway Signs, or as specified in the Plans.

3012.3 Sign Sheeting

Sign blanks shall be covered with retroreflective, high intensity prismatic sign sheeting, meeting the requirements of ASTM D4956-04 Spec. Type III. Screen-printed signs are no longer acceptable and shall not be used. Signs containing blue, red or green lettering and/or symbols shall be made with acrylic overlay film manufactured by 3M, or approved equal. Signs containing black lettering and/or symbols shall be made of black vinyl. All sign sheeting shall be applied without splices, and shall be free from air bubbles, wrinkles or other blemishes.

3012.4 Sign Posts

The type of sign post shall be supplied as shown on the Plans, Standard Drawings, or as specified in the Project Special Provisions.

3012.4.1 Square Steel Posts

All square steel sign posts shall be 2" x 2", 14 gauge galvanized steel, square tubular posts, with 3/8-inch (3/8") diameter holes at one inch (1") spacing on all sides. Square steel posts shall be galvanized according to ASTM A653. All square steel posts shall be furnished with a 12 gauge, two-piece break-away anchor as shown on the Standard Drawings. All components of the break-away anchor shall be galvanized.

3012.4.2 Decorative Posts

The City Traffic Engineer may authorize the use of decorative sign posts. Decorative sign post shall be 2" x 2", 14 gauge galvanized steel, square tubular posts, with 3/8-inch (3/8") diameter perforated holes at one inch (1") spacing on all sides. The holes on the post shall NOT be punched through. The posts shall be galvanized per AASHTO M-120 specifications. The post should also have a conversion coating, a clear organic polymer topcoat, and be powder coated black. All decorative post shall have a break-away anchor, as specified for square steel posts.

3012.4.3 U-Steel Posts

All U-Steel sign posts shall be steel, U-shaped channel, weighing three pounds per linear foot (3 lb/ft). The posts shall have 3/8-inch (3/8") diameter holes at one inch (1") spacing along the center of the

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channel. U-steel posts shall be hot dip galvanized per ASTM A123. U-Steel posts shall have an anchor as shown in the Standard Drawings.

3012.5 Sign Mounting Hardware

All sign mounting hardware shall be stainless steel, with the exception of a 5/16 inch flat plastic washer to be installed against the sign face, as shown on the Standard Drawings. All strap type sign supports, including brackets and seals shall be 3/4" wide Type 201 stainless steel, 0.030" thick.

3013 SIGNING CONSTRUCTION REQUIREMENTS

3013.1 Scope

This section governs the installation of permanent signs as shown on the Plans, the Standard Drawings, and as specified in the Project Special Provisions.

3013.2 Sign Post Installation

The Contractor shall stake the location for all proposed sign posts. The City Inspector shall inspect the staking before installation begins. Minor relocations to avoid conflicts may be allowed by the City Traffic Engineer.

Sign posts shall be located so that the nearest edge of the sign is not less than two feet (2') laterally from the back of the curb line, or six feet (6') laterally from the edge of pavement on a non-curbed facility. Street name signs shall be located so that the nearest edge of the sign is not less than one foot (1') laterally from the back of the curb line, or six feet (6') from the edge of pavement on a non-curbed facility. The minimum height to the bottom edge of the sign shall be as shown in the Standard Drawings.

The Contractor shall be responsible for determining post lengths to ensure that all signs mounted on a post have the required clearance as shown on the Standard Drawings. Field cutting of posts will be permitted, however torch-cutting steel posts is prohibited.

Sign posts shall be plumbed vertical. The cross-sectional dimensions of the posts and/or the coating shall not be damaged during installation. Any post bent or otherwise damaged to the extent that the post is considered unfit for use shall be removed and replaced with an acceptable post at the Contractor's expense.

3013.3 Storage of Signs

Signs delivered for use on a project or existing signs to be reinstalled shall be stored in a manner meeting the approval of the City Traffic Engineer. Any sign damaged, discolored or defaced during transportation, storage, or installation may be rejected.

3013.4 Sign Installation

Signs shall be mounted directly to the sign post with 5/16" bolt, nut and appropriate washers per the Standard Drawings. A flat plastic washer shall be installed between the sign face and stainless steel mounting hardware.

Signs on traffic signal posts or street light poles shall be mounted with strap or clamp type sign supports, or brackets as shown on the Plans or as approved by the City Traffic Engineer. The requirements for signs mounted on mast arms are described in Section 2900 of the City of Lee's Summit Design and Construction Manual.

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3013.5 Removal and Reinstallation of Existing Signs

Removal, transportation, storage, and reinstallation of existing signs should be as indicated in the Plans, Specifications, or Project Special Provisions. The Contractor is responsible for repair or replacement of any existing signs damaged during the removal and reinstallation operations at the Contractor's expense.

All sign blanks and sign posts that are removed and are not to be reinstalled on the project shall be delivered to the City's Public Works Maintenance Facility, 1971 SE Hamblen Road. The Contractor is responsible for disposal of any items that are damaged or any items not to be salvaged.

New bolts, nuts, washers, and other required appurtenances shall be provided by the Contractor in order to reinstall existing signs. Such items shall be considered subsidiary to sign reinstallation.

3013.6 Final Clean Up

Before final acceptance, the Contractor shall restore to a condition equal to or better than that existing prior to construction all property, both public and private, within, adjacent to and beyond the limits of construction that have been disturbed or damaged while executing the work. This includes, but not limited to, existing curb and gutter, sidewalk, pavement, drainage structures, irrigation systems, street lighting and traffic signal equipment. All unpaved areas damaged during construction shall be restored to the original condition. Unless otherwise directed, grassy areas which were originally sodded shall be re-sodded. Restoration work shall be at the Contractor's expense. All restoration work shall be acceptable to the City Inspector.

