Low-Cost Safety Improvements for Pavement Preservation Projects

Frank Julian, FHWA

Louisiana Transportation Conference
2009
(n) It is the intent of Congress that any project for resurfacing, restoring, or
rehabilitating any highway, other than a highway access to which is fully controlled,
in which Federal funds participate shall be constructed in accordance with
standards to preserve and extend the service life of highways and enhance highway
safety.

(q) Phase Construction.--Safety considerations for a project under this title may be
met by phase construction consistent with the operative safety management system
established in accordance with section 303 or in accordance with a statewide
transportation improvement program approved by the Secretary.
(n) It is the intent of Congress that any project for resurfacing, restoring, or rehabilitating any highway, other than a highway access to which is fully controlled, in which Federal funds participate shall be constructed in accordance with standards to preserve and extend the service life of highways and enhance highway safety.
(q) Phase Construction.--Safety considerations for a project under this title may be met by phase construction consistent with the operative safety management system established in accordance with section 303 or in accordance with a statewide transportation improvement program approved by the Secretary.
Domestic Scan

Good Practices:
Incorporating Safety Improvements into Resurfacing and Restoration

Participating Organizations:
American Association of State Highway and Transportation Officials
Federal Highway Administration
National Association of County Engineers
Background

- Pavement restoration projects ~ an opportunity to improve safety
- Annual expenditures to maintain NHS pavements ≈ $25 billion
- 10+ years of innovation with PM/2R/Flexible 3R approaches.
Focus on Two-lane Rural Facilities
How Locations Were Identified

- Email survey
- Literature review
- Search of agency web sites

Filters:
- Provides objective project-level guidance
- Uses historical safety data
- Effectiveness has been evaluated

Candidate Best Practices
Purpose of Scan

Programmatic topics of interest:

- Why does your state include safety enhancements in resurfacing projects?
- How do you measure the effectiveness of your resurfacing program?
- What are the impediments to pursuing safety and surface improvement through single projects?
- Do local governments (e.g., counties, towns) include safety improvements in their resurfacing projects?
Purpose of Scan

Technical/project topics of interest:

- How is safety data used in decision making?
- Are there specific criteria and features (e.g., superelevation, drop off, guiderail, delineation) considered important for integration into resurfacing?
- What are common time frames for developing resurfacing projects?
- What unique, effective safety measures and technologies are being used?
## Scan Team Members

<table>
<thead>
<tr>
<th>Person</th>
<th>Affiliation/Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ernest J. Blais</td>
<td>FHWA, Connecticut Division (Co-chair)</td>
</tr>
<tr>
<td>Keith A. Cota</td>
<td>New Hampshire DOT (Co-chair)</td>
</tr>
<tr>
<td>Lawrence Hummel</td>
<td>Van Buren County (MI) Road Commission/NACE</td>
</tr>
<tr>
<td>N. Kent Israel</td>
<td>Louisiana DOTD</td>
</tr>
<tr>
<td>Frank Julian</td>
<td>FHWA Resource Center, Safety &amp; Design Team</td>
</tr>
<tr>
<td>Bernie Kuta</td>
<td>FHWA Resource Center, Materials and Const Team</td>
</tr>
<tr>
<td>Susan Miller</td>
<td>Freeborn County, MN/NACE</td>
</tr>
<tr>
<td>Harry W. Taylor</td>
<td>FHWA, HQ, Office of Safety Design</td>
</tr>
<tr>
<td>Kevin M. Mahoney</td>
<td>Facilitator</td>
</tr>
</tbody>
</table>
Factors that Vary by Locale

- Terminology
- Program objectives and performance measurement
- Funding: amounts and flexibility
- Topography
- Population served and demography
- System characteristics
- Tort liability concerns
- Local agency roles and relationships
Observations: Good Practices

- Institutional

- Process and Technical and Technology
Institutional Good Practice

Integrating Strategies

System Preservation

Safety Improvement
Institutional Good Practice

Institutional Practice: Integrating Strategies

- Resurfacing may be only agency activity 4 – 20 years
- Economy of scale
- Mobilization, Temporary Traffic Control, Construction administration
- Not the best approach for all safety improvements
Institutional Good Practice

Leadership Support

- Identify priorities
- Integrate functional domains
- Impact funding levels
Institutional Good Practice

Multi-Fund Project Tracking

- Multi-funded projects reduce resistance to inclusion of safety improvements
- Program allocations (preservation, safety, operations, etc)
- Measurement
## Institutional Good Practice

### Multi-Fund Project Tracking

<table>
<thead>
<tr>
<th>Project</th>
<th>Pavement preservation share</th>
<th>Safety improvement share</th>
<th>Other fund share</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR 56, Sect 5B</td>
<td>358,215</td>
<td>57,551</td>
<td>36,875</td>
<td>452,641</td>
</tr>
<tr>
<td>SR 114, Sect 6G</td>
<td>876,284</td>
<td>45,842</td>
<td></td>
<td>922,126</td>
</tr>
<tr>
<td>SR 765, Sect 15E</td>
<td>982,057</td>
<td>78,452</td>
<td>258,138</td>
<td>1,318,647</td>
</tr>
<tr>
<td>SR 595, Sect 23D</td>
<td>591,882</td>
<td>53,985</td>
<td>35,807</td>
<td>681,674</td>
</tr>
<tr>
<td>SR 88, Sect 13F</td>
<td>1,298,125</td>
<td>99,212</td>
<td></td>
<td>1,397,337</td>
</tr>
<tr>
<td>SR 302, Sect 9B</td>
<td>487,381</td>
<td>85,368</td>
<td>128,375</td>
<td>701,124</td>
</tr>
<tr>
<td>SR 472, Sect 3C</td>
<td>584,682</td>
<td>78,318</td>
<td></td>
<td>663,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$5,178,626</strong></td>
<td><strong>$498,728</strong></td>
<td><strong>$459,195</strong></td>
<td><strong>$6,136,549</strong></td>
</tr>
</tbody>
</table>
Institutional Good Practice

