SCOPE OF WORK FOR LAUNIUPOKO SHORELINE MONITORING
TO SATISFY CONDITION 15 OF THE SMA

1. Shoreline profiles would be made a total of 6 stations, 4 or 5 to the North of the project site as far as Puamana Park, and 1 or 2 to the south including Launiupoko Park. Profile locations would be based on shoreline characteristics, selected to be representative of the shoreline and located where change, if any, might be reasonably expected to occur. The profile locations will be marked by a steel (rebar) stake driven flush with the ground. The profiles will be made using a level, rod and tape and will extend from the edge of the highway to approximately 200 feet or the 4-foot depth.

2. Profiles would be obtained every three months, beginning immediately prior to construction and would extend for 12 months following the completion of construction for a total of 6 profile periods. No profiles would be taken during the period of construction.

3. Photos of each of the profile lines will be taken.

4. A letter report presenting the profiles and shoreline observations will be submitted within 2 weeks of each profiling.

LAUNIUPOKO STATE SPECIFICATIONS

This attachment contains amendments to be used with the HAWAII STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND PUBLIC WORKS CONSTRUCTION, 1994.

SECTION 507 - RAILINGS

Make the following amendments to said Section:

(I) Amend **507.03 Construction Requirements** by adding the following paragraph after the eleventh paragraph:

Type "I" Culvert Headwall Upgrade Work. As shown on the plans, perform the following work for the Type "I" Culvert Headwall Upgrade Work:
Construct the Type "I" Culvert Headwall Upgrade according to Section 503 - Concrete Structures and Section 501 - Steel Structures. Remove and dispose any soil and/or asphalt concrete needed to construct the concrete curb. Drill holes, furnish and place neat epoxy anchor rebar dowels and threaded rods. Furnish and place reinforcing steel and concrete for the concrete curb. Furnish and place 40 linear feet of asphalt concrete curb according to Section 609 - Curb and/or Gutter. Furnish and place all required structural steel, threaded rods, nuts and washers for the metal bike railing. Furnish and place all pavement markings destroyed or damaged during the construction of the Type "I" Culvert Headwall Upgrade. Furnish and place other items integral with the Type "I" Culvert Headwall Upgrade such as tube splices, roofing felt, concrete adhesive, etc. Store the material as needed and furnish all labor, material, equipment, tools, and other incidentals necessary to complete the Type "I" Culvert Headwall Upgrade work.

(II) Amend **507.04 Method of Measurement** to read as follows:

"The Engineer will measure Type "I" Culvert Headwall Upgrade per linear foot. The Engineer will make the measurement along the front face of the metal bike railing as shown on the plans."

(III) Amend **507.05 Payment** to read as follows:

The Engineer will pay for the accepted pay items listed below at the Contract unit price on a linear foot basis, as shown in the Proposal Schedule. Payment will be full compensation for the work prescribed in this Section and Subsection 109.02 - Scope of Payment.

The Engineer will pay for each of the following pay items when included in the Proposal Schedule:

Pay Item	**Pay Unit**
Type "I" Culvert Headwall Upgrade:	Linear Foot

END OF SECTION

Amend **Section 606 - Guardrail** to read as follows:

"**SECTION 606 - GUARDRAIL**

606.01 Description. This work includes installing guardrails according to the contract.

The contract designates the types of guardrails as follows:

(1) Type 1 (Unassigned)

(2) Type 2 Cable-Chain Link Barrier Guardrail

(3) Type 3 Beam Type Guardrail

(4) Type 4 Rigid Barrier Type Guardrail

The construction of guardrails includes the assembly and erection of component parts at the locations shown in the contract or as specified by the Engineer.

606.02 Materials. Materials shall conform to the following:

Joint Fillers	705.01
Reinforcing Steel	709.01
Wire Rope or Wire Cable	709.02
Chain Link Fencing	710.03
Metal Beam Rail	710.04
Guardrail Posts	710.07
Guardrail Hardware	710.08

Concrete for Type 4 Rigid Barrier Type Guardrail shall be Class A. Concrete for Type 4 Rigid Barrier Type Guardrail shall conform to Section 601 - Structural Concrete.

Furnish zinc-coated steel post and zinc-coated steel rail beam for the Type 3 Beam Type Guard Rail. Do not mix the type of steel posts within the project.

When the location of manufacturing plants allows, the Engineer may inspect the plants periodically for compliance with specified manufacturing methods. The

Engineer may get samples of materials for laboratory testing for compliance with material quality requirements. This may be the basis for acceptance of manufacturing lots regarding quality.

The condition of materials will be subject to inspection for acceptance before or during incorporation of materials into the work.

606.03 Construction Requirements. Repair zinc-coated base metal surfaces that the Contractor exposes, drills, threads, cuts according to 501.03(G)(2) - Repairing of Damaged Zinc-coated Surfaces.

Preserve and protect existing facilities that the Contractor may affect by the guardrail installation. Replace the guardrails that the Contractor damages due to its operation at no cost to the State.

(A) Beam Type Guard Rail.

(1) Posts. When using a suitable method, the Contractor may drive only steel posts, except those with anchors, into the ground. Maintain an accurate vertical alignment and shall not deform the steel post.

Set the wood and steel posts with anchors plumb in hand or mechanically dug holes. Backfill post holes with acceptable material placed in layers and compact thoroughly.

Set the posts vertically in the ground to the approximate depth shown in the contract. The posts, after backfilling or driving, shall be in accurate alignment with their tops at the required grade.

The Contractor may vary the guardrail post locations shown in the contract to ease clearing utility lines or to produce smooth transitions. Request such variance for acceptance by the Engineer. The Contractor may not vary the guardrail post locations of terminal sections.

When the contract requires additional bolts and holes on posts, drill the additional bolt holes and furnish the bolts for proper installation. Drill, furnish, and install this additional bolts at no cost to the State.

Do not make the additional bolt holes in posts by burning with a torch or other method or device. Manufacture or drill the holes in the posts.

Apply a preservation treatment to the wood posts and blocks according to Section 714 - Structural Timber and Related Materials.

Where field cutting or boring is done after treatment, thoroughly swab, spray, or brush the cuts and holes with two applications of preservatives accepted by the Engineer.

(2) Rail Elements. Install the rail elements that results in a smooth, continuous installation. Draw the bolts, except adjustment bolt, tight. Bolts shall be of sufficient length to extend beyond the nuts.

When the contract requires setting the guardrail posts at non-standard spacing, cut the rail elements and drill bolt holes as necessary for proper installation.

Do not make the additional bolt holes by burning with a torch or other method or device.

The Contractor does not require paint on zinc-coated steel railing.

(3) Existing Guardrail. The Contractor shall be responsible for verifying underground facilities such as utilities ducts, cables, and pipes in locations where the Contractor will drive guardrail posts. Repair damages done to the facilities despite the location or if shown in the contract at no cost to the State.

When removing the existing guardrails, backfill and compact the holes with suitable material. Grade and compact the shoulder area before installing the new guardrails and posts.

Reinstallation of guardrail shall be according to Subsection 606.03(A).

When replacing the existing guardrails with new guardrails and posts, do not leave an unprotected opening in the guardrail system of more than 500 linear feet. Also, after each work day, protect the areas not yet completed with physical barriers according to the latest MUTCD.

(4) Reset Guardrail Post. Adjust the height of existing guardrail post such that the guardrail element will be at the required height according to the contract.

Spacer blocks bolted to the existing post are to remain intact. When required or specified by the Engineer, excavate or fill and

compact around the post to be adjusted. Replace the guardrails that are damaged by the Contractor due to its operation at no cost to the State and according to the contract.

(B) Cable-Chain Link Barrier Guardrail.

(1) Post. Place the post at equal intervals. The Contractor may space the end post closer to adjacent posts, if specified by the Engineer. Set the posts vertical. Crown the concrete portion of the post footing at the top to shed water.

(2) Chain Link and Tension Cable or Top Rail. Fasten the chain link fabric to the tension cable, top tension wires or top rail, and posts with tie wires. Space the tie wires at approximately:

(a) 24 inch intervals to the tension cable, top tension wires or top rail and

(b) 15 inch intervals to the posts.

The tie wires shall start two inches from the top of the fabric with tie wires. Give the tie wire at least one complete twist.

Install the chain link fabric on the outer portion of the cables after clamping the cables in place and torque the u-bolts properly. The chain link fabric shall be on the "U" side of the cable clamps.

Stretch the tension wire tight with the turnbuckles. Install the turnbuckles at the beginning and end of each continuous section of chain link fabric and at such intermediate points as may be necessary for tightness.

Provide turnbuckles between 500 feet and 600 feet intervals for each tension cable.

Stagger the turnbuckle connections for tension cables so that the Contractor may locate not more than one turnbuckle in one panel. When a turnbuckle assembly falls at or within six inches of a post, clamp only the cable on the side of the post opposite the turnbuckle assembly to the post. At these locations, fasten the turnbuckle assembly or the cable on the turnbuckle side to the post with a No. 9 gage tie wire.

When connecting tension cables to pipe-type turnbuckles by factory swaged steel pulls, the complete turnbuckle assembly shall develop 100% of the breaking strength of the cable.

Furnish one test sample of cable to the Engineer for each 10,000 feet or less of cable the Contractor will install. The test sample shall be three feet in total length. Fit the test sample properly with right-hand thread swaged pulls at both ends as specified in the above paragraph.

When connecting the tension cables to drop forged steel closed sockets, the complete turnbuckle assembly shall develop 100% of the breaking strength of the cable. Fill the sockets with pure zinc.

Furnish one test sample of cable to the Engineer for each 10,000 feet or less of cable the Contractor will install. The test sample shall be three feet in total length. Fit the test sample properly socketed at both ends as specified in the above paragraph.

The Contractor may use preformed zinc-coated cable dead ends as an alternative method of connecting the tension cables to the turnbuckles at anchor blocks only. The installed dead ends shall develop 100% of the breaking strength of the cable.

At structures where constructing two barrier fences, bound or weld the exposed ends of the connecting tension cables.

Do not overtighten the tension cables. Position the tension cables firmly so that between 0.25 inch and 0.5 inch sag in the cables between posts occurs.

Place the u-bolts of the cable clamp assemblies across the lay of the tension cables. Tighten the nuts on the u-bolts by applying between 30 and 35 foot-pounds of torque.

When installing barrier on existing structures, anchor the posts to the deck shown in the contract.

Drill anchor bolt holes in the deck without spalling or damaging the concrete surrounding the hole. Set the anchor bolts with a mixture of commercial quality, modified epoxy adhesive and sand. The proportions of modified epoxy shall be between one adhesive to four sand and one adhesive to six sand. The Engineer will establish the exact proportions. The cementing agent includes two component mixture of modified epoxy adhesive manufactured especially for the making of epoxy-sand grouts. Mix two components according to the manufacturer's directions for use.

(C) Rigid Barrier Type Guardrail.

(1) Preparation. Shape and compact the foundation to a firm even surface according to the contract. Remove and replace soft and yielding material with acceptable material according to Section 305 - Aggregate Subbase Course.

(2) Forms. Forms shall be according to Section 503 - Concrete Structures.

(3) Placing Concrete. Moisten the foundation thoroughly immediately before placing the concrete. Concrete shall be cast-in-place. Place the concrete according to Section 503 - Concrete Structures.

On new and existing concrete bridge deck, dowel the barrier into the deck shown in the contract.

(4) Finishing. Finish the surface to a smooth, even surface according to Subsection 503.03(M)(2) - Class 2 Rubbed Finish.

(5) Joints. Construct expansion joint shown in the contract or at existing expansion joints of structures. Expansion joint filler shall be 0.5 inch thick.

