Unpaved Safety

Presented by: Rosemarie Anderson, FHWA; Ken Skorseth, SDLTAP; and David Veneziano, IA LTAP
Webinar Logistics

• Duration is 9:00 AM - 10:30 AM Mountain

• Webinar – recorded and archived on website. For quality of recording, phone will be muted during presentation

• If listening on the phone, please mute your computer

• To maximize the presentation on your screen click the 4 arrows in the top right of the presentation

• At the end of each section, there will be time for Q&A

• There is a handout pod at the bottom of the screen

• Please complete follow-up surveys; they are vital to assessing the webinar quality
Co-hosted By

National LTAP & TTAP Association
Today’s Presenters

Rosemarie Anderson, FHWA Office of Safety

Ken Skorseth, SDLTAP

David Veneziano, IALTAP
Goals of this Webinar

Once you have completed this webinar, you will be:

familiar with the safety concerns and potential solutions on unpaved roads.
Learning Outcomes

To achieve the webinar goal, you will learn to:

- Summarize the need for discussions on unpaved road safety,
- Identify safety issues in gravel road maintenance operations,
- Illustrate the safety effectiveness of traffic control devices on unpaved roads, and
- Summarize the next steps for unpaved road safety.
Summarize the need for discussions on unpaved road safety,

Identify safety issues in gravel road maintenance operations,

Illustrate the safety effectiveness of traffic control devices on unpaved roads, and

Summarize the next steps for unpaved road safety.
Unpaved Road Safety

• Why be concerned with Unpaved Road Safety?
• What does the data show?
546 Fatal Crashes
584 Vehicles Involved
Economic Cost = $0.76B*
35% of Roads are Unpaved

* 2010 Economic Cost
Unpaved Road Safety

- Towards Zero Deaths/Road to Zero
- Unreported Crashes?
- Percentage of fatalities and serious injuries?
- Does existing technical safety literature comprehensively address unpaved road safety?
<table>
<thead>
<tr>
<th>Surface Type</th>
<th>All Surface Type</th>
<th>Unpaved</th>
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</thead>
<tbody>
<tr>
<td>Interstate</td>
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<tr>
<td>Principal Arterial - Other Freeways and Expressways</td>
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<td>416</td>
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<tr>
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<td>13</td>
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<tr>
<td>Unknown</td>
<td>81</td>
<td>5</td>
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</table>
# Unpaved Road Safety

<table>
<thead>
<tr>
<th>State</th>
<th>Percent Unpaved Roads</th>
</tr>
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<tbody>
<tr>
<td>Colorado</td>
<td>58.3</td>
</tr>
<tr>
<td>Iowa</td>
<td>63.6</td>
</tr>
<tr>
<td>Kansas</td>
<td>69.2</td>
</tr>
<tr>
<td>Michigan</td>
<td>47.2</td>
</tr>
<tr>
<td>Minnesota</td>
<td>54.6</td>
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<tr>
<td>Missouri</td>
<td>44.1</td>
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<tr>
<td>Montana</td>
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<tr>
<td>Nebraska</td>
<td>71.8</td>
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<td>North Dakota</td>
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<tr>
<td>South Dakota</td>
<td>73.8</td>
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<tr>
<td>US</td>
<td>34</td>
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</table>
Unpaved Road Safety

• 44 states had fatal crashes on unpaved roads in 2015.
• Potential for large percentage of fatalities and serious injuries
  – lack of maintenance,
  – ex-urban development (semi-rural region lying adjacent to a city’s suburbs),
  – Introduction of larger vehicles (commercial trucks)
  – larger agricultural equipment, and
  – the conversion of paved roadways to unpaved roadways
States with roads or road segments converted from paved to unpaved.

Source: NCHRP Synthesis 485
Findings

• Majority of road conversion - <100 ADT
• Factors to consider in converting include:
  – Road condition
  – Safety
  – Traffic volume
  – Economics of road treatment
  – Maintenance capability
  – Environmental issues
  – Network significance of the road
Findings

• Road Safety:
  – Dust
  – Wash boarding
  – Loose gravel
  – Potholes
Summary

• Crashes are occurring on unpaved roads
• States are reverting roadways
• Limited Safety Data
• Lack of technical information
Directing Your Questions via the Chat Pod

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2. Type your question or comment here

3. Answers will appear here unless addressed verbally
Summarize the need for discussions on unpaved road safety,

Identify safety issues in gravel road maintenance operations,

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Summarize the next steps for unpaved road safety.
Overview

