SECTION 614 GUARD FENCE, BEAM GUARD, MARKER POSTS, AND CRASH CUSHIONS

614.1 Description

(1) This section describes constructing cable guard fence, steel plate beam guard, steel three beam structure approach, anchorages, terminal ends, crash cushions, including replacement cartridges; sand barrels, and marker posts. This work also includes constructing and removing temporary steel plate beam guard and anchorages; the salvaging of guard fence; and the adjusting of steel plate beam guard.

614.2 Materials

614.2.1 General

(1) Furnish materials conforming to the following:

Concrete	section 501
Paint	section 517
Creosote-coal tar solution	507.2.3
Structural steel	section 506
Steel reinforcement	section 505
Miscellaneous metals	section 506
Lumber and timber	section 507
Pentachlorophenol	507.2.3
Petroleum solvents	507.2.3
Chromated copper arsenate	507.2.3
Ammoniacal copper arsenate	507.2.3
Ammoniacal copper zinc arsenate	507.2.3
Copper napthenate solution	507.2.3

(2) Furnish grade A, A-FA, A-S, A-T, A-IS, or A-IP concrete conforming to 501.2.

614.2.2 Cable Guard Fence and Miscellaneous Hardware

614.2.2.1 General

(1) Use cable, fittings, and miscellaneous hardware for constructing cable guard fence conforming to the requirements specified below and to all supplementary requirements for design and quality of appurtenant fittings and hardware as the plans show.

614.2.2.2 Cable for Guard Fence

(1) Use wire cable conforming to AASHTO M 30.

(2) Unless specified otherwise on the plans or in the contract, use 3/4-inch (19 mm) wire rope, type I, class A coating.

614.2.2.3 Hardware for Cable Guard Fence

614.2.2.3.1 General

(1) Use zinc coated parts, hardware, and fittings. Use a zinc coating of the quality and weight specified in AASHTO M 232.

(2) Use plate washers, hook bolts, cable fittings, bearing blocks, splice, turnbuckle, and anchor assemblies conforming to plan dimensions and requirements.

(3) Unless specified otherwise, for assembling the cable guard fence use bolts conforming to ASTM F 568, class 4.6, and nuts conforming to AASHTO A 563, class 5.

614.2.2.3.2 Fittings

(1) Externally threaded fittings, for example, end tie rods, anchor, and splicing rods that transmit direct tensile stress shall have a minimum tensile strength of 75 000 pounds per square inch (517 MPa). All internally threaded fittings, for example, turnbuckles, cable sockets, and nuts shall withstand a proof load equal to 85 percent of the proof load requirements for nuts specified in Table 3 of ASTM A 563. All cable splices and connections shall withstand a proof load equal to the tensile strength required of the attached wire rope cable.

(2) Use rectangular plate washers and cable clamps made from steel and having a tensile strength of not less than 60 000 pounds per square inch (414 MPa). Use plain washers made of ferrous metal conforming to ANSI B 18.22.1, M.

(3) Use concrete bearing blocks made of precast reinforced concrete conforming to the design and dimensions the plans show.

614.2.2.3.3 Anchor Rod Assembly

(1) An anchor rod assembly includes anchor rod, turnbuckle, anchor block, and all plates, washers, and nuts required. Ensure all rods have 1 1/4 inch (32 mm) nominal diameter unless shown otherwise. Use turnbuckles made from drop-forged steel or malleable iron with a take-up of at least 6 inches (150 mm). The complete assembly must have a minimum tensile strength of 75 000 pounds per square inch (517 MPa).

(2) Use anchor blocks made of precast reinforced concrete conforming to the design and dimensions the plans show.

614.2.3 Steel Plate Beam and Fittings

(1) Use steel plate beam conforming to class A, type II, beam in AASHTO M 180, with the following exceptions and requirements. The single-spot test is required. Shape, punch, and fabricate the beams, terminal and end sections, post anchor brackets, and other fittings as the plans show. Protect the beam and fittings by elevating off ground and from surface runoff before erecting. The department may reject all elements abraded through the zinc coating, or if white rust or zinc oxide has formed on them. The contractor may mechanically zinc coat bolts, nuts, and washers.

