

Precast Concrete Barrier Design/Selection

In light of changing crash test criteria and current research, WSDOT is in the process of evaluating and selecting the most appropriate unrestrained precast concrete barrier system to use on our highways. In addition, WSDOT seeks to create a Standard Design for the use of large drainage scuppers in the selected precast concrete barrier. The current practice is to use WSDOT's Standard Type 2 Concrete Barrier for most unrestrained concrete barrier installations. However, it is likely there may be a design option that may offer better overall performance, especially with the addition of a large scupper drainage opening. Consequently, the Design Office is asking for your assistance in evaluating alternative designs and selecting the most appropriate precast concrete barrier type.

(1) Main Issues

- (a) Selection of an appropriate precast unrestrained concrete barrier system.
- (b) Design and selection of a large scupper drainage opening to crash test in the selected barrier design.

(2) Barrier Selection

(a) Background

WSDOT has been using precast Concrete Barrier Type 2 for many years. The barrier segments are typically 12.5 feet long and are connected with steel pins inserted through wire cables ([Current System Details](#)). This system has been successfully crash tested to Test Level 3 following the guidelines listed in NCHRP Report 350. (These guidelines are currently being updated and larger test vehicles will be required for future crash testing.) With these changes, there is a possibility that WSDOT's Type 2 Concrete Barrier will not pass the new crash test criteria. However, other states have developed different precast barrier systems that are more likely to meet future crash-testing requirements. It is important to note that some of these alternative designs also include anchoring systems, optional heights, different connections, and smaller deflection values (among others) that may make some of these features or one of these complete systems a better choice for WSDOT.

As mentioned above, WSDOT seeks to develop a barrier that has a large scupper design. Unfortunately, it may not be possible to incorporate this feature into the current WSDOT design and successfully pass present or future crash-testing requirements. Therefore, prior to developing a barrier with a large scupper, it is prudent to review the current design to determine whether a barrier change will be beneficial.

(b) **Considerations**

If a barrier system other than the WSDOT Type 2 system is selected, the following important factors will need to be addressed:

- New transitions will need to be developed
- Dual barrier inventory will be required
- Barrier cost and weight may increase
- Connection methods may be different

(c) **Typical Barrier [Shapes](#)**

(d) **Existing Barrier Examples (Crash-Tested Precast Concrete Systems)**

Alternative barrier designs are shown below. Please review these designs in relation to the WSDOT Type 2 barrier. If appropriate, a future WSDOT precast barrier could be one of these systems. However, it is also a possibility a unique concrete barrier system that incorporates the desirable features of these or other systems could be developed.

The following examples include one 36-inch and three 32-inch-high systems. All examples have been crash tested to current NCHRP 350 criteria (Test Level 3). These systems incorporate various shapes and different connection designs.

To view plans, crash test videos, barrier performance, and obtain additional information, please refer to the following links:

WSDOT Type 2 Precast System (New Jersey Shape)

- [Drawings](#)
- [Connection Details](#)
- Crash Test [Video1](#) [Video2](#)
- [Photos](#)
- [Reports](#)

Oregon Precast Barrier System (F-Shape)

- [Drawings & Connection Details](#)
- Crash Test [Video](#)
- [Reports](#)

Texas Precast Barrier System (F-Shape)

- [Drawings](#)
- Connection [Detail1](#) [Detail2](#)
- Crash Test [Video1](#) [Video2](#)
- [Photos](#)
- [Report1](#) [Report2](#)

California Precast Barrier System (Single Slope)

- Drawing/Connection Details [Drawing1](#) [Drawing2](#)
- Crash Test [Video1](#) [Video2](#)
- [Photos](#)
- [Reports](#)

System Comparison Summary				
System	Shape	Approx. Weight (lb/lf)	Crash-Tested Maximum Deflection (in)	Connection Type
WSDOT Type 2	New Jersey	390	56	Steel Pin and Braided Wire Loops
Oregon (F-Shape)	F-Shape	460	30	Steel Pin and Steel Bars
Texas X-Bolt	F-Shape	460	27	Cross-Bolted Steel Rods
California Single Slope	Single Slope	770	30	Steel Pins and Steel Bars

(e) System Selection Considerations/Issues

Some questions you can help the Design Office answer in the development of a concrete barrier system with large scupper(s) are as follows:

- Shape (Single Slope, New Jersey, etc.)
- Barrier segments
 - Length (maximum and minimum)
 - Permissible weight
 - Connection type
 - Maximum allowable deflection
 - Anchoring needs/methodologies

- Maintenance considerations
 - Compatibility with existing systems
 - Considerations for additional inventories
 - Ease of segment connection and removal
- Placement considerations on or near slopes

(3) How You Can Help

Your assistance is needed as the Design Office moves forward with the design and testing of a barrier system that will accommodate large scuppers and also meet WSDOT's future needs.

If you have additional questions or comments, please e-mail or phone:

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