SECTION 02721

TRAFFIC BARRIERS

02721.01 GENERAL

A. Description

This work will include, but not necessarily be limited to, the construction of W beam or concrete traffic barriers at locations indicated on the Plans or established by the County Engineer, of the types stipulated, and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

Subgrade preparation; Section 02610.

C. Quality Assurance

1. The County Engineer will inspect all materials and work to ensure compliance with the Contract Documents.

2. Quality assurance requirements for Portland cement concrete shall be as specified in Section 03310.01.

3. Finished Surface

   The completed barrier shall not vary more than 1/4 inch from the horizontal and vertical lines shown on the Plans or as directed by the County Engineer. It shall present a smooth, uniform appearance. When a 10-foot long straightedge is laid on the top and faces of the barrier, the surfaces shall not vary more than 1/4 inch from the edge of the straightedge except at grade changes and curves. It shall be free from bumps, sags, or other irregularities.

D. Submittals

1. Shop Drawings

   Shop drawings shall be submitted as specified in the "General Provisions" for all traffic barrier components. The shop drawings shall include dimensional information, coating details, reinforcing placement, and such other information as may be required to verify compliance with these Specifications.

2. Certificates of Compliance

   Certificates of compliance shall be submitted in accordance with the "General Provisions" for W beam traffic barrier, barrier posts, and hardware stating that these components meet the requirements specified in Section 02721.02.

02721.02 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for W beam or concrete traffic barriers.

B. Contractor's Options

Concrete barriers may be cast-in-place or precast unless otherwise noted. The Contractor may construct the barriers from higher strength Portland cement concrete than specified herein.

C. Detailed Material Requirements

1. W Beam Traffic Barrier Posts

   Posts shall meet the requirements of AASHTO M 183 for steel and AASHTO M 111 for galvanized coating, and, if welded, ASTM A 769. In lieu of galvanizing, posts may be coated with a minimum 5 mil (0.13mm) dry film thickness of inorganic zinc rich primer conforming to Section 912.03 of the "MSHA Standard Specifications for Construction and Materials (1993)". The primer shall be applied as specified by the manufacture after the posts are fabricated.

2. W Beam Traffic Barrier

   Rail elements AND end treatments shall meet the requirements of AASHTO M180, Type II OR IV. In lieu of galvanizing, rail elements and end treatments may be coated with a minimum 5 mil (0.13mm) dry film thickness of inorganic zinc rich primer conforming to section 912.03 of the "MSHA Standard Specifications for Construction and Materials (1993)". The primer shall be applied as specified by the manufacture after the rail elements and end treatments are fabricated.

3. Hardware For W Beam Traffic Barriers

   Hardware shall meet the requirements of AASHTO M 183 for quality of steel and AASHTO M 232 for galvanized coating. In lieu of galvanizing, hardware may be coated with a minimum 5 mil (0.13mm) dry film thickness of inorganic zinc rich primer conforming to section 912.03 of the "MSHA Standard Specifications for Construction and Materials (1993)". The primer shall be applied as specified by the manufacture after the hardware are fabricated.

4. Portland Cement Concrete

   Portland cement concrete for W BEAM TRAFFIC BARRIERS SHALL BE MIX NO. 2 AND FOR concrete barriers shall be Mix No. 6 as specified in Section 03310.

5. Form Release Compound

   Form release compound shall be as specified in Section 02660.02.

6. Curing Materials

Curing materials shall be as specified in Section 02651.02.

7. Preformed Joint Filler

Preformed joint filler shall be as specified in Section 02651.02.

8. Reinforcing Steel

Reinforcing steel shall be as specified in Section 02651.02.

9. Epoxy Protective Coatings

Epoxy protective coatings for concrete shall be as specified in Section 09900.02.

10. Wire Rope

Refer to Section 918.05 of the "MSHA Standard Specifications for Construction and Materials (1993)".

02721.03 EXECUTION

A. W Beam Barriers

1. Post Erection

Posts shall be driven unless otherwise directed by the County Engineer. The method of driving shall avoid battering or distorting the posts. Posts not driven shall be set in hand or mechanically dug holes of sufficient diameter to allow tamping of the backfill. Post holes shall be backfilled with acceptable materials placed in horizontal layers not to exceed 6-inch loose depth, then thoroughly compacted. When it is necessary to place posts in existing paving, all loose material shall be removed and the paving replaced in kind. Prior to erection of the rail elements, the posts shall be properly aligned and be within a 1/4 inch tolerance of line and grade. Posts shall be set plumb.

2. Rail Assembly

Rail elements shall be erected in accordance with the Standard Details and in a manner resulting in a smooth, continuous installation with laps in the direction of traffic flow. All bolts except adjustment bolts shall be drawn tight.