(2) Furnish plates, anchor plates, post mounting brackets, and channel rail elements made of structural steel conforming to the requirements of 506.2.2.1. Use steel tubes for breakaway posts conforming to ASTM A 500, grade B. Zinc coat plates, anchor plates, and post mounting brackets and channel rail elements according to AASHTO M 111.

(3) Use wire cable for anchorages conforming to 614.2.2.2.

(4) Use cable assemblies for anchorages conforming to the following:

1. Use hot-rolled carbon steel swaged fittings conforming to ASTM A 576, grade 1035, and are annealed suitable for cold swaging. Zinc coat the swaged fitting according to ASTM A 123 before swaging. Drill a lock pinhole to accommodate a 1/4-inch (7 mm), plated, spring steel pin through the head of the swage fitting to hold the stud in the proper position. After zinc coating, the contractor may tap the head 0.023 inch (0.6 mm) over the ANSI class 2B tolerance.
2. Use a stud conforming to ASTM A 568 class 8.8 and zinc coat according to ASTM A 153. Ensure the threads have a class 2A fit before zinc coating. Before zinc coating, mill a 3/8-inch (10 mm) slot into the stud end for the locking pin.
3. Ensure wire rope with connecting hardware attached develop the full 25 Kip (110 KN) strength of a single cable.

614.2.3.1 Energy Absorbing Terminal

(1) Furnish and use materials in energy absorbing terminals for steel plate beam guard conforming to the manufacturer's specifications.

614.2.4 Sawed Posts for Beam Guard

614.2.4.1 Species of Wood

(1) Construct steel plate beam guard or steel plate beam median guard from sawed posts of one of the following species:

Douglas fir	Southern pine	Ponderosa pine	Jack pine	White pine
Red pine	Western hemlock	Western larch	Hem-fir	Oak

614.2.4.2 Requirements

(1) Ensure that posts are the size the plans show and conform to the nominal and minimum dimensions tabulated in 507.2.2.3. The contractor does not have to surface the posts. Provide the net length the plans show after setting and shaping.

(2) Use stress graded posts rated at1200 psi (8 280 kPa) f_b or higher. Determine the stress grade rating for douglas fir, western larch, and southern pine as specified in 507.2.2.4.

(3) For hem-fir, hemlock, red pine, white pine, jack pine, ponderosa pine, and oak; conform to the following:

SPECIES			WESTERN HEMLOCK, HEM-FIR, RED PINE, WHITE PINE, JACK PINE, PONDEROSA PINE		OAK	
MAXIMUM SLOPE OF GRAIN			1 in 15		1 in 12	
NOMINAL WIDTH OF FACE			6" (152 mm)	8" (203 mm)	6" (152 mm)	8" (203 mm)
SHAKES, CHECKS, AND SPLITS		GREEN	1" (25 mm)	1 3/8" (35 mm)	2 3/8" (60 mm)	3 1/8" (79 mm)
		SEASONED	1 1/2" (38 mm)	2" (51 mm)	2 5/8" (67 mm)	3 1/2" (89 mm)
MAXIMUM WANE			1" (25 mm)	1 3/8" (35 mm)	1 1/8" (29 mm)	1 5/8" (41 mm)
MAXIMUM ALLOWABLE KNOTS	NARROW FACE	MIDDLE 1/3 OF LENGTH	1 3/8" (35 mm)	1 5/8" (41 mm)	2 1/8" (54 mm)	2 3/8" (60 mm)
		END[1]	2 3/4" 70 mm)	3 1/4" (83 mm)	4 1/4" (108 mm)	4 3/4" (121 mm)
		SUM IN MIDDLE 1/2 OF LENGTH[2]	11" (279 mm)	13" (330 mm)	17" (432 mm)	19 (483 mm)
	WIDE FACE	EDGE KNOT N MIDDLE 1/3 OF LENGTH	1 3/8" (35 mm)	1 5/8" (41 mm)		
		EDGE KNOT AT END[1	2 3/4" 70 mm)	3 1/4" (83 mm)		
		CENTERLINE	1 3/8" (35 mm)	1 7/8" (48 mm)	2 1/4" (57 mm)	2 7/8" (73 mm)
		SUM IN MIDDLE 1/2 OF LENGTH	5 1/2" (140 mm)	7 1/2" (190 mm)	9" (229 mm)	11 1/2" (292 mm)

[1] But do not exceed the maximum allowable knot on the centerline of the wide face of the same piece.

