Virginia / September 19-22, 2012
posium on pavement surface characteristics

SU

EVALUATION OF LOW-COST SAFETY IMPROVEMENTS POOLED FUND STUDY *(ELCSI-PFS)*

PAVEMENT SAFETY PERFORMANCE

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U.S.Department of Transportation
Federal Highway Administration

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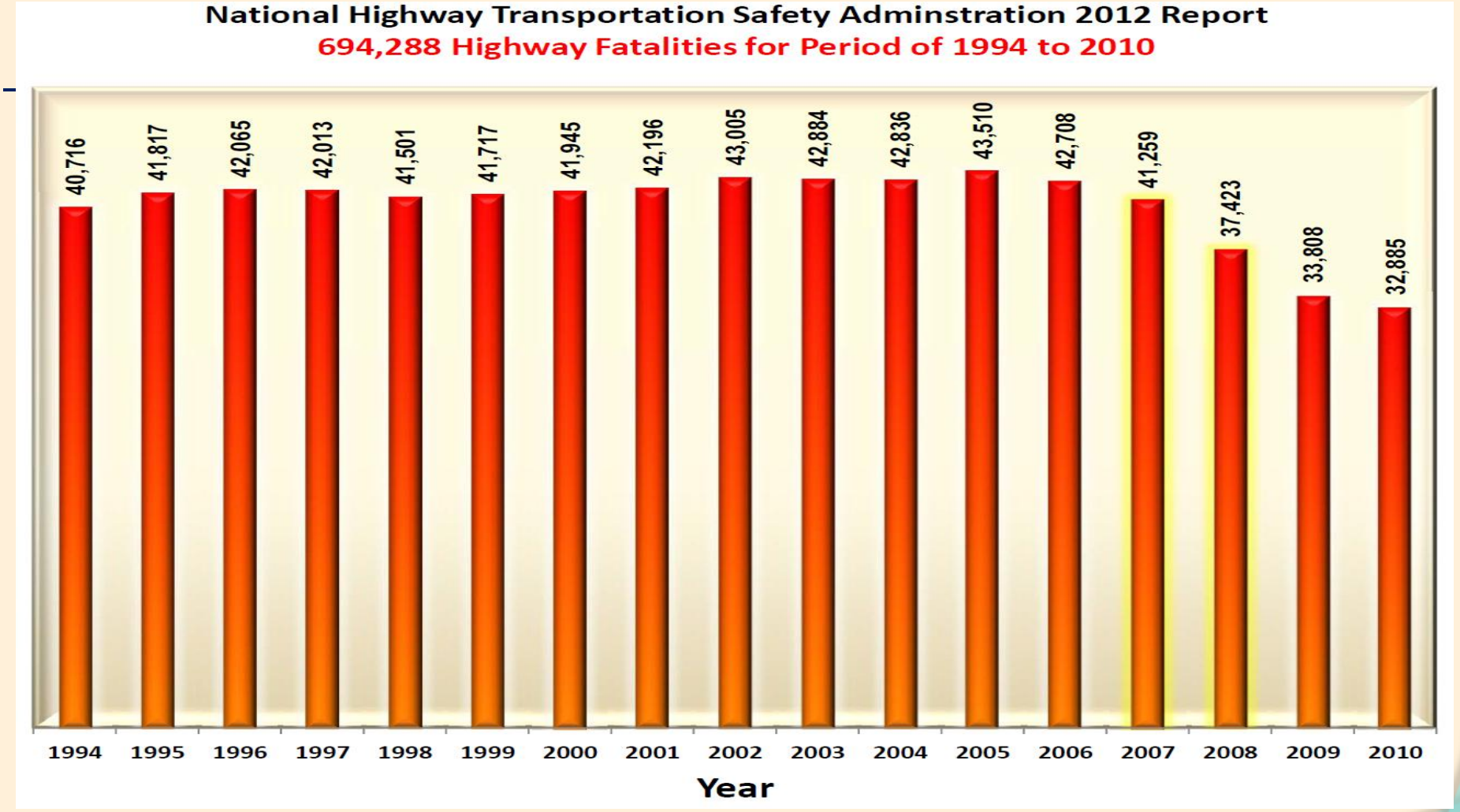
Presentation Objectives

- Why safety is important
- How FHWA, TFHRC, ELCSI-PFS is addressing safety
  - TFHRC, Pavement Safety Performance study
    - Type of pavements
    - Data collection and analysis
    - Study products
    - Other related studies
    - Every Day Counts 2- HFST
    - Future studies

Highway Crash Fatalities



Deaths: Leading Causes for 2008

CDC, National Vital Statistics, Vol. 60, No. 6, 2012

Table C. Deaths and percentage of total deaths for the 10 leading causes of death: United States, 2007 and 2008