Provide the construction joints with keys and at intervals shown in the contract.

(6) Transition Sections. At the end of the barrier, adjust or construct new and/or existing guardrail or chain link fence as specified by the Enigneer or shown in the contract.

606.04 Method of Measurement. The Engineer will not measure guardrail for payment.

606.05 Basis of Payment. The Engineer will pay for the accepted guardrail at the contract per lump sum bid price option B. The price includes full compensation for removing existing guardrails and posts; filling of post holes; grading and compacting the shoulder area; installing physical barrier; furnishing and installing the guardrails; and furnishing labor, materials, tools, equipment, and incidentals necessary to complete the work.

The Engineer will pay for the accepted end anchorage, terminal section and transition section as lump sum bid price per option B. The price includes full compensation for removing existing guardrails and posts; filling of post holes; grading and compacting the shoulder area; installing physical barrier; furnishing and installing the end anchorage, terminal section and transition section; and furnishing

labor, materials, tools, equipment, and incidentals necessary to complete the work.

The Engineer will pay for the accepted resetting guardrail post as lump sum bid price per option B. The price includes full compensation for adjusting guardrails at obstruction, guardrails with rubrail, thrie beams, transitions, end terminals, rubrail, guardrail elements, cable assemblies, footings, and posts; excavating; filling; compacting; grading; and furnishing labor, materials, tools, equipment, and incidentals necessary to complete the work.

END OF SECTION

Amend **Section 621 - Traffic Control Signs** to read as follows:

"**SECTION 621 - TRAFFIC CONTROL SIGNS**

621.01 Description. This work includes furnishing and installing sign posts and foundations, reflector markers, object markers, signs, sign panels, route markers, construction signs, milepost markers, removing, storing, and installing sign panels, and sign supports; and incidental work necessary to complete the work.

621.02 Materials. Concrete for sign structures shall be of the class specified in the contract and shall conform to Section 601 - Structural Concrete. Other materials shall conform to the following:

Zinc Paints	708.02
Dark Green Enamel Paint	708.03
Paint Thinner	708.04
Signs	712.20
Reflector Marker	712.21
Flexible Delineator Post	712.51
Sign Posts	713.11
Fasteners for Signs	713.12

621.03 Construction Requirements.

(A) Destination and Expressway Sign Supports. Submit shop drawings for acceptance before assembling according to Section 501 - Steel Structures.

Welding shall be continuous and shall conform to Section 501 - Steel Structures.

The weld metal at transverse joints shall extend to the sleeve, making the sleeve an integral part of the joint. Make the longitudinal welds by the submerged arc process. Ground flush the welds except fillet welds with the base material.

Hot-dip zinc-coat the exposed surfaces including the inner portion of the tubular posts and arms after fabrication. Hot-dip zinc-coat the upper 10

inches of anchor bolts. Zinc-coating shall be according to Section 501 - Steel Structures.

Paint the ground mounted destination sign supports at the work site after proper preparation of the zinc-coated surfaces according to Section 501 - Steel Structures. The exception is that painting shall include one prime coat of zinc-dust zinc-oxide primer followed by two coats of dark green enamel paint as specified.

The aluminum sign supports shall conform to Section 713.14(B) - Aluminum Supports.

(B) Miscellaneous Sign Supports. Install permanent signs on posts as specified in the contract. Set the posts plumb at the required locations.

(1) Sign Posts. The Contractor shall use flange channel posts or twelve (12) or fourteen (14) gauge square tube posts of the size specified in the plans for:

(a) Regulatory, warning, and construction signs,

(b) Bikeway signs,

(c) School area signs,

(d) Route marker assemblies,

(e) Civil Defense signs, or

(f) Conventional motorist services signs.

(2) Reflector Marker, Milepost Marker, And Type II Object Marker Posts. Reflector marker, milepost marker, and Type II object marker posts shall be either metal posts or flexible delineator posts as specified in the contract. Zinc-coat the metal posts. The metal post shall be 1.12 pounds per foot flanged channel posts or one and a half inch, 12 or 14 gauge square tube posts.

(3) Destination Sign Posts. Destination sign posts shall be zinc-coated steel posts, flanged channel posts, or 12 or 14 gauge square tube posts of the size specified in the contract.

(C) Destination And Expressway Signs. The Contractor shall be responsible for submitting shop drawings pertinent to the fabrication of destination and expressway signs.

Assemble and check the panels in the shop for straightness, alignment, and dimensions. Correct the variations according to the contract.

Install the sign panels carefully and securely according to the contract. Replace chipped or bent signs at no cost to the State.

(D) Reflector Marker. Make the reflector marker according to the dimensions and notes shown in the contract:

(1) Reflector markers RM-1, RM-2, and RM-3 shall be either:

(a) Type III or IV retroreflective sheeting markers,

(b) Glass sphere reflector markers with four inch by five inch reflector units, or

(c) Plastic prismatic reflector markers with three inch diameter reflector units.

(2) Reflector marker RM-4 shall be a Type III or IV retroreflective sheeting marker.

(3) Reflector marker RM-9 shall be either:

(a) Nine three inch round amber plastic prismatic reflectors fastened with blind rivets to a yellow Type III or IV retroreflective sheeting marker, or

(b) A yellow Type III or IV retroreflective sheeting marker of the dimensions shown in the contract.

(E) Type II Object Marker. Make Type II object markers according to the dimensions and notes shown in the contract. Reflective sheeting material shall conform to Subsection 712.20(C)(4) - Type III or IV Retroreflective Sheeting.

(F) Splicing of Sheet Reflecting Material. When using reflecting material as a background or signs with sheet aluminum backing, the Engineer will not allow splicing on legends. The reflecting material shall be of one piece whenever the sign dimensions are four feet by six feet or less.

(G) Removal of Existing Signs. Remove, clean, and store the existing regulatory, warning, expressway, destination and directional signs and markers that the Contractor will not incorporate in the

completed project at a location as ordered by the Engineer. The Engineer will decide which items are for disposal or storage.

(H) Shop Drawings for Refurbishing Each Sign Panel. Submit shop drawings for refurbishing each sign panel indicated on the plans for acceptance at least 10 working days before doing the work.

Complete each sign panel and in place within one working day. Exception to this requirement will be contingent upon safety considerations, equipment, and provisions for the protection of the public and with the acceptance of the Engineer.

(I) Labeling of Signs. Label the back of each new sign installed with the following information:

(1) Route Number,

(2) Mile Post (same as the existing sign), and

(3) Date (date the Contractor installs the sign).

The labeling shall be one inch high numbers using a black permanent felt-tipped marker.

(J) Construction Signs. Erect construction signs at the beginning of project and at the end of project at the location indicated by the Engineer. These signs shall remain for the duration of the highway project. Maintain these signs. Place these signs besides the required traffic control signs called for in Section 645 - Traffic Control.

The construction signs shall be new and become the property of the Contractor.

(K) Overlay Panels. Refurbish specific signs designated on the plans with overlay panels. The messages, shields, arrows, and borders shall conform to requirements set in the latest edition and amendments of the 'Manual on the Uniform Traffic Control Devices' (MUTCD), and as specified herein.

The overlay panels shall consist of aluminum sheets reflectorized according to Subsection 712.20. Reflectorize the messages, arrows, and border with Type III or IV retroreflective sheeting or acrylic plastic reflex reflectors. Reflectorize the shield symbol with Type III or IV retroreflective sheeting. The aluminum sheet shall conform to ASTM B 209, alloy 6061-T6 flat sheet, and shall be a minimum 0.100-inch thick.

Verify the sizes of sign panels affected and the sizes, shape and format of letters, numerals, symbols and borders before fabrication. Inform the Engineer immediately of discrepancies. Correct the discrepancies. Submit for acceptance the final design of the sign before fabrication.

Fabricate and install the overlay panels according to the manufacturer's instructions and as specified by the Engineer. Submit for acceptance splices before fabrication.

Remove existing letters, numerals, symbols and borders. Clean the existing sign panel before installation of the overlay. Clean and prepare the sign panel for overlaying as recommended by the panel manufacturer and as specified by the Engineer.

Installation of prefabricated overlay panels may be done with the existing sign panel remaining in place, subject to Engineer's acceptance of its methods. Engineer's acceptance will contingent upon safety, its traffic control provisions, provisions for the protection of the public and equipment. The Contractor shall be responsible for damages to public property including vehicles, as specified in Subsection 107.16 - Protection and Restoration of Property and Landscape, including all vehicles.

(L) Relocation of Existing Signs. Remove, clean, and fasten existing regulatory or warning signs to be relocated to new posts or supports according to the Standard Plans. Materials such as posts, nuts, bolts, washers, base support, brackets, and necessary hardware to install the existing sign shall be new. Submit the relocated sign location for acceptance.

621.04 Method of Measurement. The Engineer will measure the number of traffic control signs, reflectorized delineator, and route markers assemblies as complete units of the type and design specified in the contract.

The Engineer will not measure destination, and directional sign panels.

The Engineer will not measure removing and reusing existing ground mounted destination sign posts.

The Engineer will not measure relocating existing exit number sign panels to the right or left edge of expressway or destination signs.

The Engineer will not measure specific destination ('D' designation) or

expressway ('E' designation) sign posts designated on the plans per each, complete in place.

No measurement is necessary for the overhead mounted destination sign ('D' destination) post and arm of posts and foundations when contracted on a lump sum basis.

The Engineer will not measure construction signs per each complete in place.

The Engineer will not measure the street name sign mounting assembly for payment.

The Engineer will not measure bi-directional mile post markers per each complete in place.

The Engineer will not measure for removal and delivery of existing signs and markers that will not be incorporated in the completed highway separately.

The Engineer will not measure for labeling of the new signs separately.

The Engineer will not measure the relocation of existing regulatory and warning signs per each complete in place. The Engineer will not measure the removal and salvaging or storing of existing post.

The Engineer will not measure for removing, cleaning, stacking, and delivering of existing signs, markers, and posts that will not be incorporated in the completed highway for payment.

The Engineer will not measure for replacement of existing sign panel with new destination sign panel per square foot of sign face.

The Engineer will not measure for removing, storing, and installing existing signs onto overhead sign structures when contracted on a lump sum basis.

The Engineer will not measure for overlay panels per square foot of sign face.

The Engineer will not measure for replacement of existing sign panel with new expressway sign panel per square foot of sign face.

The Engineer will not measure for replacement of existing sign panel with new destination and /or expressway sign panel per square foot of sign face.

621.05 Basis of Payment. The Engineer will pay for the accepted regulatory and warning signs, object markers and route markers assemblies at the contract unit price per each complete units of the type and design specified in the

proposal. The price shall be full compensation for excavating and backfilling, furnishing and installing materials, furnishing equipment, tools, labors and incidentals necessary to complete the work.

The Engineer will pay for the accepted destination, directional, exit number sign panels and replacement of existing sign panels with new destination sign panels at the contract unit price per square foot for the type specified complete in place. The price shall be full compensation for furnishing and installing a complete sign panel, including enameling, cut-outs, post fasteners, sign framing, stiffeners, clamp assemblies, and necessary hardware, and furnishing equipment, tools, labors, materials and other incidentals necessary to complete the work.

The price includes full compensation for furnishing labors, materials, tools, equipment, necessary hardware, and incidentals necessary to complete the work

The Engineer will pay for the accepted destination sign posts designated on the plans at the contract unit price per each complete in place. The price shall be full compensation for furnishing and installing materials and furnishing equipment, tools, labors and incidentals necessary to complete the work.