3014 SIGNING MEASUREMENT AND PAYMENT

See Division I – General Requirements for CIP, Section 01120.

3021 PAVEMENT MARKING GENERAL

3021.1 Scope

This work shall consist of furnishing of all material, equipment, and labor for the complete installation of permanent pavement markings. Temporary pavement markings shall conform to the temporary traffic control requirements in Section 3031.

3021.2 Codes and Standards

All work and material shall be in accordance with the latest requirements of the Manual on Uniform Traffic Control Devices (MUTCD) and all applicable local ordinances.

3021.3 Modification of Specifications

These Specifications may be modified or deleted by appropriate items in the Project Special Provisions or by written authorization by the City Engineer.

3021.4 Incidental Work and Parts

Work incidental to pavement markings that is not covered in these Specifications shall be performed in accordance with the City of Lee's Summit specifications and standards. All incidental parts, which are not shown on the Plans or specified in the Specifications and which are necessary to complete the installation of pavement marking, shall be supplied and installed by the Contractor to the satisfaction of the City Engineer. No additional payments will be made for incidental work or parts.

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3021.5 Integrity of Design and Installation Standards

The Contractor shall make no design modification, material substitution, or revision of any kind without prior approval of the City Traffic Engineer. Materials or installation procedures deemed unsatisfactory by the City Traffic Engineer, with regard to retroreflectivity, bead distribution, paint thickness, overspray, accuracy, line width, consistency, tracking, or failure to comply with approved specifications shall not be used for pavement marking.

3021.6 Permits and Inspections

The Contractor shall contact the Public Works Department before any project work begins to notify the City Engineer of the construction schedule and to request project inspections. The Contractor is responsible for obtaining all necessary permits from the City, and is responsible for all associated costs, before any work can begin.

3021.7 Warranty

The Contractor shall warranty both the labor and the pavement marking materials used for a minimum period of one year from the date of application; the warranty period and time referenced deficiency measures noted below shall be extended for the duration of applicable project bonds. The Contractor shall submit a written warranty on company letterhead, which at a minimum shall require the Contractor to replace any line or symbol with any of the following deficiencies:

- More than 10% of a 1,000 foot length of a longitudinal line is damaged within one year of the date of application,
- More than 10% of an individual symbol is damaged within one year of the date of application, or
- A line or symbol has retroreflectivity values less than 150 millicandelas/sq m/lux for white and 100 millicandelas/sq m/lux for yellow within one year of the date of application.

3021.8 Property Damage

The Contractor shall be responsible for work-related accidents and damages to public or private property caused by pavement marking installation. All property damage shall be reported to the City Engineer. Claims of damage to private property made directly to the City will be forwarded to the Contractor for resolution. Repair of damage to private property shall be completed prior to City acceptance of completed work. An amount equal to the claim for damage sustained to public or private property may be withheld from payment to Contractor until the City Engineer determines that the claim has been satisfactorily resolved.

3022 PAVEMENT MARKING MATERIALS AND EQUIPMENT

3022.1 Scope

This section governs the furnishing of all material and equipment supplied by the Contractor, as required to complete the installation of pavement markings as shown on the Plans, the Standard Drawings, and as specified in the Project Special Provisions.

3022.2 Material Selection

The type of pavement marking material to be used on a specific project depends on the type of marking and surface. If the material to be used is not specified in the Plans or in the Project Special Provisions, the table on the following page shall be used for material selection. Selected material shall be approved by the City Traffic Engineer prior application.

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TABLE OF PAVEMENT MARKING MATERIALS

Marking Surface	Longitudinal Lines	Diagonal Lines	Crosswalk & Stop Lines	Dashed Lines	Symbols
Asphalt	Thermoplastic* or High-Build Paint	Thermoplastic* or High-Build Paint	Pre-Formed Thermoplastic	Pre-Formed Thermoplastic	Pre-Formed Thermoplastic
Concrete	Urethane or High-Build Paint	Urethane or High-Build Paint	Pre-Formed Thermoplastic	Pre-Formed Thermoplastic	Pre-Formed Thermoplastic
Nova-Chip/ Microsurface	Thermoplastic*	Thermoplastic*	Pre-Formed Thermoplastic	Pre-Formed Thermoplastic	Pre-Formed Thermoplastic
Slurry Seal	Thermoplastic* or High-Build Paint	Thermoplastic* or High-Build Paint	Pre-Formed Thermoplastic	Pre-Formed Thermoplastic	Pre-Formed Thermoplastic

* Binder-sealer recommended by the manufacturer will be required on surfaces older than two months.

3022.3 High-Build Paint

High-build paint shall be white or yellow paint that is specifically manufactured for use as pavement markings. The paint shall consist of acrylic resin, lead-free pigments, dryers, water as solvent, and sufficient pigment suspending agents to insure soft settlement during storage.

The paint supplied shall be from freshly prepared stock and shall be formulated and manufactured from first grade materials. The paint shall be a fast-drying, waterbase, acrylic resin type paint capable of withstanding air and roadway temperatures without bleeding, staining, discoloring, or deforming. The dried film shall be capable of maintaining its original dimensions and placement without chipping, spalling, or cracking. In addition, it shall not deteriorate because of contact with sodium chloride, calcium chloride, mild alkalies and acids, or other ice control materials, oil, gasoline, or diesel fuel droppings from vehicles.

The paint must comply with the following requirements:

- A. Formulation: The pigment of the Yellow paint shall consist of the following for each 100 gallons of paint:
 - i. 30 lbs. of approved Hansa Yellow
 - ii. 17 lbs. of Rutile Titanium Dioxide
 - iii. Other such extender pigments as necessary to produce a close match to the yellow color requirement.

