

905 GUARDRAIL

The Project Plans will specify the locations, type, and quantity of guardrail to be installed, removed or reconstructed. Installation will be in accordance with the appropriate standard drawings and special details and manufacturer's approved drawings. Installation of guardrail has evolved into a relatively complex procedure. The standards and manufacturer's drawings for guardrail are being constantly updated to improve the design and facilitate maintenance. It is imperative that construction personnel are aware of the latest guardrail standards and manufacturer's drawings. In order to assure installation in accordance with the correct drawings, the pre-activity meetings are required. This is discussed in more detail at the end of this section. Occasionally, a supplemental agreement to address revisions to the system after the contract has been awarded may be necessary. This can be conveyed to the Contractor at the pre-activity meeting.

When the Contractor is given the option of selecting an end treatment, the type of device to be used should be submitted at the pre-activity meeting. If this is not possible, the type must be submitted before the Contractor orders delivery of guardrail materials to the site. This will provide the lead time necessary for the Resident Engineer (RE) to determine the final location for end treatments, which in turn affects the "length of need," the total guardrail length and the quantity of material ordered. In the event of major changes in guardrail locations, the roadway designer should be consulted for placement criteria and standards.

Propriety items, such as guardrail end treatments, change as design modifications are introduced. The supplier of a propriety item is required to submit the changes to the ADOT New Product Committee. Changes which are approved are on file with the Standards Engineer in the Roadway Design Section. Installation guidelines shall also be furnished with the units so that the Contractor and inspectors can confirm that the installed end treatment meets the NCHRP 350 and manufacturer's requirements.

When staking post locations be sure to locate all drainage structures so that where possible the post location can be adjusted to eliminate any conflicts or the need for an anchoring device. Guardrail layout staking generally consists of marks on the pavement to locate the longitudinal position of the post together with the offset distance to the post. The offsets at flared end sections can be obtained from the Plans Detail Layout Sheets. Stakes or markings for guardrail control are generally adequate if set at 50-foot (15-meter) intervals for tangent sections and 25-foot (8-meter) intervals on curves.

Wood posts are to be inspected in accordance with ADOT Materials Policy and Procedure Directive 02-01 before they are placed in pre-punched, or pre-drilled holes and driven the final 10-inches to grade. Steel guardrail posts may be driven full depth, or placed in manually or mechanically dug holes and driven the final 10-inches to grade. When posts are placed in manually or mechanically dug holes, the space around posts must be backfilled with moist soils placed in compacted lifts as approved by the RE. Excessive driving effort, in some cases will cause damage to the post and which may be cause for rejection of the post. When posts are set in position, each post must be plumb, true to alignment and grade, and surrounded by well compacted ground. In paved areas, the displaced material from post driving will often cause the pavement to bulge upward or crack an adjacent curb. If either of these occurs, the Contractor is required to use other methods that will not damage existing pavements or structures and to repair any damage that has been caused by post installation.

On occasion the Contractor may encounter rock that prevents the driving of posts to the full depth for W-beam guardrail. Requests for changes should be submitted to the RE. Approval for any changes to end treatments must be obtained from the manufacturer.

When posts are set in concrete the top of the concrete "leaveout" material (normally 1-sack grout) adjacent to the posts should be finished in accordance with the plans or manufacturer's drawings. For asphalt pavement the space around the posts is backfilled with moist soils, compacted in lifts and topped with 3" of compacted bituminous material to match roadway cross slope.

Blocks are to be toenailed to the post with two galvanized sixteen-penny nails. The tops of the post and block are designed to be flush; a maximum of 1/2-inch (12 millimeters) difference in the elevation of the top of the post and block is permitted.

The rail should be inspected for any damage that may have occurred to the rail itself or to the galvanizing due to rough handling. A Certificate of Compliance is required for all rail and should be furnished before construction starts. All guardrail fasteners also require a Certificate of Compliance and one sample of each item.

Rail elements should be assembled to present a smooth, continuous appearance with the top of the rail being in near perfect alignment horizontally and vertically with the roadway. There should be no noticeable sags or humps. Rail laps must be oriented in the direction of traffic to the closest lane.

