VIRGINIA DEPARTMENT OF TRANSPORTATION

TRAFFIC ENGINEERING DIVISION

MEMORANDUM

GENERAL SUBJECT: BARRIER SYSTEMS	**NUMBER:** TE-366.2 **TO SUPERSEDE:** TE-366.1
SPECIFIC SUBJECT: **GUARDRAIL SYSTEM UPGRADE** Functional Condition Ratings and Upgrading Strategies of Existing Guardrail Systems	**DATE:** September 27, 2012 **SUNSET DATE:** None
DIRECTED TO: District Administrators Regional Operations Directors District Maintenance Engineers State Maintenance Engineer State Location and Design Engineer Regional Operation Maintenance Managers Regional Traffic Engineers Residency Administrators	**SIGNATURE: State Traffic Engineer** R. J. Kilcoyne

Guardrail systems are an important roadside safety feature. To ensure they perform their intended functions, periodic reviews of in-service guardrail systems for timely upgrade and repair are necessary.

The enclosed "Virginia Department of Transportation Guardrail System Upgrade Guidance" provides guidance to determine the functional condition ratings and upgrade strategies of existing guardrail systems. The term "guardrail systems" refers to typical guardrail sections such as W-beam and cable barriers, transition areas, and guardrail end treatments. The functional condition ratings are designed to measure the functionality of guardrail systems compared with the current FHWA/VDOT standards. The ratings are to be used to determine the level of upgrade and recommended improvement timelines to guide investment decisions. This memo is to be used in conjunction with TE Memo-367, which provides condition ratings and repair strategies for damaged guardrail systems and end treatments as part of the "Hits Repair" program. Functional condition ratings of the entire run of damaged guardrail shall be determined prior to assessing the damage condition rating of guardrail systems.

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Enclosure: Virginia Department of Transportation Guardrail System Upgrade Guidance

Virginia Department of Transportation
Guardrail System Upgrade Guidance

Central Office
Traffic Engineering Division
September 27, 2012

1. POLICY BACKGROUND

Guardrail systems are roadside safety features for redirecting errant vehicles from a dangerous path. The term "guardrail system" here refers to typical guardrail sections such as W-beam and cable barriers, transition areas, and guardrail end treatments. Because guardrail systems are potential hazards themselves, they shall only be used when it is necessary to shield vehicles from a more hazardous condition. If the hazard is no longer present or no longer deemed a hazard at the site, the installation should be scheduled for removal.

To ensure that existing guardrail systems are still warranted and that they are capable of performing their intended function, periodic reviews and evaluations of in- service guardrail systems are necessary. This memorandum provides guidance to determine the functional condition ratings and upgrade strategies of existing guardrail systems. The functional condition ratings of guardrail systems, which are similar to a bridge condition rating, shall be used to determine the severity of the problem, level of necessary upgrade, and timelines to assist in prioritizing investment decisions.

Related Policy Guidance

This memo shall be used in conjunction with **TE Memo-367** when addressing damaged guardrail issues. TE Memo-367 provides guidance on determining damage condition ratings and spot-repair strategies for damaged guardrail systems and end treatments as part of the "Hits Repair" program. Refer to the Maintenance Division Memo on Guardrail Damage Claim Estimate issued on November 10, 2011, for guidance on cost-recovery options.

Refer to the latest **IIM-LD-220** for guidance and guidelines on upgrading existing guardrail systems associated with construction and major rehabilitation projects. Refer to the **VDOT Guardrail Installation Training (GRIT)** Manual for general information on the installation, replacement and repair of guardrail systems. All new guardrail installations shall comply with current VDOT standards and specifications.

A system methodology to periodically collect physical inventory information and functional condition information will be established under a separate guidance.