White and yellow paint shall be composed of 100% acrylic polymer, which shall be Rohm and Haas HD-21 acrylic resin.

- B. Consistency (viscosity): The consistency shall not be less than 75 nor greater than 90 K.U. as determined by ASTM D562.
- C. Dry-Opacity: A contrast ratio of not less than 0.96 when the paint is applied with a 0.012 inch film applicator. Dry-opacity will be determined according to method 4121.1, Federal Test Method Standard No. 141c.

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- D. Dry to No Pick-Up Time: Maximum 5 minutes.
- E. Fineness of Grind: The fineness of grind shall be no less than 3 Hegman units when tested according to ASTM D1210.
- F. Daylight Reflectance: Daylight Reflectance of the white paint shall not be less than 80% relative to magnesium oxide when tested according to ASTM E1347.
- G. Color: Yellow color must meet the following minimum chromaticity coordinates:

CIE Chromaticity Coordinate Limits (Initial)								
Color	1		2		3		4	
	x	y	x	y	x	y	x	y
Yellow	0.475	0.450	0.490	0.433	0.520	0.450	0.495	0.475

Yellow paint must display a nighttime presence of yellow when viewed from automobile headlights.

White paint shall be pure white (free of tint)

- H. Bead Embedment: At least 90% of the glass beads must be embedded between 50% and 70%.
- I. Retroreflectivity: The following minimum retroreflectivity requirements shall be met when using an acceptable 30-meter retroreflectometer between 2 and 14 days after application:
 - i. White 250 millicandelas/sq m/lux (min.)
 - ii. Yellow 175 millicandelas/sq m/lux (min.)

Each batch of paint shall be tested and certified in the factory. Receipt of certification shall be provided to the City. High Build Paint shall be tested in accordance with the requirements of Federal Specification TT-P-1952B.

No paint shall be used that is more than 6 months old.

3022.4 Pre-Formed Thermoplastic

Pre-formed thermoplastic materials shall be suitable for use on either asphalt or concrete pavements. A manufacturer recommended heat source fuses the markings to the asphalt or concrete pavements. Glass beads are pre-mixed into the material furnished, and also must be applied to the surface either before or after fusion to the pavement. Upon cooling, the material produces an adherent reflectorized marking of specified thickness and width, capable of resisting deformation by traffic. Pre-formed thermoplastic materials shall comply with AASHTO M 249 with exception of the relevant differences due to the material being supplied in a pre-formed state, and must meet the following requirements:

- A. Material shall have a minimum thickness of 90 or 125 mils as supplied by the manufacturer.
- B. Material shall be resistant to deterioration due to exposure to sunlight, water, oil, gasoline, salt, or adverse weather conditions.
- C. All pigments must be heavy metal free, including, but not restricted to lead, cadmium, and mercury.
- D. After application, the material must exhibit no appreciable deformation or discoloration, remain tack free, and not lift from the pavement under normal traffic conditions within a road temperature range of 20° F to 150° F.

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- E. Material shall be capable of conforming to pavement contours, breaks, and faults through the action of traffic at normal pavement temperatures.
- F. Color: Yellow color must meet the following minimum chromaticity coordinates:

CIE Chromaticity Coordinate Limits (Initial)								
Color	1		2		3		4	
	x	y	x	y	x	y	x	y
Yellow	0.475	0.450	0.490	0.433	0.520	0.450	0.495	0.475

White color shall be pure white (free of tint)

- G. Retroreflectivity: The following minimum retroreflectivity requirements shall be met when using an acceptable 30-meter retroreflectometer within 14 days after application:
 - i. White 300 millicandelas/sq m/lux (min.)
 - ii. Yellow 225 millicandelas/sq m/lux (min.)

3022.5 Thermoplastic

Thermoplastic pavement marking material shall be applied to asphalt surfaces in a molten state, and which upon cooling to normal pavement temperature, produces an adherent reflectorized stripe capable of resisting deformation. Thermoplastic material shall meet the requirements of AASHTO M249-79. Thermoplastic shall only be applied to surfaces that are less than two months old, unless a binder-sealer recommended by the manufacturer is applied.

3022.6 Urethane

Urethane pavement marking material shall consist of a homogeneous blend of modified urethane resins and pigments designed to provide a simple volumetric mixing ratio of two components (must be two volumes of Part A to one volume of Part B). No volatile solvent or fillers will be allowed.

- A. Pigmentation: The pigment content by weight of component A shall be determined by low temperature ashing according to ASTM 0 3723. The pigment content shall not vary more than \pm two percent from the pigment content of the original qualified paint.

White Pigment shall be Titanium Dioxide meeting ASTM D 476 Type II, Rutile.

Yellow Pigment shall be an Organic Yellow and contain no heavy metals.

- B. Upon heating to application temperature, the material shall not exude fumes, which are toxic or injurious to persons or property when handled according to manufacturer specifications. The urethane pavement marking material compositions shall not contain free isocyanate functionality.
- C. Daylight Reflectance: The daylight directional reflectance of the cured modified urethane material (without reflective media) shall be a minimum of 80 percent (white) and 50 percent (yellow) relative to magnesium oxide when tested using a color spectrophotometer with a 45 degrees circumferential /zero degrees geometry, illuminant C, and two degrees observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength measurement interval and spectral bandpass of 10 nm. In addition, the color of the yellow modified urethane shall visually match Color Number 33538 of Federal Standard 595a with chromaticity limits as follows:

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CIE Chromaticity Coordinate Limits (Initial)								
Color	1		2		3		4	
	x	y	x	y	x	y	x	y
Yellow	0.490	0.470	0.475	0.438	0.485	0.425	0.539	0.456

- D. **Weathering Resistance:** The modified urethane, when mixed in the proper ratio and applied at 14 to 16 mils wet film thickness to an aluminum alloy panel (Federal Test Std. No. 141, Method 2013) and allowed to cure for 72 hours at room temperature, shall be subjected to accelerated weathering for 75 hours. The accelerated weathering shall be completed by using the light and water exposure apparatus (fluorescent UV - condensation type) and tested according to ASTM G 53.

