

# Colorado LTAP

September 2007

Serving local transportation agencies throughout Colorado

Fall Issue

## Hazards of Pavement Edge Drop-Offs Safety Edge Solution



Figure 1: Edge Drop-offs

By Nattapong, Colorado LTAP Research Assistant

Unsafe pavement edge drop-offs are a major concern and can be dangerous for the driving public. According to a Federal Highway Administration (FHWA) publication titled, *The Safety Edge: Preventing Crashes Caused by Unsafe Pavement Edge Drop-offs*, approximately 11,000 Americans suffer injuries and 160 die each year in crashes due to unsafe pavement edge, which costs \$1.2 billion annually. This does not include the millions that highway agencies pay in tort liability claims<sup>2</sup>.

A pavement edge drop-off is defined by a vertical elevation difference between two surfaces of the roadway, for example, when the shoulder is lower than the travel lane. It can also be when there is an elevation difference between or within the paved lanes and the shoulders, resulting in the roadside area being lower than the paved shoulder<sup>3</sup> as seen in Figure 1.

A pavement edge drop-off is generally caused by vehicular traffic on unpaved shoulder, wind, rain, and snow plowing<sup>4</sup>. Also, pavement edge drop-offs are common during asphalt pavement overlay projects. There are several areas where a

pavement edge drop-off is often encountered such as horizontal curves, near mailboxes, turnarounds, shaded areas, eroded areas, and asphalt pavement overlays because tires frequently depart the road in these areas.

### Hazards of Edge Drop-off

A vehicle may depart its travel lane for many reasons, such as driver error, poor surface conditions, or avoidance of a collision with another vehicle in the travel way<sup>1</sup>. Drivers can experience difficulty reentering the travel lane if the vertical pavement edge is 3 inches or more. If the

tires transverse a vertical or near vertical edge of any perceptible height, this edge creates a scrubbing condition. When scrubbing occurs, drivers over-steer to reenter the roadway and they tend to lose control of the vehicle. When drivers lose control of their cars, they often

overcorrect to the left when reentering on to the road, which may lead to several types of crashes such as head-on, roll over, side swipe, and road side hazards<sup>5</sup>.

### Safety Edge

Although there are no accepted

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**LOOK INSIDE**

**Chainsaw Crossword Puzzle**

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**Lindsay Nathaniel**

Training Coordinator

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**Marty Butcher**

Library/Office Assistant

**Jeremy Goldsmith**

Webmaster

The Colorado Local Technical Assistance Program is sponsored by the Federal Highway Administration, the Colorado Department of Transportation, and the University of Colorado at Boulder.

The Colorado LTAP Newsletter is published quarterly. Articles, pictures and comments are welcome.

For more information, contact:

Colorado LTAP  
University of Colorado  
at Boulder  
3100 Marine St., A-213  
UCB 561  
Boulder, CO 80309-0561

Office: (303) 735-3530  
Toll Free: (888) 848-LTAP

Fax: (303) 735-2968

Email:  
cltap@colorado.edu

Website:  
<http://ltap.colorado.edu>

Program Manager's Corner

2007 ANNUAL NEEDS ASSESSMENT SURVEY

A special thanks to all 200 respondents of our 2007 Annual Needs Assessment Survey. The format was redesigned this year, and we greatly appreciate your time and suggested comments. Your responses are critical in developing our work plan based on *your* needs. We thank you for your commitment to helping make this program better and more beneficial to local agencies. **Congratulations!** \$25 Visa gift cards are going out to these ten lucky winners who were randomly drawn from the 200 responses.

Dan Centa - *City of Pueblo*

Bill Lanfield - *City of Silverthorne*

Larry Record - *Delta County*

Bernie McGinn - *City of Grand Lake*

David Trujillo - *Custer County*

Steve Coupal - *US Forest Service*

Pat Hill - *Engineering Services*

K. Lenarcic - *Town of Jamestown*

Steve Detienne - *Weld County*

Kim Quante - *City of Aurora*

Quotes  
of  
the  
Day

Thanks to the Interstate Highway System, it is now possible to travel from coast to coast without seeing anything.

- Charles Kuralt

...when you have eliminated the impossible, whatever remains, however improbable, must be the truth.

- Sir Arthur Conan Doyle

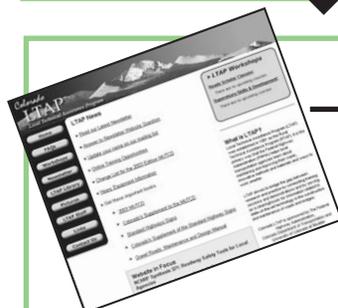
*Leaders Grow People*

If you want one year of prosperity, grow grain.

If you want 10 years of prosperity, grow trees.

If you want 100 years of Prosperity, grow people.

- Chinese Proverb



<http://ltap.colorado.edu>

Visit Colorado LTAP online today for online training, class registration, free lending library, and more.

# Advantages of Porous Pavements Asphalt and Concrete

By Nattapong, Colorado LTAP Research Assistant

**P**orous pavements have many beneficial qualities. Porous pavements can provide high pollutant removal efficiencies at a rate of 85-90%, be very durable, reduce noise, and increase safety for vehicular traffic due to reduced spray generation on driving surfaces<sup>2</sup>. It also helps to replenish ground water, reduce the volume of ground water runoff, and preserve the natural hydrology<sup>1</sup>. Because of its porosity, porous pavements improve the water's quality as it filters through the pavement.