2. EVALUATING FUNCTIONAL CONDITIONS OF GUARDRAIL SYSTEMS

2.1 Field Evaluation Scope

Field evaluation **should** be conducted to evaluate the functional conditions of guardrail systems. The evaluation shall be performed by VDOT GRIT-certified personnel. At a minimum, the inspector shall:

- Evaluate the appropriateness of the installed guardrail and identify potential needs for new guardrail at the specified location

- Examine guardrail for damage and any signs of rust and deterioration
- Assess guardrail for compliance with current AASHTO/VDOT standards and specifications
- Check guardrail height for compliance with current VDOT standards
- Check guardrail systems for compliance with current VDOT/NCHRP 350 standards and verify cable tension where applicable
- Determine if the Length of Need (LON) is in accordance with GRIT manual
- Check all hardware for tightness and proper size
- Check all offset blocks for proper position
- Check if there are any fixed objects within the deflection area
- Check the shoulder and area beneath the guardrail for excessive erosion
- Check the shoulder width behind the posts to ensure proper support of the posts
- Check guardrail location relative to any curb
- Where applicable, check if the weak post and strong post systems are properly transitioned
- Check all timber posts for visible damage, rot, and/or insect infestation
- Check steel posts for rust, being bent, or badly deflected
- Identify other obvious defects of guardrail and end treatments to be fixed.

The inspector can be directed to conduct additional work as required by VDOT engineers.

3. GUIDANCE ON GUARDRAIL FUNCTIONAL CONDITION RATINGS

3.1 General Criteria

The following provides general criteria to be used in determining the functional condition ratings of existing guardrail systems. For detailed rating criteria for each guardrail type, **refer to the Condition Rating Table/Matrix in Appendix A.**

Grade A: Guardrail system is evaluated to <u>be fully functional</u> and capable of providing protection as intended. The guardrail system meets current VDOT standards, specifications, policy and/or current FHWA testing criteria based on field observations and measurements of rail heights. The guardrail system will be rated as Grade A if **all** of the following characteristics, as applicable, are discovered:

- 60% of the measured guardrail heights are:
  - W-beam Strong Post Systems (GR-2, GR-6, GR-7, GR-9, GR-10, GR-FOA, MB-3): 27¾"-28¾"
  - W-beam Weak Post Systems (GR-8, MB-5): 31½"-33"
  - Cable Weak Post Systems (GR-3): 27"-28"
- End terminals meet current NCHRP 350 standards,
- The guardrail system has wood or composite blockouts with back-up plates present at non-splice locations, and
- The guardrail system does not have washers at rail bolts.

Grade B: Guardrail system is evaluated to <u>be adequately functional under a majority of impacts</u> but may not meet all current VDOT standards. Typically, the

guardrail system will be rated no better than Grade B if **one or more** of the following characteristics is discovered:

- 60% of the measured guardrail heights are:
    - W-beam Strong Post Systems (GR-2, GR-6, GR-7, GR-9, GR-10, GR-FOA, MB-3): 27"-27¾" or 28¾"-30"
    - W-beam Weak Post Systems (GR-8, MB-5): 31"-31½" or 33"-34"
    - Cable Weak Post Systems (GR-3): 26"-27" or 28"-29", or
- The guardrail system has steel blockouts with back-up plates present.

Grade C: Guardrail system is evaluated to provide some protection for errant vehicles but does not comply with current VDOT standards. Typically, the guardrail system will be rated no better than Grade C if **one or more** of the following characteristics is discovered:

- 60% of the measured guardrail heights are:
    - W-beam Strong Post Systems (GR-2, GR-6, GR-7, GR-9, GR-10, GR-FOA, MB-3): 24"-27" or 30"-33"
    - W-beam Weak Post Systems (GR-8, MB-5): 29"-31" or 34"-36"
    - Cable Weak Post Systems (GR-3): 24"-26" or 29"-31"
- End terminals do not meet current NCHRP 350 standards,
- The guardrail system has steel blockouts with back-up plates present at non-spice location,
- The run-on end section of a GR-6 terminal has an exposed end,
- The guardrail system has washers installed at rail bolts,
- The guardrail system has a deficient Length of Need, or
- The guardrail system has major rust.