The Engineer will pay for removing, storing, and installing existing signs onto overhead sign structure for on a lump sum basis for each structure complete in place. The price includes full compensation for furnishing materials, labors, tools, equipment, and incidentals necessary to complete the work.

The Engineer will pay for the accepted destination sign posts ('D' designation) at the contract unit price per each complete in place.

The Engineer will pay for the accepted overhead mounted destination sign posts ('D' designation), arm of posts, and foundations at a contract lump sum price on the type specified complete in place. The price shall be full compensation for furnishing and installing materials including anchor bases, brackets and necessary hardware, and furnishing labors, tools, equipment and incidentals necessary to complete the work.

The Engineer will pay for the accepted construction signs at the contract unit price per each, complete in place. The price includes full compensation for sign panels, posts, nuts, bolts, washers, base support, brackets and necessary hardware, labors, tools, equipment and incidentals necessary for the installation, maintenance, removal, cleaning, delivering, and storing of the signs with posts.

The Engineer will not pay for removal and delivery of existing signs and markers that will not be incorporated in the completed highway separately. The Engineer will consider them incidental to the various contract items.

The Engineer will not pay for labeling of the new signs separately. The

Engineer will consider them incidental to the various contract items.

The Engineer will pay for the accepted relocating of the existing regulatory and warning signs at the contract unit price per each complete in place. The price includes full compensation for cleaning the existing sign, providing new posts, nuts, bolts, washers, base support, brackets, necessary hardware, and furnishing labors, tools, equipment, and incidentals necessary to complete the work.

The Engineer will not pay for removing, cleaning, stacking, and delivering the existing signs, markers, and posts that are not incorporated in the completed project separately. The Engineer will consider them incidental to the various contract items.

The Engineer will make payment per lump sum under option B in the contract.

END OF SECTION

Amend **Section 629 - Pavement Markings** to read as follows:

"**SECTION 629 - PAVEMENT MARKINGS**

629.01 Description. This work includes installing and removing pavement markings according to the contract.

629.02 Materials. Materials shall conform to the following requirements:

White and Yellow Traffic Paint	708.06
Pavement Markers	712.40
Adhesives for Pavement Markers	712.41
Preformed Pavement Marking Tape	712.53
Reflective Thermoplastic Compound Pavement Markings	712.55

Materials installed shall be new, best of their respective grades and as specified below.

629.03 Construction Requirements.

(A) General. Pavement markings shall conform to the latest edition of:

(1) FHWA publication, "Manual on Uniform Traffic Control Devices for Streets and Highways" (MUTCD), and

(2) Traffic Standard Manual for City and County of Honolulu or governing counties.

Apply the pavement markings according to the contract. Pavement markings shall be clean cut, uniform, and neat. Correct the pavement markings according to the contract and at no cost to the State that:

(1) fail the requirements specified or

(2) the traffic damages or

(3) other causes.

Establish control points throughout the project for the layout of pavement markings. Do the layout and the Engineer will accept the layout

before installing the work.

Longitudinal pavement markings shall not deviate more than one inch from the intended alignment on tangents and curves with radii greater than 5,000 feet. On curves with radii of 5,000 feet or less, the longitudinal pavement markings shall not deviate more than two inches from the intended alignment. Immediately correct misalignments when specified by the Engineer. Remove and reinstall the misaligned portion(s) plus an additional 25 feet segment from each end according to the contract.

Before applying the pavement markings, the surface shall be free of moisture and foreign or other material that may adversely affect bonding. Thoroughly blast clean the existing surfaces. Clean, newly placed surfaces need not be blast clean. Clean a prepared surface that becomes contaminated with moisture, dust, or other foreign matter before installing the pavement markings.

The Contractor may place pavement marking tape and pavement markers installed with bituminous adhesive immediately after completion of asphalt concrete pavement or within 14 days hence. Apply other pavement markings between 7 days and 14 days after completion of the pavement.

(B) Temporary Pavement Markings. Immediately install temporary pavement markings according to Table 629-I when:

(1) the Contractor does not install permanent pavement markings after completion of each day's final paving;

(2) the Contractor needs to open the roadway to public traffic for guidance through the area and as ordered by the Engineer; or

(3) the Engineer needs the temporary pavement markings for special traffic patterns.

Install ~~flexible delineator posts with Reflector Markers or Type I Barricades spaced at 80-foot intervals or~~ temporary solid four inch pavement marking tapes on the edge of the travelway for newly paved surfaces, scarified, or cold planed surfaces, reconstructed areas, and unmarked areas for guidance of motorists.

Maintain and replace temporary pavement markings~~, flexible delineators and barricades and as~~ specified by the Engineer.

Remove temporary markings before installing permanent pavement markings.

Permanently installed PASS WITH CARE, DO NOT PASS, NO PASSING ZONE, or other signs designated by the Engineer are to be covered or temporarily removed unless they are in agreement with the temporary striping.

When failing to install pavement markings according to the contract herein immediately after completion of the construction operations for each day, the Engineer will suspend the work and progress payment according to Subsection 105.01 - Authority of the Engineer.

TABLE 629-I TEMPORARY PAVEMENT MARKINGS

TYPE	PAVEMENT MARKINGS
Passing Permitted - Both Sides	Single 4-inch yellow stripe 5 feet in length spaced 20 feet on centers with Type D markers spaced 40 feet on centers and located on the center of the 5 foot length of stripe.
Passing Prohibited - Both Sides	Double solid 4-inch yellows stripe with Type D markers placed 20 feet on centers on one of the 4-inch yellow stripes selected by the Engineer.
Passing Permitted - One Side Only	Single continuous 4-inch yellow stripe with Type D markers placed on the stripe 20 feet on centers on the no-passing side and single 4-inch yellow stripes 5 feet in length spaced 20 feet on centers on the passing side.
Lane Lines - Lane Changing Permitted	Single 4-inch yellow or white stripe 5 feet in length spaced 20 feet on centers with Type C or Type D markers spaced 40 feet on centers
Lane Lines - Lane Changing Prohibited	Double solid 4-inch white stripes with Type C markers placed 20 feet on centers on one of the 4-inch white stripes selected by the Engineer.
Crosswalk	Two 4-inch white traverse lines spaced 8 feet on centers or as specified by the Engineer.
Stop Line	Single 4-inch white traverse line.
Notes: a. The Contractor may use paint for temporary markings in areas	

where the Contractor has not completed final paving.

b. The temporary striping schedule shall be designated by the Engineer.

(C) Permanent Pavement Markings

(1) Pavement Markers. Pavement Markers shall be:

(a) of uniform composition,

(b) free from surface irregularities and

(c) free from other physical damage or defects that affect appearance and/or performance.

The shape, dimensions, tolerances, types, uses, and layout shall be according to the contract.

Submit samples of the pavement markers and bituminous adhesives and/or epoxy adhesives to the Engineer for testing and acceptance before 10 days before usage. Sampling and testing of the pavement markers shall be according to Subsection 712.40.

Use Bituminous Adhesive for Pavement Markers according to Subsection 712.41 to cement markers to the pavement. When accepted by the Engineer, the Contractor may use Standard Set epoxy adhesive according to Subsection 712.41 at no additional cost to the State.

Heat and dispense the bituminous adhesive from an acceptable equipment that can maintain the required temperature. Placement of markers using bituminous adhesive shall be similar to placement of markers using epoxy adhesive.

When using epoxy adhesive, mix the components by a two-component type automatic mixing and extruding apparatus for use on the project. Automatic mixing equipment shall use positive displacement pumps and shall properly meter the components in the ratio of one to one ± 5% by volume. Check the ratio in the presence of the Engineer at the beginning of each day or as ordered.

The Contractor may mix only Standard Set Type adhesive manually and shall not mix more than one quart by volume.

When using two component adhesives, carry out the work quickly and efficiently due to the short pot life of the adhesive. Place the pavement markers within 60 seconds after mixing and extruding the adhesive. The Engineer will not allow further movement of the marker. Use up each mixed batch of adhesive within five minutes completely after the start of mixing. Place the adhesive on the pavement surface or on the bottom of the marker in complete coverage of the area of contact, without voids and with a uniform and adequate thickness to produce a slight excess after pressing the marker in place. Place the marker in position and apply pressure with a slight twisting motion until making firm contact with the pavement. If the Contractor cannot extrude the adhesive from under the marker applying pressure, discard the remaining batch of adhesive. Immediately remove the excess adhesive:

(a) around the edge of the marker,

(b) on the pavement, and

(c) on the exposed surfaces of the markers.

The Contractor may use soft rags moisten with mineral spirits conforming to Federal Specification TT-T-291 or kerosene to remove adhesive from the exposed faces of the markers. Do not use other solvents.

Protect the pavement markers against impact until the adhesive has hardened sufficiently. The Contractor may use the following table as a guide for the determination of sufficient hardening:

Temperature* (^{O}F)	Standard Set Type (Hours)	Rapid Set Type (Minutes)
100	1.5	15

<table>
<tr><td>90</td><td>2</td><td>20</td></tr>
<tr><td>80</td><td>3</td><td>25</td></tr>
<tr><td>70</td><td>4</td><td>30</td></tr>
<tr><td>60</td><td>5</td><td>35</td></tr>
<tr><td>50</td><td>7</td><td>45</td></tr>
<tr><td>40</td><td rowspan="4">No application below 50^{O} F</td><td>65</td></tr>
<tr><td>30</td><td>85</td></tr>
<tr><td>20</td><td rowspan="2">No application below 30^{O} F.</td></tr>
<tr><td>10</td></tr>
<tr><td colspan="3">*The temperature is either pavement surfaces or air temperature whichever is lower.</td></tr>
</table>

Do not use the hardness of the rim of epoxy around the marker as an indication of the degree of cure.

Immediately reset the pavement markers implanted with improperly mixed adhesives requiring unusually long curing time as specified by the Engineer.

Do not install pavement markers when:

(a) the relative humidity is greater than 80% or

(b) the pavement surface is not dry.

Install the pavement markers according to contract as specified by the Engineer. When using Types A and J pavement markers for delineating 10-foot lane stripes, install them in sets of four with no fractional sets allowed. The Contractor may adjust the lengths of each 10-foot stripe and each 30-foot gap for skip striping ± one foot to present a uniform and balanced arrangement.

Do not install the pavement markers over longitudinal or transverse joints of the pavement surface, pavement marking tape, and thermoplastic extrusion markings.

(2) Traffic Paint. Use a wheeled applicator machine that is manually or machine propelled to apply at a nominal thickness of 0.015 inch or at a rate of 300 linear feet of single four inch stripe for one gallon paint. The applicator shall have appropriate shields around the nozzles to permit sharp stripe definition. The applicator shall have a separate nozzle to direct an air stream immediately ahead of paint application for clearing away debris, dust and other foreign matter. Immediately remove misted, dripped and spattered paint on pavements as specified by the Engineer.

The Contractor may manually paint pavement arrows, symbols, words, and curb markings upon acceptance by the Engineer.

Protect freshly painted pavement markings from traffic until the paint is sufficiently dry and will not transfer to tires or other devices. The Contractor may use cones or other acceptable traffic control devices for this purpose.

Repair or correct pavement markings damaged by traffic and paint marks on the pavement caused by traffic crossing wet paint according to Subsection 629.03(D).

(3) Thermoplastic Extrusion Pavement Marking.

(a) Equipment. Apply the material to the pavement by an extrusion method. One side of the shaping die is the pavement and the other three sides are part of the equipment.

The equipment shall provide continuous mixing and agitation of the material. Construct conveying parts of the equipment to prevent accumulation and clogging. Parts of the equipment that come in contact with the material shall easily be accessible and exposable for cleaning and maintenance.

