Strategic Safety Improvements
Focus on Low-Cost Treatments for Horizontal Curves

Presented to: 2009 Purdue Road School

Prioritized Horizontal Curve Improvements

- Average crash rate for curves is about 3X that of tangents
- Approximately 26% of fatal crashes occur along horizontal curves
- Driver behavior on curves does not match AASHTO curve design assumptions
- AASHTO methods for superelevation are based mostly on driver comfort considerations
Driver Behavior at Horizontal Curves

Curves driven faster than Policy assumption

Curves driven slower than Policy assumption

Driver tracks a ‘critical radius’ sharper than that of the curve just past the PC

Figure D-2. Relationship between roadway curvature and travel path curvature in a tangent-to-curve transition design.
Driver Behavior at Horizontal Curves

Horizontal Curve Safety Countermeasures

- Pavement Markings, Signing and Retroreflective Devices
- Widen Shoulders and/or Roadside
- Enhance Pavement Friction
- Provide Roadway Lighting
- Conduct Road Safety Audits
Conventional Pavement Markings

Centerline w/ NPZ
CRF = 30-35%

Edge lines (alone)
CRF = 4-44%

Advance Warning Signs

CRF 18% (CRF 22% with Advisory Speed Plaque)
Curve Chevron Signs

CRF 35%
Horiz Curve Signing & Marking “Package”
Delineators

CRF 58% (for ROR crashes)
Enhanced Pavement Markings
Geometric Improvements

Improving Shoulders
- Widen from 0’ to 2’: CRF 16%
- Widen from 0’ to 4’: CRF 29%
- Widen from 0’ to 8’: CRF 49%

Improve Curve Superelevation
- CRF 28% (51% for Wet conditions)

Widen Clear Zone
- Add 5’ CZ: CRF 13%
- Add 10’ CZ: CRF 25%
- Add 20’ CZ: CRF 44%
High-Friction Overlay Treatments

- Addresses site-specific pavement-related issues:
  - Polish of pavement (smooth)
  - Lack of superelevation
  - Combination of curvature and grade
- New products are thin, epoxy-bonded laminates
  - Generally easy installation with in-house forces and equipment
  - Short install duration means less WZ exposure (labor safety)
  - Applications are far-reaching, from low-volume rural to high-volume freeway
  - Most vendors offer tinting; at least one offers retroreflectivity
High-Friction Overlay Treatments
Additional Low-Cost RD-Curve Countermeasures

- Lighting
- CRF ~50%

Conducting Road Safety Audits

- Road Safety Audits:
  - Are formal, interdisciplinary examinations of safety issues for a site, project or corridor
  - Consider the needs of all users
  - Account for the interaction of elements beyond a project’s limits
  - Benefit from input from Law Enforcement
  - Can be a proactive element of an agency’s safety program
Conducting Road Safety Audits

Expressed Benefits of RSA Programs:

- “[RSAs] demonstrate a proactive approach to identifying and mitigating safety concerns.”

- “Our attorneys say that once safety issues are identified, and if we have financial limitations on how much and how fast we can correct the issues, then the RSA will help us in defense of lawsuits.”

- Benefit/Cost ratios for performing RSAs have routinely been found to be high.
Helpful Resources

NCHRP 500 Volume 7

http://safety.transportation.org

Helpful Resources

FHWA Guide to Improving Safety at Horizontal Curves

http://safety.fhwa.dot.gov/roadway_dept/pubs/sa07002
Helpful Resources

Desktop Reference of CRFs


Helpful Resources

Road Safety Audits
- “How-To”
- Case Studies
- Peer-to-Peer

http://safety.fhwa.dot.gov/rsa/
Thank You!

Contact Information:

Jeffrey Shaw, P.E., PTOE, PTP  
Safety/Design Engineer

Email: jeffrey.shaw@fhwa.dot.gov  
Office: (708) 283-3524

FHWA Resource Center  
Safety & Design National Technical Services Team  
19900 Governors Drive, Suite 301  
Olympia Fields, Illinois  60461  
http://www.fhwa.dot.gov/resourcecenter/teams/safety/