Grade D: Guardrail system is evaluated to provide little protection for the errant vehicles. Typically, the guardrail system will be rated no better than Grade D if **one or more** of the following characteristics is discovered:

- 60% of the measured guardrail heights are:
    - W-beam Strong Post Systems(GR-2, GR-6, GR-7, GR-9, GR-10, GR-FOA, MB-3): Less than 24" or greater than 33"
    - W-beam Weak Post Systems (GR-8, MB-5): Less than 31" or greater than 36"
    - Cable Weak Post Systems (GR-3): Less than 24" or greater than 31"
    - Proprietary High Tension Cable Systems: Does not meet manufacturer's requirements
- Has steel blockouts present and with washers installed on the rail bolts but no backup plates,
- Blunt end terminals for W-beam guardrail or median barrier at run on direction,
- Turned-down terminals at the run-on direction,
- Bridge approach guardrail that is not connected to the bridge railing, or
- Has less than one foot of soil backing behind posts.

Weathering Steel (COR-TEN or ASTM A588) W-Beam Guardrail

Except in rare situation, as discussed in Section 5: GUIDANCE ON GUARDRAIL SYSTEMS UPGRADE AND TIMELINES of this memo, weathering steel guardrail

and end treatments are no longer acceptable for use due to the potential for premature material failure from excessive rust. All weathering steel guardrail and end treatments shall be rated as, at best, Grade C or D based on the above criteria. Upgrade options are provided in Section 5 of this memo. Weathering steel guardrail systems should be replaced every five (5) to seven (7) years as part of regular maintenance.

Curb Use with Guardrail

Detailed guidance on guardrail systems installed with curb is provided in the VDOT GRIT Manual. There are currently no terminals approved for use in conjunction with curbs. Existing guardrail terminals installed with curb should be identified and evaluated on a case-by-case basis to see if site conditions allow these guardrail terminals to be brought up to standard based on strategies discussed in the VDOT GRIT Manual and IIM-LD-220.

4. GUIDANCE ON GUARDRAIL SYSTEMS EVALUATION

The detailed guidance on guardrail system evaluation is provided in the VDOT GRIT Manual and the VDOT Road and Bridge Standards and Specifications. The following provides key elements of the guidance related to guardrail system evaluation.

4.1 Guardrail Sections

Measuring the Height of Guardrail Section

The height of the cables or W-beam rail elements is critical for the proper performance of the guardrail system. The cables or W-beam rail elements must contact the design vehicle bumper at the correct position in order to prevent vaulting over or running under the guardrail system.

- For Standard GR-2 guardrail systems, the minimum height to the top of the rail is 27¾" and the maximum height is 28¾".

- For Standard GR-8 guardrail systems, the minimum height to the top of the rail is 31½" and the maximum height is 33".

- For Standard GR-3 cable guardrail systems, the minimum height to the top cable is 27" and the maximum height is 28". The cables are spaced 3" apart.

One important point to consider in determining the proper height of the system is the technique or method used to measure the height of the cable/rail elements. The location of the guardrail system relative to the slope beneath the cable/W-beam rail element will determine how the height of the guardrail is measured. The guidelines for the standard guardrail systems listed below shall be used when measuring the height of respective guardrail systems. The ground profile grade for

these systems must be a 6:1 or flatter slope. A minimum of three (3) measurements is required for each guardrail section. Additional measurements should be taken as needed based on the length of each section, with a maximum of twenty (20) measurements taken on a single guardrail section.

A. W-Beam Systems

- For Standard GR-2 the height is measured at the posts with a splice. It is recommended to measure the height of Standard GR-2 guardrail systems in linear increments of 50 feet.

- For Standard GR-8 the height is measured at the posts or posts at a splice, as appropriate. It is recommended to measure the height of Standard GR-8 guardrail systems in linear increments of 50 feet.

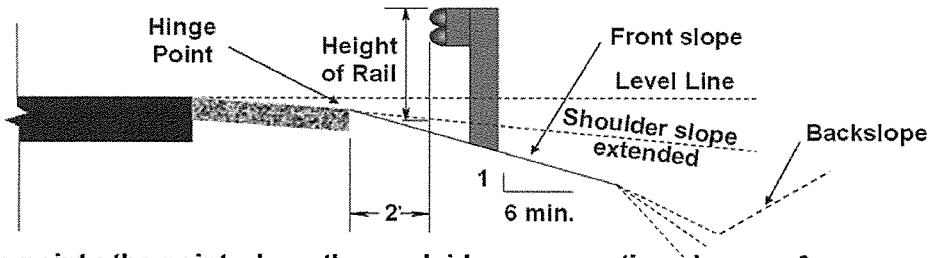
- No W-beam system should be placed between 2' and 12' from the shoulder hinge point on a slope steeper than 10:1.

