

**Project Title:** W-Beam Guardrail Post Installation in Rock  
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**Project Contract Period:** 2/19/2007-2/18/2008  
**Reporting Period:** 4/1/2007-6/30/2007

## **Project Objective**

The objective of this project is to develop cost effective guidelines for placement of W-beam guardrail posts in rock by optimizing current placement guidelines and by investigating sensitivity of W-beam guardrail performance to post embedment depth.

## **Work Performed to Date**

In this quarter, TTI researchers evaluated the existing guidelines with the objective of optimizing requirements of coring in rock for guardrail post installations. The researchers also completed a series of pendulum tests with posts installed at varying depths in soil. The objective of these tests was to evaluate the performance of W-beam guardrail posts at reduced embedment depths. The test data will be used to validate the response of the finite element model of the post-soil interaction, which is a key component of the W-beam guardrail system model.

## **Results of Work Performed**

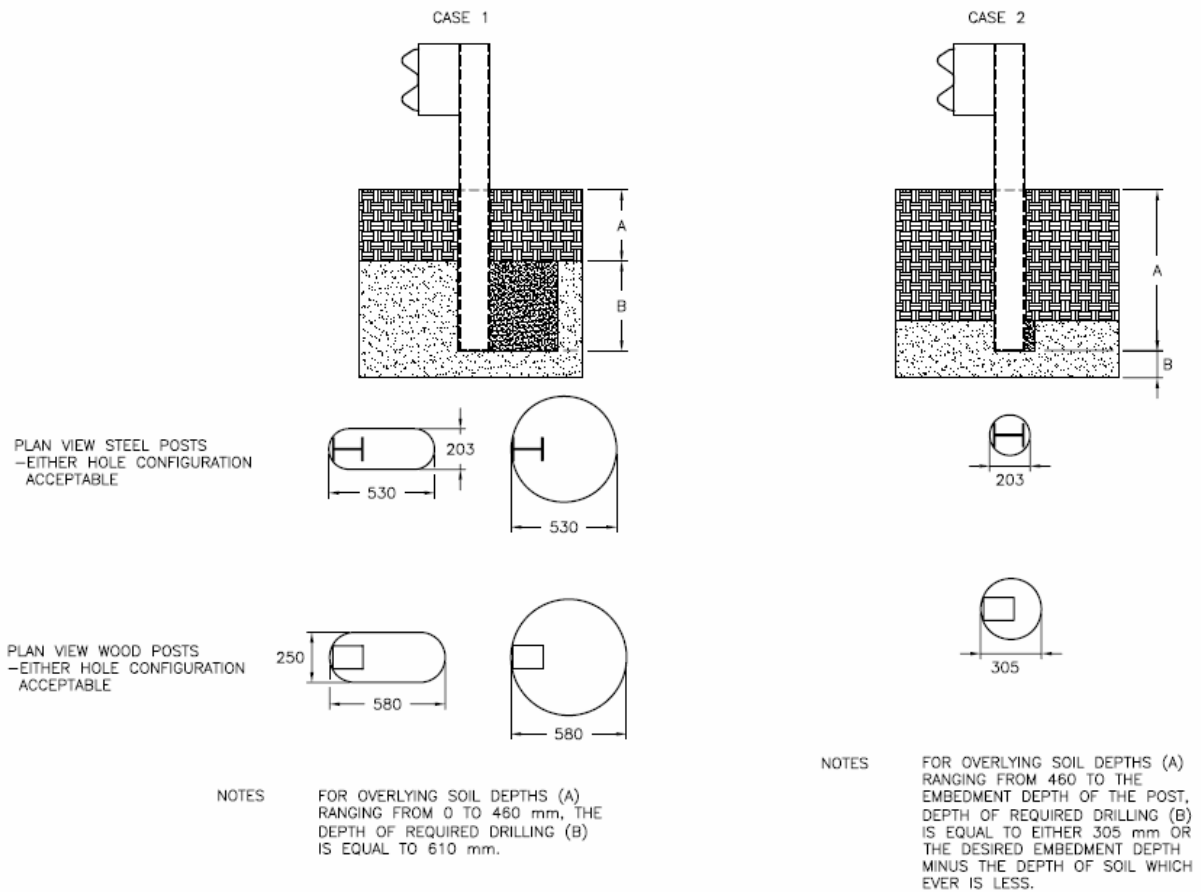
FHWA's memorandum on W-beam guardrail installation in rock presented a guideline (see figure 1) that was a simplified version of the original MwRSF's guideline (see figure 2). MwRSF's guideline contained more scenarios depending on the range of depths at which the rock was encountered below the ground. Some of these scenarios required reduced coring when compared to the simplified version of the FHWA memorandum.

