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COMBATTING ROAD USER ERRORS

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Drivers speed, run red lights, and drive impaired — none of which we can easily influence. However, transportation workers can affect road user errors that are facilitated by the roadway environment.

Thinking about these five basic human factor principles can be useful in reducing driver errors:

- **Information Overload:** When road users are overwhelmed with information, they tend to make more errors. Road users faced with too much information may not have time to locate the most critical information, make sense of it, make decisions, and respond appropriately.
- **Positive Guidance:** Road users need information about the road ahead so they can prepare the correct maneuvers. They need accurate information, placed in the correct location, in a form they can understand easily.
- **User Expectancy:** Road users make assumptions about the road ahead based on their previous experiences (e.g., exits on Interstate highways are located on the right). When these expectancies are violated, users' planned responses will be incorrect, and they may not have time to evaluate the roadway and change their responses quickly enough.



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• **Priority of Information Needs:** Information that is necessary for basic vehicle control is more urgent than guidance (e.g., choosing the correct lane); guidance is more urgent than wayfinding information. When offering information to road users, consider which level of information they need.

• **Visual Perception at Night:** Nighttime conditions (low-light or complete darkness, headlights from oncoming vehicles, or vehicles traveling behind a road user) limit the timing, quality, and location of information road users can acquire and use for safe travel.

Principles adapted from FHWA Practical Safety Solutions for Local and Tribal Roads: A Human Factor Approach (safety.fhwa.dot.gov/local_rural/training/docs/fhwasa20071.pdf)

REAL LIFE EXAMPLE



Let's take a look at this real-life example and analysis of a roadway that violates several of the principles listed.

Photo 1 presents the view of a northbound "X Road" driver approaching the intersection with "Y Avenue."

For northbound traffic, the roadway is particularly deceptive.

The vantage point shown in the photo suggests the road continues straight ahead, essentially to the horizon. Even in the vicinity of the speed limit sign (photo 2), the curve is not readily apparent to northbound motorists during daylight. At night, the streetlights and headlights/tailights on "Y Avenue" would be more conspicuous than the curb and grass. This is an example of the road user's expectation being violated; due to the misleading cues of streetlights and vehicle lights, the road appears to be straight to northbound drivers despite an upcoming curve.



Several hundred feet in advance of the curve for northbound traffic there is a yellow and black diamond-shaped right curve with a side road warning sign. However, as photo 1 illustrates, there is nothing in terms of size or color (e.g., the sheeting is standard yellow as opposed to fluorescent yellow) to make this sign conspicuous. In fact, the curve warning

sign is sandwiched between a SHARE THE ROAD warning sign, a municipality identification sign, and a 25 mph Speed Limit sign. Here the signs are not prioritizing information drivers need. The SHARE THE ROAD sign should not be the most prominent traffic control device in the driver's visual field at this location; it is a non-critical device that can be placed anywhere along the

roadway. In the configuration shown, the SHARE THE ROAD warning sign diminishes the importance of the curve warning sign and complicates the driver's information gathering process.

While it is hard to see in these photos, a paving joint is located a short distance north of the speed limit sign, separating two different “ages” of pavements. Closer examination reveals that the solid white edge lines end at this paving joint. That is, there are no edge lines in the curve, where their delineation function is most important. Best practice, as described in the *Low-Cost Treatments for Horizontal Curve Safety* guide is to apply edge lines just prior to and within curved sections of roadway, if not on the entire section of roadway. In this instance, where the apparent roadway alignment straight ahead is the most prominent visual feature, drivers are deprived of the positive guidance of a delineation cue since the edge lines do not continue through the curve.

As noted above, the most prominent visual feature is the apparent straight-ahead alignment of the roadway. It is foreseeable that at night drivers would be surprised by the horizontal curve and find it difficult to make the appropriate steering and speed adjustments. Several issues contribute to this difficulty:

- While there is a warning sign for the curve, the warning message is diminished by its position near other signs.
- The only delineation for the curve is the painted double yellow centerline.
- At night, there is no other delineation of the alignment of the curve.
- The lack of curvature upstream of the location in question
- The hillcrest, which prevents motorists from seeing the curve alignment
- The inadequate advance warning

Research has shown drivers adjust their speed only as a curve becomes imminent. In this case, it is foreseeable that drivers would not be able to adjust their speed in time to safely negotiate the curve, especially at night.