- If the face of the W-beam is above a 10:1 or flatter surface, measure the height from the ground directly below the face of the W-beam.

- Where grading is steeper than 10:1, but not steeper than 6:1, and the W-beam is within 2' of the shoulder/front slope hinge point (see below) for Standard GR-2 and GR-8, the height is measured from the shoulder slope extended.

- If the W-beam rail is 12' or more from the shoulder/front slope hinge point, measure guardrail height from the ground directly below the face of the rail.

Please refer to the following illustration for a graphical description of the guardrail height measuring procedure for W-beam systems.



Hinge point : the point where the roadside cross section changes from one cross-slope to another, such as from the shoulder cross-slope to the front slope.

B. Cable Systems

- For Standard GR-3 cable systems the height of the cable system is measured at the posts. It is recommended to measure the height of Standard GR-3 cable guardrail systems in linear increments of 48 feet.

- For GR-3 cable systems installed on 6:1 or flatter surface, the height shall be measured from the ground directly below the cable.

C. W-Beam Systems

- For transitions between systems measure the height at the posts at the beginning and end of the transition between standard section lengths.

D. Proprietary Systems

- For proprietary systems follow the manufacturer's instructions to determine height.

Soil Backing

The area immediately behind the guardrail systems' post directly affects the performance of the system. Therefore the distance to the end of the competent soil backing behind the guardrail shall be measured to assess the condition of the system. On a 6:1 or flatter slope, a minimum distance of one (1) foot of competent soil backing from the back of the guardrail posts is required.

Guardrail Deflection Distance

Guardrail systems are designed to absorb energy during a vehicle impact. This is accomplished by the guardrail's ability to deflect upon impact. Maximum dynamic deflection distance shall be measured from the back of guardrail posts. No rigid or semi-rigid objects (hazards) shall exist within the deflection distance of any guardrail system, as shown in the table below.

Guardrail System	Maximum Deflection Distance (ft)
W-beam Systems	
GR-2	3
GR-2A	2
Nested/Stiffened GR-2	2
GR-8	7
GR-8A	5
GR-8B	4
Cable Systems	
GR-3	11
Proprietary High Tension	Refer to Manufacturer's Specifications

4.2 Guardrail End Treatments

Site preparation for all installations shall be in accordance with current FHWA/VDOT Standards. The following items shall be inspected when assessing the condition of an existing guardrail end treatment installation.

- GR-3 Anchorage – Height of top cable, length of terminal, location and type of first post compared to current standard, and length of terminal.

- GR-6 – Height of rail, number of rail elements, system transition prior to the ditch, slope of rail element, depth of end anchorage, and adequacy of back slope. Note: anchorage should be buried and not be exposed.

- GR-7 – Manufacturer and Model number, height of rail elements, breakaway posts, extruder assembly, reflective sheeting, and cable anchorage, if applicable.

- GR-9 – Manufacturer and Model number, height of rail elements, breakaway posts, extruder assembly, reflective sheeting, and cable anchorage, if applicable.

Existing end treatments should be checked to ensure the run of guardrail is adequate to shield the vehicle from existing hazard. The following process should be used to determine adequate length of need in the field.

- GR-3, GR-7 and GR-9 Terminals – Refer to the GRIT Manual, Chapter 1 or the AASHTO Roadside Design Guide.

- GR-6 Terminals – 75 feet minimum from where the rail element crosses the cut/fill break or flow line of the ditch to the hazard.

5. GUIDANCE ON GUARDRAIL UPGRADE STRATEGIES AND TIMELINES

5.1 Upgrade Strategies

Due to funding limits, only guardrail systems with functional condition ratings of Grade C or D are recommended for upgrade. The general upgrading strategies for the following substandard guardrail systems are shown below. Users should use engineering judgment to provide the best upgrade strategies for each specific situation.

Existing length of need and site conditions of existing end treatments scheduled for repair or upgrading shall be evaluated for compliance with current VDOT requirements.