[2] But do not exceed 4 times the maximum allowable knot on the centerline of the wide face of the same piece.

614.2.5 Round Posts for Cable Guard Fence

(1) Use one of the softwood species listed in 614.2.4.1

(2) Cut and manufacture posts from live, green, growing trees. Stack and season these posts in a manner approved by the American Wood Standards.

(3) Peel the entire length of each post, closely trim knots, saw both ends square, and shave the entire length of the post to the white.

(4) Make the post a sufficient length to provide, after setting and shaping, the net length the plans show. Ensure the top diameter of each post after shaving is within 1/2 inch (13 mm) less than and 1 1/4 inch (32 mm) more than the nominal top diameter the plans show.

(5) Ensure all posts are free from sap rot, woodpecker holes, plugged holes, ant eaten areas, and hollow knots extending to center of post. Butt rot may not exceed 5 percent of the butt area. Ensure that the tops of all posts are sound. The department will allow one pipe rot not exceeding 3/8 inch (10 mm) in diameter exist in a cedar post having a net top diameter of 6 inches (150 mm) or more.

(6) Use posts that are sound and show no evidence of excessive checking, short kinks, or one-way sweep exceeding 2 inches (50 mm). Posts may have winding twist unless unsightly and excessive.

(7) The contractor shall not use posts having both the maximum crook and maximum butt rot. Not more than 10 percent of the posts required under the contract may contain the maximum crook or the maximum butt rot.

(8) The department may reject posts for other defects of any kind that give a post an unsightly appearance or impair its durability or strength.

(9) Complete all debarking, trimming and sizing operations before treatment.

614.2.6 Preservative Treatment

(1) Unless specified otherwise on the plans or in the contract, treat all posts furnished for beam guard or guard fence with one of the following:

- Creosote-coal tar solution.
- Pentachlorophenol[1] solution, in heavy petroleum solvent.
- Chromated copper arsenate solution.
- Ammoniacal copper arsenate solution.
- Ammoniacal copper zinc arsenate solution.
- Copper napthenate solution.

[1] The pentachlorophenol-petroleum solution should contain a minimum of 5 percent pure pentachlorophenol, by weight, of the total solution.

(2) Treat all posts used in one continuous section of run of beam guard or guard fence with the same type of preservative.

(3) Use the pressure process to apply preservative treatment to the posts as specified in 507.2.2.6.

614.2.7 Marker Posts

614.2.7.1 Wooden Posts

(1) Use round posts made from one of the softwood species listed in 614.2.4.1.

(2) Ensure wooden marker posts conform to 614.2.5. Except, the department may allow a one-way sweep exceeding 3 inches (75 mm).

(3) Unless provided otherwise, use untreated wooden marker posts.

614.2.7.2 Recycled Plastic Posts

(1) Use recycled plastic posts for marker posts for right-of-way manufactured from recycled plastic of at least 95 percent high-density polyethylene, obtained from post consumer products. Use posts colored yellow throughout with an ultraviolet ray inhibitor added to prevent color fading. Use Federal Highway Standard 595a-33538 according to the Federal Highway Administration color tolerance chart for standard highway yellow. Ensure posts are solid and free from cracks or other defects that cause them to have an unsightly appearance or impair their durability or strength. Do not use posts having a one-way sweep exceeding 1/4 inch (6 mm). Furnish and use posts conforming to the details and dimensions the plans show and are able to sustain normal loadings at temperatures between –25 F and 100 F (-32 C and 38 C) without distortion.