Cause of death (based on ICD–10, 2004)	Rank[1]	2008 Deaths	2008 Percent of total deaths	2007 Deaths	2007 Percent of total deaths
All causes	…	2,471,984	100.0	2,423,712	100.0
Diseases of heart	1	616,828	25.0	616,067	25.4
Malignant neoplasms	2	565,469	22.9	562,875	23.2
Chronic lower respiratory diseases	3	141,090	5.7	127,924	5.3
Cerebrovascular diseases	4	134,148	5.4	135,952	5.6
Accidents (unintentional injuries)	*5*	*121,902*	*4.9*	*123,706*	*5.1*
Alzheimer's disease	6	82,435	3.3	74,632	3.1
Diabetes mellitus	7	70,553	2.9	71,382	2.9
Influenza and pneumonia	8	56,284	2.3	52,717	2.2
Nephritis, nephrotic syndrome and nephrosis	9	48,237	2.0	46,448	1.9
Intentional self-harm (suicide)	10	36,035	1.5	34,598	1.4

ELCSI-PFS

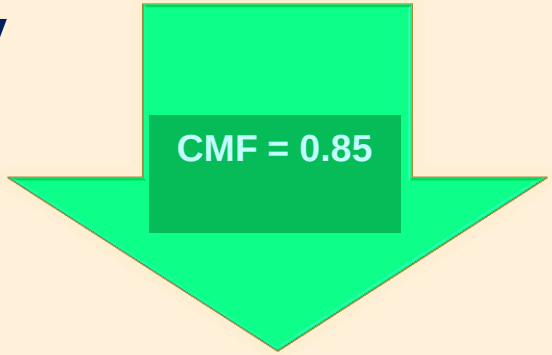
Started 2005 and continue to 2017 and beyond

Often state DOTs and other Transportation agencies are reluctant for investing in building safety strategies without scientific evidence that demonstrates effectiveness

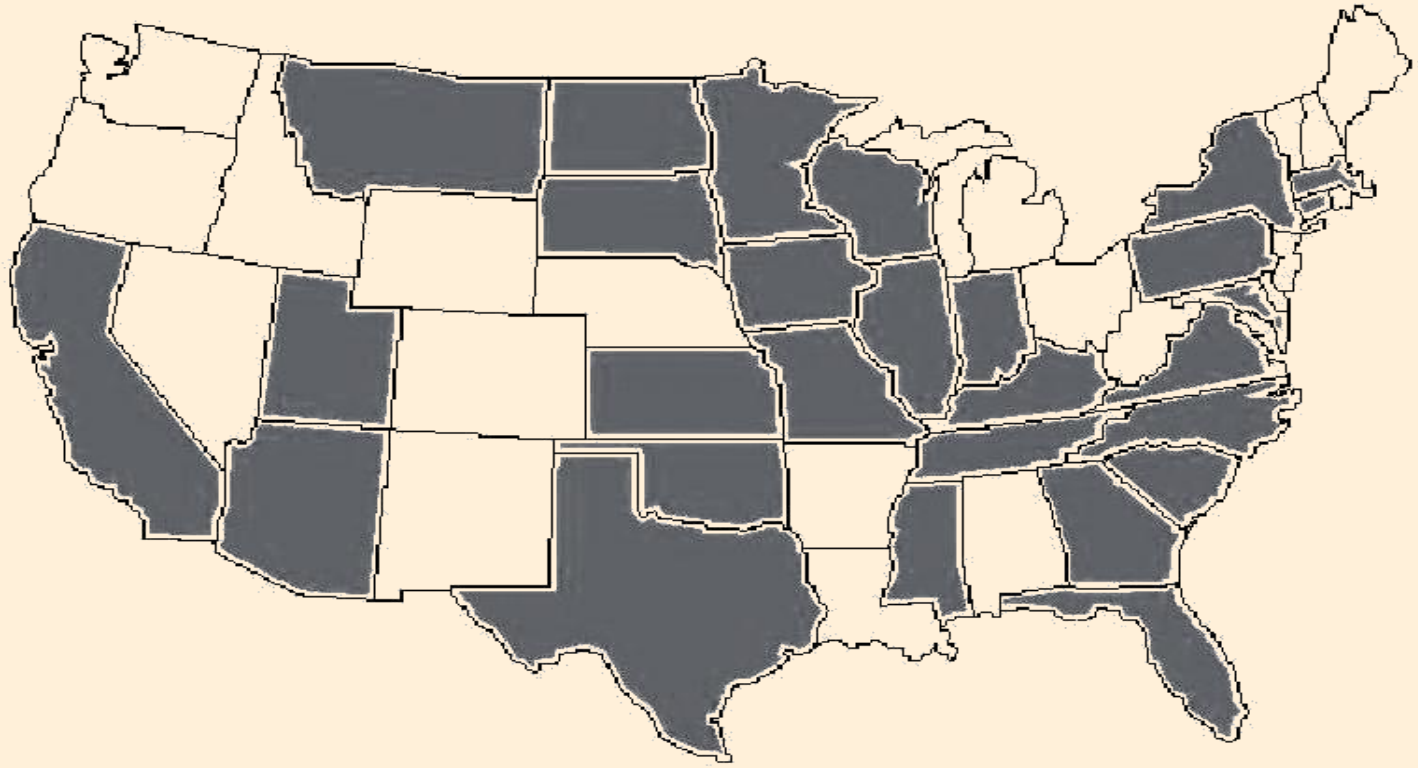
- **Evaluates unproven low cost (< $100k/site) safety improvements and determines reliable and scientific measure of strategy effectiveness in improving safety**
- **Using Empirical Bayes statistical methodology**
- **Crash Modification Factors (CMFs) are developed by conducting before/after safety evaluations using crash, road, and other data collected from the sites where improvements were made.**