- **Standard GR-1**

  All Standard GR-1 guardrail should be identified on all roadway systems and replacement schedules should be set so that appropriate funding can be budgeted for upgrades. Existing Standard GR-1 guardrail systems installed on any roadway within the National Highway System (NHS) shall receive first priority for upgrading as soon as possible.

- **Standard GR-5**

  All Standard GR-5 turn-down terminals installed at run-on locations on any NHS roadway shall be removed and replaced immediately with the appropriate terminal treatment meeting NCHRP 350 criteria.

  All other GR-5 terminals on non-NHS roadways shall be scheduled for upgrading per scheduling guidelines.

- **Standard GR-6**

  If the installation site does not provide at least 75' of clear run-out path in addition to the length of need required for the hazard (exclusive of the terminal), a GR-9 terminal should be installed.

- **Standard GR-7**

  A site investigation shall be made to determine whether the terminal should be upgraded or eliminated.

  If there is a cut slope is within approximately 200' longitudinal distance from the location of an existing GR-7 terminal, the guardrail shall be extended to the cut slope and a Standard GR-6 terminal installed.

  If the space between two runs of guardrail is $\leq$ 200', closing the gap by continuing the run of guardrail is recommended, thereby eliminating the need for a terminal.

  If an extensive amount of grading would be required for site preparation to install a Standard GR-7 terminal, consideration should be given to installing a Standard GR-9 terminal.

- **Standard GR-8**

  For any existing GR-8 guardrail adjacent to curb, the curb shall be removed. For existing CG-3 (4" curb) or CG-7 (4" curb and gutter) that cannot be removed, refer to the current GR-INS Standard. For existing CG-2 (6" curb) or CG-6 (6" curb and gutter) that cannot be removed, refer to the instructions in IIM-LD-220.

- **Standard GR-9**

  A site investigation shall be made to determine whether a GR-9 terminal should be upgraded or eliminated.

  If there is a cut slope is within approximately 200' longitudinal distance from the location of an existing GR-9 terminal, the guardrail shall be extended to the cut slope and a Standard GR-6 terminal installed.

  If the space between two runs of guardrail is $\leq$ 200', closing the gap by

continuing the run of guardrail is recommended, thereby eliminating the need for a terminal.

- **Standard GR-11 and Additional Longitudinal Guardrail as End Anchorage**

  The trailing end section (last 50 feet) of any longitudinal GR-2 guardrail with rectangular washers on divided highways should be replaced with a Standard GR-11.

- **Weathering Steel (COR-TEN or ASTM A588) W-Beam Guardrail**

  Unless otherwise noted, weathering steel guardrail systems shall be upgraded to galvanized steel guardrail according to the appropriate VDOT standards.

  In rare situations where roadside barriers are required in areas where aesthetics are a primary concern, VDOT may utilize powder coated galvanized steel guardrail. This includes W-beam, posts, terminals, fixed object attachments, and all hardware. **The use of power coated galvanized steel guardrail shall be limited and must be approved by the Regional Traffic Engineer.** The installed guardrail system should be earth-tone in color. The Special Provision for Powder Coated Galvanized Guardrail can be obtained from the VDOT Materials or Scheduling and Contract Divisions.

  There are two exceptions that allow the use of weathering steel:

  - Weathering steel may be used on the backside of the Steel Backed Timber rails and for the posts and hardware used with them, as the steel thickness of Steel Backed Timber rails is significantly greater than on the typical 12 gauge W-beam section. The Steel Backed Timber Guardrail is a special design and additional information is available from the Standards/Special Design Section of the VDOT Location and Design Division.
  - Weathering steel systems (W-beam, posts, and hardware) may be used if requested by an agency outside of VDOT. However, the agency must agree, through a Memorandum of Agreement, to maintain the installation by implementing a rigorous inspection and replacement schedule as referenced in the FHWA memorandum-Roadside Design: Steel Strong Post W-beam Guardrail issued on May 17, 2010.

- **Radial Guardrail**

  All radial guardrail used as an end treatment at driveways and private entrances shall be replaced with either GR 9 or GR-11 as appropriate or per standards.