Typically, porous pavement is designed by taking fine aggregates out of a mix and allowing air, water and precipitation to pass through the porous pavement. The porosity of the pavement is made by the space between single-sized gravels. As a result, porous pavement typically has a porosity of 30-40%.

Although the cost to construct porous pavement initially seems to be more expensive than conventional pavement, there are several factors to consider when taking cost into account. After looking at the whole picture, porous pavement may prove to not be much more expensive. There is no deep excavation required because porous pavement is designed to fit the topography. In addition, for porous pavement, the underlying stone bed is commonly used instead of compacted sub-base. The underlying stone bed for porous pavements is comprised of uniformly graded 1.5-2.0 in. clean-washed stone mix to avoid clogging and to maximize void space. The stone bed is usually between 18 and 36 in. deep, may be more expensive than conventional compacted sub-base; but there is a considerable reduction in the number of stormwater pipes and inlets required and the need for detention basin is eliminated. These factors can greatly offset the cost of stone bed<sup>3</sup>.

For the long term, porous pavement is long lasting and requires fewer repairs. There are many case studies that show that porous pavement outlasts traditional pavement. One example is porous parking lots located at the Walden Pond State Reservation in Massachusetts. It was

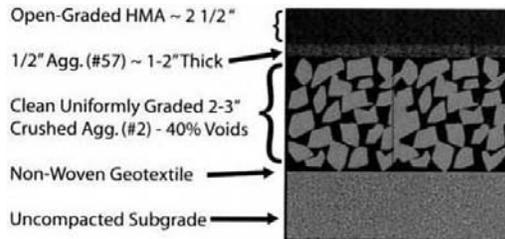


Figure 1: Porous Pavement Technology

found that after twenty years, while the pavement has never been repaved, it is still in good shape and drains effectively. Another 25 year study of porous pavement constructed at the Centre County/Pennsylvania State Visitor Center in Pennsylvania showed that their porous pavement had maintained a consistent infiltration rate. Additionally, there was no surface discharge from the stone bed<sup>4</sup>.

### Pervious Concrete or Porous Asphalt?

There are several types of porous pavements such as porous aggregate, porous turf, plastic geocells, open-jointed paving blocks, open-celled paving grids, porous concrete, porous asphalt, soft paving materials, and decks. Selecting the right porous pavement to fit your need depends on each material's characteristics such as cost, installation methods, performance levels, advantages and disadvantages for a specific application, and maintenance requirements<sup>5</sup>. Two types of porous pavements most commonly used are *porous asphalt* and *pervious concrete*. Both have been used for the last 25 years in the U.S.

### Pervious concrete

Unlike conventional concrete, pervious concrete mixes contain cement, aggregates, and water with little or no sand, providing a 20-25% void and allowing 3-8 gallons of water to pass through per minute per square foot. Both rounded aggregate (gravel) and angular aggregate (crushed stone) can be used in pervious concrete mixes. Typically, if higher strengths are required rounded aggregates should be used. Due to the strength and durability of the cement and aggregates mix, pervious concrete

...continued on page 6

## Colorado LTAP Advisory Committee Members

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Colorado LTAP



## 9 THINGS YOU CAN DO TO SAVE WATER IN THE BATHROOM

The following tips can help save thousands of gallons of water each year. So be alert. If you see water being wasted - SPEAK UP! Remember, a little effort and a little common sense will make a big difference.

- 1. Check your toilet for leaks.** Put a little food coloring in the tank. If, without flushing, the color appears in the bowl, you have a leak to repair.
- 2. Stop using the toilet as a wastebasket.** Every time you flush a cigarette, tissue, or other bit of trash, you waste 5-7 gallons.
- 3. Put plastic bottles in your toilet tank.** Put 1-2 inches of sand inside 2 bottles, fill with water, and place in tank - safely away from operating mechanisms.
- 4. Take shorter showers.** Long showers can waste 5-10 gallons a minute.
- 5. Install water-saving shower heads.** Local hardware stores stock inexpensive water-saving shower heads or flow restrictors - easy to install.
- 6. Take baths instead of showers.** A partially filled tub can use less water than even a short shower.
- 7. Turn off water after wetting your toothbrush.**
- 8. Rinse your razor in the sink.** Fill basin with a few inches to rinse blade.
- 9. Check faucets and pipes for leaks.** The smallest drip from a worn washer can waste 20 or more gallons a day.

USE WATER...  
AND USE IT WISELY

## Road to Rapid City 2007 Local Roads Conference

The LTAP centers of Colorado, Wyoming, Nebraska, North Dakota and South Dakota present the annual two-day Local Road Coordinators Conference in Rapid City, SD for local agencies to learn about current hot topics in transportation.