Quantifying Safety Performance

- **CMFs are estimate of the safety effectiveness for a given strategy**
  - **CMF < 1.0 indicates a reduction in crashes**
  - **CMF > 1.0 indicates an increase in crashes**
  - **CMF = 1.0 indicates no change in crashes**



29 States in the Pool



Broad base has helped to advance safety research

ELCSI-PFS

- Currently, ELCSI-PFS has 7 phases and has evaluated or in the process of evaluating over 15 Strategies
- Numerous states contribute data from sites that they have installed new and innovative safety improvements
- Numerous states build new and innovative safety improvements for the ELCSI-PFS evaluations
- Phases III and V of the ELCSI-PFS were build-to-evaluate phases.

ELCSI-PFS, Phase VI Objectives

Innovative Pavement Safety Research

- **Evaluate the effectiveness of low-cost pavement improvements in reducing crashes for various pavement types (concrete and asphalt.)**
- **Use rigorous statistical analysis of crash, pavement and relevant data to:**
  1. **Develop Crash Modification Factors (CMFs)**
  2. **Provide Benefit/Cost ratios.**
  3. **Provide recommendations and guidance for various improvements based on monitoring and evaluation the performance of various pavement surface treatments.**

Low-Cost Pavement improvements

- **Treatments applied to existing pavements that effectively changed the surface properties (texture, friction, smoothness, noise, etc.)**
- **Pavement preservation to restore/enhance friction, smoothness, etc.**
- **Other pavement treatments that are considered:**
  - **Curves**
  - **Cross-slope or superelevation correction**
  - **Spot pavement treatments for safety purposes**