614.2.8 Sand Barrels

(1) Furnish sand barrels from the department's approved products list or as the contract specifies. Fill barrels with sand conforming to the requirements of 501.3.6.3. Mix sand with sodium chloride conforming to the requirements of AASHTO M 143.

614.2.9 Crash Cushions

(1) Furnish permanent and temporary crash cushions from the department's approved products list or as the contract specifies. Submit a manufacturer set of design details to engineer before installing.

614.3 Construction

614.3.1 Placing Posts for Cable Guard Fence

(1) Under the Cable Guard Fence bid item, provide 3 lines of cable supported on treated wooden posts, unless specified otherwise.

(2) Set the posts in holes dug in the ground at the required locations. Compact the bottom of the holes so the posts have a stable foundation.

(3) The department will allow a tolerance of +/- 3 inches (75 mm) in the depth of holes for posts, provided the post length is adequate to obtain required elevation for finished top.

(4) Space the posts as the plans show, and set plumb with the front faces in a straight line or, if on a curve, at a uniform distance from the centerline. After placing the posts, backfill the holes with engineer-approved material, compact in layers in a manner that does not shift the posts from the correct position or alignment. Then drive the posts to a firm bearing with at least a 13-pound (6 kg) maul. Determine the finished elevation of the post top after setting the post, and cut off the top of the post to this elevation, as the plans show. Round the tops of round posts in a manner that centers the dome on the axis of the post. After cutting off treated posts, apply 2 coats of the preservative originally used to treat the post to the cut surfaces.

(5) The contractor may drive posts instead of setting posts in previously dug holes and backfilling, except if bearing blocks are required. If driving posts, then drive them plumb, to the required depth and alignment, with adequate lateral stability. Ensure the shoulders and adjacent slopes are not damaged by the driving operations. Remove and replace any post that fails to conform to the above requirements, or becomes damaged below cutoff during driving with a sound post.

614.3.2 Placing Anchors, Cable, and Fittings for Cable Guard Fence

(1) Under the Anchorages for Cable Guard Fence bid item, furnish cast in place concrete anchors for cable guard fence.

(2) Place and securely fasten the anchors, cables and fittings in a competent manner, as the plans show. If bolts project more than one inch (25 mm) from the nut, cut them off 1/2 inch (13 mm) from the nut, or as the plans show, and burr them. Paint the ends of cut-off bolts with an engineer-approved zinc-rich paint. Bore holes for cable supports after setting the posts to line and grade.

(3) Place end and intermediate anchorages and bearing blocks at the locations the plans show.

(4) Excavate the trenches for anchor blocks to the neat lines of the anchor block to be placed, as the plans show. Excavate in a manner that avoids further disturbance of the earth between the block and the anchored posts than necessary to allow installing the anchor rod. Place the block with anchor rod in place, against the undisturbed earth. The contractor shall not apply final tension to the anchor assembly until after completing the backfilling. Place and compact backfill material in layers. Excavate holes for bearing blocks to the neat lines of the block and place the block on undisturbed soil and level to allow the post’s full bearing.

(5) After completing the anchor assemblies, adjust and fasten the cables properly and securely, draw uniformly taut and then loosen as the plans show for the applicable temperature range.

(6) Affix reflective sheeting, 3 inches (75 mm) wide, conforming to 637.2.2.1 for standard reflective sheeting, Silver White No. 2, mounted on flexible aluminum alloy, to each end post and at maximum intervals of 100 feet (30 m) on intermediate posts with a minimum of 3 strips on all installations.

(7) Wrap the reflective strips completely around each post before installing the post plate washers.

(8) If manufacturing concrete used in precast anchor and bearing blocks, conform to 614.3.3.

614.3.3 Erecting Steel Plate Beam Guard

614.3.3.1 General

(1) Under the Steel Plate Beam Guard Class A bid item, provide a single steel beam, fabricated from steel plate to specified shape and dimensions, attached to treated posts and offset blocks, unless specified otherwise.

