

The Pennsylvania Local Roads Program Pavement Edge Maintenance

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The Transportation Research Board of the National Research Council considers pavement edge shoulder drop-offs among the top crash related pavement disturbances and a common source of tort claims against roadway agencies. A pavement edge drop is created by a difference in elevation between two adjacent surfaces of the roadway. This condition frequently occurs on narrow pavement or roads without paved shoulders, where the wheels of vehicles frequently traverse off the pavement.



*Edge drop-off on narrow roadway
(from TxDOT Project 0-4396).*

Several recent studies have concluded that the proper maintenance of pavement shoulders and edges can facilitate safe roadway reentry by vehicles that stray onto the shoulder, to prevent run-off-the-road crashes, improve motorist safety, and reduce tort liability claims. This tech sheet will address edge maintenance and edge repair techniques associated with a paved traveled way and an unpaved shoulder.

CAUSES OF PAVEMENT EDGE DROP-OFF

Pavement edge drop-offs are generally caused by erosion from wind, rain or other environmental conditions and by vehicular traffic on an unpaved shoulder. If the shoulder areas are not compacted properly, they erode easily. When shoulder slopes are too steep, surface runoff will flow too fast while crossing the shoulder and create significant erosion. Edge drop-offs can also occur during pavement overlay construction as we learned in the Fall 2005 Technical Information Sheet # 123, *Remedy for Pavement Edge Drop-Offs from Resurfacing Projects*.

Areas that are more susceptible to pavement edge drop-off are: the inside of horizontal curves, the turning radius of intersections with other roads or driveways, and at approaches to uphill or vertical curve areas. Other common locations are mail box turnouts and school bus stops. Snow plowing operations also cause pavement edge drop-off, because the operators often drive on the edge and the plowing can score the pavement surface, which creates raveled and damaged edges.

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PAVEMENT EDGE MAGNITUDE

There are no accepted standards that represent an acceptable risk with regard to pavement edge drop-offs. However, the U.S. DOT suggests that a drop-off of 3 inches or more of vertical differential is unsafe, and the American Association of State Highway and Transportation Officials suggests that no vertical differential greater than 2 inches occur between lanes. Agencies can use a technique that involves placing a straight edge or level on the pavement to measure the depth of the drop-off using a ruler or tape measure. If a drop-off greater than 2 inches exists, the shoulder should be scheduled for maintenance and repaired immediately.

MAINTENANCE PRACTICES

Maintenance personnel identify or become aware of pavement edge problems in various ways, but the most common method is a frequent windshield survey of their roads. It is important to remember that the assessment of severity associated with edge damage is subjective so, when in doubt, get out of the vehicle and observe the conditions. Since edge drops tend to occur in particular locations, maintenance personnel will become aware of these locations. Complaints from road users and other agency employees are also sources of information for edge drop-offs. A majority of these reports may relate to construction zone edge drop-offs or driveways and mailbox turnouts.

An effective edge maintenance strategy is not only important in achieving good roads, without good edge maintenance an agency cannot achieve good roads. An effective edge maintenance strategy is the key element of a successful road maintenance program.

PREVENTIVE EDGE MAINTENANCE

Preventive edge maintenance can be defined as a group of activities performed to protect the pavement and decrease the rate of deterioration of the pavement edge. Asphalt roadway surfaces tend to deteriorate over time as the elements of nature cause the asphalt to become brittle. This often occurs in the form of raveling (loss of aggregate) or

surface cracks. Application of a seal coat can restore the resilient properties of the asphalt surface and prevent further deterioration. Seal coats commonly used for pavement maintenance are fog seals, scrub seals, slurry seals and chip seals. Our discussion will be limited to the use of fog seals and chip seals in preventive edge maintenance operations.



Fog seal applied along the edge of pavement
(from TxDOT Project 0-4396).

Fog Seal

A fog seal is a light application of a diluted, slow-setting asphalt emulsion, similar to a tack coat, to the roadway surface. It is used to renew old asphalt surfaces that have become dry and brittle with age and to seal small cracks and surface voids. Typically fog seals are used to seal shoulders, dig outs and patches.

Using a fog seal as a preventive edge maintenance activity involves spraying asphalt emulsion along the pavement edge to cover 1 or 2 feet of the edge. A thin layer of fine-grained soils (e.g., blow sand) can be applied over the sprayed edges with a motor grader to eliminate stickiness, especially if excessive asphalt has been applied.

In Texas, this practice is known as raw edging and is generally performed after pavement edge repair or shoulder reshaping as a preventive measure. It offers some degree of stabilization against wind or light rain erosion. The emulsion also helps seal the pavement to retard moisture infiltration.

