

12.30 FORMED STEEL BEAM GUARDRAIL

12.31 GENERAL INSTRUCTIONS

Safety implications make it very important that engineer, inspector, and contractor know the plans, *Specifications 2505 and 4155*, and standard road plans that apply to this work.

Letting date and standard road plan date should be compatible. Standard road plan dates are listed in Table 105-4 on plan cover sheet. When these dates do not match date of current standard road plan, contact the Office of Construction. Determination will be made on appropriate standard road plan to be applied.

A guardrail installation checklist is provided in *Appendix 12-3*. This checklist may be helpful in preparation and inspection for guardrail work. The installation checklist identifies important checks that should be made prior to installation and again at the completion of the installation to ensure that the installed guardrail system will perform as intended. The inspection and material acceptance requirements are identified in *Materials I.M. 204 Supplemental Guide Basis of Acceptance*.

Guardrail installations are dependent on correct location of shoulder or bridge approach paving and 10:1 approach slope to guardrail. Prior to the start of guardrail installations, these need to be reviewed and verified.

Specific attention should be given to location of curb and intake in the area of paved shoulders. *Section RK of the Standard Road Plans* identifies length of shoulder paving and curb for bridge approaches. *Section RE* identifies guardrail installation line and offsets which define the location of back of curb from face of rail. Guardrail post locations identify location of *RF-38* intake and *RF-39* sod flume for bridge end drains.

Slope on finished surface between shoulder edge and a point at least 1.2 m (4 feet) behind the face of rail should be 10:1 or flatter. This provides a slope which will keep vehicle wheels in contact with the ground and adequate soil support for the posts.

If inspector or engineer observes a variance from plans or specifications, contractor should be advised immediately. *When situations arise that are not covered by specifications, plans, standard road plans, or this instruction, contact the Office of Construction.*

12.32 FORMED STEEL BEAM GUARDRAIL INSTALLATION

Rail Alignment

Rail shall be installed with reasonably smooth vertical and horizontal lines. Kinks in both straight and factory curved sections shall be avoided. Face of rail shall have no protrusions that could catch a vehicle sliding along the rail. Typical detail and table in *Appendix 12-4* may be used as a guide for installing steel guardrail. Minor adjustments may be made to meet this requirement.

Guardrail Posts

Posts shall be installed at intervals shown on correct standard road plan. On *RE-27B and RE-69 A & B* bridge end anchorages, prepunched holes should be positioned to match holes for *RE-2B* Type "J" terminal end section and first post away from bridge end post.

Space between first post and last bolt in bridge end post shall be 800 mm (2 feet 7.5 inch). All posts shall be reasonably plumb in both directions. An occasional post out of plumb may be accepted.

Standard Road Plans *RE-37* and *RE-66C* provide for guardrail installations at culverts where it is not possible to get 1.0 m (3 feet) of wood post embedment because of a low-fill situation over the culvert. *RE-37* details the use of steel guardrail posts which are bolted to the top slab of the culvert. *RE-66C* details the spanning of the culvert width through the use of nested sections of W-beam guardrail. *RE-66C* is used for culvert widths up to a maximum of 7.42 m (24 feet 4 inches). The *RE-66C* standard has been developed to improve the constructability of guardrail over culverts with low-fill conditions.

Where longitudinal obstructions (electric cables, curbs, etc.) are encountered, 2 or 3 posts may have a maximum of 2 blockouts to provide an offset. If this cannot be done, obstruction shall be removed or relocated.

Specification 2505.04 states that guardrail posts may be driven provided that:

- Driving does not damage the posts, and
- Resulting post installation is firm, plumb, and at the location, spacing, and elevation designated.

Standard Road Plans RE-12A and RE-12B stipulate a requirement that guardrail posts to be installed within 1.5 m (5 feet) of paved shoulders shall be predrilled. This requirement was established in 1988 due to concerns that driving guardrail posts within or near pavement without predrilling could result in the development of a void under the pavement. Recent field observations of guardrail installation methods have shown that guardrail posts can be driven without development of void areas around the post. This specific requirement is being deleted from the *RE-12A* and *RE-12B*. In the interim, predrilling for installation of guardrail posts will be a requirement of the contractor when driven posts are found to be unacceptable.

Rail Section Location

All prepunched rail sections should be in proper location within each guardrail assembly. This involves sections with 952 mm (3 feet 1 ½ inch) post spacing, sections with 1.90 m (6 feet 3 inch) post spacing, and *RE-76 (FLEAT-350)* standard breakaway end anchorage.

Rail Height

Guardrail installations are constructed with W-beam and thrie-beam rail. *RE-12A* and *RE-12B* indicate the mounting height is measured from surface of ground at face of rail to top of rail. Target height is 686 mm (27 inches) for W-beam and 813 mm (32 inches) for thrie-beam.