(2) Under the Steel Plate Beam Guard Over Low-Fill Culverts Class A bid item, provide nested class A beam guard spanning less than 25 feet (7.62 m) over culvert structures with shallow cover.

(3) Under the Steel Plate Beam Guard Class B bid item, provide a single steel beam, fabricated from steel plate to specified shape and dimensions, supported on treated wood posts, unless specified otherwise.

(4) Under the Steel Plate Beam Median Guard bid item, provide 2 lines of steel beams and 2 lines of steel channels, each line supported on opposite sides of a single line of treated wood posts with the steel beams attached to offset blocks, unless specified otherwise.

(5) Under the Steel Plate Beam Guard Temporary and Steel Thrie Beam Structure Approach Temporary bid items, furnish, install, and maintain temporary beam guard conforming to the requirements for Steel Plate Beam Guard Class A, except the contractor may furnish used materials. Remove and dispose of the beam guard when no longer needed.

(6) Under the Steel Thrie Beam Structure Approach bid item, provide beams fabricated from steel plate to specified shape and dimensions, attached to treated wood posts and offset blocks, unless specified otherwise.

(7) Set or drive posts at the spacing the plans show and in the manner specified above for cable guard fence. After setting or driving the posts to proper line and grade, bore holes at the proper locations to receive the bolts for attaching offset blocks, beam rail, and channel rail, if required. If using offset blocks, make them conform to the dimensions the plans show, of the same materials, and have the same preservative treatment specified for the posts. After erection, cut off the posts at the required elevation and in the manner the plans show. Give all cut surfaces of posts or offset blocks 2 applications of the preservative originally used to treat the posts. Instead of the original preservative, the contractor may use a 2-percent solution of copper naphthenate conforming to AWPA Standard P8.

(8) Erect beam rails that splice by lapping, with the lap in the direction of traffic. Place the round head of bolts that go through the rail on the traffic side. Equip the ends of each section of beam guard, if not attached to a structure, or to cast in place concrete anchors, with terminal sections conforming to plan.

(9) Make all splices, including splices of existing rail to new rail, at posts. Ensure the splice, including the number and dimensions of holes and bolts, conforms to the requirements for splices for new railing as the plans show.

(10) Cut beam rails, if necessary, by shearing. Drill holes for bolts. The contractor shall not use cutting torches.

(11) Install reflectors conforming to plan details at the locations, spacing, and as the plans specify.

(12) After erecting the rails, cut off all anchor bolts that project more than one inch (25 mm) from the nut, to 1/2 inch (13 mm) from the nut, except studs for cable assemblies. Burr the threaded end of the cutoff bolt. After completing erection, paint the ends of cut-off bolts and all abraded or damaged zinc coated surfaces with 2 coats of engineer-approved zinc-rich paint. Clean the damaged and adjacent areas thoroughly before applying.

(13) Under the Anchorages for Steel Plate Beam Guard bid item, furnish cast in place concrete anchorages for Steel Plate Beam Guard Class A or Steel Plate Beam Median Guard.

(14) Under the Anchorages for Steel Plate Beam Guard Temporary bid item, furnish and remove cast in place concrete anchorages for temporary steel plate beam guard. Conform to the requirements for permanent beam guard anchorages.

(15) Under the Anchorages for Steel Plate Beam Guard bid item of the specified type, furnish cable anchorages for class A steel plate beam guard.

(16) Under the Anchor Assemblies for Steel Plate Beam Guard bid item, furnish and install anchors for steel plate beam guard and steel thrie beam structure approach in the parapets of structures.

(17) The contractor shall not use forms when placing the concrete for the anchor. Fill the entire excavation with concrete to the indicated top of the anchor the plans show.

(18) For the manufacture of concrete, the engineer may waive the requirements for proportioning by weight and may allow mixers or mixing methods other than those ordinarily specified, provided they produce a concrete mixture equal in quality to that produced by equipment and methods specified in section 501.

(19) If casting the concrete anchor, ensure the rods and rail element are in place. The contractor shall not apply forces to the rail element embedded in the concrete anchor until after the concrete attains sufficient strength to support the force or a minimum of 3 days.

