



SECTION 606

GUARDRAIL, CRASHWORTHY END TERMINALS, ONE-STRAND ACCESS RESTRAINT CABLE AND THREE-STRAND GUARD CABLE

606.1 Description. This work shall consist of furnishing and installing guardrail, crashworthy end terminals, one-strand access restraint cable or three-strand guard cable as shown on the plans or as directed by the engineer.

606.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Concrete	501
Guardrail, End Terminals, Crash Cushions, One-Strand Access Restraint Cable and Three-Strand Guard Cable	1040

606.2.1 Concrete. Concrete shall be placed, finished and cured in accordance with [Sec 703](#).

606.2.2 Cold Weather. During cold weather, the weather limitations of [Sec 502](#) will apply to concrete work.

606.2.3 Aesthetic Guardrail. When specified, aesthetic guardrail shall be in accordance with NCHRP 350, Test Level 3 criteria and shall be of new stock. End terminals and crash cushions for aesthetic guardrail shall be fabricated and installed in accordance with [Sec 606.30.3](#).

606.3 Construction Requirements.

606.3.1 General. Work on guardrail or guard cable removal and replacement when the adjacent travel or auxiliary lane is open to traffic during non-working hours shall adhere to the following requirements:

- (a) The contractor shall provide a schedule of work prior to the beginning of work.
- (b) Remove no more guardrail or guard cable than can be replaced in the same day.
- (c) Schedule guardrail and guard cable installation to ensure guardrail beam or guard cable is properly attached to all installed posts at the end of each work day.
- (d) Ensure end sections or terminals exposed to traffic meet current standards. Guardrail or guard cable shall be maintained to within 3 inches (75 mm) of the nominal barrier height shown on the plans.
- (e) Notify the engineer prior to delivery of the material to the project.

606.3.1.1 If guardrail or three-strand guard cable cannot be replaced the same day as removal, traffic control measures meeting the approval of the engineer shall be provided. The contractor will not be compensated for any additional traffic control items required to perform

this work. In all cases, the contractor shall ensure that the guardrail or guard cable installation is fully anchored before opening the adjacent lane to traffic.

606.3.1.2 The shoulders and slopes shall be in accordance with all standards shown on the plans or shall be as directed by the engineer before the installation of any guardrail, guard cable or end treatments.

606.3.2 Field Repair of Galvanizing. Galvanized material shall be handled in a manner to avoid damage to the surface. No punching, drilling, cutting or welding will be permitted after galvanizing, except as approved by the engineer to provide for lapped beams, or for changes in location of splices necessitated by field clearances. Any galvanized material on which the galvanizing has been damaged will be rejected or may, with the engineer's approval, be repaired in accordance with [Sec 1080](#).

606.3.3 Posts for Guardrail and One-Strand Access Restraint Cable.

606.3.3.1 Posts may be wood or steel. The same material shall be used for all new installations within a single project, except for end treatments. If the project requires an extension of existing guardrail, the new post material for the extension shall match the existing material.

606.3.3.2 Wood posts for end anchors shall be installed as shown on the plans.

606.3.3.3 Posts may be installed by either drilling or driving.

606.3.3.3.1 Posts installed by drilling shall have sufficiently sized holes to permit thorough compaction of backfill material around the posts. The backfill material shall be compacted in layers not exceeding 12 inches (300 mm) high.

606.3.3.3.2 Posts installed by driving may be driven by a power hammer or any other method approved by the engineer. Any mushrooming on the top of the post shall be removed. Damaged zinc coating on galvanized posts shall be field repaired in accordance with [Sec 1081](#). If, in the judgment of the engineer, the exposed portion of a wood post is split or the driving process noticeably worsens the check cracking, the post shall be replaced by the contractor at the contractor's expense.

606.4 Basis of Payment. The accepted quantities of grading and drainage at barrier locations will be paid for at the contract unit price for each of the pay items included in the contract.

SECTION 606.10 GUARDRAIL.

606.10.1 Description. This work shall consist of furnishing and installing guardrail as shown on the plans or as directed by the engineer.

606.10.2 Construction Requirements.

606.10.2.1 Beams. Beams shall be spliced by lapping in the direction of traffic. The use of 25-foot (7.62 m) sections of beam rails and channels, if required, will be permitted for bridge anchor sections, and any place where true line and grade can be maintained.

606.10.2.2 End Anchors. End anchors shall be installed on ends of guardrail runs where crashworthy end terminals are not required.

606.10.2.3 Delineators. Delineators shall be placed on all guardrail located 2 feet (600 mm) or less from the edge of the shoulder. Delineators shall be spaced at 50-foot (15 m) intervals.