**WHEN:** October 17-18, 2007

**WHERE:** Ramkota Hotel

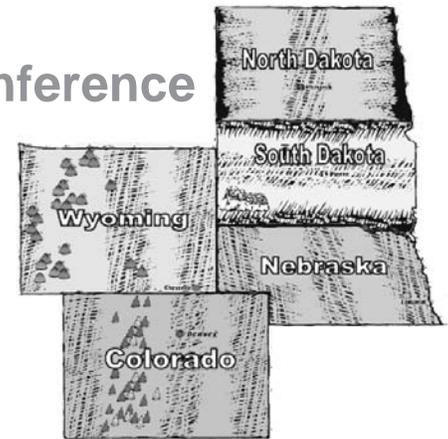
2211 LaCrosse Street, Rapid City, 605-343-8550

LTAP County Road Conference room block

**REGISTRATION FEE:** \$70.00

### CONFERENCE TOPICS:

- Local Road Safety, NE LTAP
- "You Show Us" Contest Awards
- Organizational & Leadership Challenges
- Training Today's Workforce
- Dust Control on Haul Roads
- Blotter Construction / Seal Coats
- Communicating at the Local Level
- "RAP"
- Economic Impact on Highways
- Sign Management



**REGISTER:** <http://ltap.colorado.edu>



The LTAP centers of Missouri, Iowa, Nebraska & Kansas present a two-day conference in St. Joseph, MO for local agencies to learn about current topics of interest and share similar transportation concerns. The conference committee is encouraging participation from surrounding states.

**WHEN:** October 23-24, 2007

**REGISTRATION FEE:** \$50.00

**REGISTER:** <http://www.ctre.iastate.edu/events/mink7-registration-postcard.pdf>

### CONFERENCE TOPICS:

- Planning for the New Highway Bill  
*By Sue Miller, NACE President-Elect*
- Emergency Response Lessons at the Local Level Panel
- Roadside Design Guide Updates
- Federal Programs to Improve Local Safety
- FHWA Local Projects Administration
- 4 Roundtable Discussions
  - Erosion & Sediment Control and Compliance Issues
  - Local Response to Higher Material Costs
  - Local Funding Options
  - County Associations

**WHERE:** Stoney Creek Inn, St. Joseph  
1-800-659-2220

**ROOM COST:** \$70 plus tax  
(MINK Conference room block)

### SIGN INVENTORY SOFTWARE

Do you use *Terra Sync* software to manage your sign inventory? And would you be willing to share your data dictionary? If so, please contact Renée at the LTAP center; email: [cltap@colorado.edu](mailto:cltap@colorado.edu) or 303-735-3530.

**Thanks for your help!**

# 2008 CO Safe Routes to School Call for Applications

Lenore C. Bates, CDOT Safe Routes to School Coordinator

Applications are now being accepted for Colorado's 2008 Safe Routes to School funding. The Colorado Department of Transportation (CDOT) will be awarding up to \$1.6 million in infrastructure (capital) and non-infrastructure (education) projects.

Eligible applicants include any political subdivision of the state (school district, city, county, state entity). Nonprofits may also apply by partnering with a state subdivision. The state subdivision must agree to be the contracting authority.

This program is 100% federally funded, and managed through the CDOT. Grants are awarded through a statewide competitive process, and in proportion to the geographic distribution of the student population K-8 grades. Non-infrastructure will receive between 10 to 30% of the total Safe Routes to School funds, with the remaining funds going towards infrastructure (capital) projects and staffing a full-time Safe Routes Coordinator position at CDOT.

Research has shown the most successful way to increase bicycling and walking is through a comprehensive approach that includes the "5 E's" (Evaluation, Encouragement, Education, Enforcement, and Engineering). Applicants requesting funding for infrastructure projects are also required to include an educational component in their project. At a minimum, grantees are required to collect and report information from a pre- and post-evaluation using the Safe Routes to School Student In-class Tally and Parent Survey.

Colorado's 2008 Infrastructure and Non-Infrastructure Applications are available online at:

<http://www.dot.state.co.us/bikeped/SafeRoutesToSchool.htm>

**The application deadline is 4 p.m.,  
Friday, December 14, 2007.**



Colorado Safe Routes to School application sessions will be available at the following locations:

- **Ordway, CO** - October 9, 2007, Tuesday, 10 a.m. to noon, Library, 1007 Main St, Ordway CO 81063, (719) 267-3823
- **Pagosa Springs, CO** - October 10, 2007, Wednesday, 10 a.m. to noon, First Southwest Bank, 249 Navajo Trail Drive, Pagosa Springs CO 81147, (970) 731-1300
- **Rifle, CO** - October 11, 2007, Thursday, 10 a.m. to noon, Garfield RE-2 School District, Learning Opportunity Center, Room 111, 839 White River Ave, Rifle CO 81650
- **Brighton, CO** - October 16, 2007, Tuesday, 10 a.m. to noon, Brighton Recreation Center, Community Room, 555 North 11th Ave, Brighton CO 80601, (303) 655-2200.

Since space is limited, please RSVP to Lenore Bates at [lenore.bates@dot.state.co.us](mailto:lenore.bates@dot.state.co.us) or (303) 757-9088.

For more information regarding the *Safe Routes to School* program, please visit the *National Center for Safe Routes to School* at [www.saferoutesinfo.org](http://www.saferoutesinfo.org) or call toll-free at 1-866-610-SRTS.



Need a little  
Extra cash?  
Your  
knowledge is  
worth  
something.

