

INDIANA DEPARTMENT OF TRANSPORTATION



INTER-DEPARTMENT COMMUNICATION
Standards Section Room N642



Writer's Direct Line
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DESIGN MEMORANDUM No. 00-02 POLICY CHANGE

TO: All Design, Operations, and District Personnel, and Consultants

FROM: /s/ Richard L. VanCleave
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SUBJECT: Guardrail End Treatment (GRET) Design and Contract Document Preparation Procedures

SUPERSEDES: Design Manual Section 49-5.04(01), Information Contained in Section 49-5.04(03) Regarding Buried W-Beam Guardrail in Backslopes, and Figure 49-5P

EFFECTIVE: September 12, 2000, Letting

The policy relating to GRETs has been changed as listed below.

1. There are now four basic types of GRETs: Types OS, MS, I, and II.
2. The format for GRET pay items is Guardrail End Treatment (OS, MS, I or II).
3. The selection of the appropriate type of GRET is now based on traffic volume, location and the direction of traffic. The GRETs Type OS, I and II are used for single-faced guardrail and GRETs Type MS and I are used for double-faced guardrail installations.
4. GRET Type I may be used where the design year ADT is < 1000 regardless of the design speed. Double-faced GRET Type I is used in conjunction with double-faced guardrail. **Type I GRET shall not be used on the National Highway System.**
5. WR-beam guardrail will be required where Type II GRETs are Used.

Attached is an interim Design Manual Section to replace Section 49-5.04(01). This interim section also replaces the information contained in Section 49-5.04(03) regarding Buried W-Beam Guardrail in Backslopes and Figure 49-5P. This interim procedure will remain in effect until superseded by an official Design Manual revision or another Design Memorandum/Policy Change document. Designers are instructed to follow the interim procedure to verify guardrail end treatment warrants. In addition, Design Memorandum No. 00-02 Technical Advisory provides additional information regarding the design and contract documents preparation procedures related to guardrail end treatments.

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Attachment

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INTERIM DESIGN MANUAL CHANGES

49-5.04 Guardrail End Treatments and Transitions

49-5.04(01) Guardrail End Treatments and Usage

There are four basic types of guardrail end treatments (GRETs). They are as follows:

Guardrail End Treatment Type OS. This type of GRET dissipates energy when hit head-on and has the ability to redirect an errant vehicle on one side only, where backside impacts are not anticipated. It is used with single-faced guardrail.

Guardrail End Treatment Type MS. This type of GRET dissipates energy when hit head-on and has the ability to redirect an errant vehicle on two sides, where backside impacts are anticipated. It is used with double-faced guardrail.

Guardrail End Treatment Type I. This type of GRET is used where the design year **ADT is < 1000** regardless of the design speed. Double-faced Guardrail End Treatment Type I may be used in conjunction with double-faced guardrail installations. The Type I Guardrail End Treatment is shown in the INDOT Standard Drawings. **This guardrail end treatment type shall not be used on the National Highway System.**

Guardrail End Treatment Type II. This type of GRET is used where cut slopes or backslopes above the roadway grade are encountered along the roadside. The Type II GRET is shown in the INDOT Standard Drawings. Type II GRET is used to terminate single-faced guardrail in backslopes. This type redirects an errant vehicle on one side only. In some cases it may be necessary to modify the details on the Standard Drawings to adapt to unique conditions. Any deviation from the Standard Drawings should be shown on the plans and include the design characteristics relative to guardrail design and embankment slopes as shown in the Standard Drawings.

Where practical, it is desirable to bury the ends of guardrail runs into the backslopes. Important factors to consider when burying guardrail in backslopes are proper guardrail flare, maintaining the proper height of the guardrail, providing proper shoulder, embankment and approach slopes in front of the guardrail and maintaining drainage.

The following lists several design considerations the designer should evaluate in the selection of a Type II GRET:

1. In order to use Type II GRET, a minimum **22.86 m** straight run of standard W-beam guardrail which may include a guardrail transition, is required preceding the area of concern (hazard)
2. If this **22.86 m** guardrail run is not adequate, extend the guardrail run to shield the hazard.

3. The cut slope or backslope should be located laterally approximately **2 m** minimum and **5.25 m** maximum from the face of guardrail, at the end of the **22.86 m** guardrail run. The designer should ascertain that the backslope extends parallel to the roadway for a sufficient distance to bury the end of the Type II GRET, otherwise, a different type of GRET will be required.
4. The total length of Type II GRET is measured **from the end of the WR-beam** guardrail run **to the last post** of the steel post anchor system of the Type II GRET. This buried-in backslope guardrail system is made up of three components as follows:
 - A. The first component is **7.62 m** long WR-beam guardrail at the specified ratio a:b, depending upon the project design speed at the specific location.
 - B. The length of the second component which is also WR-beam guardrail varies from **0 to 30.48 m** to fit field conditions at the specified ratio a:b, depending upon the project design speed at the specific location.
 - C. The third component is **11.43 m** long plus the steel post anchor system at the specified ratio 8:1.
5. **Generally, for the buried-in backslope guardrail system to be cost effective, the total length of the system should not exceed approximately 50 m beyond the guardrail length of need as determined in Section 49-5.0.**

49-5.04(03) Design Considerations

5. Buried End sections. Guardrail end treatment Type I is not allowed on freeways including interchange ramps.
8. Buried W-beam Guardrail in Backslopes. Where practical, consideration should be given to burying the ends of a guardrail run into the backslope. Important principles to consider when burying guardrail in back slopes are....
 - c. Anchors. The end of the guardrail buried in the backslope will be anchored with a W-beam steel post anchor system as shown in the INDOT Standard Drawings.

49-5.04(04) Design Procedure

After the design of a roadside barrier including the appropriate railing transitions and the determination of the barrier length of need in accordance with Design Manual Section 49-5.0 is completed, it is necessary to select the proper guardrail end treatment type **(MS, OS, I or II)** for the guardrail in accordance with Section 49-5.04(01).

In order for a designer to determine the appropriate type of GRET, the following information must be considered:

Relationship of Guardrail End Treatment to Traffic. The designer must determine if there will be **traffic on one or both sides of the guardrail end treatment**. Will the GRET be located beyond the outside shoulder with traffic passing on one side only or will it be in a median, gore, or other location where traffic passes on two sides? If all traffic will pass a GRET only on one side, the GRET will not require redirective capability on more than one side. If traffic will pass the GRET on two sides, it may be necessary for the GRET to be capable of redirecting errant vehicles from two sides.

- 1. GRET for single-faced guardrail.** For this situation, the GRET only needs to provide redirective capability on the traffic side. **GRET Type OS or Type II should be selected for this situation.**
- 2. GRET for double-faced guardrail.** For this situation, the GRET must provide redirective capabilities on both sides. **GRET Type MS should be selected for this situation.**
- 3. Guardrail End Treatment in an Area Where the design year ADT is < 1000.** For this situation the **GRET Type I** may be selected regardless of the design speed. Double-faced Guardrail End Treatment Type I may be used in conjunction with double-faced guardrail; however **GRET Type I shall not be used on the National Highway System.**

Relationship between Guardrail End Treatment and Guardrail Length of Need. A portion of GRETs OS and MS function as typical guardrail and can be considered as part of the length of need in advance of the obstruction. A **3.81 m** portion of the down stream end of GRETs Type OS and MS should be considered as part of the length of need of the guardrail run. **Therefore when Types OS and MS are selected as GRETs, the pay length for the standard guardrail is equal to the required length of need for the guardrail less 3.81 m. This reduced pay length is to be reflected in the guardrail length shown on the plans.**