• Lack of Warning Devices on Equipment Used in Maintenance Operations

• Problems with Roadway Geometry

• Surface Gravel Quality
Proper Warning too often lacking when aggressive gravel road rehabilitation is done.
Actual photo sent to me in a liability claim situation
Lack of warning lights is often blamed for equipment being struck by vehicles
Failure to have the SMV (Slow Moving Vehicle) warning on all equipment used on the roadway has also been a cause of liability claims.
Roadway Geometry

Primary Issues:

• Roadway crown – either lack of or excessive crown

• Rough surface or unsafe driving condition – generally corrugation (washboard), potholes or excessive windrows

• Problems with superelevation in curves
Lack of crown in road surface results in potholes and rough surface
Excessive crown:
All vehicles use the middle of the road
Large windrows of material can be a hazard to vehicles during rehabilitation operations.
Superelevation in a curve?
Excellent example of superelevation
Great contrast to previous photo
Example of severe corrugation in road surface
Examples of Standards as Defined by the US Army Corps of Engineers.

Example of Corrugation Rating Guidance:

- **Low Severity**: Less Than 1 Inch
- **Medium Severity**: 1 – 3 Inches
- **High Severity**: Greater Than 3 Inches

*a. Severity levels.*
Surface Gravel Quality

Generally two problems will be claimed:

• Does not meet state or “standard” specification or –

• Simple allegation that gravel was not of proper type to provide a safe driving surface
Substandard material
Very hard to defend if this causes a crash
Contrast to the previous slide
Gravel that meets a state DOT specification for surface gravel
Closing Comments

• Risk is always present on a public road
• You must manage risk, but unpaved roads have unique issues
• Are all unpaved roads dangerous?
• Are all pavements safe?
Is this a safe road?
Is this an unsafe road?
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Unpaved Safety Challenges

• Many conditions require or impact signing on unpaved roads
  – Intersection control
  – Narrow lanes
  – Narrow/no shoulders
  – Reduced passing opportunities
  – Limited stopping/horizontal sight distances
  – Limited or poor signing/delineation
  – Poor intersection sight distances
  – Roadside obstacles
  – No/limited clear zone
  – Vegetation
What Can Be Done?

• Install/upgrade signing
  – Curves
  – Tangents
  – Intersections

• Maintain/clean existing signs
Sign Installation/Enhancement

• Options:
  – Install signs where none present (if needed)
  – Enhance existing signs with:
    • Pennants
    • Larger size
    • Highly reflective sheeting
    • Realign signs to increase visibility

• Increasing stop sign retroreflectivity has reduced crashes on paved roads
Signing Background

• Commonly used signs on unpaved roadways
  – Stop
  – Yield
  – Speed Limit
  – Chevron/Curve Warning/Adv. Speed Plaque
  – Stop/Yield ahead
  – Large Arrow
  – Road Narrows
  – Narrow/One Lane Bridge
  – Pavement Ends
  – Etc.

• Have they been studied?
• Are they effective?
## Have Signs Been Studied?

<table>
<thead>
<tr>
<th>Sign</th>
<th>MUTCD Requirement</th>
<th>Safety Study</th>
<th>Operations Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Yield</td>
<td></td>
<td>X</td>
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<tr>
<td>Speed Limit</td>
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<tr>
<td>Chevron</td>
<td>X*</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Curve Warning</td>
<td>X*</td>
<td>X</td>
<td></td>
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<tr>
<td>Advisory Speed Plaque</td>
<td>X*</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Road Narrows</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Narrow/One Lane Bridge</td>
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<tr>
<td>Pavement Ends</td>
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</tr>
<tr>
<td>Stop/Yield Ahead</td>
<td>X*</td>
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<td></td>
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</table>

* Based on specific site conditions. See the current MUTCD for more detail.
Are They Effective?

• Little research has evaluated basic signs
• Focus has largely been on paved system
• Robustness of approaches/results varies
  – Safety Rating - “Low”, “Medium” and “High” based on CMF Clearinghouse scale
  – Operations Rating - “Low”, “Medium” and “High” based on no. of sites and diversity, statistical eval. employed
• Results generally apply to conditions studied
Stop Sign Effectiveness

• Safety
  – Increased control did not significantly reduce crashes - “Medium” rating
  – Crash rates not significantly different between control/no control - “Medium” rating
  – 68.1% total crash reduction when converted to AWSC - “High” rating
  – Crash rate declines at uncontrolled compared to AWSC ints. - “Medium” rating

• Operational - 19% voluntarily stopped at 2- and 4-way stops - “Medium” rating
Yield Sign Effectiveness

• Safety - Conversion from stop to yield increased crash frequency – “Low” rating