B. Concrete Barriers

Concrete barriers shall be either precast or cast-in-place. Excavation for concrete barriers shall be made to the required depth and to a width that will permit the installation and bracing of forms where necessary. All soft and unsuitable material shall be removed and replaced with suitable material.

The subgrade shall be properly shaped and compacted as specified in Section 02610.03.

1. Cast-in-Place Barriers

When casting in place, the forming may be by either the slip-form or conventional fixed form method.

Cast-in-place concrete barriers shall be in accordance with the following:

a. Conventional Fixed Form Method

The barriers shall be cast-in-place in sections having a uniform length of 20 feet.

Forms shall be steel and of such construction that there shall be minimum interference to inspection for grade and alignment. The condition and the stability of the forms shall be such that they will produce a barrier that meets the required tolerance of deviations not exceeding 1/4 inch in 10 feet in either grade or alignment. Before concrete is placed against the forms, they shall be thoroughly cleaned and coated with form release compound each time they are used.

Concrete shall be placed in accordance with Section 03300.03. Volumetric batching and continuous mixing will be permitted on this work. Concrete shall be vibrated by means of an approved immersion type mechanical vibrator.

Construction or contraction joints shall be constructed every 20 feet. However, sections of 10-foot length may be constructed if necessary to make use of delivered concrete. Expansion joints shall be placed when indicated on the Plans or as directed by the County Engineer.

When finished, the top of barrier shall show no deviations from grade and alignment in excess of 1/4 inch in 10 feet.

The minimum time required before removal of forms will depend on the temperature at the time of pour and shall be as follows:

Temperature	**Hours**
Greater than 50^{o}F	12
Between 40^{o}F and 50^{o}F	24
Less than 40^{o}F	72

All honeycomb and damaged areas shall be repaired to the satisfaction of the County Engineer immediately after the removal of the forms.

b. Slip-Form Method

Slip-form construction shall not be used when the concrete aggregate is gravel.

Slip-form equipment shall be approved by the County Engineer and include the incorporation of automatic guidance controls to follow line and grade reference. The use of manual control on slip-form equipment will not be permitted. Line and grade reference shall consist of taut lines or wire suspended from supports set in the subgrade or adjacent pavement. The references shall be at 25 foot intervals on

uniform grades and tangent sections. On vertical and horizontal curves, an additional intermediate support shall be set in the field to establish a reference line acceptable to the County Engineer. The use of ski or shoe sensors reflecting variations in grade of existing roadway surface will not be permitted.

The concrete shall be of such consistency that after extrusion it will maintain the shape of the barrier without support. The surface shall be free of surface pits larger than 3/16 inch in diameter. The concrete shall require no further finishing other than light brushing with water only. Finishing with a brush application of grout will not be permitted.

If during the operation of the slip-form equipment a tear occurs, it shall be repaired immediately. The repair shall be made in accordance with good concrete practices that are acceptable to the County Engineer. It will be at the sole discretion of the County Engineer as to whether the tear can be repaired or whether the areas will require removal and replacement.

Contraction joints shall be sawed or formed at 20-foot intervals in the barrier and footer. Each joint shall be a minimum of 2 inches in depth and 1/8 inch in width. Expansion joints will be required when shown on the Plans or as directed by the County Engineer. However, sections of 10-foot length may be constructed if necessary to make use of delivered concrete. At the terminus of any pour less than 20 feet, a bulkhead form shall be placed; and six No. 8 dowels, 2 feet long, shall be placed through the bulkhead. No joint material is required.

The concrete footer may be constructed by the conventional fixed form or the slip-form method. The construction of the footer and the barrier section as a monolithic pour is not permitted.

2. Precast Concrete Barriers

Precast concrete barriers shall be in accordance with the following:

a. Fabrication work shall meet the requirements of Section 03400.03.

b. Precast concrete barriers will not be permitted on curves of short radius.

c. Barriers shall be cast in sections having a uniform length of 10 feet. The concrete shall be placed, cured, and protected in accordance with Section 03400.03. Lifting holes, rings, hooks, or other handling devices, as approved by the County Engineer, may be inserted in the precast sections. Holes exposed to completed work shall be filled with mortar. Other handling devices shall be removed to the satisfaction of the County Engineer.

d. The supporting concrete base shall be constructed by the conventional fixed form method and shall have joints constructed at 10 foot intervals. The joint shall be constructed by sawing or other methods for the width of the base to a minimum depth of 3 inches. The base section shall be doweled to the barrier section as shown on the Plans.

e. Precast barriers shall be placed in such a manner that there will generally be a joint opening, of 1/4 inch between sections. To this specified joint

opening, a tolerance of 1/8 inch plus or minus will be permitted throughout the plane of the joint.

f. All surfaces shall have an ordinary finish as specified in Section 03300.03.