5.2 Upgrade Timelines

Only guardrail systems with functional condition ratings of C or D are recommended to be upgraded. The recommended timelines for guardrail upgrades are still under

development. Other than where specifically noted, there are no standard requirements for guardrail system upgrade timelines.

For guardrail upgrades in paving projects, refer to the latest version of VDOT Safety Analysis Guidelines for Paving Projects to determine the required timeline.

Appendix A: Functional Condition Rating Table/Matrix

This table only applies to evaluating existing guardrail systems based on existing pavement elevations. If assessment is part of a pavement overlay, then the overlay thickness and resulting guardrail height must be taken into consideration during the assessment of the guardrail system's functional condition rating.

*The guardrail system will be rated as Grade A if **all** of the characteristics contained in Grade A are discovered. Typically, the guardrail system will be rated no better than Grade B, Grade C, or Grade D if **one or more** of the applicable characteristics is discovered.*

Standard Guardrail Designation	Typical Characteristics	Functional Condition Rating Grade			
		A	B	C	D
GR-1	• Post Spacing: 12'-6" • Post Size: 6" steel, 8" wood/concrete • Blockouts: No				X
GR-2 or GR-2A or MB-3 system	• Post Spacing: 6'-3" or 3'-1½" • Post Size: 8" • Blockouts: 6"x8"x1'-2" Wood or Composite • Back-up plates at non-splice locations: Yes • Washers Present: No • Rail Height: 27¾"-28¾"	X			
	• Blockouts: 6" Steel • Rail Height: 27"-27¾" or 28¾"-30"		X		
	• Washers Present: Yes • Guardrail system has a deficient Length of Need • Guardrail system has major rust • Rail Height: 24"-27" or 30"-33"			X	
	• Less than 1 foot of soil behind the posts due to erosion • Back-up plates at non-splice locations: No • Rail Height: <24" or >33"				X
GR-3	• Post Spacing: 16 ft • Post Size: 3" • Cable Height: 27"-28" • Terminal: NCHRP 350 compliant	X			
	• Cable Height: 26"-27" or 28"-29" • Terminal: Non-NCHRP 350 compliant		X		
	• Guardrail system has a deficient Length of Need • Guardrail system has major rust • Cable Height: 24"-26" or 29"-31"			X	
	• Less than 1 foot of soil behind the posts due to erosion • Cable Height: <24" or >31" • Non-NCHRP 350 Terminal run on condition				X
GR-4 or GR-4A	• 37'-6" Length of GR-2A as a Fixed Object Attachment (FOA) • Run-off condition on Divided Roadway	X			
	• Guardrail system has major rust • Run-on Condition			X	
GR-5	• Strong Post Turn-down Terminal • Run-off Condition on Divided Roadway	X			
	• Run-on Condition				X

Standard Guardrail Designation	Typical Characteristics	Functional Condition Rating Grade			
		A	B	C	D
GR-6	• Rail height of 27¾"-28¾" • Rail height held constant relative to roadway and maintained to anchorage • Rail element(s) buried 1' in Backslope • Foreslope 4:1 or flatter • Backslope 4:1 or steeper	X			
	• Rail height of 27"-27¾" or 28¾"-30" • Rail height not held constant relative to roadway and/or maintained to anchorage • Rail element(s) not buried 1' in Backslope		X		
	• Rail height of 24"-27" or 30"-33" • Rail height relative to the roadway not maintained to ditch bottom • Rail element(s) exposed at anchorage • Guardrail system has a deficient Length of Need • Guardrail system has major rust			X	
	• Rail height <24" or >33"				X
GR-7	• Proprietary terminal meeting NCHRP-350 test criteria (Stamped on 1st post) • Rail height of 27¾"-28¾" • Meets site preparation standards	X			
	• **MELT:** Non-Proprietary terminal meeting NCHRP-230 test criteria (strut between first two wooden breakaway posts, cable anchorage) • Rail height of 27"-27¾" or 28¾"-30"		X		
	• Rail height of 24"-27" or 30"-33 • Does not meet site preparation standards • Guardrail system has a deficient Length of Need • Guardrail system has major rust			X	
	• **BCT:** Non-Proprietary terminal not meeting any test criteria (concrete footings for first two posts, large posts, no metal strut, posts not breakaway, cable anchorage) • Rail height <24" or >33"				X
GR-8 or GR-8A or GR-8B or MB-5 system	• Post Spacing: 12'-6", 6'-3" or 3'-1½" • Post Size: 3" • Rail splice between posts (GR-8 only) • Back-up Plates at non-splice locations: Yes • Rail Height: 31½"-33"	X			
	• Rail splice at posts (GR-8 only) • Rail Height: 31"-34"		X		
	• Guardrail system has a deficient Length of Need • Guardrail system has major rust • Rail Height: 29"-31" or 34"-36"			X	
	• GR-8 turn down terminal at run-on condition • Less than 1 foot of soil behind the posts due to erosion • Rail Height: <31" or >36"				X