Mixing and conveying parts, including the shaping die, shall maintain the material at the plastic temperature.

The equipment shall assure continuous

uniformity in the dimensions of the stripe.

The applicator shall cleanly cut off square stripe ends and apply "skip" lines. The Engineer will not permit the use of pans, aprons or similar appliances that the die overruns.

Apply beads to the surface of the completed stripe over the entire surface of the stripe and by an automatic bead dispenser attached to the liner.

Equip the bead dispenser with an automatic cutoff control synchronized with the cutoff of the thermoplastic material.

Construct the equipment to provide for varying die widths to produce varying widths of traffic markings.

Provide a special kettle for melting and heating the composition. Equip the kettle with an automatic thermoplastic control device so that the Contractor can do the heating by controlled heat transfer liquid than direct flame.

Equip and arrange the applicator and the kettle according to the Nation Fire Underwriters requirements.

The applicator shall be mobile and maneuverable so that the Contractor can follow straight lines and make normal curves in a true arc.

The applicator shall contain a minimum of 125 pounds of molten material.

(b) Application. Clean off dirt, blaze, paint, tape and grease and ordered by the Engineer.

The Contractor may apply the material in variable widths from two inches to twelve inches. Apply the material for the full width of stripe in one application or pass. For example, form an 8 inch stripe with an 8 inch die.

On concrete pavements and pavements containing less than 6% bituminous asphalt, pre-stripe the application area with a binder material, primer or prime seal coat recommended by the manufacturer.

The minimum installed thickness of the line as viewed from a lateral cross section shall be:

(a) not less than three thirty-secondth inch at the edges, and

(b) not less than one-eighth inch in the center.

Take the measurements as an average throughout 36 inch sections of the line. Two thousand pounds of thermoplastic materials supplied in granular or block form will yield approximately 6,600 feet of four inch striping with a 90-mil thickness.

The new line, when applied over an old line of compatible material, shall bond itself to the old line so that no splitting or separation takes place during its useful life.

The finished lines shall have well defined edges and be free of waviness.

(4) Preformed Pavement Marking Tape. The Contractor may apply the preformed pavement marking tape manually or with the tape applicators acceptable by the tape manufacturer. Apply the markings according to the tape manufacturer's recommendations and according to the contract.

Install either temporary or permanent preformed pavement marking tape according to the contract or specified by the Engineer.

Do not apply the preformed pavement marking tape over other markings. Remove the old markings and prepare the surface for tape application according to Subsection 629.03(A).

The minimum temperatures for the applications

of preformed pavement marking tape shall be 60 ^{O}F. for air and 70 ^{O}F. for roadway surfaces, with both temperatures rising. The maximum temperature shall be 150 ^{O}F. for surfaces.

Before applying the permanent preformed pavement marking tape, prime the existing roadway surfaces with an acceptable primer as recommended by the tape manufacturer and ordered by the Engineer.

Apply the primer in one thin coat extending at least one inch beyond the tape edges. Allow the primer to dry until the primer feels tacky and will not lift or string.

The Contractor may use tapes of different widths to form a specified stripe width. For example, the Contractor may use two four-inch wide tapes to form an 8-inch wide stripe). The Engineer will make payment for the specified stripe width according to the contract.

Use butt splices only and shall not overlap the tape material.

Tamp the markings thoroughly with an acceptable mechanical tampers. Also, slowly drive a truck on the newly applied markings several times.

Areas marked with preformed pavement marking tape shall be ready for traffic immediately after application.

(D) Removal of Existing Pavement Markings. Remove the existing pavement markings according to the contract and as specified by the Engineer. Resolve the conflicts between existing and new markings by removing the existing as specified by the Engineer and according to the following:

(1) remove the existing pavement markings before applying the traffic paint, thermoplastic extrusion or preformed pavement marking tape;
(2) remove the existing markings so that the Contractor can make a smooth transition between existing and new markings; and

(3) remove the unnecessary markings before making changes in the traffic pattern.

Use removal methods that will cause the least possible damage to the pavement and its surface. Do not cause impressions of old markings to remain after the removal operations. Repair the damage to the pavement or its surface caused by removal operations including impressions of old markings at no cost to the State. Make the reparations as specified and accepted by the Engineer.

The Engineer will not permit eradication of existing markings by painting over them. The Engineer will permit burning off existing paint markings provided the Contractor uses an acceptable method using excess oxygen. Do not burn nor ground off the preformed pavement marking tape. Remove the preformed pavement marking tape and thermoplastic extrusion markings by methods recommended by the manufacturer and acceptable by the Engineer.

The Engineer will permit sandblasting for paint removal. Remove the sand or other material deposited on the pavement due to removal operations as work progresses. The Engineer will not permit accumulation. Immediately remove excess sand or other material deemed hazardous to traffic when specified by the Engineer.

629.04 Method of Measurement. The Engineer will not measure for furnishing and installing pavement striping, pavement markers, detour pavement striping, curb markings, temporary pavement markings, flexible delineators posts with reflector markers, Type I Barricades, and temporary signs and removing pavement markings for payment.

The Engineer will not measure the pavement arrow, pavement word, and pavement symbol per each.

629.05 Basis of Payment. The Engineer will pay for the accepted pavement striping at the contract lump sum price complete in place. The price includes full compensation for establishing control points, laying out, cleaning the existing surface, furnishing and applying the pavement stripings, and furnishing labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will pay for the accepted detour pavement striping on a contract lump sum basis. The price includes full compensation for establishing control points, laying out, cleaning the existing surface, furnishing and applying the detour pavement striping, and furnishing labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will pay for the accepted pavement arrow, pavement word, and pavement symbol at the contract unit price per each. The price includes full compensation for establishing control points; laying out; cleaning the existing surface; furnishing and applying the pavement arrow, pavement word, and pavement symbol; and furnishing labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will pay for the pavement markers including adhesives at the contract lump sum price. The price includes full compensation for submitting samples; applying adhesives; furnishing, installing, and protecting the pavement markers; and furnishing labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will not pay for the accepted temporary pavement markings, flexible delineators posts with reflector markers, Type I Barricades, and temporary signs. The Engineer will consider the price for them included in the bid price of the various contract items. The price includes full compensation for maintaining, replacing, and eventually removing the temporary pavement markings, flexible delineators and barricades; and furnishing labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will pay for the accepted curb markings at the contract lump sum price. The price includes full compensation for establishing control points; laying out; cleaning the existing surface; furnishing and applying the curb markings; and furnishing labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will pay for the accepted removal of existing pavement markings at the contract lump sum price. The price includes full compensation for removing the existing pavement markings; and furnishing labor, materials, equipment, tools, and incidentals necessary to complete the work.

The Engineer will pay under lump sum payment per option B of the contract.

END OF SECTION

SECTION 645 - TRAFFIC CONTROL DEVICES

Make the following amendments to said Section:

(I) Amend the title to read as "**SECTION 645 - WORK ZONE TRAFFIC CONTROL**"

(II) Amend **Table 645-I - For Traffic Control Plan** to read as follows:

TABLE 645-I - FOR TRAFFIC CONTROL PLAN

POSTED SPEED LIMIT (M.P.H.)	SIGN SPACING (D) (FEET)	TAPER LENGTH (T) (FEET)		LONGI-TUDINAL BUFFER SPACE (B) (FEET)	SPACING OF CONES OR DELINEATORS (FEET)		
		W = 12' OR LESS *	W = GREATER THAN 12' *		TAPER	TANGENT	WORK AREA
20	250	200	W x 17	35	20	20	10
25	250	200	W x 17	55	25	25	10
30	250	250	W x 20	85	30	30	10
35	250	250	W x 20	120	35	35	10
40	500	350	W x 30	170	40	40	10
45	500	550	W x 45	220	45	45	10
50	1000	600	W x 50	280	50	50	10
55	1000	700	W x 55	335	55	55	10

* W = width of lane or shoulder

(III) Amend **645.03 Construction Requirements** by adding the following:

"Traffic control devices including cones, barricades, warning signs with supports, lights, and temporary signals shall conform to 'The Hawaii Administrative Rules, Title 19, Subtitle 5, Chapters 127, 128 and 129', the MUTCD and Section 104 - Scope of Work. Reflectorization for protective devices such as cones, barricades, delineators, and signs, shall conform to Subsection 712.20 - Signs.

Do not use steel drums and steel barrels for traffic controls in construction and maintenance work zones.

As of 10/01/2000, all new barricades, signs with sign supports and vertical panels without lights shall require an FHWA approval letter certifying that the device is NCHRP Report 350 compliant. Do not use barricades, signs with sign

supports, and other traffic control devices purchased before 10/01/2000 that are not certified to be NCHRP Report 350 compliant after 10/01/2003.

Upon request of the Engineer, furnish a self-certified NCHRP Report 350 compliant letter from the vendor for each type of single-piece traffic cone, single-piece drum, tubular marker and delineator.

(A) Signs

(1) General. Install signs ahead of the place where operations may interfere with the use of the road by traffic and at intermediate points where the new work crosses or coincides with an existing road.

Place such signs as specified by the contract and as specified and accepted by the Engineer.

Submit to the Engineer 8 sets of FHWA approval letter certifying that the signs and sign supports are NCHRP Report 350 compliant.

(B) Barricades

(1) General. Apply and install the barricades according to the contract.

Provide, erect, and maintain necessary barricades, suitable and sufficient lighting devices, signs and other traffic control devices, and precautions for the protection of the work and safety of the public

Protect roadways closed to traffic, illuminate obstructions during hours of darkness, and provide warning signs to control and direct traffic according to the contract.

Submit to the Engineer 8 sets of FHWA approval letter certifying that the barricades are NCHRP Report 350 compliant.

Barricades shall be in good condition. Submit barricades for acceptance by the Engineer for use within the project limits according to this section. Barricade application and installation shall be according to the contract and as specified by the Engineer.

Provide sand bags if required or specified by the Engineer. All sand bags and their method of installation shall comply with the MUTCD and be accepted by the Engineer prior to use. Do not place sand bags on the striped barricade rail.

Install steady burn and/or flashing lamps on selected barricades used during hours of darkness. Locations shall be according to the contract and specified by the Engineer. Attach the

lamps on the barricade ends closest to the traveled way. Lamps shall be visible to the motorist.

Do not install signs on barricades unless the sign on barricade system has been crash tested, accepted under NCHRP Report 350, and accepted by the Engineer.

The Contractor may use the accepted barricades for temporary detours, construction phasing, or other temporary traffic control work.

The Contractor may use the accepted barricades used in temporary detours or construction phasing for permanent locations according to the contract.

Upon completion of the construction work, leave the barricades in place, relocate the barricades, or remove and dispose the barricades according to the contract or as specified by the Engineer. Barricades left in place or relocated to new permanent locations shall become the property of the State. Barricades removed and disposed of shall become the property of the Contractor.

(2) Reflectorization. Reflectorize barricade rails and the attachment with reflective sheeting according to Subsection 712.20(C)(4) - Type III or IV Retroreflective Sheeting (High or specified and accepted by the Engineer.

Reflectorize both vertical faces of each barricade rail according to the contract.

(3) Color. Rails, frames and braces shall be white. The front and back faces of barricade rails shall have 6 inch wide alternate colored and white stripes sloping downward toward the traveled way at an angle of 45 ^{O} with the vertical. The colored stripes shall be either orange or red according to the following requirements:

(a) Use orange and white stripes for construction, detour or maintenance work.

(b) Use red and white stripes on roadways with no outlet such as dead-ends and cul-de- sacs, ramps or lanes closed for operational purposes, or permanent or semi-permanent closure or termination of a roadway.