(20) Place and securely fasten the cable assemblies for anchorages in a competent manner, and as the plans show.

614.3.3.2 Energy Absorbing Terminal

(1) Under the Steel Plate Beam Guard Energy Absorbing Terminal bid items, furnish and install energy absorbing terminal ends according to the manufacturer's instructions and as the plans show.

(2) Under the Steel Plate Beam Guard Energy Absorbing Terminal Temporary bid item, also remove and dispose of crash cushions when no longer needed.

614.3.4 Adjusting Steel Plate Beam Guard

(1) Under the Adjusting Steel Plate Beam Guard bid item, adjust the existing steel plate beam to the plan height. Use the existing guardrail beam, bolts, posts, and block unless they become damaged or lost in this operation. Replace damaged material.

614.3.5 Salvaged Guard Fence

(1) Under the Salvaged Guard Fence bid item, remove and reset existing cable guard fence or steel plate beam guard.

(2) Remove and store the cables or beam rails, and all posts, offset blocks, bolts, fittings, and appurtenant hardware until re-erected in a manner that prevents damage.

(3) Re-erect the guard fence at the new location in the same manner specified above for erection of that particular type of guard fence.

(4) For salvaged cable guard fence, the contractor may construct the anchor assemblies with suitable salvaged parts supplemented with new parts as required.

614.3.6 Marker Posts

(1) Under the Marker Posts bid item, provide untreated round wooden posts, unless specified otherwise, erected, and painted.

(2) Under the Marker Posts for Right-of-Way bid item, provide square recycled plastic posts, erected with state-furnished markers attached.

614.3.6.1 Placing Wooden Posts

(1) Excavate holes at the required locations and to the required depth. Set the wooden posts in the holes in a true vertical position. Unless directed otherwise, place posts in a straight line on shoulders or, if on a curve, at a uniform distance from the centerline. After placing the posts, backfill the holes with suitable material. Place and compact the backfill material in layers and in a manner that does not shift the post from its true position. After erection, cut off the top of the post at the proper elevation and round as the plans show.

(2) If attaching delineators, notch the marker posts as the plans show. Drill a one inch (25 mm) hole transversely through the center of marker post at the ground line when diameter of post is greater than 5 1/2 inches (140 mm), or make a transverse saw cut approximately one inch (25 mm) deep on the side of the post facing traffic.

(3) The contractor may round the tops of marker posts and paint them with a prime coat of paint before erection. After the prime coat is thoroughly dry, erect the post with the top at the required elevation.

614.3.6.2 Painting Wooden Posts

(1) Paint untreated wooden marker posts as specified painting in section 517, and in the manner specified below. Paint all marker posts with at least 3 coats of paint. The prime coat shall consist of the first coat of paint and a minimum of 2 other coats will consist of a total of 3 coats. Prime posts before erection, stack, store, and handle the posts in a manner to prevent damage or marring of the paint. Apply all other coats of paint after erecting the posts.

(2) For the prime coat use white paint for wood as specified in 517.2.6. Apply the prime coat from the top of the post to a point at least 3 inches (75 mm) below the ground line.

(3) For the second and third coats of paint, use white paint for wood as specified in 517.2.6. Apply these coats from the top of the post to a point 24 inches (600 mm) below, and then apply 2 coats of black paint for wood as specified in 517.2.8, from a point 21 inches (530 mm) below the top of the post to a point 3 inches (75 mm) below the ground line. If the plans show, form a cap of the required dimensions on the top of the post by applying 2 additional coats of the black paint.

(4) The contractor shall not apply paint unless the air temperature is above 40 F (4 C). The contractor shall also not apply on damp or dirty surfaces, on material containing frost, if the air is misty, or if the engineer determines conditions are unsatisfactory otherwise for this work.

(5) Stir all paint thoroughly. While painting, stir the paint often enough to keep the pigments suspended.

(6) Brush each coat of paint into the wood and allow to dry according to the manufacturer's requirements before applying the succeeding coat. Make the lines of demarcation between the white and black paints horizontal, sharp, and well defined.

