Evaluation of low-cost Safety Improvements
Pooled Fund Study (ELCSI-PFS)

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Presentation Overview

• The ELCSI-PFS:
  – Background.
  – Importance to highway safety.
  – How it works.
  – FHWA program to support ELCSI-PFS.
  – Statistical accomplishments.
  – Completed Studies.
  – Current Studies.
  – Summary.
Since 1994, highway crashes have caused:

– Average **39,348** fatalities per year.
– Over **2.4 million** nonfatal injuries per year.
– Costs more than **$200 billion** to our national economy per year.
Addressing highway crash fatalities/injuries with high-cost countermeasures is not feasible, but with low-cost improvements it is!

- State departments of transportation (DOTs) need to install low-cost safety improvements to meet their safety goals.
- Before investing in low-cost safety countermeasures, DOTs need to know:
  1. Crash modification factors (CMFs) use objective measures to improve safety.
  2. Benefit to Cost ratios (B/C).
  3. Technical information (material, design, construction, maintenance).
ELCSI-PFS Background

- ELCSI-PFS was established with 23 State members to study existing (tried) and experimental strategies during the years 2005 through 2010.
- With 41 State members, the study is still going strong at 16 years to date and is the largest FHWA pooled fund study.

Source: FHWA
ELCSI-PFS Importance to Safety

An effective nationwide effort to save lives and prevent injuries with low-cost solutions implemented in less time!

1. Is of significant importance to 41 States DOT: to build improvements, collaborate, and communicate on safety matters.
2. Is 41-States strong and includes research and application.
3. Builds bridges between State DOTs, FHWA, and stakeholders.
4. Improves safety culture for research and application.
5. Provides tools (CMFs, B/C, and technical support.)
6. Identifies and communicates emerging safety needs.
8. Advances safety research by identifying needs, methodologies, and analysis.
Annual Meetings

The direction is set by the **Technical Activity Committee (TAC)**. Annually, the TAC attends a 2-day meeting to:

1. Receive study progress updates.
2. Conduct peer exchange.
3. Present and share results for safety efforts (technology transfer).
4. Build network to enhance capabilities (seating, organized outings).
5. Provide opportunity to learn from an invited expert (i.e., infrastructure, statistician).
6. Learn from invited safety experts on related efforts (i.e., State, Federal, nonprofit, academia).
7. Become informed on emerging safety needs (in-house studies).
8. Identify future studies (TAC feedback).
FHWA established the Development of Crash Modification Factors (DCMF) in 2012, to save lives by:

1. Evaluating and identifying new safety strategies (low-to-high cost) that effectively reduce crashes and injuries.
   - Promoting effective strategies for nationwide installations.
   - Providing CMFs, B/C, and technical support.

2. Advancing statistical methodologies for safety research in partnership with:
   - The U.S. Department of Transportation (USDOT).
   - The American Statistical Association (ASA).
   - The U.S. Census Bureau.
Accomplishments

Reducing fatalities/injuries with low-cost safety improvements have become a *practice* norm!

Total funding (2005-present): $8,500,000, the ELCSI-PFS, and DCMF have:

• Developed over **800 CMFs** to be used in HSM and CMF Clearinghouse.
• Published **58** technical reports, techbriefs, and white papers (**8** more in progress).
• Had contributed to National Cooperative Highway Research Program (NCHRP), TRB, ASA, and other transportation communities.
Research Cultural Change Highlights

1. Started build-to-evaluate concept.
2. Supported evaluation of multistrategy safety countermeasures.
3. Educated TACs for use of high-friction surface treatments for addressing ran-off road crashes (a Volpe program evaluation.)
4. Introduced “pavement safety performance” (CMFs for 11 pavement types)
5. Started identification of new methodologies and applications.
6. Evaluated access management improvements.
7. Evaluating wrong way driving low-cost safety countermeasures.
8. Evaluated pedestrian and bike countermeasures.
9. Evaluated many intersection, including mini-roundabouts improvements.
10. Evaluated HFST using friction data collected in the field.
11. Identified focus crash types and risk factors for systemic improvements.
12. Others.
Advancing statistical Methodologies


• Statistical methodologies are heavily relied upon for all the ELCSI-PFS and DCMF studies.
• These methodologies are borrowed from various statistical fields, and have limitations in capability and applicability when used for highway safety research.
  – Started with few methodologies, and used Empirical Bayes as gold standard.

FHWA Statistical Publications:
1. Enhancing Statistical Methodologies for Highway Safety Research – Impetus from FHWA, Publication Number FHWA-HRT-14-081
2. Focus Crash Types and Contributing Risk Factors (in progress)
3. Highway Transportation Statistical Paper Synthesis (in progress)
## PUBLISHED TECHNICAL REPORT