Our center is continuing its program to encourage local participation in the publishing of Colorado LTAP's quarterly newsletter. We would like the recipients of our newsletter to benefit from all the knowledge local agencies have in the areas of roadway maintenance, design, and construction. We are offering **\$50.00** to city, town, or county employees that submit an article that is chosen to be published in our newsletter. Articles can address current methods and procedures, best practices, innovative techniques, or projects in the transportation industry. Content should contain as much detail as possible, but we can provide assistance in editing and writing the final version. We request articles not promote any particular product. *Photos are encouraged.* To submit articles and/or photos, include author name and contact info, and mail or email to

[cltap@colorado.edu](mailto:cltap@colorado.edu)



Each year 42,000 Americans are killed on our Nation's Roadways. **Imagine... a day with ZERO traffic fatalities.** You can become involved to promote the reduction of fatalities by utilizing resources and information available on the "Put the Brakes on Fatalities" website at: [brakesonfatalities.org](http://brakesonfatalities.org) Use this information to initiate and create your own event or program. Mark **October 10, 2007** on your calendars as "Put the Brakes on Fatalities Day". Change your driving habits and encouraging others to do the same. Tell your family, coworkers, and friends, AND...

**Drive as if Your Life Depends on It**

## Did You Know?

**43,300 traffic fatalities occurred last year.**

**That's about 119 fatalities every single day — one fatality every 12 minutes!**

## Porous Pavements Asphalt and Concrete

*continued from page 3...*

pavement is suitable for a wide range of applications such as parking lots, driveways, sidewalks, and paths. For parking areas, if it is properly designed and constructed, it will last 20-40 years with little or no maintenance<sup>5</sup>.

### Pervious Concrete Pros:

- Good strength and durability, commonly 2000 psi or more.
- Firm, regular, and well drained.
- Smooth surface for automobiles, bicycles, wheel chairs, etc.
- Surface is very visible at night. This helps improve driving safety.
- Low absorption of solar heat because of its light-colored surface.
- Lower life-cycle cost than alternatives due to its superior durability and strength.
- Fewer repairs than porous asphalt.
- Has long overall lifespan.

### Pervious Concrete Cons:

- Low rate of radiant cooling.
- The cost is higher than conventional, dense concrete.
- Loosening of surface aggregates commonly occurs in the first few weeks after paving. However, it can be reduced with proper compaction and curing techniques.
- Vacuuming of the pavement at least twice per year is recommended to prevent material from clogging.

### Porous Asphalt

Porous asphalt has been used since the mid-twentieth century in highway and airfield overlays. Similar to pervious concrete, porous asphalt contains open-graded aggregates, asphalt binders, and no sand. As a result, it is porous and permeable, and improves surface drainage, traction, and visibility. According to the liquidity of the asphalt binder, the structure of this pavement is flexible. Therefore, it is more susceptible to rutting and shoving. Rutting is the formation of a track or channel where the repeated passage of wheels has pushed the material aside. Shoving is the formation of surface waves or bulges where traffic pushes the material forward. Porous asphalt is most commonly used for parking lots, bike paths, and playgrounds.



**Figure 2: Pervious Concrete<sup>7</sup>**

### Porous Asphalt Pros:

- Less expensive cost of installation and easier to install than porous concrete pavement for sidewalk and parking areas.
- Reduced water ponding.
- Can be installed with the same equipment as for impervious pavement.

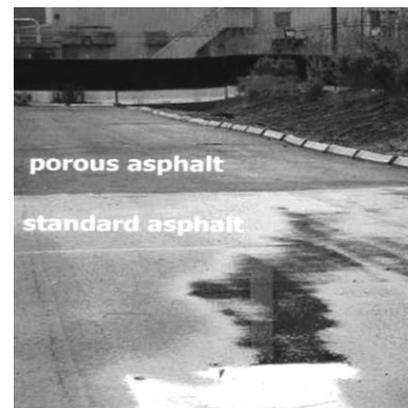
### Porous Asphalt Cons:

- Less shear strength because of reducing fine aggregates. As a result, it is inappropriate for airport taxiways or slope over six percent.
- Vacuuming of the pavement at least twice per year is recommended to prevent material from clogging.



### References:

1. *Slipping Through The Cracks*. Jeff Yoders.
2. *A Test of Porous Pavement Effectiveness on Clay Soils During Natural Storm Events*. Erin Dreelein, Laurie Fowler, and Carroll C. Ronald.
3. *Porous Asphalt Pavement*. Anderson Brothers.
4. *Porous Asphalt Pavements*. NAPA.
5. <http://www.perviouspavement.org/benefits,%20environmental.htm>
6. *Porous Pavements*, Bruce Ferguson.
7. *Pervious Concrete Pavement*, Paul Tennis, Michael Leming, and David Akers.
8. *Porous Asphalt- The Right Choice for Permeable Pavements*, Cahill, H. Thomas, The Link.



**Figure 3: Water drains through porous asphalt, but is seen pooling on standard asphalt<sup>8</sup>.**



# What's New in the LIBRARY?

All videos, publications and CDs in the LTAP lending library are available for checkout for a two-week period, free of charge. To check out materials or request a library catalogue, contact the Colorado LTAP office at 1-888-848-5827.

Below is a list of most recent materials added to the library. Our library materials can also be ordered online at: <http://ltap.colorado.edu>

## New CDs

### Location

### Title

#### CD RSP

#### *Ready, Set, Plow! Tips and Tasks for Preparing Your Fleet for Snow Season*

Winter weather is an annual force to be reckoned with. Learn how to plan ahead to ensure that both your equipment and plow operators are up to the task. This program features checklists, tips on alternate vehicle usage, and how to stretch your budget dollars.