On a project where all new guardrail is installed or existing guardrail is being removed and reinstalled, tolerance will be plus or minus 25 mm (1 inch). Allowable mounting height is 660 to 711 mm (26 to 28 inches) for W-beam and 787 to 838 mm (31 to 33 inches) for thrie-beam. Where existing rail is being brought to current standards, tolerance will be plus or minus 50 mm (2 inches). Allowable mounting height is 635 to 737 mm (25 to 29 inches) for W-beam and 762 to 864 mm (30 to 34 inches) for thrie-beam. If any portion of existing rail is more than 50 mm (2 inches), correct by Change Order.

Rail height should be based on edge of pavement so shoulder can be adjusted to meet correct cross section. Table in [Appendix 12-4](#) may be used as a guide for installing steel guardrail. Following completion of guardrail installation, the rail height from surface of ground at face of rail should be verified. If rail height is outside allowable tolerance, correction of ground surface will be required to provide for specified rail height.

At posts, guardrail may be raised a maximum of 75 mm (3 inches) according to detail in [Appendix 12-5](#).

Lapping of Guardrail

Lapping of rail must be accomplished in a uniform manner. General criteria outlined in RE series of standard road plans will achieve uniformity statewide. However, clarification may be helpful in obtaining this uniformity in specific instances.

Standard road plans indicate guardrail shall normally be lapped in direction of traffic flow. Following this general rule, most installations will be lapped correctly. Standard road plans provide a lapping procedure detail for each type of guardrail installation except:

- On long guardrail installations involving more than one hazard such as a combination of bridges, culverts, high fills, sign truss footings, etc., lap should protect near traffic from being speared by an end of a section of guardrail. Lapping procedure is illustrated in [Appendix 12-6](#).
- Where guardrail alignment is curved away from the centerline, i.e. bridge ends or *RE-76 (FLEAT-350)* end sections, lap should protect approach vehicles. Lapping procedures for bridge ends for one-way and two-way traffic are in [Appendix 12-7](#).

Keep in mind that the basic principle of lapping has to do with favoring the traffic for which the guardrail is being installed.

All laps of rail shall take place at a post. The 16 mm x 32 mm (5/8 inch x 1 1/4 inches) splice bolts at these laps do not require washers.

12.33 END ANCHORAGE

The FLEAT-350 end anchorage is constructed on projects that protect side hazards and is detailed on *Standard Road Plan RE-76*.

The *RE-76 (FLEAT-350)* is a flared energy-absorbing guardrail end terminal. *Standard Road Plan RE-76* states, "The contractor shall furnish and install the *FLEAT-350* Flared Guardrail End Terminal according to the manufacturer's recommendations. The manufacturer provides a manual of installation instructions for each *FLEAT-350* system supplied. A copy of the FLEAT-350 installation manual can also be viewed on the manufacturer's web site at www.roadsystems.com.

Steel bearing plate washer 16 mm x 200 mm x 200 mm (5/8 inch x 8 inches x 8 inches) shall be installed with 75 mm (3 inches) dimension below bolt. Hole in end post should be located 75 mm (3 inches) above the surface of ground for *RE-76*.

Soil removed from all end anchorage holes should be disposed of away from the hole to insure proper installation height.

12.34 BRIDGE CONNECTIONS

RE-2B Type "J" terminal section shall be installed under rail so a vehicle cannot be snagged by end section. Exception to this is on trailing end of a one-way bridge where Type "J" terminal section shall be installed on outside of rail.

On new construction, bridge rail or retrofit rail 25 mm (1 inch) inner diameter sleeves may be placed for attachment bolts (5 sleeves for *RE-69*). Be positive that location and height of each sleeve are right. CHECK HEIGHT ABOVE DECK!

On guardrail attachments to concrete which require a bolt longer than 610 mm (24 inches), 22 mm (7/8 inch) bolt anchors may be grouted into concrete using threaded insert anchors with epoxy listed in *Materials I.M. 491.22*.

All bolts on bridge end connections shall be high strength, galvanized hex bolts. Surface of bolt head should be marked A-325, A-449 or have three radial marks at 120 degree intervals.

12.35 OBJECT MARKERS

Object markers (OM-3L or OM-3R) should be lined up with inside edge of marker in line with face of curb and face of guardrail. All object markers shall be attached to the delineator post by installation of an offset bracket as detailed on *RE-47*. If post cannot be driven into the ground, delineator post may be attached to guardrail post (not spacer block) with 2 bolts and object marker attached with bracket detailed on *RE-47*. Note that a neoprene washer is required on face of object marker under bolt head. Be sure dimensions shown on *RE-47* are followed. If ground installation used, a 3 m (10 foot) delineator post is required.

12.36 DELINEATORS

Location of delineators is shown on *RE-48A and RE-48B*. Specific attention should be given to Type 1, 2, and 4 installations on *RE-48A* and Type 5, 8 and 9 installations on *RE-48B*. These installations involve guardrail encroaching on shoulder or shoulder not full width through guardrail installation.