(4) Maintenance. Keep the barricades in good condition throughout their usage during construction.

(a) To maintain their effectiveness and appearance, repair, clean or replace the required barricades as specified by the manufacturer guidelines and as specified by the Engineer.

(b) Immediately replace lost, stolen or damaged barricades, lamps and sand bags.

Clean and repair the barricades used during construction phasing, temporary detours or other temporary traffic control work before relocating to permanent locations according to the contract or as specified by the Engineer.

The Engineer will not make payment for repair work or cleaning of barricades. The Engineer shall decide the suitable condition of each barricade and when each barricade needs repairing or cleaning.

(C) Traffic Delineators. Install traffic delineators to show the temporary alignment of detour roads according to the contract or as specified by the Engineer.

Upon request of the Engineer, submit to the Engineer an FHWA approval letter certifying that the device is NCHRP Report 350 compliant.

Maintain the traffic delineators and keep the traffic delineators clean and in good repair. Replace lost, stolen or damaged traffic delineators immediately.

At the end of a detour phase, relocate the traffic delineators and keep the traffic delineators clean and in good condition to the next detour phase. At the end of the construction period, leave in place or remove the traffic delineators according to the contract or as specified by the Engineer. The traffic delineators will become the property of the Contractor when no longer required on the project.

(D) Cones. Install traffic cones according to the contract or as specified by the Engineer.

Upon request of the Engineer, submit to the Engineer an FHWA approval letter certifying that the cones are NCHRP Report 350 compliant.

Maintain the traffic cones and keep the traffic cones clean and in good repair. Replace lost, stolen or damaged traffic cones as needed."

(IV) Amend **645.04 Method of Measurement** to read as follows:

"**645.04 Method of Measurement.** The Engineer will not measure Additional Police Officers And/Or Additional Traffic Control Devices such as hiring the services of additional Police Officers that the Engineer requested; furnishing, installing, maintaining and removing the additional devices; and inserting the legal notices required by the Engineer on a lump sum basis according to the contract and as specified by the Engineer.

The Engineer will not measure traffic control, barricade or barricade with lamp, traffic delineator, and construction and maintenance of detours for payment."

(V) Amend **645.05 Basis of Payment** to read as follows:

The Contractor shall submit a paid invoice for the legal notice. The Engineer will make payment under the various contract items.

The Engineer will not pay for Traffic Control separately. The Engineer will consider the cost for Traffic Control as included in the contract price of the various contract items. The cost is for hiring the services of the flaggers and/or police officers; furnishing, installing, maintaining and removing all traffic controls shown in the traffic control plans; and furnishing labor, materials, tools, equipment, and incidentals necessary to complete the work.

The Engineer will not pay for Barricade or Barricade With Lamp separately. The Engineer will consider the cost for Barricade or Barricade With Lamp as included in the contract price of the various contract items. The cost is for furnishing, delivering, installing, maintaining, relocating, and removing the barricade and furnishing and installing sand bags and other accepted weights; and furnishing labor, materials, tools, equipment, and incidentals necessary to complete the work.

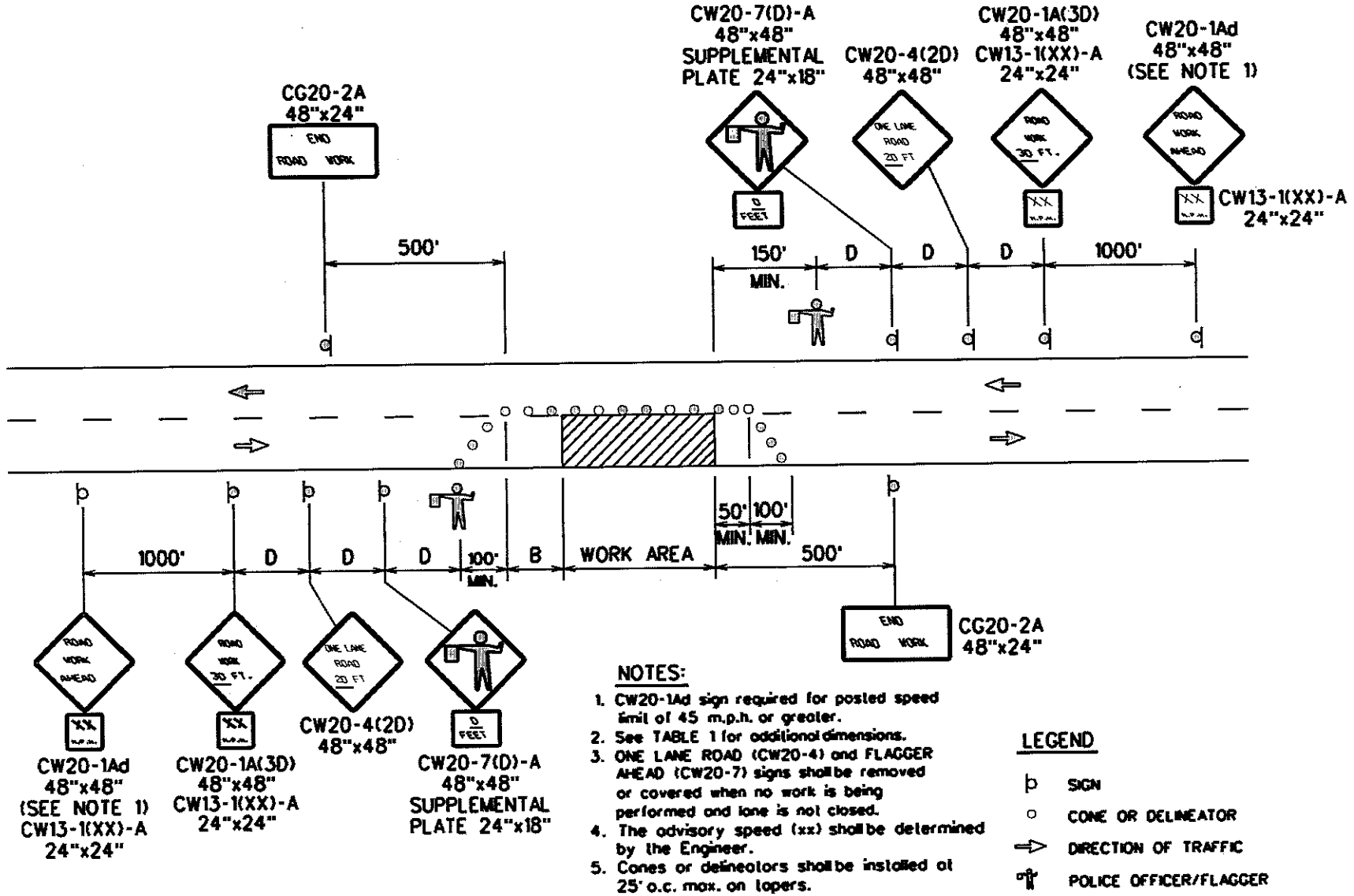
The Engineer will not pay for delineators separately. The Engineer will consider the cost for delineators as included in the contract price of the various contract items. The cost is for furnishing; installing; cleaning; maintaining correct placement; removing when required; and furnishing and installing sand bags or other accepted weights; and furnishing labor, materials, tools, equipment, and incidentals necessary to complete the work.

The Engineer will not pay for construction and maintenance of detours separately. The Engineer will consider the cost for construction and maintenance of detours as included in the contract price of the various contract items. The cost is for replacing installed traffic delineators that are lost, stolen, or damaged and not due to the Contractor's negligence; relocating of traffic delineators to the next detour phase; and furnishing labor, materials, tools, equipment, and incidentals necessary to complete the work."

(VI) Replace Figures 1 through 6 dated 5/01/93 with the attached Figure 1 dated r11/97, Figure 2 dated r2/97 and Figures 3 through 7 dated r10/96.

END OF SECTION

DE-0200(803)
645-4o
(Am-0001)



NOTES:

1. CW20-1Ad sign required for posted speed limit of 45 m.p.h. or greater.
2. See TABLE 1 for additional dimensions.
3. ONE LANE ROAD (CW20-4) and FLAGGER AHEAD (CW20-7) signs shall be removed or covered when no work is being performed and lane is not closed.
4. The advisory speed (xx) shall be determined by the Engineer.
5. Cones or delineators shall be installed at 25' o.c. max. on tapers.

LEGEND

- SIGN
- CONE OR DELINEATOR
- DIRECTION OF TRAFFIC
- POLICE OFFICER/FLAGGER

TWO-LANE HIGHWAY - ONE LANE CLOSED

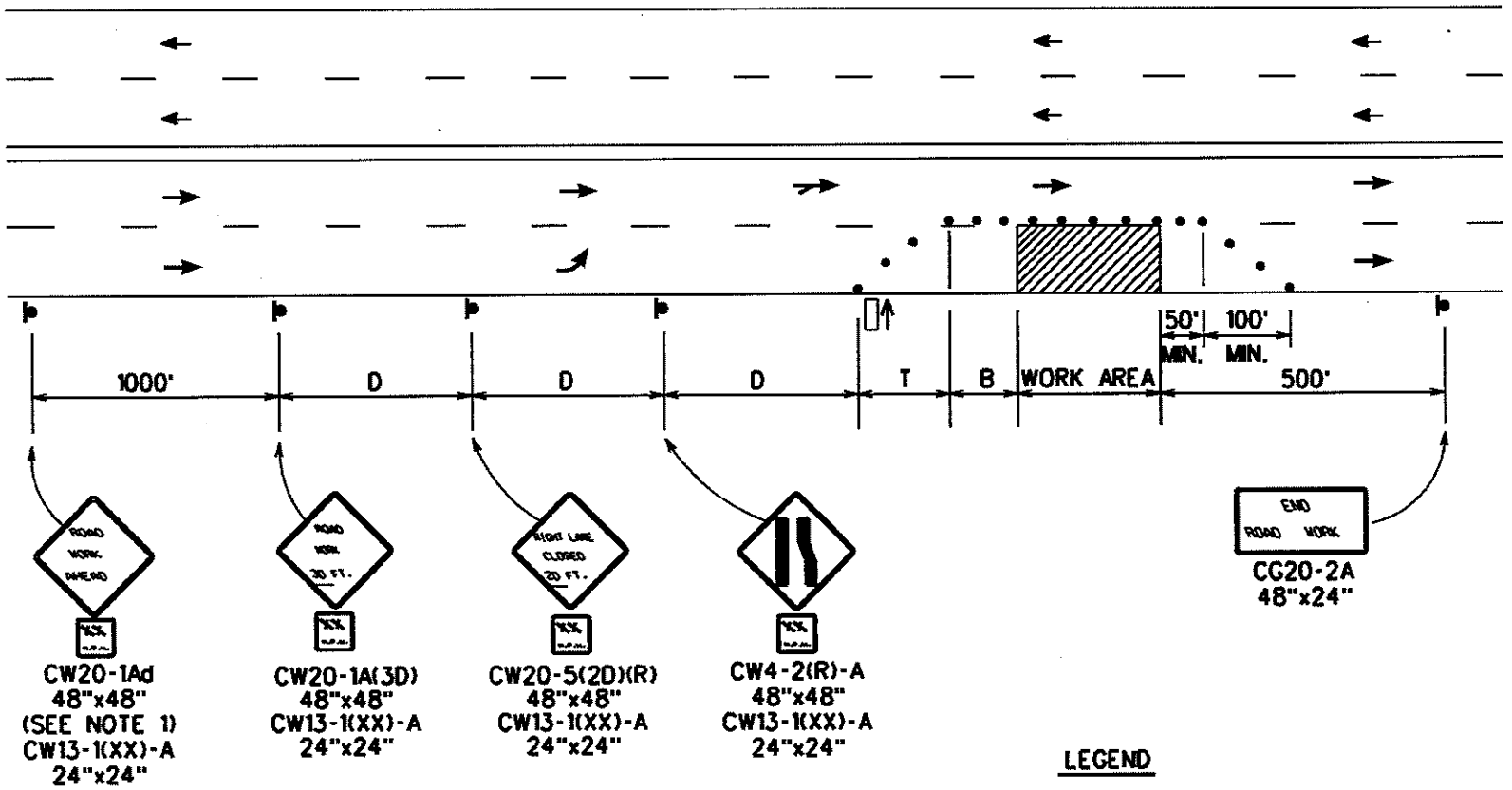
FIGURE 1 - TRAFFIC CONTROL PLAN

2/7/00

R11/97

DE-0200(803)
645-5a

(Am-0001)



NOTES:

1. CW20-1Ad sign required for posted speed limit of 45 m.p.h. or greater
2. See TABLE 1 for additional dimensions.
3. The advisory speed (xx) shall be determined by the Engineer.