#### CD TFRS

#### *Training First-Rate Snowfighters*

Put an end to persistent and inadequate snowfighting once and for all! If you didn't attend the 2005 North American Snow Conference, you can still experience the excitement of being onsite. This program discusses how to get the most value from your snowfighter training program. Training resources will be identified, as well as key concerns and practical tips for training both experienced and inexperienced snowfighters.

#### CD CSR

#### *Construction Site Runoff: A Proactive Approach to NPDES Compliance*

Stormwater flowing over a construction site often picks up a variety of pollutants that can upset the ecological balance of streams and lakes. NPDES Phase II regulations cover construction areas of one to five acres in size. Learn what steps you should take during the construction planning stage to meet these requirements and minimize pollution runoff on your projects.

#### CD ECCNP

#### *Erosion Control Compliance with NPDES Phase II*

Is development putting enormous pressure on you and your agency's efforts to enforce local erosion and sediment control ordinances and NPDES Phase II regulations? In this two-hour program, learn tactics for conducting inspections and enforcing the ordinances and regulations, get information on EPA's new Construction General Permit and electronic application system, how to more effectively implement erosion control programs, and much more.

#### CD GSWBBT

#### *Guidelines for the Selection of W-Beam Barrier Terminals*

This CD provides information for designers and construction/maintenance personnel responsible for selecting and properly installing the most appropriate terminal design at any site. In addition to showing the actual crash performance of each terminal type, this CD provides guidance on proper site grading and presents real-world examples of both appropriate and inappropriate installations.

#### CD LNAPW

#### *Leadership in the New Age of Public Works*

Dr. John Luthy, long-time public works advocate insists that it is time for public works to step into a new era of visible and proactive community leadership. This 2-hour program will stimulate leadership thinking at all levels. Don't miss this opportunity to explore evolving new roles for public works leaders, leadership competencies needed for embracing these new roles, hard realities of recruitment, retention, and employee development and more.

## New Videos & DVDs

### Location Title

DVD FRE *Forest Roads and the Environment DVD*  
18 minutes - Covers how roads interact with the environment and how to maintain them to safeguard the environment.

V40 HTMG *How to Get More Out of Your Motor Grader*  
25 minutes - Every municipality that owns a motor grader wants to find additional ways to capitalize on the investment. Road maintenance and road building techniques many grader operators never believed possible are demonstrated. Produced by John Deere.

V40 TC07 *Taking Control of Your Motor Grader*  
19 minutes - Modern motor grader controls and functions are shown in this video designed to improve operator skills. Produced by John Deere and applicable to most brands.

DVD MGSMO *Motor Grader: D Series Safety, Maintenance, and Operation DVD*  
33 minutes - This video is divided into 3 sections: Section 1 - Pre-start, walk-around, and daily service; Section 2 - The operator's station, controls and safety systems; Section 3 - Safety tips for operating the motor grader. Produced by John Deere.

## New Publications

### Location Title

5 CCPMW *Building on the Basics: Core Competencies for Public Works - MANAGERS*  
Building on the Basics: Core Competencies in Public Works Are you a leader or a manager? Do you know the difference? This collection of articles, written by APWA leaders, will help you understand the core competencies that are important for the leader or manager and, hopefully, provide some direction for self-improvement. Use these experience and insight of these public works leaders to help you reach your own highest potential.

24 CS *Chip Seal Manual*  
Based on NHI's course No. 131103, Pavement Preservation: Design and Construction of Quality Preventive Maintenance Treatments, this reference manual was developed by the Texas DOT and sponsored by FHWA. This Chip Seal reference Manual covers an overview and introduction of chip seals, lists the purposes of chip seal applications, and describes recommended materials and recommended application procedures.

17 GLD *Good Until the Last Drop - A Practitioner's Guide to Water Reuse*  
This book is for the public utility/public works professional, to provide an understanding of the important considerations needed to capture the greatest value from the recycled water resource. The book raises many questions and provides guidance to help resolve many issues.

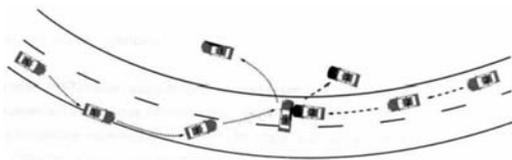
5 DPWOM *Developing a Public Works: Operations Manual*  
Developing a Public Works Operations Manual An operations manual is an essential asset to any agency, but there's no standard that will fit all agencies. However, there are some common, key elements that should be included in any operations manual, and this book will identify them and teach you how to use them. Learn how to ensure smooth transitions in your workforce, guard against the risk of lost information, and provide consistently good service to your community.

20 HCS *Low-Cost Treatments for Horizontal Curve Safety*  
This Guide identifies 20 strategies as alternative countermeasures--or treatments--to address the specific safety problem at horizontal curves. These strategies share one of two objectives: 1. Reduce the likelihood of a vehicle leaving its lane and either crossing the roadway centerline or leaving the roadway at a horizontal curve. 2. Minimize the damaging consequences of a vehicle leaving the roadway at a horizontal curve.

# Hazards of Pavement Edge Drop-Offs

## The Safety Edge Solution

continued from page 1...