The cycle shall consist of four hours UV exposure at 50nC (122 OF) and four hours of condensation at 40°C (104 OF). UVB 313 bulbs shall be used. At the end of the exposure period, the material shall show no substantial change in color or gloss.

- E. **Drying Time:** The modified urethane material, when mixed in the proper ratio and applied at 14 to 16 mils wet film thickness and with the proper saturation of glass spheres, shall exhibit a no-tracking time of three minutes or less when tested according to ASTM D 711.
- F. **Adhesion:** The catalyzed modified urethane pavement marking materials when applied to a 100 x 100 x 50 mm (4 x 4 x 2 in.) concrete block shall have a degree of adhesion which results in a 100 percent concrete failure in the performance of this test

The concrete block shall be brushed on one side and have a minimum strength of 3,500 psi. A 2 in. square film of the mixed modified urethane shall be applied to the brushed surface and allowed to cure for 72 hours at room temperature. A 2 in. square cube shall be affixed to the surface of the modified urethane by means of an epoxy glue. After the glue has cured for 24 hours, the modified urethane specimen shall be placed on a dynamic testing machine in such a fashion so that the specimen block is in a fixed position and the 2 in. cube (glued to the modified urethane surface) is attached to the dynamometer head. Direct upward pressure shall be slowly applied until the modified urethane system fails. The location of the break and the amount of concrete failure shall be recorded.

- G. **Hardness.** The modified urethane marking materials, when tested according to ASTM 0-2240, shall have a Shore D Hardness greater than 75. Films shall be cast on a rigid substrate at 14 to 16 mils in thickness and allowed to cure at room temperature for 72 hours before testing.
- H. **Abrasion.** The abrasion resistance shall be evaluated on a Taber Abrader with a 1,000 gram load and CS-17 wheels. The duration of test shall be 1,000 cycles. The wear index shall be calculated based on ASTM test method 0-4060 and the wear index for the catalyzed material shall not be more than 80. The tests shall be run on cured samples of modified urethane material which have been applied at a film thickness of 14 to 16 mils to code S-16 stainless steel plates. The films shall be allowed to cure at room temperature for at least 72 hours and not more than 96 hours before testing.
- I. **Tensile.** When tested according to ASTM 0-638, the modified urethane pavement marking materials shall have an average tensile strength of not less than 6,000 pounds per square inch. The Type IV Specimens shall be pulled at a rate of X" per minute by a suitable dynamic testing machine. The samples shall be allowed to cure at 75 °F± 2°F for a minimum of 24 hours and a maximum of 72 hours prior to performing the indicated tests.
- J. **Compressive Strength.** When tested according to ASTM D-695, the catalyzed modified urethane pavement marking materials shall have a compressive strength of not less than 12,000 pounds per square inch. The cast sample shall be conditioned at 75°F± 2°F for a

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minimum of 72 hours before performing the indicated tests. The rate of compression of these samples shall be no more than ¼" per minute.

3022.7 Drop-On Glass Beads

Drop-on glass beads shall be specifically manufactured to be compatible with pavement markings, and shall comply with AASHTO M 247, Type I.

3023 PAVEMENT MARKING CONSTRUCTION REQUIREMENTS

3023.1 Scope

This section governs the installation and removal of pavement markings as shown on the Plans, the Standard Drawings, and as specified in the Project Special Provisions.

3023.2 Surface Preparation

The surface on which markings are to be placed shall be clean and dry. The street surface shall be cleaned of debris, sand, or any other deleterious material by sweeping and or use of jets of compressed air immediately preceding the application of markings. New PCC pavements shall be blast-cleaned to remove all curing compounds.

3023.3 Weather Limitations

The pavement surface temperature and air temperature shall be determined before the start of each day of marking operation and at any other time deemed necessary by the City Traffic Engineer. Temperatures shall be obtained with appropriate devices using the manufacturer's recommended procedure.

The pavement markings shall not be applied if the pavement shows any visible signs of moisture or it is anticipated that damage causing moisture, such as rain showers, may occur during the installation and curing periods.

3023.4 High-Build Paint Application

Paint shall be machine applied using spray guns designed and adjusted to apply paint at the required thickness and width. If there is any evidence of gun clogging, splattering or uneven paint distribution, painting operations shall cease until equipment is restored to proper operation. Paint shall be applied from a vehicle that was specifically manufactured for pavement marking applications.

The pavement surface temperature and ambient air temperatures shall be above 50° F during all times when paint is being applied. Paint shall not be applied if the forecast conditions for the eight hours immediately following final application include precipitation. High-build paint shall be applied to a minimum wet thickness of 20 mils. Paint may be heated to a maximum temperature of 150° F before application.

Drop-on glass beads shall be mechanically applied to the wet paint directly behind the paint spray guns. Glass beads shall be applied evenly at a minimum rate of 9 pounds per gallon of paint. Glass beads shall be applied evenly and shall completely cover the painted area. If beads do not embed properly in the paint, all marking operations shall cease until the Contractor can demonstrate that the problem has been corrected.