MwRSF's research findings were reviewed to ascertain if the post deflection in the coarse aggregate backfill resulted in yielding of the post below the ground level. In bogie impact tests, the post rotated through the rock backfill without any appreciable plastic deformation. Therefore, for the purpose of geometric optimization of the existing guidelines, only rigid-body rotation of the post was considered (see figure 3).

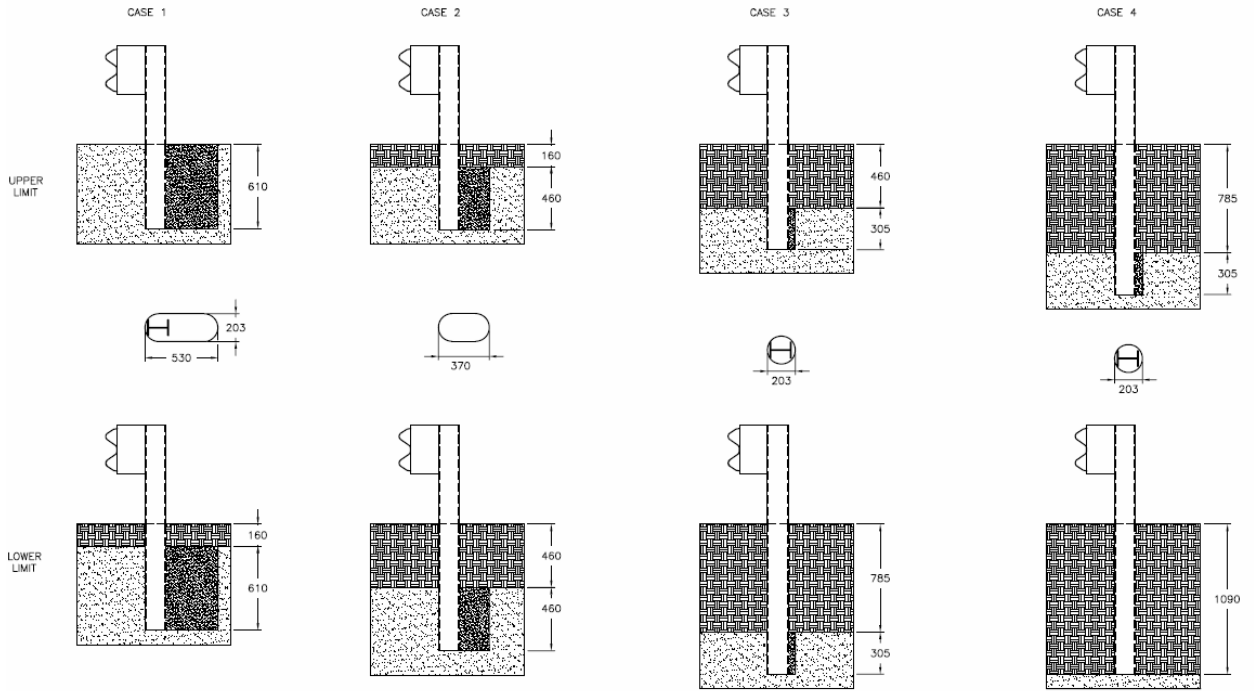
It was determined that the geometric optimization of the existing guidelines does not render significant savings in coring requirements. The elongated hole in Case 1 of figure 3 is the only case for which the coring requirements can be reduced. In this case, the elongated 530-mm long hole is created by drilling three overlapping 203-mm holes. The depth of the third hole can be reduced by 282 mm. If an elongated hole cannot be achieved in the field, or the user agency or contractor has a preference for drilling a single larger diameter hole, this savings cannot be achieved.

## Work Remaining to be Completed

TTI researcher will now develop finite element models of the posts in soil and validate the post-soil interaction using pendulum test results. Once the post-soil model has been validated, it will be used to develop a full system W-beam guardrail model. Parametric simulations will then be performed to evaluate the performance of W-beam guardrail when embedment depth of one or more posts is compromised by the presence of rock. Simulation results obtained from the parametric study will be used to develop guidelines for installation of guardrail posts when rock is encountered.