Flexible Project Development Cycles

- Consideration and inclusion of safety improvement requires time for:
  - Right-of-Way
  - Environmental documentation/permits
  - Coordination

- Forcing all projects into short development cycle precludes many cost-effective improvements
Institutional Good Practice

Flexible Project Development Cycles

Letting  Letting  Letting

FY 1  FY 2  FY 3  FY 4
Institutional Good Practice

Engaging Safety Experts in Resurfacing Project Development

- Project initiation based on pavement conditions
- Multi-disciplinary development teams
- Projects developed in regions/districts
- Safety expertise: local or central office (both observed with good results)
Institutional Good Practice

Alliances with Local Governments

- State DOTs own < 20% of network
- Local agency ownership concentrated on facility types with higher crash rates
- Local gov’t do not have experts/specialists
- Extension of DOT resources (expertise, data, analysis techniques) to local gov’t is “force multiplier”
Technical Good Practice

Targeting Selected Safety Improvements

- Universal upgrading to geometric and safety standards not practical through resurfacing
- Historical safety (crash records) & agency knowledge used to select countermeasures
- Probabilistic techniques in use and improving
Technical Good Practice
Targeting Selected Safety Improvements

Excerpt From Colorado DOT Safety Assessment
Technical Good Practice
Targeting Selected Safety Improvements

Accidents When Dark for SH 74, MP 8.0 - MP 15.0

Ensure adequate delineation for night-time driving.

Excerpt From Colorado DOT Safety Assessment
Technical Good Practice

Selective Geometric Improvements

- Cross slope improvement
- Superelevation improvements
- Segment cross section improvements
- Drainage improvements
- Sight distance improvements
- Auxiliary lanes
Curves

- Super elevation: add or correct
- Pave shoulders: outside & inside
- Flatten outside slope
- Remove objects outside curve
- Delineate, chevron, RPM’s, ball bank advisory
Sight Distance Before
Sight Distance After
Daylight: Intersections, Drives

- Vegetation: crops, bushes
- Cut or fill problem
- Signs & poles
Before

Realignment to Improve Intersection Sight Distance

After

Photographs Courtesy of NY State DOT
Turn Lanes

- Check warrants & crash history
- Offset left turn lanes
Added Turn Lanes

Photos courtesy of Iowa DOT
Pennsylvania

Turn-lane added; New guardrail block-outs
Technical Good Practice

Traffic Control Devices and Guidance

- Centerline and edge rumble strips
- Curve delineation and warning
- Pavement markings
- Retroreflective pavement markings
- Sheet delineation
- Signs
- Signal upgrades
Centerline and Shoulder Rumble Strips

Washington State
Rumble Stripe

Photo courtesy of Iowa DOT
Pavement Markings and Centerline Rumble Strips – Elements of Advanced Curve Warning
Chevrons and Shoulder Rumble Strips

Photo courtesy of Iowa DOT
Larger Stop Sign
Chevrons, Barrier-Mounted Sheet Delineation

Colorado
Roadside Delineators, Shoulder Rumble Strips (Bicyclist)

Washington State
Technical Good Practice

Roadside Interventions

- Bridge rail and connections
- Culvert end treatments
- Culvert extensions
- Edge drop-off mitigation
- Guardrail (installation, replacement, adjustment)
- Guardrail terminal
- Headwall replacement
- Obstacle delineation
- Obstacle removal
- Selective clearing
- Slope stabilization
- Utility pole relocation
Barrier and End Terminal, Approach, Delineators  

Photo courtesy of Iowa DOT
Unshielded Culvert
Modifying the Inlet Design
Drop-off During Construction
The Safety Edge: A Practical Solution
Checking Guardrail Height

Photo courtesy of NY State DOT
Barrier System Prior to Retrofit
Newly-Installed Barrier System
Newly-Installed Barrier System

Photo courtesy of NY State DOT
Barrier and End Treatment

Photo courtesy of New York State DOT
Standing Headwall
Modifying the Headwall Design

Single pipes up 36” cut to match the sideslope.
Improvements

- Reduce access points
- Eliminate headwalls
- Construct 6:1 Slope
- Still need end treatment
Culvert Extension and End Treatment

Photo courtesy of Iowa DOT
Shoulder Backup; Full-width resurfacing  Pennsylvania
Shoulder Backup - Mailbox
Utility Pole Delineation
Utility Pole Relocation

Photos courtesy of New York State DOT
Technical Good Practice

Access and Intersection Modifications

- Commercial entrance consolidation
- Commercial entrance reconfiguration
- Farm drive consolidation and reconfiguration
- Intersection reconfiguration
- Lighting
- Safety dikes
- Signal upgrades
Vertical Realignment of Intersection at Two County Roads

Iowa
Safety Dike
QUESTIONS?