3. Curing

Concrete shall be cured and protected in accordance with Section 03300.03 and 03400.03.

When liquid membrane-forming compound is used to cure concrete for precast, cast-in-place, or slip-form construction, a waiting period of 60 days will be required prior to the application of epoxy protective coating. This shall also be supplemented with a visual inspection to determine that the concrete is free of curing compound or other foreign substance.

02721.04 METHOD OF MEASUREMENT

A. W Beam Traffic Barrier

RESERVED FOR FUTURE USE

B. Concrete Traffic Barrier

RESERVED FOR FUTURE USE

02721.05 BASIS OF PAYMENT

A. General

RESERVED FOR FUTURE USE

B. W Beam Traffic Barrier

RESERVED FOR FUTURE USE

C. Concrete Traffic Barrier

RESERVED FOR FUTURE USE

SECTION 02722

PAVEMENT MARKING

02722.01 GENERAL

A. Description

This work will include, but not necessarily be limited to, the preparation of surfaces and furnishing and applying pavement marking paint or tape at locations indicated on the Plans or established by the County Engineer and as specified in the Contract Documents.

B. Related Work Included Elsewhere

1. Traffic control plan; Section 01411.

2. Temporary painted stripe marking for maintenance of traffic; Section 01450.

3. Temporary pavement tape marking for maintenance of traffic; Section 01451.

C. Quality Assurance

1. The County Engineer will inspect all materials and work before and/or after installation to ensure compliance with the Contract Documents.

2. All paint shall be furnished in original containers from the paint manufacturer. The containers shall be legibly marked with the manufacturer's name, paint color, and manufacture date.

3. Pavement marking tape shall be of good appearance, free from cracks, and shall have true, straight, and unbroken edges. The materials, when installed, shall have no more than three splices per 50 yards of length. The material shall be packaged in accordance with acceptable commercial standards. The tape shall be suitable use for a period of at least one year after purchase when stored under normal conditions.

4. Repair or remove and reapply any pavement markings that fail to satisfy the requirements indicated. Submit proposed means of cleaning, removing, or obliterating unsatisfactory markings to the County Engineer for approval prior to commencing corrective work. Use materials for cleaning pavement of spills, spatter, or overspray that will not injure the paved surface.

D. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for all

paint and tape supplied. The shop drawings shall include general product description and storage and application recommendations.

2. Certificates of Compliance

Certificates of compliance shall be submitted as specified in the "General Provisions" for all paint and tape supplied stating that the paint and tape meets the requirements specified in Section 01450.01 and 01451.02 respectively.

02722.02 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for pavement marking.

B. Contractor's Options

Not applicable.

C. Detailed Material Requirements

1. Paint

Paint for pavement marking shall be as specified in Section 01450.02.

2. Tape

Tape for pavement marking shall be as specified in Section 01451.02.

3. Guides and Templates

Guides and templates shall be specifically designed to apply strips, symbols, and letters of uniform size and cross section.

02722.03 EXECUTION

A. Preparation

1. Surfaces to receive pavement marking shall be generally clean and dry. The recommendations of the paint or tape manufacturer shall be strictly adhered to by the Contractor.

2. Provide sufficient control points to permit application of stripes, directional arrows, messages, crosswalk marking, and parking space delineations as shown on the Plans, within the tolerances specified.

3. Furnish, install, and maintain traffic cones, barricades, lights, and other protective devices required to protect traffic, workmen, and completed pavement marking and striping, and remove when marking and striping, including painted sections of curbing, have set and hardened to such degree that they will not be damaged.

B. Tolerance

1. Width of Lines: Minus zero, plus 1/8 inch.

2. Lengths of Skip or Lane Lines and Unpainted Surface Between the Skip Lines: Plus or minus 3 inches.

3. Wet Film Thickness (paint): Minimum 15 mils.

4. Location of Directional Arrows, Messages, and Stripes: Within 2 inches of indicated location.

5. Size of Letters and Arrows: Plus or minus 2 inches.

C. Installation

1. Location

   The location of the lines shall be as shown on the Plans or as directed by the County Engineer.

2. Paint

   a. Paint shall be applied in accordance with the manufacturer's directions. Newly applied paint shall be dry so as not to track when crossed by a vehicle 20 seconds after application.

   b. Do not apply to new bituminous pavement until 24 hours after pavement has been placed. On new Portland cement concrete pavement, do not apply paint until the pavement has been allowed to cure for a minimum of 7 days.

   c. Apply traffic paint only when the ambient air temperature is 40^{o}F or higher and the temperature of the surface to be painted is 45^{o}F or higher. If pavement is wet, allow the surface to dry for a minimum of 8 hours after it appears surface dry.

   d. Exercise care to prevent paint from dripping on the pavement, curb, and sidewalks, and remove any drippings or spillage before they harden. Protect adjoining surfaces against over-spray or paint splash stains, throughout painting operations.