Chip Seal

A chip seal can be used where light to moderate cracking or raveling is occurring. This surface treatment provides skid resistance and improves ride quality, as well as seals the roadway. Chip seals generally involve applying asphalt emulsions or liquid asphalts, covering them with aggregate and then rolling them.

An edge or strip seal (chip seal) can be used as a preventive edge maintenance activity. It involves the spray application of a single layer of asphalt followed immediately by application of a thin aggregate cover, which is rolled. The operation is similar to a seal coat treatment, but the edge seal is typically done for a 1- to 2-foot strip instead of the full width. The edge or strip seal serves some of the same purposes as the fog seal: sealing hair-line cracks on the surface and rejuvenating oxidized asphalt. This technique can be used to help maintain cracked or broken edges.

In Texas, this practice is generally performed as a preventive measure after pavement edge repair or shoulder reshaping. Some districts report that edge sealing helps other repairs last longer. One concern about using an edge seal is creating a build-up of fine aggregate at the pavement edge after repeated application.



Edge seal at pavement edge
(from TxDOT Project 0-4396).

EDGE REPAIR TECHNIQUES

Standard repair techniques include pavement edge repair, reshaping (pulling up) the shoulder, cutting

high edges, and replenishing the shoulder with select materials.

Pavement Edge Repair

Edge repairs are needed when the pavement has failed along the edge due to the action of traffic and the loss of edge support. The repair of localized edge damage is similar to pothole patching and is among the most simple of repair techniques because it involves hand patching. Different types of repair materials are used, including hot mix asphalt and cold mix asphalt. The basic procedure to repair the pavement edge can be defined as follows: Clean, Tack, Place and Compact.

- Clean the edge drop area.
- Apply a tack coat to exposed surfaces.¹
- Place patching material to fill the drop.
- Compact materials using compaction equipment.



Pavement edge failure (from TxDOT Project 0-4396).

Reshaping (Pulling) Shoulders and Replenishing Shoulders

The purpose of both these techniques is to reestablish the slope and shape of the shoulder, to ensure proper drainage from the surface of the pavement, to eliminate any edge drop between the pavement and shoulder, and to provide side support to the pavement.

Reshaping is done when there is very little erosion and when there is enough material in place to allow reestablishing the correct shape. On the other hand, replenishing is a similar operation but is done when there is more than a 2-inch drop-off

and where there are not enough materials in place on the shoulder to restore it to its original shape and slope.

Both of these operations may also involve cleaning and reshaping of the adjacent ditches. The best time to perform these operations is when the shoulder surface is moist; otherwise a water truck will be needed to dampen the surface.

A basic procedure to reshape earth and gravel shoulders involves the following:

- Remove debris from the shoulder and ditch.
- Blade the shoulder and spread the material using a motor grader.
- Compact the shoulder using compaction equipment after achieving proper cross-slope.
- Remove excess material and sweep pavement surface.

Replenishing pavement edges with select materials is an operation similar to reshaping the shoulder, with a few additional steps, as described below:

- Place and spread additional select material over the compacted shoulder surface.
- Compact additional select material.
- Apply a seal coat to stabilized shoulders.
- Remove excess material and sweep pavement surface.

Since replenishing involves the use of selected materials, this repair technique may be preferred at locations with recurring problems, such as the inside of horizontal curves, turning radii at intersections, erosion-prone areas and locations of pull-offs. If pavement edge drop-offs continue to be a problem, the local agency may want to consider paving the shoulder at these locations.



Replenishing repair in progress at inside of horizontal curve (from TxDOT Project 0-4386).

Cutting High Edges

Another problem at the pavement-shoulder junction is build-up of material. This occurs as a result of not cleaning the shoulders after winter operations. Anti-skid material gets shoved to the side of the road by traffic action and catches dust and dirt. Vegetation then begins to grow in this excess material. Accumulated debris, excess materials, and vegetation along the edge of the pavement must be bladed off periodically to facilitate proper drainage. Shaved-off materials from the high edges are frequently used to fill low spots elsewhere. Cutting high edges is often scheduled during spring maintenance operations to avoid exposing soils to erosion when there is no vegetation.

NOTES

¹ PennDOT does not require the use of a tack coat when placing a cold mix.

SOURCES

Lawson, W.D., and Hossain, M.S. *Best Practices for Pavement Edge Maintenance*. Report No. 0-4396-1. Texas Department of Transportation. May 2004.

Shoulder Maintenance. LTAP Technical Information Sheet # 62. The Pennsylvania Local Roads Program. Summer 1995.

Pavement Maintenance Manual. Nebraska Department of Roads, www.nebraskatransportation.org/docs/pavement/pdf.

Call 1-800-FOR-LTAP for more information on pavement edge maintenance.