

**Delaware Department of Transportation  
Division of Transportation Solutions  
Design Guidance Memorandum**

**Memorandum Number 1-25 Revised**

- |                       |                            |                                  |
|-----------------------|----------------------------|----------------------------------|
| 1. Road Design Manual | 2. Bridge Design Manual    | 3. Utilities Design Manual       |
| 4. Real Estate Manual | 5. Standard Specifications | 6. Standard Construction Details |
- 

Title: Safety Edge Effective date: January 24, 2011

Sections to Implement:

- |   |   |   |
|---|---|---|
| <input checked="" type="checkbox"/> Project Development | <input checked="" type="checkbox"/> Planning                    | <input type="checkbox"/> DTC                |
| <input checked="" type="checkbox"/> Bridge              | <input checked="" type="checkbox"/> Quality                     | <input checked="" type="checkbox"/> Traffic |
| <input checked="" type="checkbox"/> Team Support        | <input checked="" type="checkbox"/> Maintenance &<br>Operations | <input type="checkbox"/> Other _____        |
| <input type="checkbox"/> Utilities                      |   |   |

**I. Purpose**

To reduce the occurrence of roadway departure crashes and to minimize the consequences of such crashes by providing a pavement edge treatment termed Safety Edge which has better performance compared to a vertical edge.

**II. Design Guidance**

A Safety Edge is a  $32^\circ \pm 2^\circ$  fillet of pavement installed along the edge of the road in place of a vertical drop-off. The Safety Edge should be implemented during all pavement overlay operations and new pavement road construction where the road surface is not adjacent to curb or guardrail regardless of shoulder width. Safety Edge is constructed only on the final lift of the top wearing course 1¼” or greater in thickness at the edge of the roadway. (Note that throughout this document, “bituminous concrete” is being used as a general term which refers to both hotmix asphalt (HMA) and warm mix asphalt (WMA).) Safety Edge does not replace the requirement for securing pavement edge drop-offs during construction operations. The requirements of Table 6G-1 Vertical Difference of the *Delaware Manual on Uniform Traffic Control Devices* still apply for treating pavement vertical edges during construction operations.

Pavement-edge drop-off is the uneven edge or vertical drop-off between the paved travel lane/edge of roadway and the unpaved shoulder area. A drop-off of 2 inches or more is considered to be a hazard to errant vehicles, especially if the edge is at a 90° angle to the shoulder surface.

Pavement-edge drop-offs result from overlays, pavement-edge breaking, erosion, wear of unpaved shoulders, inadequate maintenance, or when the shoulder is not flush with the pavement following a construction project. A combination of shoulder erosion and edge rutting caused by vehicles repeatedly leaving the paved travel lane are typically found at these locations.

Safety edge is a relatively easy and inexpensive countermeasure to pavement-edge drop-offs. It is a tapered (rather than vertical) transition between the paved surface and the unpaved shoulder of a paved highway. The recommended  $32^\circ \pm 2^\circ$  degree angle with the horizontal tapered pavement edge or fillet can help drivers make a smoother, more controlled reentry back onto the paved travel lane compared to a more abrupt or vertical edge. The tapered edge helps prevent drivers from overcorrecting if they drift onto the shoulder, thus decreasing the likelihood of the vehicle crossing into opposing traffic or leaving the roadway.