The glass beads shall appear uniform on the entire marking surface. The cured paint shall properly adhere to the pavement surface. If the marking paint does not provide initial retroreflectivity or if the

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marking does not have the required minimum thickness or required color, the Contractor shall re-apply the marking paint to the required thickness, at the Contractor's expense, and shall meet all requirements as previously described.

3023.5 Pre-Formed Thermoplastic Application

To apply pre-formed thermoplastic, use a heating device recommended by the material manufacturer to fuse the pre-formed thermoplastic to the pavement. Apply the pavement markings as recommended by the manufacturer. When recommended by the manufacturer, use solvent or other type of adhesive primer. Remove all existing markings or exposed aggregate before applying pre-formed thermoplastic.

3023.6 Thermoplastic Application

Thermoplastic material shall be applied to the pavement by the extrusion method wherein one side of the shaping die is the pavement and the other three sides are contained by, or a part of, suitable equipment for heating and controlling the flow of material. The equipment used to install hot thermoplastic materials under this Specification shall be constructed to provide mixing and agitation of the materials. Conveying parts of the equipment between the main material reservoir and the shaping die shall be so constructed as to prevent accumulation and clogging. All parts of the equipment that come in contact with the material shall be constructed as to be easily accessible and exposable for cleaning and maintenance. The equipment shall be constructed so that all mixing and conveying parts up to and including the shaping die will maintain the materials at a temperature not less than 375° F. To assure that the thermoplastic 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. The equipment shall be so 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 use of pans, aprons or similar appliances that the die overruns will not be permitted under this Specification. The equipment shall be so constructed as to provide for varying die widths and to produce varying widths of traffic marking.

A special kettle shall be provided for melting and heating the thermoplastic material. The kettle must 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. The heating kettle 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 local authorities.

Glass beads applied to the surface of the completed strip shall be applied by an automatic bead dispenser attached to the striping machine in such a manner that the beads are dispensed almost instantaneously upon the installed line. The glass bead dispenser shall be equipped with an automatic cut-off control synchronized with the cut-off of the thermoplastic material.

The equipment shall be so 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 mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc. The applicator shall be capable of containing a minimum of 125 pounds of molten material.

The pavement and ambient air temperatures shall be not less than 55° F, and the thermoplastic material shall be applied in a melted state at a temperature of 375° F to 450° F. The temperature of the thermoplastic in the shaping die shall be maintained at the manufacturer's recommended application temperature, but in no case shall the temperature fall below 375° F.

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The finished lines shall have well defined edges and be free of waviness. All lines will have minimal dribbles, runs and overlaps. In the event that thermoplastic long lines must stop and then continue, the restart shall line up to within 0.5 inches of the existing long line and maintain a totally straight line. The minimum thickness of thermoplastic lines shall be not less than 90 mils near the edges, nor less than 125 mils at the center. The drop-on glass beads shall be applied at a rate of one pound per 20 square feet of line.

3023.7 Urethane Application

The urethane pavement marking compounds shall be applied through equipment specifically designed to precisely meter the two components in the ratio of 2:1. This equipment shall produce the required amount of heat at the mixing head and gun tip and maintain those temperatures within the tolerances specified. This equipment shall also have as an integral part of the gun carriage, a high pressure air spray capable of cleaning the pavement immediately prior to the marking application.

The equipment shall be capable of spraying both yellow and white urethane, according to the manufacturer's recommended proportions and be mounted on a truck of sufficient size and stability with an adequate power source to produce lines of uniform dimensions and prevent application failure. The truck shall have at least two urethane tanks each of 110 gallon minimum capacity and shall be equipped with hydraulic systems and agitators. It shall be capable of applying glass beads by the double drop pressurized bead system. The system shall apply both the first drop glass beads and the second drop glass beads at a rate of 10 lb/gal. The equipment shall be equipped with pressure gauges for each proportioning pump. All guns shall be in full view of operators at all times. The equipment shall have a metering device to register the accumulated installed quantities for each gun, each day. Each vehicle shall include at least one operator who shall be a technical expert in equipment operations and urethane application techniques.

The pavement markings shall be applied at a minimum uniform wet thickness of 20 mils in accordance with the manufacturer's installation instructions. At the time of installation the pavement surface temperature and the ambient temperature shall be above 35° F and rising. Urethane shall not be applied if the forecast conditions for the eight hours immediately following final application include precipitation.

3023.8 Pavement Marking Removal

All pavement marking removal shall be per the Plans or as authorized by the City Traffic Engineer. Pavement markings shall be completely removed with minimal damage to the pavement. No more than five percent of the existing marking shall remain. The pavement surface shall not be left scarred with an image that misleads traffic. Any excess damage or scarring of the pavement shall be repaired at the Contractor's expense.

3023.9 Deficiencies

The Contractor shall remove and replace, at the Contractor's expense, any finished markings that have the following deficiencies:

- Drag marks, gashes, gouges, foreign covering, discolored areas, or areas that have failed to solidify
- Improper adhesion, length or thickness
- Ragged appearance with areas that do not present sharply defined edges
- Lateral deviation in excess of two inches in a length of 200 feet of marking

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3023.10 Final Clean Up

Before final acceptance, the Contractor shall restore to a condition equal to or better than that existing prior to construction all property, both public and private, within, adjacent to and beyond the limits of construction that have been disturbed or damaged while executing the work. The Contractor shall be responsible for removing all pavement marking material spilled upon the road surface or adjoining area. All restoration work shall be acceptable to the City Inspector.

3024 PAVEMENT MARKING MEASUREMENT AND PAYMENT

See Division I – General Requirements for CIP, Section 01120.