606.10.2.3.1 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Specification
Delineators	1065

606.10.2.3.2 Construction Requirements.

606.10.2.3.2.1 Delineator reflector colors shall correspond with pavement marking. Delineators shall be sheeted on one side, facing oncoming traffic, unless otherwise specified. Where guardrail divides opposing lanes of travel, the delineators shall have retro-reflective sheeting on both sides corresponding to adjacent pavement markings. Guardrail located on ramps shall have red reflective sheeting placed on the reverse side of the reflector. Guardrail located on two lane roads shall have retro-reflective sheeting on both sides corresponding to the adjacent pavement markings. If there are not edgelines present, white retro-reflective sheeting shall be used.

606.10.2.3.2.2 Delineators will be installed according to manufacturer's recommendations.

606.10.2.3.2.3 Any damaged or missing delineators shall be replaced by the contractor at the contractor's expense.

606.10.3 Method of Measurement. Measurement of guardrail will be made to the nearest 1/2 linear foot (0.5 m) for each increment along a line passing through the centerline of each post, and totaled to the nearest linear foot (0.5 m) for the sum of the increments in the contract. The length will be measured separately for each guardrail type, as shown on the plans, excluding bridge anchor sections, end anchors, transition sections and bullnose guardrail systems. Bridge anchor sections, end anchors, transition sections and bullnose guardrail systems will be measured per each item furnished and installed.

606.10.4 Basis of Payment. The accepted quantities of guardrail, bridge anchors, end anchors, transition sections and bullnose guardrail systems, complete in place, will be paid for at the contract unit price for each of the pay items included in the contract. No direct payment will be made for end sections or terminal connectors. No direct payment will be made for setting posts in rock. No direct payment will be made for guardrail delineators provided on new guardrail. Delineators specified for installation on existing guardrail will be measured and paid for per each.

SECTION 606.20 BLANK.

SECTION 606.30 CRASHWORTHY END TERMINALS.

606.30.1 Description. This work shall consist of furnishing and installing crashworthy end terminals as shown on the plans or as directed by the engineer.

606.30.2 Material.

606.30.2.1 Equipment and material shall be of new stock and in accordance with [Sec 1040](#).

606.30.2.2 Type A end terminal installations shall be a minimum of 50 feet (15 m) long. Additional Type A guardrail shall be provided by the contractor, at the contractor's expense, to increase the Type A end terminal to a length of 50 feet (15 m).

606.30.3 Construction Requirements. End terminals and crash cushions shall be fabricated and installed in accordance with the manufacturer's approved shop drawings, recommendations and as shown on the plans. Any units damaged during the term of the contract shall be replaced immediately at the contractor's expense.

606.30.3.1 Where a specific end terminal or crash cushion is shown by product name, that unit shall be used as shown on the plans. No substitutions will be permitted without prior approval from the engineer.

606.30.3.2 The contractor shall not install flared Type A end terminals in medians or on curbs.

606.30.3.3 The contractor shall not install Type B end terminals on paved surface locations, unless the location is temporary and the paved area is to be resurfaced after removal of the system.

606.30.3.4 The contractor may use Type C, D, and E end terminals where Type B units are specified or shown on the plans.

606.30.3.5 Crashworthy end terminals located 12 feet (3.6 m) or less from the edge of the traveled way shall be furnished with a modified Type 3 object marker. The marker size, shape, method of attachment and placement shall be approved by the engineer prior to installation.

606.30.4 Method of Measurement. Measurement for crashworthy end terminals will be made for each unit assembled, installed and complete in place.

606.30.5 Basis of Payment. The accepted quantities of Type A, B C, D and E crashworthy end terminals, complete in place, will be paid for at the contract unit price. Payment will be considered full compensation for complete installation including grading, any transition sections, backup assemblies or other items necessary for proper installation of the end terminal or crash cushion as required. If the contractor elects to use a flared Type A crashworthy end terminal, additional embankment as shown on the plans shall be provided at the contractor's expense.

SECTION 606.40 ONE-STRAND ACCESS RESTRAINT CABLE.

606.40.1 Description. This work shall consist of furnishing and installing one-strand access restraint cable as shown on the plans or as directed by the engineer.

606.40.2 Construction Requirements. The cable shall be strung directly from the reel and pulled tight after the initial anchoring. The cable shall then be attached to the second anchor assembly with all turnbuckles fully opened. The cable shall be completely anchored before attaching to the line posts. Only one splice will be permitted between anchors, located between the line posts. Splices will not be permitted in spans adjacent to the anchor and cable end assemblies.