**Figure 2:** Crash diagram indicating potential tire scrubbing<sup>1</sup>

standards regarding the hazard of edge drop-offs, the U.S. DOT suggests that a drop-off with a height of 3 inches or more is unsafe. AASHTO suggests that no vertical differential greater than 2 inches occur between lanes<sup>4</sup>. Many researchers have studied the risk of edge drop-offs and have shown that the ability of drivers to recover safely without veering into an adjacent lane is a function of the edge-drop height and shape; vehicle speed and path angle; and the width of lane available for recovery<sup>3</sup>. This is shown in the table.

Speed (mph)	Drop-off height (in) warranting traffic control for various lane widths (ft)			
	12	11	10	9
30	4	4	3	2
35	4	3	2	1
40	3	2	1	1
45	2	1	1	1
≥ 50	1	1	1	1

Safety edges are being used by many states to help prevent drop-offs. The safety edges can be used as a temporary device during resurfacing projects and can be put into place as a permanent device during a pavement project. The safety edge is designed to create a fillet at the edge of the pavement between the paved travel lane and the unpaved shoulder. Typically, a slope of 45 degrees from the pavement surface to the shoulder improves safety, but 30 degrees is preferred<sup>2</sup> as shown in Figure 3 and Figure

### Initial Construction



**Figure 3:** For proper edge slope, specify a 30° - 35° angle asphalt fillet "Safety Edge."

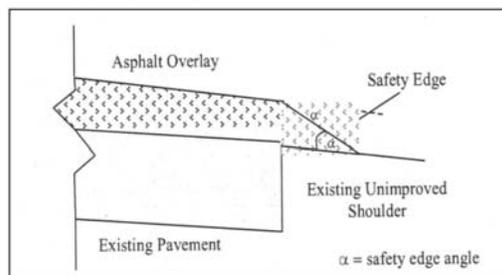
4. The construction is performed so that the angle break lines up directly over the paved surface that is in place. The edge is placed during the asphalt pavement wearing layer and does not necessitate a second operation. The safety edge is not meant to replace a shoulder that is level with the paved travel way; it is used to moderate the drop-off that is created during asphalt overlay projects<sup>7</sup>. When the overlay is finished, the shoulder should be graded so that it is even with the paved surface.

### Preventive Edge Maintenance

Edge maintenance should be preventive to protect the pavement and decrease the rate of deterioration of the pavement edge. Over the years, roadway surfaces tend to deteriorate and asphalt becomes brittle. As a result, cracks or raveling (loss of aggregate) may occur on the surface leading to edge drop-offs. Using seal coat can revive the elastic properties of the asphalt surface and prevent further deterioration. Seal coats commonly used for pavement maintenance include fog seals, scrub seals, slurry seals, and chip seals. There are four standard methods to repair the pavement. As listed in the Nevada Transportation publication *Streetwise*<sup>4</sup>, these four methods are provided in the column to the right.

### References

1. *Safety Impacts of Pavement Edge Drop-Offs*, Hallmark, Shauna.
2. *The Safety Edge: Preventing Crashes Caused By Unsafe Pavement Edge Drop-Offs*, FHWA.
3. *Primer on Roadway Pavement Edge Drop Offs*, John Glennon.
4. *Pavement Edge Maintenance and Repair. StreetWise Vol VI #1*.
5. *Managing Pavement Edge Drop Offs CD*, FHWA
6. *Work Zone Design Considerations for Truck Operations And Pavement/Shoulder Drop-Offs*, J. L. Graham and J. C. Glennon.
7. *Construction of a Safe Pavement Edge: Minimizing The Effects of Shoulder Dropoff*, Chris and Kim Wagner, Stanley Yeonsoo.
8. *The Safety Edge*, Georgia DOT



**Figure 4:** Safety edge detail.

### EDGE DROP-OFF SAFETY ENHANCEMENTS

- \* Decreases the vertical elevation difference.
- \* Decreases the drop-off face to reduce vertical edge.
- \* Increases lane widths.
- \* Constructs a wedge shaped pavement to mitigate tire scrubbing.
- Cost is very low. Some agencies found the cost to be less than 1% of the material cost.
- Very durable.
- Helps to preserve the pavement edge.

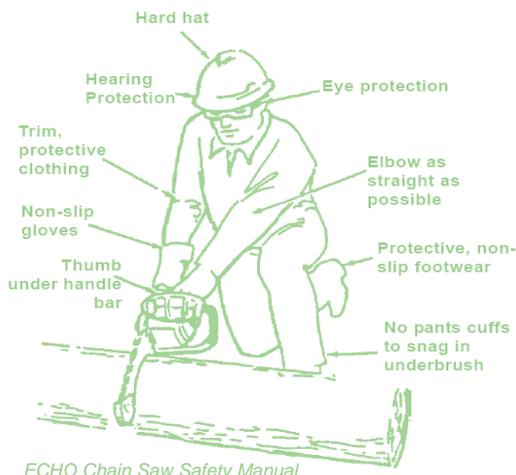
### FOUR STANDARD METHODS TO REPAIR PAVEMENT

1. **Pavement edge repair** is similar to pothole patching and is among the simplest of repair methods. Both hot and cold mixes can be used in this method.
2. **Reshaping shoulder** is selected when there is very little erosion and is suitable where there is enough material to restore the correct shape.
3. **Replenish shoulders** is similar to the reshaping technique. However, this technique is done when there is more than a 2 inch drop-off and is suitable for the place where there is not enough material on the shoulder to recover it to its original shape and slope.
4. **Cutting high edge** is often considered to be done during spring maintenance operations that prevent exposing soils from erosion when there is no vegetation.