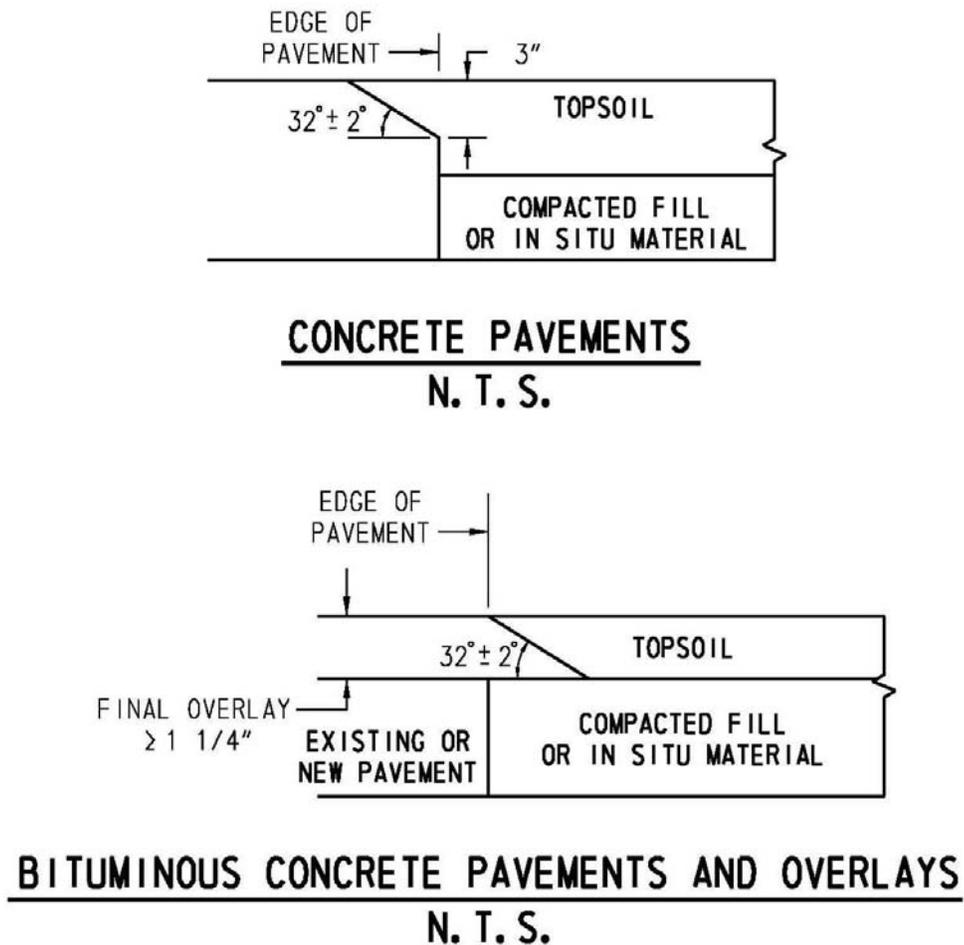


Figure 1  
Safety Edge Configuration

Prior to placing concrete or bituminous concrete pavement, prepare the shoulder material where the Safety Edge will be placed to provide a foundation that will support its placement.

The Safety Edge is installed during a bituminous concrete resurfacing project using a special, removable wedge shape compaction device attached to and extending below the screed strike-off plate of the paver. This device is used to construct a pre-compacted, long lasting, low angle wedge fillet on the outside edge of the paved mat. The device has a self-adjusting internal spring that allows it to follow the surface independent of other paver components. The device has an angled surface that compacts the asphalt as it enters the device while another fixed-angle surface forms the tapered edge. As the asphalt continues under the wedge-forming surface, the asphalt is smoothed to create a finished surface on the tapered edge. Two wedge shape compaction devices that are commercially available are TransTech's Shoulder Wedge Maker and Advant-Edge Paving Equipment's Advant-Edger. The use of a single plate strike off is not allowed. Compaction of the edge should not be done with the first pass of the roller in order to give the Safety Edge a chance to harden some.

For concrete pavement or overlay, modify the paver screed to create the shoulder wedge as per the Safety Edge cross section.

Fill or in situ material shall be placed and compacted as shown in the figures.

In conjunction with the placement of the Safety Edge, there may be handwork, such as at transitions at driveways, intersections, interchanges and bridges, as approved by the engineer.

The Safety Edge shall be included on all roadway improvements projects on state maintained roads. The Safety Edge will be detailed on the typical sections as well as the construction details. Notes will be added to the plans to provide any necessary information to the Contractor.

The Divisions of Maintenance and Operations and Planning will also ensure that the Safety Edge is incorporated when paving work is authorized on a state maintained roadway.

### **III. Justification**

According to the Federal Highway Administration, it is estimated from studies that about 11,000 injuries and 160 deaths occur annually in the United States from crashes related to unsafe pavement edges. In Delaware, road departure crashes accounted for about 47% of all fatal crashes from 2007 through 2009. Although rural roads were only 29% of the vehicle-miles traveled in 2007 through 2009, 57% of fatal roadway departure crashes occurred on rural roads. Additionally, 40% of fatal roadway departure crashes occurred on collector roads; collector roads only accounted for 16% of vehicle miles traveled in 2007 through 2009.

Once a vehicle has slipped off the pavement and onto the unpaved or deteriorated shoulder, abrupt or vertical pavement-edge drop-off can make it difficult for a driver to reenter the paved travel lane. Studies show that drivers tend to attempt to return immediately to the paved travel lane; in doing so, they tend to oversteer when "scrubbing" (the intense rubbing of the right-side vehicle tires against the pavement edge) prevents the vehicle from climbing back onto the pavement. This oversteering can result in loss of control when the tire climbs back onto the pavement, and may result in a crash. When crashes related to pavement-edge drop-off occur, they are often more severe than other crash types, according to studies, primarily because the vehicle often leaves the roadway, rolls over, hits a roadside object, or is involved in a head-on

collision. A Safety Edge provides an easily traversable transition for an errant vehicle to reenter the roadway from the unpaved shoulder/edge of road.

The Safety Edge can be constructed with no impact to production with minimal additional material cost.

A demonstration project using Safety Edge was constructed in 2010 on Old Furnace Road in Seaford.

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1-19-11  
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