Given the roadway design and traffic control associated with this section of roadway, a history of run-off-road incidents and/or crashes would be expected. Indeed, photo 3 shows there is physical evidence of roadway departures. This photo presents a close-up view of the west edge of “X Road” in the curve. Note that several clearly visible gouges are in the top of the curb and these gouges all have the same orientation. These gouges are indicative of vehicles failing to negotiate the curve and running off the west side of the road. As the vehicles do so, their undercarriages cause gouges and scratches on the top of

the curb. The physical evidence is clear that drivers are having difficulty negotiating the curve and are leaving their lane.

Review of police crash reports and incident reports provides proof of these crashes. There were four nighttime, single-vehicle run-off-road crashes where northbound vehicles ran off the road to the left and roads were not snow or ice-covered. These occurred as follows:

Crash Date	Time
05/23/07	3:27 AM
03/30/08	9:29 PM
07/11/08	11:00 PM
07/18/10	9:07 PM

From May 2007 to July 2010 there was an average of one night-time single-vehicle, run-off-road crash per year involving northbound vehicles. There are reported crashes and physical evidence of vehicles running off the road on the outside of the curve. It is apparent the existing delineation is not sufficient to show the alignment of the roadway at night and to overcome the misleading information created by the alignment of “Y Avenue.” The recommended low-cost safety countermeasures for this situation include enhancing delineation of the curve by installing edge lines, chevrons, and other guidance enhancements. Installing a grass-covered earth mound to prevent northbound drivers from seeing “Y Avenue” ahead would also be beneficial.

As a transportation worker, try to keep the five basic human factor principles in mind as you manage and maintain the roadway environment. Try to look at the area from a driver's perspective and focus on Information Overload, Positive Guidance, User Expectancy, Priority of Information Needs, and Visual Perception at Night.

Resource:
[Low-Cost Treatments for Horizontal Curve Safety 2016](#)
[Federal Highway Administration \(Office of Safety\)](#)

The gouges in the top of the curb indicate vehicles failing to negotiate the curve and running off the west side of the road.



BUILD A BETTER MOUSETRAP

We are pleased to award two first place prizes for the WV LTAP's 2021 Build a Better Mousetrap Competition. The winning entry in the New Tools, Applications, or Equipment category goes to WVDOH-D4 employee Everett Sine for his Tack Coat Sprayer. The winning entry in the Sustainability category goes to the City of Buckhannon Public Works Director Jerry Arnold, Street Supervisor Brad Hawkins, and Council Member CJ Rylands for their Self-Batching Concrete Mixer and Silo. Both of these entries have been submitted to the National Build a Better Mousetrap Recognition Program as well.

TACK COAT SPRAYER - SUBMITTED BY EVERETT SINE, WVDOH-D4

Problem Statement

The steps involved with tack coat, from the initial mixing stage to transporting to applying to potholes needed to be more efficient. Previously, tack coat was taken to the job site in five-gallon buckets, mixed on-site, and applied using paint brushes or brooms to get the tack coat material into the hole.

Discussion of Solution

I have worked on farms my whole life. When things break down or need done, you learn to rig things to work and do the jobs you need done. Years of experience in highways have also helped me think about better ways to complete jobs in a more efficient labor reducing way. When working on pothole patching, I just started to think about a better way to apply the tack coat and this is the idea, through trial and error, I came up with.

Labor, Equipment, Plans or Materials Used

2 hours of labor

Materials

one 55-gallon drum

(A metal drum might be better than plastic, as you are putting 15 to 20 pounds of pressure in it and the plastic barrel does expand a lot.)

one 2" t

two 2" caps

one truck rim air steam

two 1" gas valves

one 1" nipple

10' of ¾" water hose

two ¾" water hose to 1" male thread adapter

four 1" hose clamps

Cost

We had most of the materials at the shop, so no more than \$200 for materials plus two-hours of labor.

Savings/Benefits to the Community

The tack coat sprayer allows our crew to mix and haul from 1-gallon to 55-gallons of tack and spray it instead of brushing or brooming it on. This makes the process quicker and more efficient. Being able to patch holes faster benefits both our crews and the traveling public. We have also made additional units for other maintenance crews within the WVDOH.