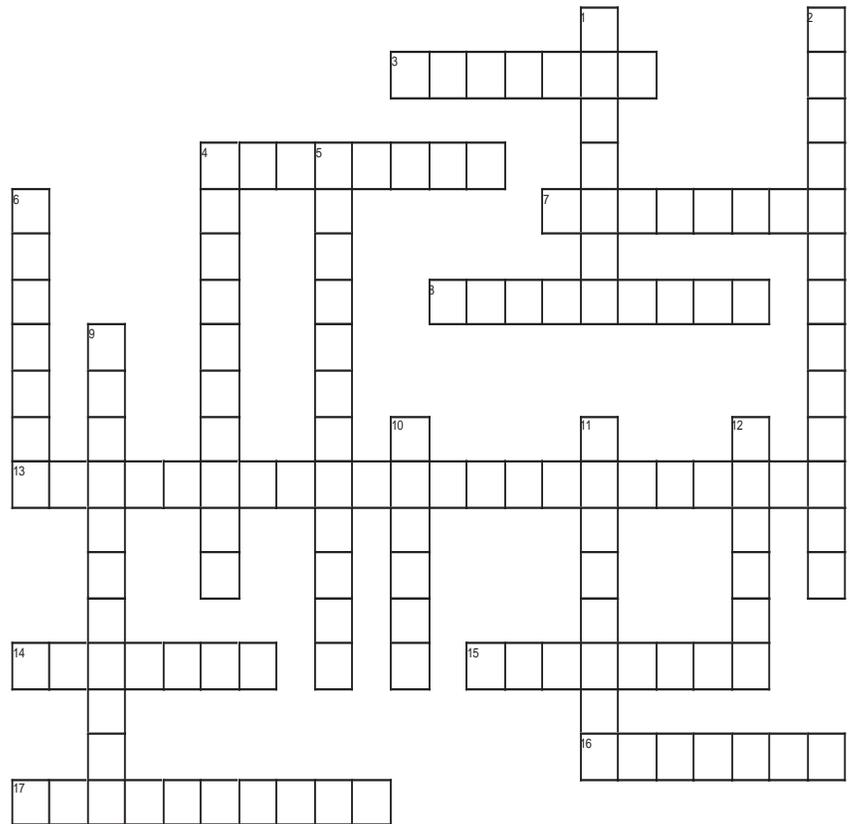
# Chainsaw Safety and Applications

## Test Your Knowledge

One of the most important aspects of safely operating a chain saw is to select a saw equipped with safety features. However, it is important to remember that the safety features do not take the place of proper training, safe operating practices and common sense. Test your knowledge of these procedures and safety features used at our Chainsaw Safety workshops.



**VITAL SAFETY GEAR TO WEAR WHEN USING A CHAINSAW**



www.CrosswordWeaver.com

**ACROSS**

- 3 Designed to decrease the noise level and direct hot exhaust gases away from the operator.
- 4 Composed of drive links and cutters.
- 7 This dangerous reaction occurs when the tip of the blade catches on an object such as a branch or a log.
- 8 A defensive plastic shield designed to reduce the operator's risk of injury and protect from coming in contact with the chain in the event the operator loses his grip.
- 13 A system to assure the operator's right hand is in the correct position before the saw can be accelerated, and prevents the accidental opening of the throttle.
- 14 The process of cutting the tree into useable lengths; often occurs as the tree is being limbed.
- 15 To remove a wedge-shaped piece of trunk from the side to which the tree will fall.
- 16 Cutting off unwanted branches, never done above the height of your shoulders.
- 17 Any loose overhead debris such as limbs or tree tops that may fall at any time, extremely dangerous and present the faller with a continual source of danger.

**DOWN**

- 1 Cutting, knocking, or bringing down a tree.
- 2 Required in many areas, it keeps sparks from being ejected by the exhaust.
- 4 Should be located so that it can be activated easily by your right thumb without losing your grip on the rear handle of the saw.
- 5 A guard designed to prevent a broken or derailed saw chain from striking the operator, found on the bottom of the saw engine.
- 6 Made on the opposite side to which the tree will fall and allows the tree to fall.
- 9 Activates the saw by pulling upward quickly, never pull to its full length, and always rewind slowly.
- 10 To evaluate the situation and consider all aspects of what might happen prior to making any cut with a chainsaw.
- 11 A weighted disk that controls engine speed and assists in cooling the engine.
- 12 The first of two cuts that result in a V-shaped notch.

The completed puzzle can be found on our website at: <http://ltap.colorado.edu/>

## Upcoming Events

### Upcoming Training

NOTE: Please contact the Colorado LTAP office for an updated schedule, or check online at <http://ltap.colorado.edu>.