LEGEND

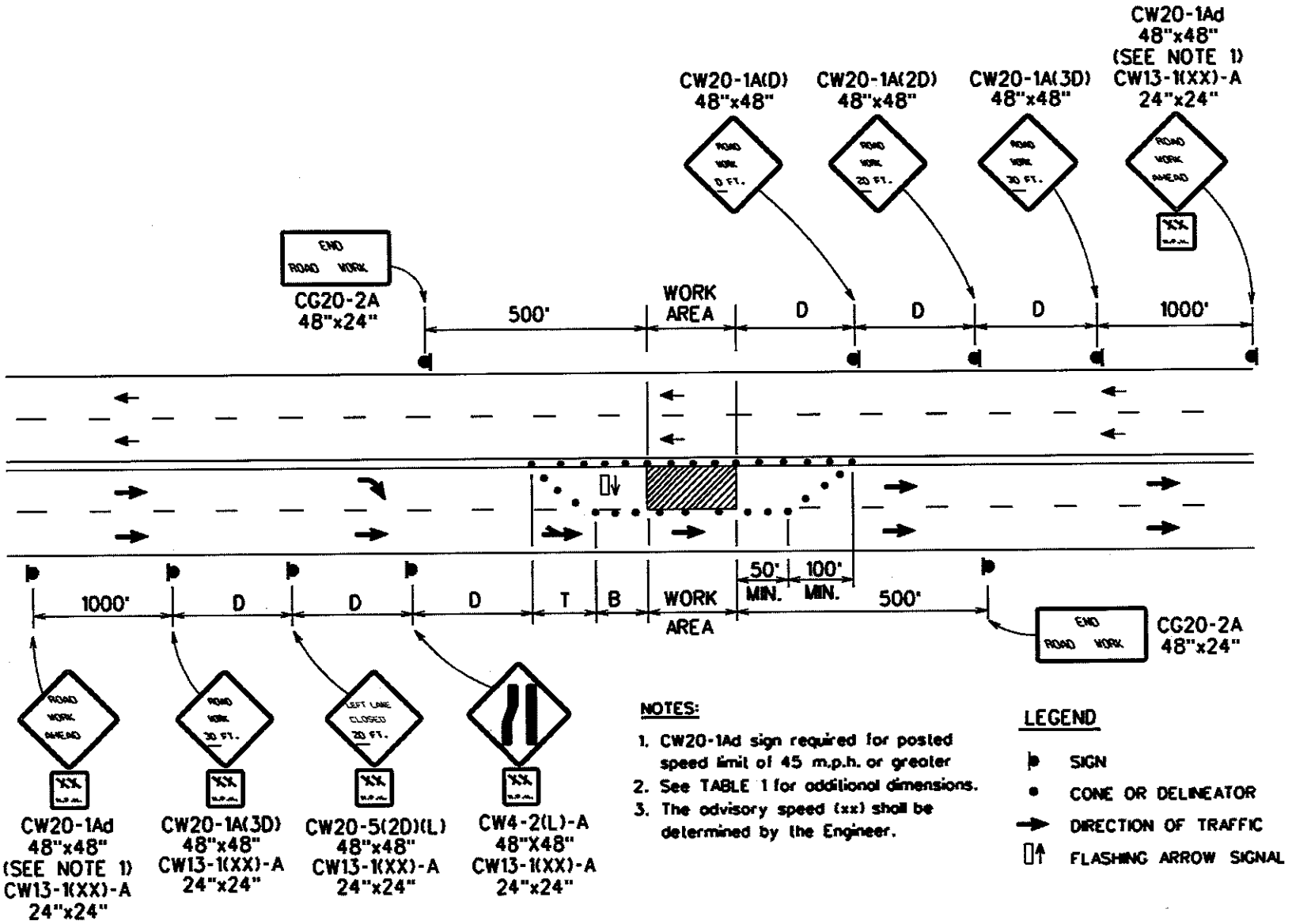
- SIGN
- CONE OR DELINEATOR
- DIRECTION OF TRAFFIC
- FLASHING ARROW SIGNAL

MULTILANE UNDIVIDED HIGHWAY - RIGHT LANE CLOSED

FIGURE 2 - TRAFFIC CONTROL PLAN

2/7/00

R2/97



NOTES:

1. CW20-1Ad sign required for posted speed limit of 45 m.p.h. or greater
2. See TABLE 1 for additional dimensions.
3. The advisory speed (xx) shall be determined by the Engineer.

LEGEND

- SIGN
- CONE OR DELINEATOR
- DIRECTION OF TRAFFIC
- FLASHING ARROW SIGNAL

MULTILANE UNDIVIDED HIGHWAY - LEFT LANE CLOSED

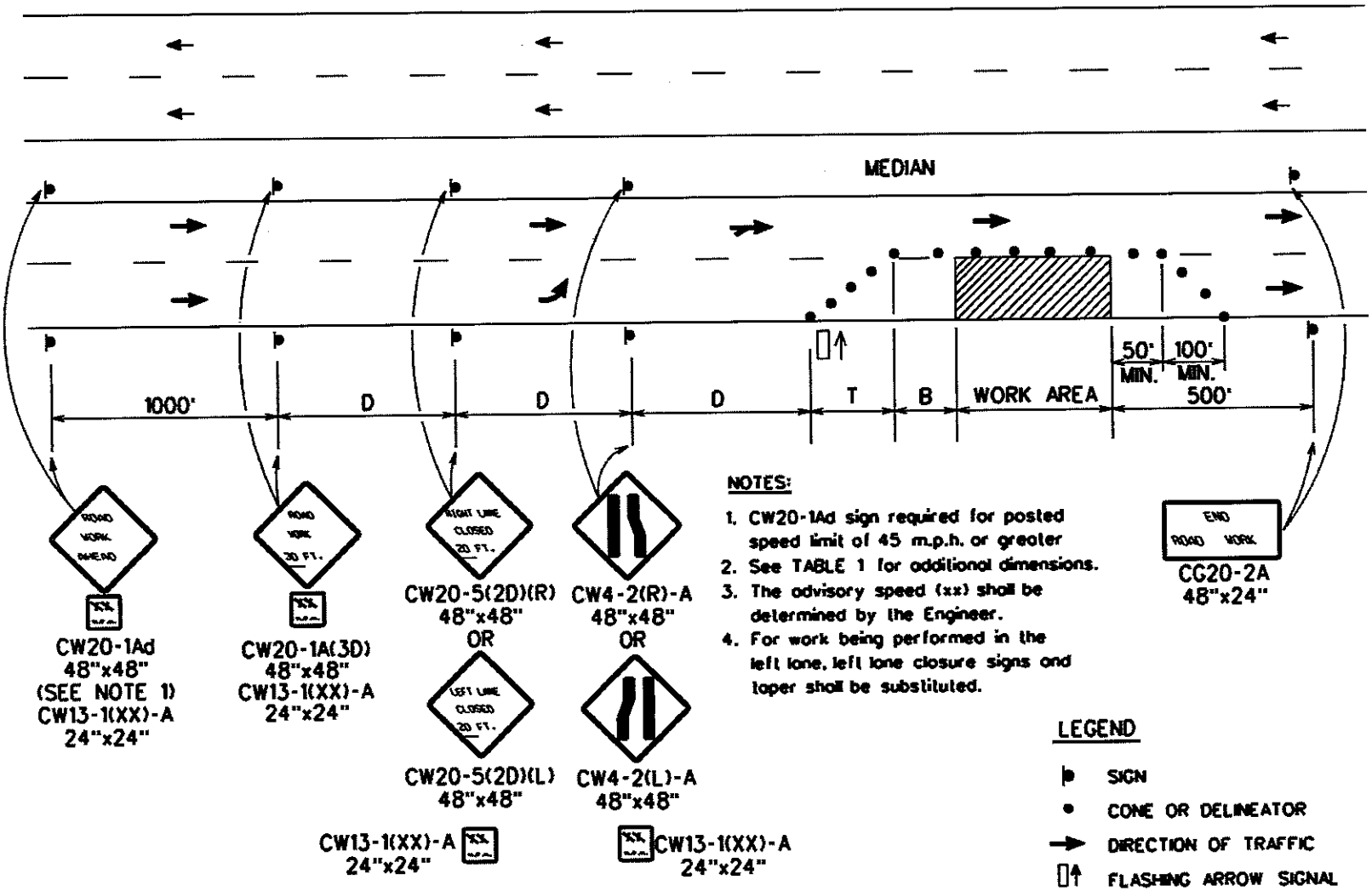
FIGURE 3 - TRAFFIC CONTROL PLAN

DE-0200(803)
645-6o

(Am-0001)