606.40.3 Method of Measurement. Measurement of one-strand access restraint cable will be made to the nearest 1/2 linear foot (0.5 meter) for each increment, from center of end post to center of end post, and totaled to the nearest linear foot (0.5 meter) for the sum of the increments on the project.

606.40.4 Basis of Payment. The accepted quantities of one-strand access restraint cable, end anchors, posts and hardware, complete in place, will be paid for at the contract unit price for each of the pay items included in the contract.

SECTION 606.50 THREE-STRAND GUARD CABLE.

606.50.1 Description. This work shall consist of furnishing and installing three-strand guard cable, including all hardware, appurtenances and aggregate bedding, as shown on the plans or as directed by the engineer.

606.50.2 Construction Requirements.

606.50.2.1 Line Posts. All posts shall be driven unless otherwise directed by the engineer. Driving shall be accomplished with approved equipment and methods that will leave the posts in the final position, free from any distortion, burring or other damage. All posts shall be aligned to a tolerance of 1/4 inch (6 mm) for plumb and grade line. If rock is encountered when setting line posts, the contractor may set line posts with or without a soil plate. Line posts set with a soil plate shall be installed by digging or boring a hole into the rock to the required depth and of sufficient size for the post to be set with the soil plate attached. Line posts set without the soil plate shall be installed by drilling a hole to the required depth not to exceed 5 inches (125 mm) in diameter. Following placement of the post, the hole shall be backfilled with a cohesive soil or sand in accordance with [Sec 1005.3](#), and thoroughly tamped.

606.50.2.2 Anchor Assemblies. The specified type of anchor assembly shall be constructed at each end of a run of guard cable. If intermediate end anchors are required, the cable assembly shall be overlapped as shown on the plans. The location of all intermediate anchor assemblies shall be determined by the contractor and approved by the engineer. The concrete anchor shall be cast in place with the centerline normal to the line of the guard cable. The top 12 inches (300 mm) of the anchor below finished ground line shall be formed, unless the engineer determines soil conditions permit excavation to be made to the neat lines of the anchor and the anchor cast against the undisturbed vertical soil face. Anchors shall be constructed on firm, stable, undisturbed soil to the minimum dimensions shown on the plans. Anchor bolts and anchor post slip bases shall be firmly held in the proper position supported at the top by a template during concrete placement. Backfill shall be thoroughly compacted with mechanical tampers with care taken to prevent damage to the finished concrete. Backfill shall be brought up level with the finished grade line. The anchor may be cast in place or precast as either one or two units.

606.50.2.3 Cables. Cables shall be attached to the line posts, anchor posts, cable transition brackets and anchor brackets as shown on the plans. Where compensating devices or turnbuckles are required, the cables shall be attached to the end anchor with turnbuckles fully opened. Compensating devices and turnbuckles shall be installed such that no interference with the functions of any other part of the system occurs. Individual cables may be spliced with a device approved by the engineer. Each cable shall be stretched taught by mechanical means to eliminate sag between the posts. The contractor may tighten cable hook bolts after final cable tensioning is complete to allow cable slack to be adequately taken up. Prior to final acceptance, the cables shall be tensioned in accordance with the temperature and spring compression table shown on the plans and all cable hook bolts tightened.

606.50.2.4 Aggregate Bedding. Material for aggregate bedding shall consist of a durable crushed stone, shot rock or broken concrete with approximately 20 percent of the pieces being between 1 inch and 3 inches in diameter but none greater than 3 inches. The remainder of the material shall be such that provides a uniform, angular appearance. Acceptance by the engineer will be made by visual inspection.

606.50.2.5 Delineators. Delineator spacing and reflector colors shall be in accordance with [Sec 606.10](#).

606.50.3 Method of Measurement.

606.50.3.1 Three-Strand Guardrail. Measurement of three-strand guard cable will be made from center of line post to center of line post, totaled to the nearest linear foot (0.5 meter).

606.50.3.2 Anchor Assemblies. Measurement of anchor assemblies will be made per each.

606.50.3.3 Aggregate Bedding . Aggregate bedding material will be measured to the nearest cubic yard (m) of material.

606.50.4 Basis of Payment. The accepted quantities of three-strand guard cable, end anchors, posts, hardware and aggregate bedding will be paid for at the contract unit price for each of the pay items included in the contract. No direct payment will be made for setting posts in rock. No direct payment will be made for guard cable delineators provided on new guard cable. Delineators specified for installation on existing guard cable will be measured and paid for per each.