614.3.6.3 Placing Recycled Plastic Posts

(1) Set recycled plastic posts into excavated holes to the required depth, to a true vertical position, at the locations the plans show or as the engineer directs. Use equipment that causes no damage to the posts. Attach the department furnished right-of-way information plaque to the post.

(2) Replace any damaged or missing posts necessary.

614.3.7 Sand Barrels

(1) Provide sand barrel inertial barrier systems at each location the plans show. Have the sand barrel manufacturer design the barrel array layout and determine the sand weights for each individual barrel. Ensure that the manufacturer's design conforms to the design speed, shields the required obstruction width, and is appropriate for the traffic direction the contract shows. Submit a copy of the manufacturer's design details to engineer before installing the sand barrels.

(2) Fill the barrels with a mixture of sand and sodium chloride. Mix the sand and sodium chloride to a 3:1 ratio by volume. Stockpile the mixture in the open air for one week and mist each day with water spray to provide a coating of sodium chloride to the sand particles. Test the mixture for sodium chloride content just before placing into the barrels, at this time the mixture shall contain a minimum of 20 percent sodium chloride by dry weight. The contractor shall not place the mixture into the barrels in a wet condition.

(3) Construct concrete foundation pads as specified for concrete sidewalk under section 602 at the plan location, conforming to dimensions the sand barrel manufacturer specifies, and to the elevations the engineer determines.

614.3.8 Crash Cushions

(1) Under the Crash Cushion bid items, furnish, install, and maintain construction zone crash cushions as the manufacturer specifies and the plans show. Replace damaged parts of the crash cushion.

(2) Under the Crash Cushions Temporary bid item, also remove and dispose of crash cushions when no longer needed.

614.4 Measurement

(1) The department will measure Cable Guard Fence and Salvaged Guard Fence Cable by the linear foot acceptably completed, measured as the length from center to center of end posts.

(2) The department will measure Anchorages for Cable Guard Fence, the Anchorages for Steel Plate Beam Guard bid items, Anchor Assemblies for Steel Plate Beam Guard, the Steel Plate Beam Guard Energy Absorbing Terminal bid items as each individual unit acceptably completed.

(3) The department will measure the Steel Thrie Beam Structure Approach bid items by the linear foot acceptably completed.

(4) The department will measure the Steel Plate Beam Guard (class) bid items, Steel Plate Beam Guard Over Low-Fill Culverts Class A, Steel Plate Beam Guard Temporary, Adjusting Steel Plate Beam Guard, and Salvaged Guard Fence Steel Beam by the linear foot acceptably completed, measured along the face of the rail element.

(5) The department will measure Steel Plate Beam Median Guard by the linear foot acceptably completed, measured along the centerline of the completed installation.

(6) The department will measure the Marker Posts and Crash Cushions bid items as each individual unit acceptably completed.

(7) The department will measure Sand Barrels as each individual sand barrel system acceptably completed, measured individually for each required plan location.

614.5 Payment

(1) The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
614.0100	Cable Guard Fence	LF
614.0103	Anchorages for Cable Guard Fence	EACH

614.0105	Anchorages for Steel Plate Beam Guard	EACH
614.0110	Anchorages for Steel Plate Beam Guard Temporary	EACH
614.0115 - 0149	Anchorages for Steel Plate Beam Guard (type)	EACH
614.0150	Anchor Assemblies for Steel Plate Beam Guard	EACH
614.0200	Steel Thrie Beam Structure Approach	LF
614.0250	Steel Thrie Beam Structure Approach Temporary	LF
614.0300 - 0339	Steel Plate Beam Guard (class)	LF
614.0340	Steel Plate Beam Guard Over Low-Fill Culverts Class A	LF
614.0355	Steel Plate Beam Median Guard	LF
614.0360	Steel Plate Beam Guard Temporary	LF
614.0370	Steel Plate Beam Guard Energy Absorbing Terminal	EACH
614.0380	Steel Plate Beam Guard Energy Absorbing Terminal Temporary	EACH
614.0400	Adjusting Steel Plate Beam Guard	LF
614.0500	Salvaged Guard Fence Cable	LF
614.0555	Salvaged Guard Fence Steel Beam	LF
614.0600	Marker Posts	EACH
614.0605	Marker Posts Right-of-Way	EACH
614.0700	Sand Barrels	EACH
614.0800	Crash Cushions Permanent	EACH
614.0805	Crash Cushions Permanent Low Maintenance	EACH
614.0905	Crash Cushions Temporary	EACH