2/7/00

R10/96



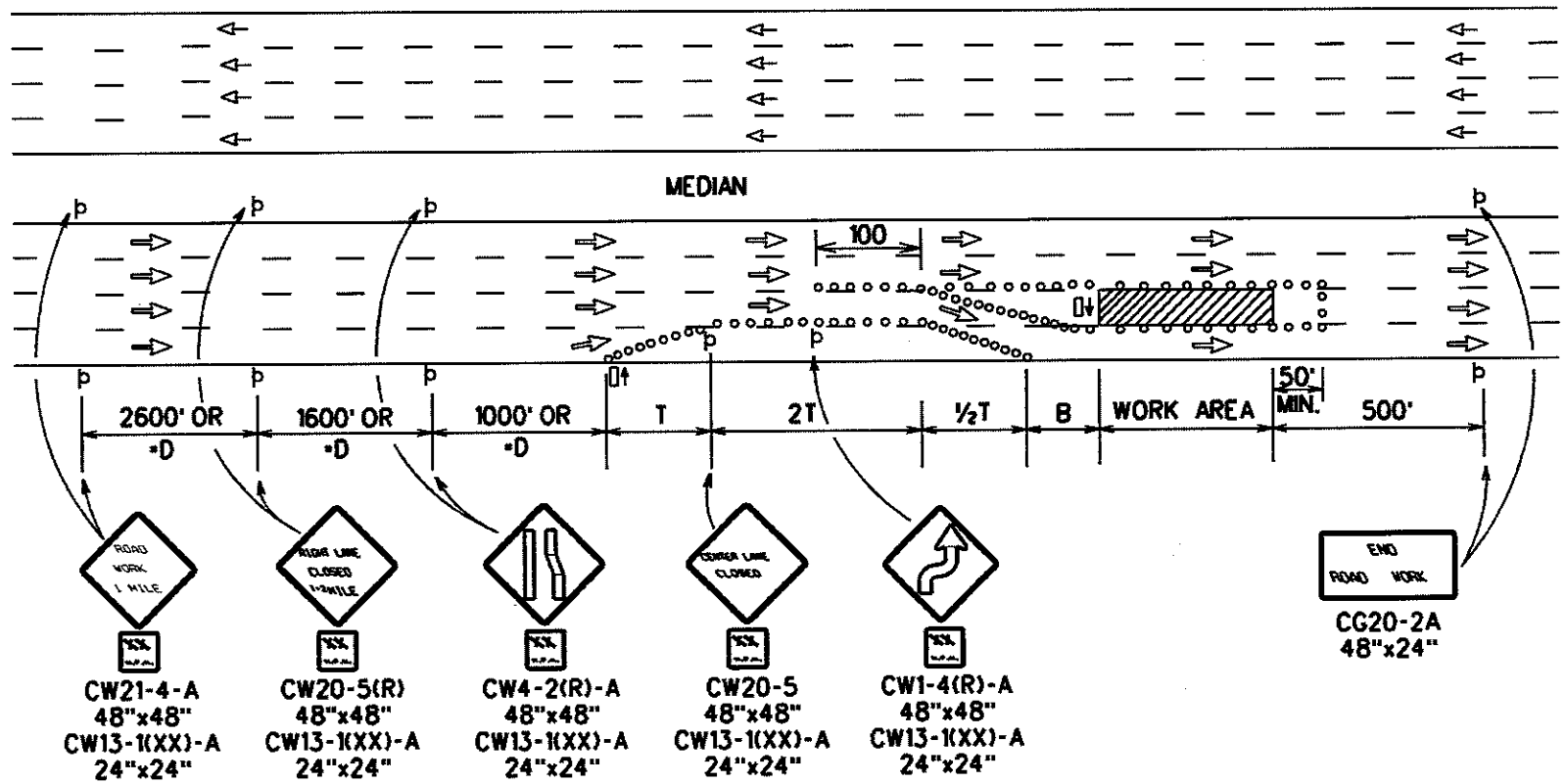
MULTILANE DIVIDED HIGHWAY - ONE LANE CLOSED

FIGURE 4 - TRAFFIC CONTROL PLAN

DE-0200(803)
645-7o
(Am-0001)

2/7/00

R10/96



NOTES:

1. For work being performed in the left center lane, use mirror image of above with appropriate left lane closure signs and taper.
2. For undivided highways, delete advance warning signs shown posted in median area.
3. The advisory speed (xx) shall be determined by the Engineer.
4. See TABLE 1 for additional dimensions.
*5. For posted speeds of 40 m.p.h. or less, use sign spacings and taper lengths from TABLE 1 and change signs CW21-4-A and CW20-5(R) to CW20-1A(30) and CW20-5(20)(R) as shown in Figure 4.

LEGEND

- SIGN
- CONE OR DELINEATOR
- DIRECTION OF TRAFFIC
- FLASHING ARROW SIGNAL

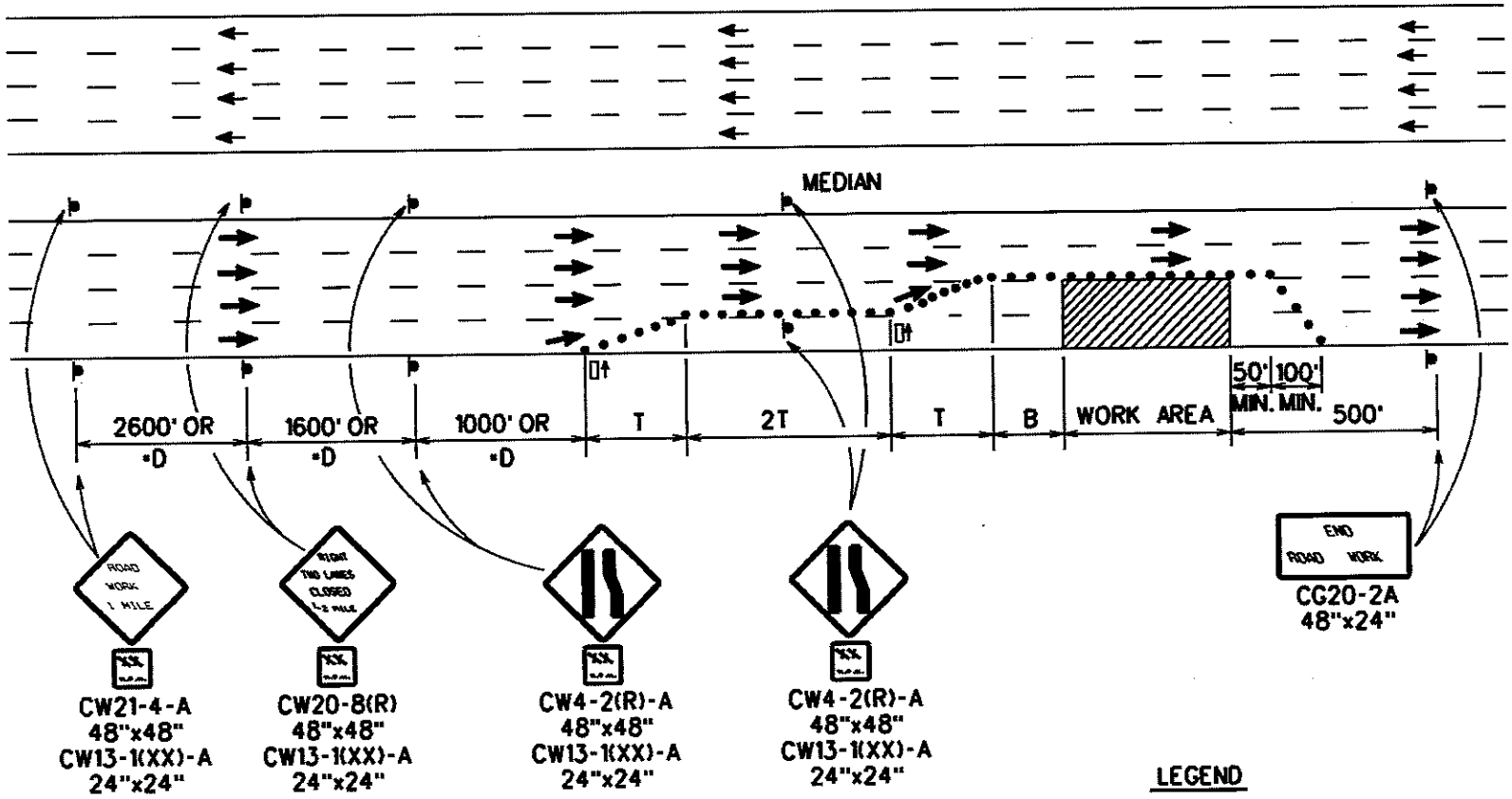
MULTILANE HIGHWAY - CENTER LANE CLOSED

FIGURE 5 - TRAFFIC CONTROL PLAN

DE-0200(803)
645-8o
(Am-0001)

2/7/00

R10/96



LEGEND

- SIGN
- CONE OR DELINEATOR
- DIRECTION OF TRAFFIC
- FLASHING ARROW SIGNAL

NOTES:

1. For work being performed in the left center lane, use mirror image of above with appropriate left lane closure signs and taper.
2. For undivided highways, delete advance warning signs shown posted in median area.
3. The advisory speed (xx) shall be determined by the Engineer.
4. See TABLE 1 for additional dimensions.
*5. For posted speeds of 40 m.p.h. or less, use sign spacings and taper lengths from TABLE 1 and change signs CW21-4-A and CW20-8(R) to CW20-1A(30) and CW20-8(20)(R) respectively.

MULTILANE HIGHWAY - MULTIPLE LANE CLOSED

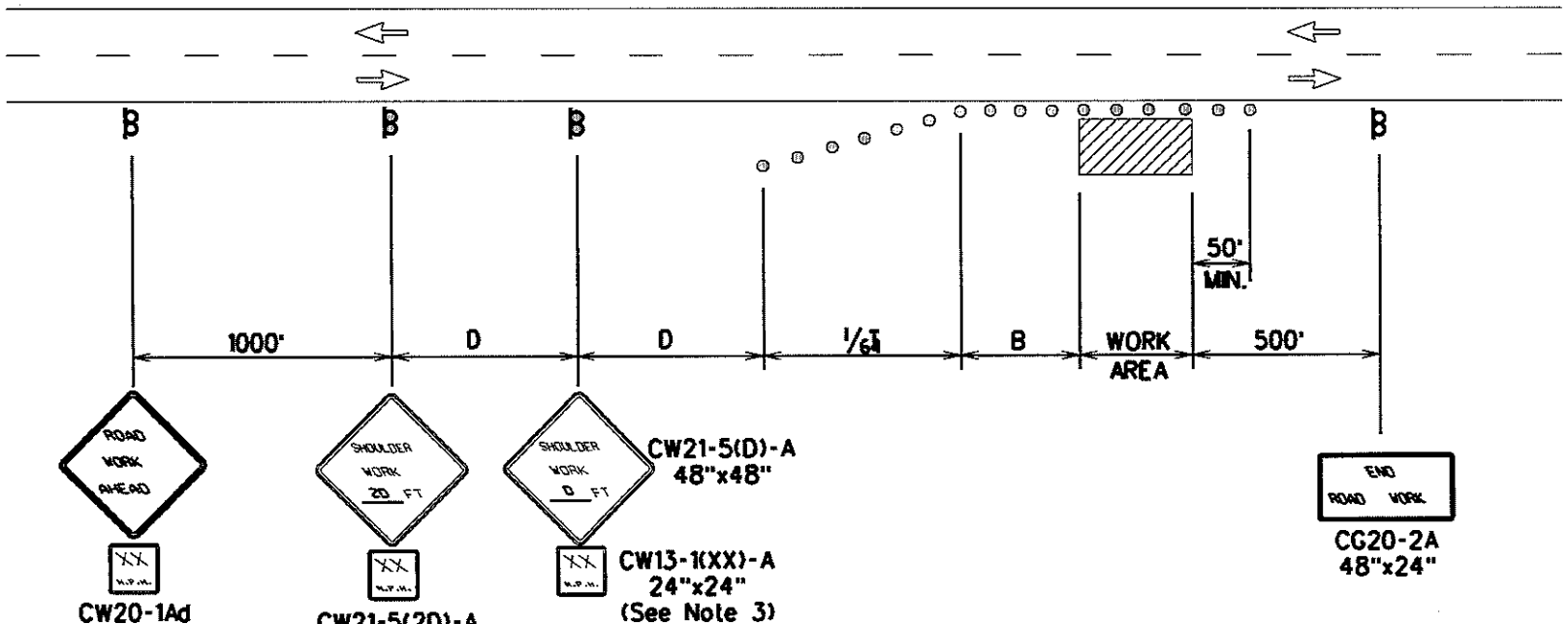
FIGURE 6 - TRAFFIC CONTROL PLAN

DE-0200(803)
645-90
(Am-0001)

2/7/00

R10/96

DE-0200(803)
645-10o
(Am-0001)



LEGEND

- Cone or Delineator
- Direction of traffic
- Sign

NOTES:

1. This plan may be used only if all road work, including equipment and workers are off the travel way.
2. See TABLE 1 for additional dimensions.
3. Engineer will determine if Advisory speed sign is necessary.
4. Contractor will provide necessary adjustments to accomodate Bicyclists and Pedestrians.
5. CW20-1Ad sign required for posted speed limit of 45 MPH or greater.
6. Signing is not required if the work area including equipment and workers, is outside the clear zone distance, as specified in the latest AASHTO Roadside Design Guide.