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Mike Cronin - Michael.G.Cronin@wv.gov

COMPETITION WINNERS

SELF-BATCHING CONCRETE MIXER AND SILO - SUBMITTED BY JERRY ARNOLD, CITY OF BUCKHANNON

Problem Statement

City street crews pour, on average, about 1200 cu. yds. of concrete annually. The problem we encountered was that in our location we have only one vendor to purchase ready mix concrete. We were constantly having to try to schedule concrete sometimes ahead of time to meet our needs. This coupled with the ever-increasing costs of purchasing concrete (around 7% annually) got us brainstorming for a solution.

Discussion of Solution

We started talking about ways to solve the problem of getting concrete to our crews when they needed it and at an affordable price. Myself, Street Supervisor Brad Hawkins, and Council Member CJ Rylands started talking about different options to batch our own concrete, and I started looking into different equipment options. After some extensive research, we decided on a self-batching truck and a portable concrete silo.

Labor, Equipment, Plans or Materials Used

FIORI DB460 Self-Loading Concrete Mixer and an HS 15.0 Silo

Cost

\$150,000

Savings/Benefits to the Community

We did a detailed analysis and we project a cost savings of over \$660,000 over five-years. This investment is making us much more PROWAG compliant because now we're able to do about twice as much sidewalk and ramp work for the same money. We also use this to batch concrete for our other departments. This allows us to quickly remediate road cuts, which reduces our liability.



Contact

Jerry Arnold

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ROADS SCHOLAR GRADUATES

The WV LTAP staff is excited to recognize these recent graduates who committed to completing the course requirements for either the Roads Scholar I or II programs by attending virtual training. If you are not familiar with the Roads Scholar programs, please visit our website at wvltap.org and click on the training tab to learn more.



Bruce (L) receives his RS recognition items from Tony Clark (R), Highway District Manager for WVDOT-D6.



Troy (L) receives his RS recognition items from Lee Thorne (R), Highway District Engineer for WVDOT-D5.



Dave (L) receives his RS II recognition items from Jake Bumgarner (R), WVDOT Operations Division Director.



Jennifer (L) receives her RS II recognition items from Tony Clark (R), Highway District Manager for WVDOT-D6.

ROADS SCHOLAR I

Tom Collins
WVDOT-D8 Deputy District Engineer

Bruce Debolt (1)
WVDOT-D6 TW3 Crew Chief

Troy McCumbee (2)
WVDOT-D5 Technician

Stephanie Neuman
WVDOT-D6 Transportation Engineer Trainee Associate

Michael Roberts
WVDOT-D6 TW3 Crew Chief

ROADS SCHOLAR II

Scott Billings
WVDOT-D10 Transportation Engineer Technician Senior

Dave Brabham (3)
WVDOT Regional Operations Engineer

Jennifer McNamara (4)
WVDOT-D6 Transportation Engineer Trainee Senior



WV LTAP'S VIRTUAL TRAINING PLATFORM

You can now earn Roads Scholar (RS) credit and PDHs through our self-paced virtual training platform!

The WV LTAP recently launched this platform on our website, which features recordings of a few of our popular Roads Scholar classes. Anyone wanting to get credit will need to watch the entire recording and complete the associated quiz, earning a grade of 70% or higher.

This training platform can be accessed on our website, wvltap.org. Select WV LTAP Virtual Training under the Training tab. You can also access the platform directly at wvltap.org/virtual. Once you arrive on the training platform's page, simply click the title of the class you'd like to attend; you can also watch a short video with instructions on how to use the platform.

If you have questions about the Roads Scholar Program or this new virtual training opportunity, email Kim at Kim.Carr@mail.wvu.edu.

These four Roads Scholar II classes are currently available through the virtual training platform.

- **Common Sense Solutions for Intersection Safety**
- **Gravel Roads Design and Maintenance**
- **Introduction to Asphalt Technology**
- **Pavement Preservation**

SAFETY BRIEF Working in the Heat

Adapted from the NLTAPA Tailgate Safety Series

The WV LTAP has approximately ninety tailgate safety talks available on our website. They are intended to be short and focused so that, over time and together with your existing practices and policies, they help build a culture of safety within your crews. Please visit wvltap.org/tailgatetalks to access.