1. Safety Evaluation of Increasing Retroreflectivity of STOP Signs, FHWA-HRT-08-041, December 2007
2. Safety Evaluation of Flashing Beacons at STOP-Controlled Intersections, FHWA-HRT-08-044, April, 2008
3. Safety Evaluation of STOP AHEAD Pavement Markings, FHWA-HRT-08-043, December 2007
4. Safety Evaluation of Installing Center Two-Way Left-Turn Lanes on Two-Lane Roads, FHWA-HRT-08-042, December 2007
5. Safety Evaluation of Improved Curve Delineation, FHWA-HRT-09-045, September 2009
6. Safety Evaluation of Offset Improvements for Left-Turn Lanes, FHWA-HRT-09-035, June 2009
7. Safety Evaluation of Lane and Shoulder Width Combinations on Rural, Two-Lane, Undivided Roads, FHWA-HRT-09-031, June 2009
8. Safety Evaluation of Advance Street Name Signs, FHWA-HRT-09-029, June 2009
15. Safety Evaluation of Cable Median Barriers in Combination with Rumble Strips on the Inside Shoulder of Divided Roads, FHWA-HRT-17-070, August 2017
16. Safety Evaluation of Red-Light Indicator Lights (RLILs) at Intersections, FHWA-HRT-17-077, November 2017
17. Safety Evaluation of Edge-Line Rumble Stripes on Rural Two-Lane Horizontal Curves, FHWA-HRT-17-069, December 2017
18. Safety Evaluation of Signalized Restricted Crossing U-Turn Intersections, FHWA-HRT-17-082, December 2017
19. Safety Evaluation of Multiple Strategies at Stop-Controlled Intersections, FHWA-HRT-17-086, January 2018
20. Safety Evaluation of Corner Clearance at Signalized Intersections, FHWA-HRT-17-084, February 2018
21. Safety Evaluation of Profiled Thermoplastic Pavement Markings, FHWA-HRT-17-075, March 2018
22. Safety Evaluation of Turning Movement Restrictions at Stop-Controlled Intersections, FHWA-HRT-17-064, March 2018
23. Safety Evaluation of Horizontal Curve Realignment on Rural, Two-Lane Roads, FHWA-HRT-17-066, April 2018
24. Safety Evaluation of Multiple Strategies at Signalized Intersections, FHWA-HRT-17-062, May 2018
25. Safety Evaluation of Flashing Yellow Arrow Treatment at Signalized Intersections,
26. Safety Evaluation of Pedestrian Countdown Signals,
27. Green T Intersections
28. High Friction Surface Treatments (in progress)
29. High Friction Surface Treatments Change Report (in progress)
30. Focus Crash and Facility Types Report
31. Highway Transportation Statistical Paper Synthesis
PUBLISHED TECH BRIEFS

1. Safety Evaluation of Flashing Beacons at Stop-Controlled Intersections, FHWA-HRT-08-048, April 2008
2. Safety Evaluation of Increasing Retroreflectivity of STOP Signs, FHWA-HRT-08-047, March 2008
4. Safety Evaluation of Center Two-Way Left-Turn Lanes on Two-Lane Roads, FHWA-HRT-08-046, March 2008
5. Safety Evaluation of Improved Curve Delineation, FHWA-HRT-09-046, August 2009
7. Safety Evaluation of Lane and Shoulder Width Combinations on Rural, Two-Lane, Undivided Roads, FHWA-HRT-09-032, May 2009
8. Safety Evaluation of Advance Street Name Signs, FHWA-HRT-09-030, June 2009
13. Safety Evaluation of Multiple Strategies at Signalized Intersections, FHWA-HRT-17-063, August 2017
14. Safety Evaluation of Cable Median Barriers in Combination with Rumble Strips on the Inside Shoulder of Divided Roads, FHWA-HRT-17-071, September 2017
15. Safety Evaluation of Horizontal Curve Realignment on Rural, Two-Lane Roads, FHWA-HRT-17-067, November 2017
16. Safety Evaluation of Red-Light Indicator Lights (RLILs) at Intersections, FHWA-HRT-17-078, November 2017
17. Safety Evaluation of Signalized Restricted Crossing U-Turn Intersections, FHWA-HRT-17-083, November 2017
18. Safety Evaluation of Edge Line Rumble Stripes on Rural Two-Lane Horizontal Curves, FHWA-HRT-17-068 November 2017
19. Safety Evaluation of Turning Movement Restrictions at Stop-Controlled Intersections, FHWA-HRT-17-065, December 2017
20. Safety Evaluation of Multiple Strategies at Stop-Controlled Intersections, FHWA-HRT-17-087, December 2017
21. Safety Evaluation of Profiled Thermoplastic Pavement Markings, FHWA-HRT-17-076, December 2017
22. Safety Evaluation of Corner Clearance at Signalized Intersections, FHWA-HRT-17-085, February 2018
23. Safety Evaluation of Flashing Yellow Arrow Treatment at Signalized Intersections (in progress)
24. Safety Evaluation of Pedestrian Countdown Signals (in progress)
25. Green T Intersections (in progress)
26. Focus Crash and Facility Types Quick Reference Guide
27. High Friction Surface Treatment Reference Guide
In 2020, ELCSI-PFS Completed Six Studies

**Safety evaluations of:**

1. Bicycle lane additions accomplished by reducing lane and shoulder widths.
3. Variable speed limits (VSL).
4. Protecting fixed objects with guardrails.
5. Removal of light poles.
6. Flattening side slopes.
ELCSI-PFS Current Studies

Safety Evaluations of:

1. Mini-roundabouts.
2. Bicycle lane configurations at intersections.
3. Wrong way driving (WWD) low-cost safety improvements.
4. Wrong way driving research and technical resources for one-day workshop (50 State DOTs).
5. Innovative pedestrian countermeasures at intersections.
6. Innovative bicycle countermeasures at intersections.
ELCSI-PFS and DCMF Summary

• Total ELCSI-PFS fund: $8,500,000
  – FHWA: $5,500,000 (65%)
  – State DOTs: $3,000,000 (35%)

• Average annual cost: $530,000
  – If “one” life is saved: benefit of $13,800,000 (FHWA-SA-17-071).
  – Annual Benefit to Cost Ratio= 25
  – New tools for advancing safety research/applications priceless!

The ELCSI-PFS is “cost effective” for cooperation with States DOTs to advance safety research and applications!
Thank you!

Questions?

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