3. Tape

   Tape may be installed either by hand application or by mechanical applicator in accordance with the manufacturer's recommendations.

02722.04 METHOD OF MEASUREMENT

A. Striping

RESERVED FOR FUTURE USE

B. Other Pavement Marking

RESERVED FOR FUTURE USE

02722.05 BASIS OF PAYMENT

A. General

RESERVED FOR FUTURE USE

B. Striping

RESERVED FOR FUTURE USE

C. Other Pavement Marking

RESERVED FOR FUTURE USE

SECTION 02723

PRECAST CONCRETE WHEEL STOPS

02723.01 GENERAL

A. Description

This work will include, but not necessarily be limited to, furnishing, placing, and anchoring precast concrete wheel stops as indicated on the Plans or established by the County Engineer and as specified in the Contract Documents.

B. Related Work Included Elsewhere

None.

C. Quality Assurance

1. The County Engineer will inspect all materials and work before and/or after installation to ensure compliance with the Contract Documents.

2. Quality assurance requirements for Portland cement concrete shall be as specified in Section 03310.01.

D. Submittals

1. Shop Drawings

   Shop drawings shall be submitted as specified in the "General Provisions" for all precast concrete wheel stops. The shop drawings shall include dimensional information, reinforcing size and placement, and such other information as may be required to verify compliance with these Specifications.

2. Certificates of Compliance

   Certificates of compliance shall be submitted in accordance with the "General Provisions" for precast concrete wheel stops stating that the wheel stops meet the requirements specified in Section 02723.02.

02723.02 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for precast concrete wheel stops.

B. Contractor's Options

The Contractor may construct the wheel stops from higher strength Portland cement

concrete than specified herein.

C. Detailed Material Requirements

1. Portland Cement Concrete

   Portland cement concrete for precast concrete wheel stops shall be Mix No. 2 as specified in Section 03310.

2. Reinforcing Steel

   Reinforcing steel for precast concrete wheel stops and anchors shall be bar reinforcement as specified in Section 03200.02.

3. Anchorage Pins

   Anchorage pins shall be No. 7 reinforcing steel with a minimum length of 22 inches.

02723.03 EXECUTION

Precast concrete wheel stops shall be located as shown on the Plans, then secured in place with two anchorage pins per wheel stop. Except for the anchorage pins, all reinforcement within the wheel stops will have a minimum 2-inch cover.

02723.04 METHOD OF MEASUREMENT

RESERVED FOR FUTURE USE

02723.05 BASIS OF PAYMENT

RESERVED FOR FUTURE USE

SECTION 02724

SIGNS

02724.01 GENERAL

A. Description

This work shall consist of furnishing and erecting signs of sheet aluminum or extruded aluminum panels, all with a reflective or nonreflective sheeting background, and all direct applied or silk screened copy or demountable copy with bolts and fittings to erect the signs at locations indicated on the Plans or established by the County Engineer and as specified in the contract documents.

B. Related Work Included Elsewhere

Maintenance of Traffic, Section 01410.

C. Quality Assurance

1. The County Engineer will inspect all materials before and/or after installation to ensure compliance with the Contract Documents.

D. Submittals

1. Certificates of Compliance

   Certificates of compliance shall be submitted as specified in the "General Provisions" for sign materials stating that the materials meet the requirements and/or standards specified herein.

02724.02 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for signs.

B. Contractor's Options

Not applicable.

C. Detailed Material Requirements

1. Materials to be used for Sign Panel Supports and Hardware, Reflective and Nonreflective Sheeting, and Sign Material shall conform to the specifications Section 813.02 of the latest version of “MSHA Standard Specifications for Construction Materials.”

02724.03 EXECUTION

A. General

All signs used in both rural and urban areas shall be in accordance with applicable sections of the Manual on Uniform Traffic Control Devices (MUTCD).

The placement of the signs shall be in accordance with the detailed dimensions shown in MUTCD or as shown on the approved construction plans. Sign posts lengths shall be sufficient so that the buried portion will adequately and firmly support the sign. The developer is responsible for mounting and maintaining signs in their proper location until the roads are taken into the County road system for operation and maintenance.

02724.04 METHOD OF MEASUREMENT

RESERVED FOR FUTURE USE

02724.05 BASIS OF PAYMENT

RESERVED FOR FUTURE USE