3031 TEMPORARY TRAFFIC CONTROL GENERAL

3031.1 Scope

The safety and mobility of all right-of-way users, including workers, drivers, and pedestrians throughout the project area is of paramount importance and shall be the responsibility of the Contractor. All work performed, whether in the right-of-way or adjacent to the right-of-way, that impacts vehicular or pedestrian traffic in any way shall be properly signed, marked, barricaded, and otherwise protected. This work shall consist of furnishing of all material, equipment, and labor to provide safe temporary traffic control within or adjacent to the area of work.

3031.2 Codes and Standards

All work and material shall be in accordance with the latest requirements of the Manual on Uniform Traffic Control Devices (MUTCD), Standard Highway Signs (SHS), American Traffic Safety Services Association (ATSSA) Quality Standards for Work Zone Traffic Control Devices, Standards of the American Society of Testing Materials (ASTM), National Cooperative Highway Research Program (NCHRP) Report 350, Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG), City of Lee's Summit Pavement Marking and Signing specifications and standards, and all applicable local ordinances.

3031.3 Modification of Specifications

These Specifications may be modified or deleted by appropriate items in the Project Special Provisions or by written authorization by the City Engineer.

3031.4 Traffic Control Plans

If a traffic control plan is not part of the Plans the Contractor shall submit a traffic control plan in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) as well as all federal, state, and local regulations and ordinances. Contractor is responsible for obtaining the City Traffic Engineer's approval of said traffic control plan, before implementation.

If the Contractor would prefer to use a traffic control plan that differs from the approved plans, the Contractor may request modifications to the traffic control plan. The Contractor will submit a plan based on the timeframes and requirements of the Contract. Contractor is responsible for obtaining the City Traffic Engineer's approval of said traffic control plan, before implementation.

Based on field conditions or unforeseen circumstances, the Contractor and/or City Traffic Engineer may request modifications to the traffic control plan, whether it is the approved plan or the Contractor's plan.

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The Contractor is required to maintain access to all properties served by the streets within the construction site limits.

3031.5 Minimum Requirements

The temporary traffic control requirements shown on the Plans are minimum requirements only and do not attempt to address in depth the variety of situations that may occur once construction has begun. In no way do the requirements shown on the Plans relieve the Contractor of his responsibility for selecting proper traffic control devices and implementation procedures that will assure the safety of motorists, pedestrians, and workers at all times. The Contractor shall be fully responsible for damage or injuries whether or not traffic control devices have been provided.

3031.6 Incidental Work and Parts

Work incidental to temporary traffic control that is not covered in these Specifications shall be performed in accordance with the City of Lee's Summit specifications and standards. All incidental parts, which are not shown on the Plans or specified in the Specifications and which are necessary to provide proper traffic control, shall be supplied and installed by the Contractor to the satisfaction of the City Engineer. No additional payments will be made for incidental work or parts.

3031.7 Permits and Inspections

The Contractor shall contact the Inspector 48 hours prior to installing any traffic control devices. The Contractor is responsible for obtaining all necessary permits from the City, and is responsible for all associated costs, before any work can begin. The City Inspector shall inspect and approve the final location of all traffic control devices.

3032 TEMPORARY TRAFFIC CONTROL MATERIALS AND EQUIPMENT

3032.1 Scope

This section governs the furnishing of all channelizers, construction signing, barricades, and other material and equipment supplied by the Contractor, as required, to implement the temporary traffic control as shown on the Plans, the Standard Drawings, and as specified in the Project Special Provisions. All equipment and material shall be in good condition, and shall meet the approval of the City Traffic Engineer.

3032.2 Construction Signs

All construction signs shall comply with the size, shape, legend, layout, and color requirements of the MUTCD and Standard Highway Signs book. For all signs that will be used at night, the legend, border, and background other than black shall be made from high intensity retro-reflective sheeting.

Supports or posts used for mounting signs or devices shall be designed to yield upon impact to minimize hazards to motorists, and be approved by NCHRP Report 350. Portable sign supports should not be used for durations of more than three (3) days. Sand bags shall not be used as ballast for sign supports for durations of more than seven (7) days. Supports and posts shall not be installed in pavement.

For mobile operations, a sign may be mounted on a work vehicle, a shadow vehicle, or a trailer stationed in advance of the work area or moving along with it.

3032.3 Channelizers

Channelizers, including cones, tubular markers, drums, and trim-lines shall be per the sizes shown on

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the Plans or Standard Drawings. Orange shall be the predominant color on the channelizers, with bands of white high intensity retro-reflective sheeting. Trim-line channelizers are the preferred channelizing devices. Channelizers shall have a broadened base and may be constructed of polyethylene or other material to withstand impact without damage to themselves or to vehicles. Cones may not be used at nighttime.

3032.4 Barricades

Barricades shall be per the sizes shown on the Plans or Standard Drawings and in compliance with NCHRP Report 350. Stripes on barricade rails shall be alternating orange and white retro-reflective sheeting sloping downward at an angle of 45 degrees in the direction road users are to pass. Sand bags used as ballast for barricades shall be kept in good condition. Contractor shall be responsible for removing and cleaning up any sand bags that have sand escaping from them.

3032.5 Arrow Panels

Arrow panels are a matrix of lamps capable of flashing or sequential displays, to be used where necessary to divert traffic. Two types of arrow panels are acceptable for use on City streets; Type C and Type D, meeting the requirements listed in the MUTCD.

Type C arrow panels shall be used during nighttime operations. They shall have a minimum width of 96 inches and a minimum height of 48 inches. Type C arrow panels shall be mounted on a portable chassis at a minimum height of seven feet (7') measured from the bottom of the panel to the road surface.