**Figure 1. Coring requirements from FHWA's memorandum.**



**Figure 2. MwRSF's detailed guideline for post installation in rock.**

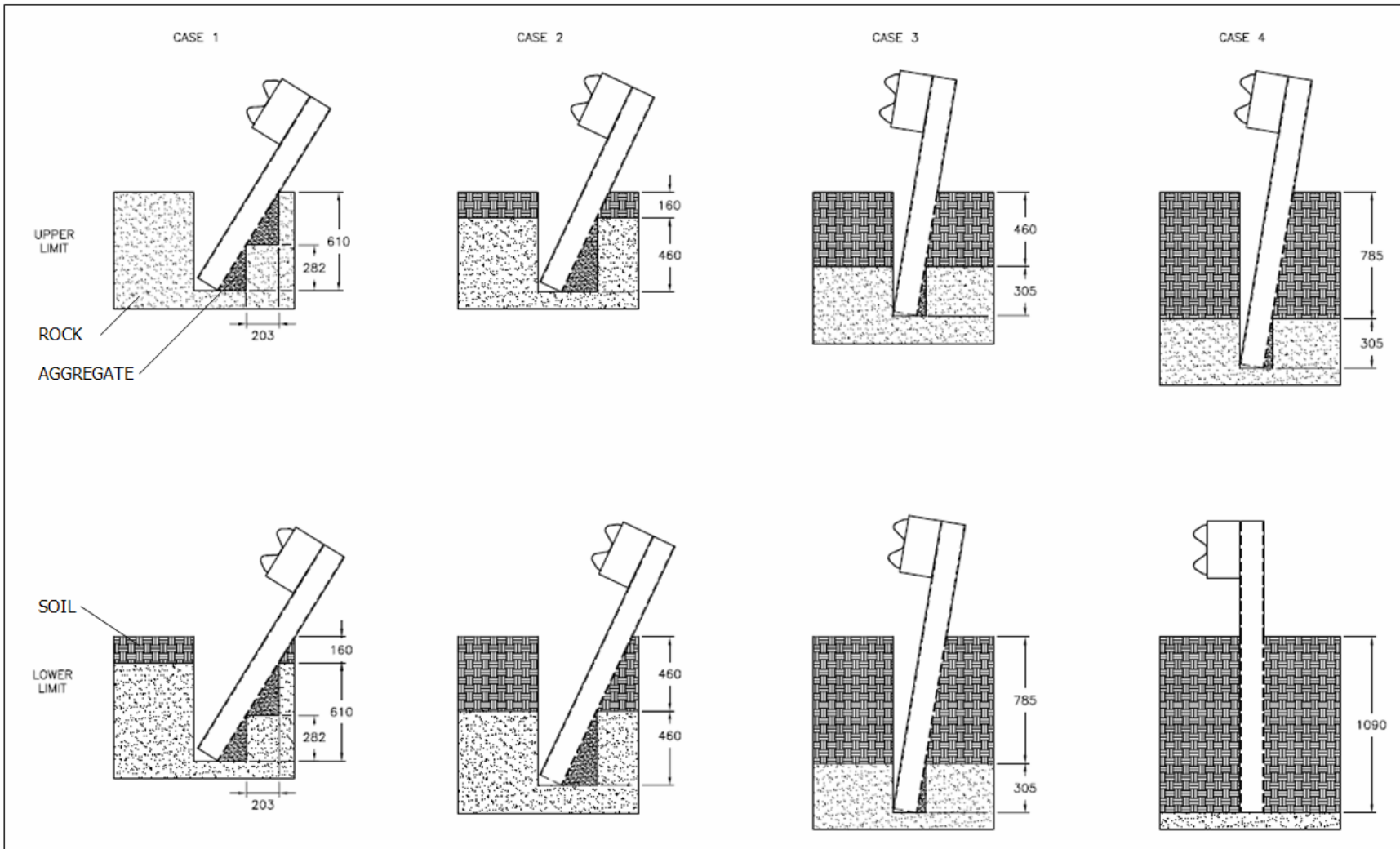


Figure 3. Evaluation of the existing guidelines through geometric optimization.