#### Road Scholar Core Classes

##### Drainage

- October 2, 2007 - Sterling
- October 4, 2007 - Colorado Springs
- October 9, 2007 - Frisco
- October 11, 2007 - Montrose

##### Safety on the Job

- October 26, 2007 - Akron
- November 6, 2007 - Walsenburg
- November 7, 2007 - Colo Springs
- November 20, 2007 - Montrose
- November 27, 2007 - Fort Collins

#### Road Scholar Electives

##### NEW! Chain Saw Safety

- October 9, 2007 - Southwest, tbd
- October 10, 2007 - Midwest, tbd
- October 11, 2007 - Northwest, tbd

##### Winter Maintenance

- October 24, 2007 - Glenwood Springs
- October 31, 2007 - Colorado Springs
- November 8, 2007 - Durango
- November 14, 2007 - Fort Morgan

##### Intermediate Math for Road Workers

- November 19, 2007 - Grand Junction
- November 20, 2007 - Frisco
- November 21, 2007 - Greeley
- November 29, 2007 - Pueblo

Remember!

You can register *online* at:  
<http://ltap.colorado.edu>

#### Supervisory Skills Classes

**Dos & Donts: Legal and Liability Issues**  
October 19, 2007 - Grand Junction

**So You Are a Supervisor Now**  
*Supervisory Roles and Responsibilities*  
November 8, 2007 - Castle Rock

**Successful Employees Make Successful Supervisors**  
November 9, 2007 - Castle Rock

**Whole New World**  
*Local & State Government Operations*  
December 4, 2007 - Grand Junction

### Conferences

**APWA Snow & Ice Conference**  
September 25-28, 2007  
Holiday Inn, Estes Park  
Visit <http://www.westernsnowandice.com/>  
for registration information.

**Annual Local Roads Conference**  
October 17-18, 2007  
Rapid City, SD  
Contact Colorado LTAP for registration info.

**CCI 25th Annual Fall Conference**  
November 26-28, 2007  
Sheraton Hotel, Colorado Springs  
For registration and information, visit CCI online  
at: <http://www.ccionline.org>



#### SPRING COLORADO ROADS SCHOLAR GRADUATES

Alan Green - Grand County

Brian Gupton - Arapahoe County

Brandon Wallace - Basalt

Jason Redman - Phillips County

Ross Stuckman - Durango

Jesus Arreola-Mesa County

Robert Cox - Snowmass

Ken Haynes - Grand County

Ricky Lott - Thornton

Gary Mast - Town of Mead

Tom Powell - Grand Lake

Efren Rodriguez - Platteville

Kelly Rosson - Wheat Ridge

James Lindenblatt - Summit County

Dave Beard - Summit Cnty

Allen Bader - Arapahoe County

Clark Lucero - Thornton

Tina Booton - Weld County

#### SPRING COLORADO SUPERVISORY SKILLS GRADUATES

Duane Naibauer - Weld County



### Web Based Training Opportunities

**Oct 18, 2007** Crafting a Written Snow and Ice Plan

**Nov 1, 2007** Maintenance Management Systems

**Nov 15, 2007** Sustainable Design

**Dec 13, 2007** Emergency Preparedness

For more information visit: <http://apwa.net/Events/>

# FREE MATERIALS

The following is a list of **FREE materials** available to Colorado local government agencies in the transportation field. Quantities are limited and available on a first-come, first-serve basis.

Contact the Colorado LTAP office to put in a request for these free publications.

\*\*Check out our website for additional free materials not listed here.

<http://ltap.colorado.edu>



## F40 DIG

### *Distress Identification Guide*

This handbook provides a guide in identifying different forms of distress in asphalt concrete pavements, such as cracking, potholes, surface deformation, surface defects and miscellaneous distress. Colored figures accompany the explanations.

## FCD GSWBBT

### *Guidelines for Selecting W-Beam Barrier Terminals*

This CD provides information for designers and construction/maintenance personnel responsible for selecting and properly installing the most appropriate terminal design at any site. In addition to showing the actual crash performance of each terminal type, this CD provides guidance on proper site grading and presents real-world examples of both appropriate and inappropriate installations.

## FCD RRR

### *Riparian Roads and Restoration:*

#### *A Short Course About Roads and Riparian Areas*

This CD was developed by the USDA Forest Service and addresses minimizing impacts on riparian/wetland areas and restoring or improving riparian wetland ecosystem health.

## F60 ACH

### *Erosion Control Handbook for Local Roads*

This handbook is helpful in identifying key issues and concerns of those responsible for controlling erosion on low volume roads. Topics include: The Importance of Erosion Control; Regulation and Permitting; Designing an Erosion Control Plan; Treatment Selection; Erosion & Sediment Control During Construction; Permanent Erosion control; and Erosion Control for Coastal Areas.

## F50 FHS

### *Manual Del Abanderado (Spanish Flagging Handbook)*

This Spanish handbook was prepared to assist in the understanding of proper flagging in a work zone and should be studied by the flagger and kept available for reference.

## F50 CWZBPS

### *Guia De Mejores Practicas De Seguridad En Las Zonas De Trabajo En Colorado*

*Spanish - CDOT Work Zone Best Practices Safety Guide*, Provides information and tools needed to enhance compliance with industry best practices. This guide focuses on reducing accidental vehicle intrusion into roadway work zones; reducing worker and public accidents, injuries, and deaths; ensuring contractor compliance; educating the public; and reducing construction impacts on mobility and safety.

Colorado LTAP

University of Colorado at Boulder  
3100 Marine St, A-213  
UCB 561  
Boulder, CO 80309-0561

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