(2) Payment for Cable Guard Fence is full compensation for all materials, including posts, cable, tension assemblies, bearing blocks, beams, channels, fittings, painting, and incidentals; for setting and driving posts; and for all excavating, backfilling, and disposing of surplus material. The department will pay separately for anchorages under the Anchorages bid items.

(3) Payment for Anchorages for Cable Guard Fence, Anchorages for Steel Plate Beam Guard, Anchorages for Steel Plate Beam Guard Type 2, and Anchor Assemblies for Steel Plate Beam Guard is full compensation for providing all materials, except right-of-way information plaque; and for placing all materials, including posts, paint, concrete, rods, cables, anchors and fixtures; and for all excavating, backfilling and disposing of excess material.

(4) Payment for Anchorages for Steel Plate Beam Guard Temporary is full compensation for providing anchorages, including concrete and rods; for all excavating and backfilling; and for removing and disposing of all materials. The department will not pay for concrete placed outside the concrete anchor dimensions the plans show.

(5) Payment for the Steel Thrie Beam Structure Approach bid items is full compensation for providing thrie beams, including posts, bearing blocks, terminal connector, beams, fittings and hardware; for setting and driving posts; and for all excavating, backfilling, and disposing of surplus material.

(6) Payment for the Steel Plate Beam Guard (class) bid items, Steel Plate Beam Guard Over Low-Fill Culverts Class A, and Steel Plate Beam Median Guard is full compensation for providing beam guard, including posts, cable, tension assemblies, bearing blocks, beams, channels, fittings, painting, and incidentals; for setting and driving posts; and for all excavating, backfilling, and disposing of surplus material. The department will pay separately for anchorages under the Anchorages bid items.

(7) Payment for Steel Plate Beam Guard Temporary is full compensation for providing temporary beam guard, including posts, beams, and hardware; and for removing and disposing of all materials. The department will pay separately for anchorages under the Anchorages bid items.

(8) Payment for the Steel Plate Beam Guard Energy Absorbing Terminal bid items is full compensation for providing energy absorbing terminals required under the selected system; for setting and driving posts; and for all excavating, backfilling, and disposing of surplus material.

(9) Payment for Adjusting Steel Plate Beam Guard is full compensation for adjusting existing steel plate beam guard; and for replacing damaged material.

(10) Payment for Salvaged Guard Fence Cable and Salvaged Guard Fence Steel Beam is full compensation for removing, handling, storing, and transporting the existing fence materials; for re-erecting posts, cables, beams, and fittings; and for all excavating, backfilling, and disposing of surplus material. The

contractor is responsible for all parts damaged by its operations and will replace damaged parts at no expense to the department. Payment does not include anchorages; the department will pay for these separately as specified below.

(11) Payment for the Marker Posts bid items is full compensation for providing marker posts, except right-of-way information plaque; and for placing all materials, including posts, paint, concrete, rods, cables, anchors and fixtures; and for all excavating, backfilling and disposing of excess material.

(12) Payment for Sand Barrels is full compensation for providing manufacturer design details for each sand barrel system; for the foundation pad; and for providing each system at the plan location including barrels, sand, sodium chloride, and watering.

(13) Payment for Crash Cushions Permanent and Crash Cushions Permanent Low Maintenance is full compensation for providing crash cushions, including beam guard; and for maintaining, including providing replacement components if needed.

(14) Payment for Crash Cushions Temporary is full compensation for providing crash cushions, including beam guard; for maintaining, including providing replacement components if needed; and for dismantling and removing.