2/7/00

WORKING ON SHOULDER OR ROADSIDE

FIGURE 7 - TRAFFIC CONTROL PLAN

Make the following Section a part of the Standard Specifications:

"SECTION 647 - PORTABLE CONCRETE BARRIERS

647.01 Description. This section is for furnishing, installing, maintaining, relocating, and subsequently removing portable concrete barriers according to the contract.

647.02 Materials. Materials shall conform to the following:

Reinforcing Steel	709.01
Reflector Marker	712.21
Preformed Pavement Marking Tape	712.53
Structural Steel	713.01
Bolts and Nuts	713.03

647.03 Construction Requirements.

(A) Fabrication. Construct the portable concrete barriers according to Standard Plan TE - 64 and as modified herein. The barriers shall be in 20 - foot segments. Prior to fabrication of the portable concrete barrier, submit detailed shop drawings to the Engineer for acceptance.

(1) Forms. Forms shall be according to Section 503 - Concrete Structures.

(2) Placing Concrete. Moisten the form thoroughly immediately prior to the placing of the concrete. Place the concrete according to Section 503 - Concrete Structures.

(3) Curing. Steam or water-cure the portable concrete barriers according to Subsection 504.03(G) - Curing.

(4) Handling. Do not handle the portable concrete barriers until the concrete has attained a compressive strength of more than 3,000 pounds per square inch. Use the lifting holes to hoist the portable concrete barrier. Repair or replace units damaged by improper handling at no cost to the State.

The Engineer will permit stacking of precast units with prior

acceptance by the Engineer of the method to be employed by the Contractor.

(5) Accessories. Furnish and install one RM-2 reflector marker on top of the concrete barrier (not RM-3 as shown on the Standard Plan) and a longitudinal 4-inch by 20 feet permanent preformed pavement marking tape, Type I (color to match appropriate roadway pavement stripe) on the side of the barrier facing traffic on each section.

(6) Ownership. Upon completion of the project, the portable concrete barriers shall become the property of the State.

(B) Installation. Erect all units as shown on the plans or as specified by the Engineer. Set the units in a vertical position, closely following the roadway grade. The units shall have a maximum of 1/4-inch offset in any direction between adjacent panels at the connections. Horizontal alignment of the panels shall be such that any panel is not out of alignment by more than 1/2-inch from straight line. Furnish and install steel pins for connecting the barrier sections.

Remove, clean, repair, and store all units as specified by the Engineer upon completion of the work.

647.04 Method of Measurement. The Engineer will not measure portable concrete barriers.

647.05 Basis of Payment. The Engineer will pay for the accepted portable concrete barriers at the lump sum price in option B. The price includes full compensation for furnishing, installing, maintaining, relocating and removing the portable concrete barriers, including reflector markers, permanent preformed pavement marking tape, reinforcing steel, nuts and bolts; and furnishing labors, materials, tools, equipment, and incidentals necessary to complete the work.

END OF SECTION

Make the following section a part of the Standard Specifications:

SECTION 649 - INERTIAL BARRIER SYSTEMS

649.01 Description. This section is for furnishing and installing Inertial Barrier Systems according to the contract or as specified by the Engineer.

649.02 Materials. The Inertial Barrier System shall consist of the following:

(A) Modules. The modules shall consist of containers in 200, 400, 700, 1400, and 2100-pound sizes. The 200, 400, 700 and 1400-pound modules shall consist of a container with a minimum capacity of 14 cubic feet. The 2100-pound modules shall consist of a container with a minimum capacity of 21 cubic feet.

(B) Containers. The material shall be durable, weatherproof, and shall resist deterioration from ultraviolet rays. The color shall be yellow. The Container shall be of continuous molded construction and be nestable. The containers shall be a frangible polyethylene material which shatter upon impact to permit dispersion of the sand mass contained within.

(1) Lid. Each container shall have a black lid which locks securely over the top lip of the outer container. Material shall be durable, weatherproof, and shall be formulated to resist deterioration from ultraviolet rays.

(2) Insert. All 200, 400 and 700-pound containers will require a cone-shaped supporting insert used to support various sand masses. Cone inserts shall be of one-piece molded construction and be nestable.

(C) Sand. Sand placed into these modules shall be washed concrete sand conforming to ASTM-C-33 or equal.

Each Inertial Barrier System array shall be configured to provide a satisfactory average rate of deceleration (8 g's maximum preferred for each row) for errant vehicles in the weight ranges of 1810 to 4410 pounds. The Inertial Barrier System shall meet the requirements of NCHRP 350 for Test Level 3 for nonredirective gating crash cushions. For impact vehicles weighing between 1810 and 4410 pounds and traveling at speeds of up to 62 miles per hour, the maximum 24 inches occupant flail space velocity shall be less than 39 feet per second and the vehicles' highest 10 millisecond occupant ridedown acceleration shall be less than 20 g's.

The center of gravity of each properly-filled module shall be at a height which

will control the pitch of standard passenger vehicles.

The components of the modules shall interface to prevent leakage of sand contained therein. The interface shall, however, permit drainage of excess water contained within the sand mass.

649.03 Construction Requirements. The Contractor shall submit, within 7 days of contract award, a Certificate of Compliance to the Engineer stating that the Inertial Barrier System meets the requirements of NCHRP 350, Test Level 3.

Placement of the modules within an array and the geometric design of the array shall be as shown on the plans, as indicated by the manufacture's specifications or as specified by the Engineer based on the posted speed of the roadway. In locations where the barrier system separates two roadways, the barrier array and geometric design shall be based on the higher posted speed of the two roadways.

649.04 Method of Measurement. The Engineer will not measure inertial barrier modules.

649.05 Basis of Payment. The Engineer will pay for the accepted inertial barrier modules at the lump sum price in option B. The price includes full compensation for submitting a list of materials and equipment to be incorporated in the work; grading; furnishing, installing, and compacting aggregate subbase; furnishing, assembling, and installing an Inertial Barrier System; filling each installed inertial barrier module with sand; and furnishing labor, materials, tools, equipment and incidentals necessary to complete the work.

END OF SECTION

Make the following section a part of the Standard Specifications:

SECTION 649 - INERTIAL BARRIER SYSTEMS

649.01 Description. This section is for furnishing and installing Inertial Barrier Systems according to the contract or as specified by the Engineer.

649.02 Materials. The Inertial Barrier System shall consist of the following:

(A) Modules. The modules shall consist of containers in 200, 400, 700, 1400, and 2100-pound sizes. The 200, 400, 700 and 1400-pound modules shall consist of a container with a minimum capacity of 14 cubic feet. The 2100-pound modules shall consist of a container with a minimum capacity of 21 cubic feet.

(B) Containers. The material shall be durable, weatherproof, and shall resist deterioration from ultraviolet rays. The color shall be yellow. The Container shall be of continuous molded construction and be nestable. The containers shall be a frangible polyethylene material which shatter upon impact to permit dispersion of the sand mass contained within.

(1) Lid. Each container shall have a black lid which locks securely over the top lip of the outer container. Material shall be durable, weatherproof, and shall be formulated to resist deterioration from ultraviolet rays.

(2) Insert. All 200, 400 and 700-pound containers will require a cone-shaped supporting insert used to support various sand masses. Cone inserts shall be of one-piece molded construction and be nestable.

(C) Sand. Sand placed into these modules shall be washed concrete sand conforming to ASTM-C-33 or equal.

Each Inertial Barrier System array shall be configured to provide a satisfactory average rate of deceleration (8 g's maximum preferred for each row) for errant vehicles in the weight ranges of 1810 to 4410 pounds. The Inertial Barrier System shall meet the requirements of NCHRP 350 for Test Level 3 for nonredirective gating crash cushions. For impact vehicles weighing between 1810 and 4410 pounds and traveling at speeds of up to 62 miles per hour, the maximum 24 inches occupant flail space velocity shall be less than 39 feet per second and the vehicles' highest 10 millisecond occupant ridedown acceleration shall be less than 20 g's.

The center of gravity of each properly-filled module shall be at a height which

will control the pitch of standard passenger vehicles.

The components of the modules shall interface to prevent leakage of sand contained therein. The interface shall, however, permit drainage of excess water contained within the sand mass.

649.03 Construction Requirements. The Contractor shall submit, within 7 days of contract award, a Certificate of Compliance to the Engineer stating that the Inertial Barrier System meets the requirements of NCHRP 350, Test Level 3.

Placement of the modules within an array and the geometric design of the array shall be as shown on the plans, as indicated by the manufacture's specifications or as specified by the Engineer based on the posted speed of the roadway. In locations where the barrier system separates two roadways, the barrier array and geometric design shall be based on the higher posted speed of the two roadways.

649.04 Method of Measurement. The Engineer will not measure inertial barrier modules.

649.05 Basis of Payment. The Engineer will pay for the accepted inertial barrier modules at the lump sum price in option B. The price includes full compensation for submitting a list of materials and equipment to be incorporated in the work; grading; furnishing, installing, and compacting aggregate subbase; furnishing, assembling, and installing an Inertial Barrier System; filling each installed inertial barrier module with sand; and furnishing labor, materials, tools, equipment and incidentals necessary to complete the work.

END OF SECTION

Make the following Section a part of the Standard Specifications:

"SECTION 672 - RESET PORTABLE CONCRETE GUARDRAIL SECTIONS

672.01 Description. This work shall consist of removing, transporting, setting and resetting the intermediate and terminal portable concrete guardrail sections in the new locations as shown on Plans and as ordered by the Engineer. This work also includes transportation and final placement of the portable concrete guardrail sections to Maui District Base Yard.

672.02 Construction Requirements.

(A) The units shall be removed from the stockpile at the casting yard or from the project site or from the Maui District Baseyard, transported and set at the location shown on the Plans or as ordered by the Engineer.

(B) All units shall be erected as noted on the Plans or as ordered by the Engineer. The units shall have a maximum of 1/4 inch offset in any direction between adjacent panels at the connections. Horizontal alignment of the panels shall be such that any panel is not out of alignment by more than 1/2-inch from straight line.

(C) The units shall be set in a vertical position, closely following the roadway grade. All installations shall be done in a first class workman-like manner.

(D) All units shall be removed, cleaned, repaired and stored as ordered by the Engineer upon completion of the work.

(E) The Contractor shall furnish and install one (1) RM-2 reflector marker on each section (not RM-3 as shown on the Standard Plan) and a longitudinal 4-inch wide, 20 feet long permanent preformed pavement marking tape, Type 1 (color to match appropriate pavement stripe) on the side of the guardrail facing traffic on each section. The Contractor shall furnish and install steel pins for connecting the guardrail sections.

672.03 Method of Measurement. The Engineer will not measure resetting portable concrete guardrail sections. Each section of the intermediate and terminal portable concrete guardrail panel shall be considered as a unit.

672.04 Basis of Payment. The Engineer will pay for the accepted resetting portable concrete guardrail sections at the lump sum price in option B, as installed as shown on the plans. Resetting concrete guardrail to facilitate the Contractor's work shall not be paid for separately and shall be considered incidental to the various contract items. Payment for resetting the sections shall be full compensation for furnishing all labor, materials, tools, equipment and incidentals necessary for removing sections from the casting yard, from locations on-site or

from the Maui District Baseyard, transporting them to the new locations, preparing beds, setting sections, furnishing, installing and maintaining reflector markers and permanent pavement marking tape, furnishing connection pins, connecting sections as necessary to complete a satisfactory installed unit, maintaining units, and final removal, cleaning, repairing and storing sections within the Maui District Baseyard or as ordered by the Engineer.

END OF SECTION