Type D arrow panels can be used during daylight hours, for mobile operations, or for emergencies. They shall have a minimum width of 48 inches and a minimum height of 24 inches. Type D Arrow panels are mounted on work vehicles at a minimum height of seven feet (7') measured from the bottom of the panel to the road surface. Any vehicle displaying an arrow panel shall be equipped with high-intensity rotating beacon, flashing beacon, oscillating beacon, or strobe lights.

3032.6 Warning lights

Type A, B, and C Warning lights shall be portable, battery powered, yellow, enclosed lights. All types of warning lights shall be in accordance with the current edition of "Purchase Specification for Flashing and Steady-Burn Warning Lights", published by the Institute of Transportation Engineers.

3032.7 Temporary Pavement Markings

Temporary pavement markings on finish surface pavement or existing surface pavement shall be removable retro-reflective polymer marking tape. When installed on pavement that will be removed, surfaced, or resurfaced, temporary pavement markings shall be water-borne traffic paint or removable retro-reflective polymer marking tape.

3032.8 Portable Changeable Message Boards

Portable changeable message boards may be provided by the City at the discretion of Public Works. The City Traffic Engineer shall coordinate the use of portable changeable message boards with the City's Public Works Operations Division. The Operations Division shall be notified at least five (5) days before a portable changeable message board is required. All messages displayed on the boards shall be approved by the City Traffic Engineer.

3032.9 Temporary Concrete Traffic Barrier

Temporary concrete traffic barrier shall be per the standards and specifications of the Missouri

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Department of Transportation (MoDOT).

3033 TEMPORARY TRAFFIC CONTROL CONSTRUCTION REQUIREMENTS

3033.1 Scope

This section governs the installation and placement of traffic control devices as shown on the Plans, the Standard Drawings, and as specified in the Project Special Provisions. All temporary traffic control shall be in conformance with the MUTCD.

3033.2 Sign Installation

The installation of all construction signage shall be in compliance with the MUTCD and the City of Lee's Summit Standard Drawings for Signing. All existing and temporary construction signs shall be removed or covered when they are not applicable. No sign posts shall be installed in paved surfaces in a manner that could cause damage to the finished surface.

Signs shall be properly maintained for cleanliness, visibility, and correct positioning. Signs that have lost significant legibility shall be promptly replaced.

Signs mounted on portable sign supports or Type 2 barricades must be installed at least one foot above the road surface. Signs mounted on Type 3 barricades should not cover more than 50 percent of the top two rails or 33 percent of the total area of the three rails.

Type B warning lights shall be installed in conjunction with all construction warning signs that will be in place at nighttime, which alert road users about a change in alignment, traffic control, lane closure, or road closure. Warning lights shall be mounted on signs in a manner that, if hit by an errant vehicle, they will not be likely to penetrate the windshield.

3033.3 Temporary Pavement Marking Installation

Temporary pavement markings are required to delineate the travel way for vehicles when the intended traffic pattern differs from the normal traffic pattern for a duration of three calendar days or more. The installation of all temporary pavement markings shall be in compliance with the MUTCD and the City of Lee's Summit Standard Drawings for Pavement Marking.

All travel lanes should be at least 11 feet wide, however a minimum lane width of 10 feet may be allowed if approved by the City Traffic Engineer. A "Narrow Lanes" sign should be installed in advance of any location where the lane width is reduced to less than 11 feet.

Where temporary pavement markings are to be placed on a surface which has existing markings, the incorrect markings shall be removed or obscured to the fullest extent possible without damage to the pavement surface. Any appreciable damage or different appearance from the surrounding surface shall be repaired by the Contractor at his expense, by methods approved by the City Engineer.

On the finish surface of pavement, interim markings are required if the permanent pavement markings cannot be installed within 24 hours. Interim markings on finish surface of pavement shall consist of four inch (4") wide by two feet (2') long stripes on the center line of the street or lane line, at approximately 50 foot spacing. Interim markings shall be the same color and configuration as the permanent pavement markings.

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3033.4 Placement of Channelizers

Channelizers shall be used to delineate the travel way for vehicles when the intended traffic pattern differs from the normal traffic pattern on a street. Channelizers shall be spaced as indicated on the Standard Drawings.

Type C warning lights may be mounted on channelizers that delineate the edge of the travel way. If warning lights are installed on channelizers, they shall be mounted in a manner that, if hit by an errant vehicle, they will not be likely to penetrate the windshield.

3033.5 Lane Closures

Lane closures are not permitted on arterial or collector streets before 9:00 A.M. and after 4:00 P.M. Monday thru Friday, nor anytime on Saturday, Sunday or holidays observed by the City unless prior approval is received through the City Traffic Engineer. Emergency repairs will be evaluated on a case-by-case basis. The Contractor shall not store materials or park vehicles within an otherwise moving lane of traffic.

All lane closures for durations longer than 30 minutes shall be signed and delineated with traffic control devices as illustrated in the Standard Drawings. Lane closures for durations of 30 minutes or less are considered to be short duration or mobile operations. Lane closures for short duration or mobile operations, at a minimum, shall require that a vehicle be equipped with high-intensity rotating beacon, flashing beacon, oscillating beacon, or strobe lights. Warning signs, channelizers, and/or arrow panels should also be considered, if possible.

The City Engineer reserves the right to suspend or delay certain operations to adequately provide for the movement of traffic. This may include periods of inclement weather or unusually heavy traffic.

3033.6 Flaggers

Flaggers are required anytime vehicles are directed to cross into an opposing lane of traffic on arterial or collector streets. If proper line-of-sight cannot be provided at intersections, drives, or curves, flaggers will also be required. Flaggers shall be trained by an ATSSA certified program. Flaggers shall be equipped with a STOP/SLOW paddle, and must be properly attired per the requirements of the MUTCD.