Standard Guardrail Designation	Typical Characteristics	Functional Condition Rating Grade			
		A	B	C	D
GR-9	• Proprietary terminal meeting NCHRP-350 test criteria (Stamped on 1st post) • Rail Height: 27¾"-28¾" • Meets site preparation standards	X			
	• Rail height of 27"-27¾" or 28¾"-30"		X		
	• Rail height of 24"-27" or 30"-33" • Does not meet site preparation standards • Guardrail system has a deficient Length of Need • Guardrail system has major rust			X	
	• Rail height <24" or >33"				X
GR-10 Type 1	• Rail Height: 27¾"-28¾" • Span: 12'-6" • 25' double nested W-beam	X			
	• Rail Height: 27"-27¾" or 28¾"-30"		X		
	• Rail height of 24"-27" or 30"-33" • Guardrail system has major rust			X	
	• Rail height <24" or >33" • Less than 1 foot of soil behind the posts due to erosion				X
GR-10 Type 2	• Rail Height: 27¾"-28¾" • Span: 18'-9" • 37'-6" double nested W-beam	X			
	• Rail Height: 27"-27¾" or 28¾"-30"		X		
	• Rail height of 24"-27" or 30"-33" • Guardrail system has major rust			X	
	• Rail height <24" or >33" • Less than 1 foot of soil behind the posts due to erosion				X
GR-10 Type 3	• Rail Height: 27¾"-28¾" • Span 25' maximum • 100' double nested W-beam • 6" X 8" CRT posts with two 8" blockouts	X			
	• Rail Height: 27"-27¾" or 28¾"-30"		X		
	• Rail height of 24"-27" or 30"-33" • Guardrail system has major rust			X	
	• Rail height <24" or >33" • Less than 1 foot of soil behind the posts due to erosion				X
GR-11	• Non-crashworthy terminal end treatment for anchorage • Run-off condition only	X			
	• Guardrail system has major rust			X	
	• Run-on condition				X
Longitudinal Guardrail as Anchorage	• Additional 50 feet of guardrail beyond length of need with washers • Run-off condition			X	
Blunt End	• Guardrail terminated with blunt end at run-on direction				X

Standard Guardrail Designation	Typical Characteristics	Functional Condition Rating Grade			
		A	B	C	D
GR-FOA-1 or GR-FOA2	• Nested W-beam with "C" shape rub-rail • 8" X 8" wood or W8 X 13 steel posts adjacent to fixed object	X			
	• Nested W-beam with "C" shape rub-rail • 6" X 8" wood or W6 X 8.5 steel posts adjacent to fixed object		X		
	• Nested W-beam with W-beam rub-rail • 6" X 8" wood or W6 X 8.5 steel posts • Guardrail system has major rust			X	
GR-FOA-3	• Nested W-beam with no rub-rail • 6" X 8" wood or W6 X 8.5 steel posts • Fixed object tapers away from traffic and terminates behind FOA		X		
GR-FOA-4	• Nested W-beam with W-beam rub-rail • 6" X 8" wood or W6 X 8.5 steel posts (Median Application)	X			
GR-FOA-2 or GR-FOA-4	• Nested W-beam with W-beam rub-rail • 6" X 8" wood or W6 X 8.5 steel posts • Missing steel spacer tube • Guardrail system has major rust			X	
Aesthetic Guardrail	• Weathering Steel (Cor-Ten or ASTM A588) W-beam Rail, Posts, and Hardware			X	