The reflector tabs for guardrail are thin and pliable, so they can be bent over the head of the bolt. The tabs are bent to keep them from falling off when the bolt loosens due to the drying and shrinking of the posts and blocks. The reflective material is high intensity reflective type sheeting. See the Standard Specifications for post spacing and color requirements.

Projects with an average elevation over 4000 feet (1200 meter) require flexible markers in addition to reflector tabs. Sheet 2 of the plans should show average project elevation. See the Standard Specifications for height, attachment hardware, post spacing, and color requirements.

The end treatments (terminals) for guardrail are numerous and each has specific construction requirements. Therefore it is important that construction personnel carefully review and adhere to all the construction details in the Project Plans, Standard Drawings, Standard Specifications, Special Provisions, Manufacturer's Drawings and Manufacturer's Installation Manual associated with end treatments. Delineation of guardrail posts must be done in accordance with Table 905-1 of the Special Provisions. See the Standard Specifications and Special Provisions for post locations and type of barrier marker required.

When existing guardrail elements are to be reused, it is important to mark any damaged or otherwise unsuitable elements before construction begins. Reconstruction of guardrail shall meet the same requirements as construction of new guardrail. Existing guardrail designated on the Project Plans to be reconstructed should be carefully removed from the old location, and reused materials should be inspected with care. Sharp kinks or enlarged bolt holes are reasons for the rejection of rail elements. Posts that are severely cracked, rotted or splintered are to be rejected (see Policy and Procedures Directive No. 02-01). The Special Provisions or the plans may require all reconstructed posts to be replaced with new posts, if the Resident Engineer requested it during the project planning, or design phases.

It should be noted that the Standard Specifications prohibit the use of a cutting torch for making bolt holes. Heat may weaken the metal around the bolt hole so that the bolt head may pull out under the force of impact. The only acceptable methods of making bolt holes in the field are drilling or punching.

Prior to acceptance, each section of guardrail should be inspected utilizing the appropriate quantified checklist for the specific type of guardrail installed.

Inspection Guidelines For Guardrail

Schedule the pre-activity meeting sufficiently in advance of ordering the materials to resolve all issues (a minimum of 20 days is recommended). Attendees should include the superintendent, the subcontractor(s) as applicable, the foreman installing the devices, the RE, the Project Supervisor and any Inspectors who will be working on the installations.

A suggested agenda for the pre-activity meeting for Roadside Safety Devices is shown in Exhibit 905-1. The RE should assign discussion roles and times.

It is understood the Contractor will bring the manufacturer's installation requirements to the meeting, including the manufacturer's drawings approved by ADOT. When a newer end treatment system has been approved the RE should encourage the contractor to install the current approved system. ADOT personnel will bring the current Quantlists.

The most recent [manufacturer's approved drawings](#) can be found on the Roadway Design web page.

Current versions of ADOT Inspection Quantlists for Guardrail End Sections can be accessed using the Construction software application. Quantlist access instructions are in Subsection 105.12 of this manual.

AGENDA**ROADSIDE SAFETY DEVICES****PRE-ACTIVITY MEETING**

- 1) Introduction of participants**
- 2) Review Special Provisions**
- 3) Discuss Barrier Summary Sheets (Roadway Engineering Memorandum, dated 6-27-2002)**
- 4) Review Plans Layout Sheet**
 - a) Dimensions of widening**
 - b) Foreslope rate**
 - c) Borrow source (if needed)**
 - d) Bituminous material (source and type)**
- 5) Discuss schedule and sequencing**
 - a) Blue staking**
 - b) Surveying layout**
 - c) Borrow for pad construction**
 - d) Potential drainage conflicts (e.g., created by widening)**
 - e) Units to be installed before or after paving**
 - f) Compaction around posts**
 - g) Removal of existing rail and unit completion in same day**
 - h) Traffic control**
- 6) Review traffic standards and specifications for delineation**
- 7) Review [manufacturer's approved drawings](#) & other standards**
- 8) Review the manufacturer's installation requirements (e.g., manuals and instructions)**
- 9) Review the ADOT checklists**
- 10) Discuss governing order of requirements, authority and escalation practices**

Exhibit 905-1 Suggested Pre-activity Agenda for Roadside Safety Devices