• Operations - Small travel time savings over stop control or no control - “Medium” rating
• Safety Effectiveness
  – Avg. crash rate rose from 21.06 to 37.92 – “Medium” rating
  – No evidence that crashes change with posted increases or decreases - “Medium” rating
  – Crash rates increase as variability in vehicle speeds increase – “Low” rating

• Operational Effectiveness - No evidence driver speeds change when speed limit raised or lowered – “Medium” rating
• Options:
  – Horizontal alignment
  – Horizontal alignment with advisory speed plaque
  – Chevrons
  – Reflective sheeting on chevron posts
  – Post mounted delineators

• Paved road research has shown these signs/combinations reduce crashes
Curve Warning Signs 2/3

• Safety Effectiveness

– Chevrons reduced crashes 4% - 25% - “High” rating
– Chevrons reduced crash frequency by 50% - “Low” rating
– Upgraded curve warning sign sheeting reduced crashes 18% – 35% - “High” rating
– Chevrons/curve warning sign combinations reduced crashes 2.6% - 47.6% - “Medium” rating
– Advisory speed plaques reduced crashes but impact was small - “Medium” rating
– Curve warning signs reduced crashes by 42.1% - “Low” rating
Curve Warning Signs 3/3

• Operational Effectiveness
  – Chevrons - 1.28 - 2.20 mph mean speed reduction - “Medium” rating
  – Chevrons - 0.17 to 4.08 mph mean speed reduction - “Medium” rating
  – Chevrons - 0.50 to 3.0 mph mean speed reduction - “Medium” rating
  – Adv. Speed Plaque - 60% of drivers exceeded posted adv. speed approx. 1/3rd into curves - “Medium” rating
Other Considerations

• Sign maintenance
  – Clean dirty signs
  – Address knockdowns and vandalism
  – Replace stolen/missing signs
  – Remove vegetation

• Sign minimization
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NCHRP Synthesis 485

- In Sitka, Alaska, a road was converted because of safety concerns. Anecdotal evidence suggested that safety improved after the conversion.
- Montcalm County, Michigan, no documented increase in crashes since conversion.
- Tooele County, Utah, decreased visibility resulting from dust after conversion to unpaved. Isolated rollover crashes occurred on the unpaved road “did not know how to drive on the gravel surface”
- Rogers County, Oklahoma, state troopers noted that gravel could exacerbate the risks of speeding.
- Sonoma Mountain Road in California vehicle crashes attributed to drivers losing control on the new unpaved surface.
There is a lack of or limited safety information/data on unpaved road safety!!!
Growing number of agencies reverting to unpaved roadways
Limited information on countermeasures addressing specific safety issues
Unpaved County Roads Safety

Unpaved Road Pooled Fund Study

– Exploring ways to advance safety on unpaved roads. Stakeholder/partners can participate in this proposed FHWA Transportation Pooled Fund (TPF) research effort.

http://www.pooledfund.org/Details/Solicitation/1419
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Resources

• NCHRP Synthesis 485
  http://www.trb.org/Publications/Blurbs/173716.aspx

• FHWA’s Gravel Roads Construction and Maintenance Guide

• Unpaved Road Safety Pooled Fund Study
  http://www.pooledfund.org/Details/Solicitation/1419

• Safety Center April 2017 Webinar: Converting Paved Roads to Unpaved Roads
  https://ruralsafetycenter.org/resources/list/convertin-paved-roads-to-unpaved-roads/
Learning Outcomes

In this webinar, you have learned to:

1. Summarize the need for discussions on unpaved road safety,
2. Identify safety issues in gravel road maintenance operations,
3. Illustrate the safety effectiveness of traffic control devices on unpaved roads, and
4. Summarize the next steps for unpaved road safety.
Upcoming 2017-2018 Webinars

- **The Culture of the Swedish Vision Zero**
  
  *Tues., Dec. 12, 2017 9:00 – 10:30 AM Mountain*

- **Pedestrian Treatments at Uncontrolled Locations**
  
  *Thurs., Jan. 18, 2018 11:00 – 12:30 PM Mountain*

- **Highway Safety Manual/Human Factors Guide**
  
  *Feb. 2018 - Date and Time TBA*

Archived Webinars

[Access the webinar archives]
FHWA Office of Tribal Transportation Webinar

• Proven Safety Countermeasures

  *Tues. Jan. 23, 2018 11:00 AM Mountain*

  [https://survey.max.gov/416797](https://survey.max.gov/416797)
Contact Information

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(844) 330-2200 or info@ruralsafetycenter.org

http://ruralsafetycenter.org/