You know you're stressed from the heat when you sweat a lot, have muscle spasms, get a headache, get tiny red bumps on your skin, or feel dizzy, weak, or sick to your stomach. If this describes you on a hot work day, drink plenty of water throughout the day. Take your rest breaks in a cool or shady area. Massage muscle cramps. Use a mild drying lotion to get rid of heat rash. Do not take salt tablets unless recommended by a doctor.

If a fellow worker passes out from the heat, get them into shade, loosen clothing to cool them down, and give water only when they're conscious.

WHAT SIGNS DO YOU NOTICE WHEN YOUR BODY IS TOO HOT?

First, you may notice that you are tired and less mentally alert. This increases the danger of accidents. You may sweat. The body produces sweat so the evaporation will cool you off. Sweating isn't as effective if the air is very humid, because not as much sweat evaporates. Heat rash is possible. You get it when your sweat glands swell and get plugged up. You can get a sunburn if you're in direct sunlight too long without using sunscreen to protect your skin. Sunburn can be painful and may even lead to skin cancer.

HEAT STRESS, EXHAUSTION & STROKE

If you don't pay attention to these early symptoms and get out of the heat, you can get heat stress. What does this do to your body?

The first symptom is usually **heat cramps**. If you don't replace the fluids and salts (called electrolytes) that you lost by sweating, you may get muscle pain or muscle spasms. These are most common in the arms, legs, back, and stomach.

Heat exhaustion can follow. Your whole body (especially your circulatory system) is extremely stressed out. Some possible symptoms include: a pale and flushed face and neck, clammy skin, heavy sweating, fatigue, shortness of breath, headache, dizziness or fainting, nausea, vomiting, rapid heartbeat and breathing.

Heat stroke is the most serious stage of heat stress and your body temperature shoots up. Fifty percent of people with heat stroke die. Symptoms are: dizziness and confusion; red, hot, dry skin; nausea and vomiting; very little sweating; rapid pulse; high body temperature around 105 degrees; convulsions; fainting. Anyone with heat stroke must be taken to a doctor or hospital immediately.

WHAT'S THE BEST TREATMENT FOR THE DIFFERENT STAGES OF HEAT STRESS?

Heat cramps - Stop work, drink fluids, and rest in a cool area. Drinking electrolyte replacement fluids may also help.

Heat exhaustion - Give first aid by moving the person to a cool place to rest. Remove as much clothing as possible. Give the person water. Drinking electrolyte solutions may also help. Don't allow the person to get chilled, and treat for shock if necessary. Get medical help.

Heat stroke - Call 911 to get medics immediately. Immerse the person in cool water or ice.

WHAT TO DO WHEN WORKING IN THE HEAT

- Drink a lot of cool water or an electrolyte replacement drink like Gatorade. You may need a quart or more depending on conditions. Drink even if you don't feel thirsty.
- Take frequent breaks in an air-conditioned or shaded area.
- Wear appropriate clothing when you're in the sun. The best clothing is a loose, lightweight cotton shirt and pants in a light color.
- Wear a wide-brimmed hat in the sun. Wear a lightweight long-sleeve shirt and long pants if it's over 95 degrees.
- Use a sunscreen product to protect your skin from ultraviolet rays in sunlight. It should have a sun protection factor (SPF) of at least 15 or more. Check the label.
- Limit your use of alcohol. Ask your doctor about prescription drugs you're taking.



COUNTRY ROADS & CITY STREETS

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Country Roads & City Streets is published three to four times per year. The purpose of this newsletter is to provide information that is beneficial to decision makers, elected officials, and roadway construction, maintenance, and management personnel.

The material and opinions included in this newsletter are those of the West Virginia LTAP and do not necessarily reflect the views of FHWA or the WVDOT. Every effort has been made to ensure the integrity and accuracy of both original and borrowed material. However, the West Virginia LTAP does not assume responsibility for any information that is found to be incorrect.

THE MISSION

The mission of the West Virginia LTAP is to foster a safe, efficient, and environmentally sound surface transportation system by improving skills and increasing knowledge of the transportation workforce and decision makers.

To help achieve this mission, training, demonstrations, technical assistance, and resource materials are provided.

2021 SNOW & ICE CONTROL WORKSHOP

September 30 in-person event

Summersville, WV Arena and Conference Center



WV LTAP will adhere to applicable safety protocols.

Registration information, workshop agenda, and additional details will be available on our website. The attendee registration fee will be \$50 per person.

[wvltap.org](https://www.wvltap.org)