3033.7 Street or Sidewalk Closures

All street or sidewalk closures must be approved by the City Traffic Engineer. If a detour route will be provided around the closure, the detour route signing must be inspected and approved before the street or sidewalk can be closed.

When a section of street is completely closed to traffic, Type 3 barricades shall be erected at the points of closure. Barricades must extend completely across a roadway and its shoulders or from curb to curb. Type A warning lights should be installed on each Type 3 barricade used to alert drivers of a closure. Where provisions must be made for access of equipment and authorized vehicles, the Type 3 barricades should be provided with gates or movable sections that can be closed when work is not in progress, or with indirect openings that will discourage public entry. Where access is provided through the Type 3 barricades, the Contractor shall assure closure at the end of each working day.

When a street is closed, but access must still be allowed for local traffic, the Type 3 barricades usually are not erected completely across a roadway. Instead, an arrangement should be devised that will

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permit local use but effectively discourage use by through traffic. A sign with the appropriate legend concerning permissible use by local traffic shall be installed.

Whenever possible, a section of sidewalk that is removed should be replaced the same day, or other materials may be used to temporarily fill the area in order to maintain pedestrian traffic.

3033.8 Detours

All detour routes are subject to the approval of the City Traffic Engineer. Where detours are permitted, all necessary detour route signing must be installed a minimum of 48 hours before the detour is in effect to allow for inspection. All detour signing shall utilize high intensity retro-reflective sheeting. While traffic is detoured, construction operations shall be expedited. Periods when detours are allowed will be strictly enforced.

3033.9 Excavations, Embankments, and Obstructions

The Contractor shall be responsible for maintaining all safeguards around excavations, embankments, obstructions, or open trenches on an around-the-clock basis, whether or not work is being actively pursued.

An all-weather surface wedge capable of supporting vehicles should be provided adjacent to an edge drop-off of more than two inches (2"), but less than four inches (4"). Such a wedge should have a slope no greater than 1:1. An all-weather surface wedge capable of supporting vehicles shall be provided adjacent to an edge drop-off of more than four inches (4"). For drop-offs of more than four inches (4"), the maximum slope of the wedge shall be 3:1. Concrete traffic barrier may be used in lieu of wedge; and should be considered if an edge drop-off exceeds twenty-four inches (24"), or for other factors such as the presence of heavy machinery or workers. "Shoulder Drop Off" signs (MUTCD No. W8-9) shall be installed adjacent to any edge drop-off of more than two inches (2") that is not protected by a wedge or barrier.

If it is necessary to leave a trench excavated in the street open during times when work is not actively being pursued, the Contractor shall provide structurally adequate steel plates to bridge the excavation. All steel plates shall be A36 certified steel, minimum one inch (1") thick, with lift hooks, securely fastened to the pavement with stakes or pins. Steel plates shall be installed per the requirements of the City of Lee's Summit specifications and standards.

Orange mesh temporary fencing shall be installed around all excavations outside the street during times when work is not actively being pursued. Fencing shall be at least four feet (4') in height, bright orange in color, and attached to posts capable of supporting the fencing without significant sagging or bowing. If the excavation or an obstruction extends into a sidewalk or driveway, a Type 2 barricade with a Type A warning light should be placed adjacent to the fencing or obstruction to warn of the hazard.

3033.10 Additional Traffic Control

The City Traffic Engineer may require additional signs, channelizers, barricades, warning lights, flaggers, or other traffic control devices at any time or at any place that, in his opinion, are necessary for proper protection of vehicular or pedestrian traffic and workers.

3033.11 Maintenance Work

The Contractor shall be responsible for maintaining all traffic control devices on an around-the-clock basis, whether or not work is actively being pursued. All traffic control devices shall be maintained in

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acceptable condition as defined by the latest ATSSA "Quality Standards for Work Zone Traffic Control Devices." Devices in unacceptable or marginal condition as determined above shall be removed from the job site and replaced with devices in acceptable condition. The Contractor shall be responsible for cleaning all temporary traffic control devices as needed so that they have a neat and clean appearance at all times.

The Contractor shall be responsible for periodic checks of traffic control devices at night to verify that all devices are visible to drivers.

3033.12 Deficiencies

Deficiencies in traffic control shall be corrected immediately. Should the Contractor fail to enforce the traffic control plan or fail to clean, replace, or otherwise maintain the traffic control devices within 24-hours of verbal or written notice from the City Engineer, the City may take one or more of the actions listed on the following page:

- A. City or another agency employed by the City may correct deficiencies in signing or warning devices and deduct the cost from the Contractor's pay estimate,
- B. Stop the work until deficiencies are corrected,
- C. Suspend all pay estimates until deficiencies are corrected, or
- D. Place the Contractor in default.

3033.13 Final Clean Up

Before final acceptance, the Contractor shall restore to a condition equal to or better than that existing prior to construction all property, both public and private, within, adjacent to and beyond the limits of construction that have been disturbed or damaged while executing the work. This includes, but not limited to, existing curb and gutter, sidewalk, pavement, drainage structures, irrigation systems, street lighting and traffic signal equipment. All unpaved areas damaged during construction shall be restored to the original condition. Unless otherwise directed, grassy areas which were originally sodded shall be re-sodded. Restoration work shall be at the Contractor's expense. All restoration work shall be acceptable to the City Inspector.

3034 TEMPORARY TRAFFIC CONTROL MEASUREMENT AND PAYMENT

See Division I – General Requirements for CIP, Section 01120.