Low-Cost Pavement Improvements

- **Asphalt Pavement**

Open **G**raded
Friction **C**ourse

Thin Overlay

Low-Cost Pavement Improvements

- **Asphalt Pavement**

Chip Seal / Seal Coat

Low-Cost Pavement Improvements

- **Asphalt Pavement**

Skidabrader

Micromilling

VDOT

Shotblasting/Abrading

Low-Cost Pavement Improvements

- **Concrete Pavement**

Shotblasting/Abrading

Ultrathin Cementitious Overlay

Low-Cost Pavement Improvements

- **Concrete Pavement**

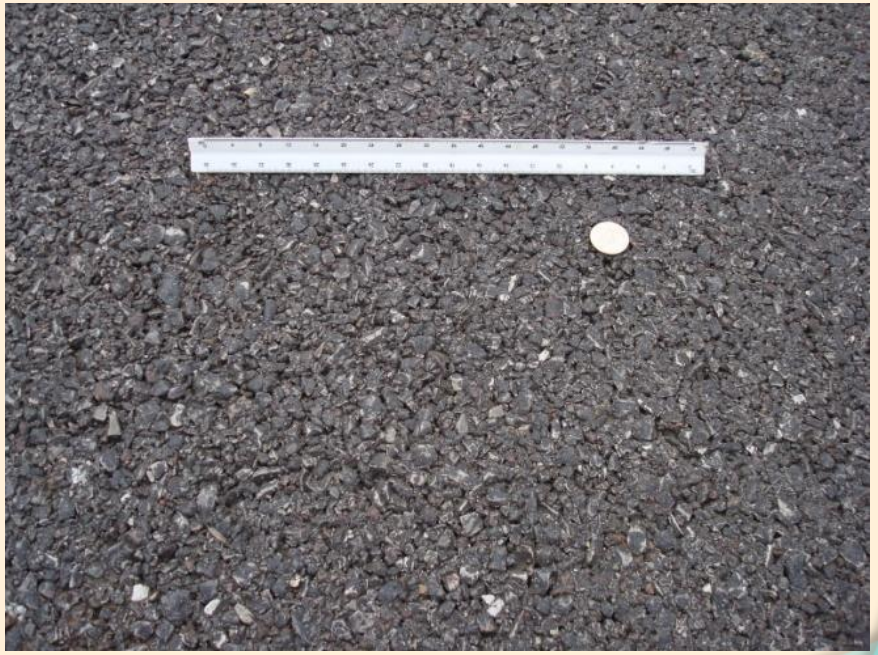
Diamond Grinding

Grooving
"Next Generation Diamond Grinding"

Low-Cost Pavement Improvements

- **Asphalt / Concrete Pavement**

Ultrathin Bonded Wearing Course



Low-Cost Pavement Improvements

- **Asphalt / Concrete Pavement**

Microsurfacing / Slurry Seal

Low-Cost Pavement Improvements

- **Asphalt / Concrete Pavement**

  High Friction Surfacing

Data Collection

- **Criteria for Candidate Sites**
  - **Treatment improvements are commonly used in the State (i.e., non-experimental unless substantial mileage)**
  - **Minimum of 3 years of pre-treatment and post-treatment crash data (i.e., 2008 or earlier)**
  - **Minimum ~8-10 treatment sites in the State**
  - **Availability of Reference Sites**
- **Data Formats**
  - **“Raw” data format preferred**

Data Collection

- **Crash and Roadway Data**

Crash Data	• Number of crashes • Location type (intersection, non-intersection etc.) • Crash type (run-off-road, sideswipe etc.) • Crash classification (PDO, Injury, Fatal) • Vehicle type • Pavement conditions • Ambient conditions • Reported driver action • Direction of travel • Reference location (milepost) • Other factors affecting crash classification (alcohol, seat belt use, etc.)
Roadway and Traffic Data	• Roadway classification (rural, urban, Interstate, non-Interstate) • Traffic volume and directional/lane distribution • Number of lanes • Median type • Geometrics (grade, curvature, superelevation, cross-slope) • Shoulder information • Roadside features • Safety devices/features (striping, signage, guardrails, etc.)

Data Collection

- **Pavement and Site Data**

Pavement File Data	• Original/Existing pavement type (pre-treatment) • Original/Existing pavement construction dates • Rationale for applying surface treatment (e.g., pavement preservation or friction enhancement) • Pavement materials for original/existing pavement • Surface treatment strategy type • Construction dates for treatment strategy • Construction methods and equipment used for treatment strategy • Length of treatment strategy section • Material properties for treatment strategy (includes, but is not limited to: binder type/properties, aggregate properties • Pavement Condition (rutting, polished surface, etc.) • Skid Resistance Measurement (SRV and test type)
Climatic Data	• Average temperatures (by month) • Average rainfall (by month) • Crash-specific weather (if available)

Data Collection Update

- Most Common Treatments (in order of data availability)
  - Asphalt Pavement
    - Thin Overlays
    - Chip Seals/Seal Coats (single and double layer)
    - OGFC
    - Ultrathin Bonded Wearing Course (e.g., Novachip)
    - Microsurfacing and Slurry Seals
    - High Friction Surface Treatment (HFST)
  - Concrete Pavement
    - Diamond Grinding
    - Microsurfacing
    - High Friction Surfacing

Data Collection Update

- **Treatment Strategy Needs**
  - **Asphalt Pavement**
    - **OGFC**
    - **HFST**
    - **Slurry Seal**
    - **Shotblasting/Skidabrading**
    - **Micromilling**
  - **Concrete Pavement Treatments (All)**
  - **Geographic Diversity of Treatments (More States!)**
  - **Reference Sites**

Data Collection Update

- **Data needs for selected treatments/sites**
  - **More detailed site information (terrain, geometrics, shoulders, median information, etc.)**
  - **Information on changes to site during B/A periods**
  - **More detailed treatment material information**
  - **Skid Data**
  - **Construction Information (cost info, lessons learned, etc.)**
  - **Treatment Performance Information**

Some Evaluation Details

- Before and After Period Data Collection
- Verify Installation Dates
- Stage Risk Assessment and Quarterly Conference Calls
- Select Suitable Reference Sites
- Document Changes in the B/A Periods
- Conduct Sample Size Estimation
- Develop Final Study Design
- Conduct analysis
- Benefit Cost Ratio Analysis
- Compilation of States' Experience for Strategy Installations
- Final Report (spring of 2014)

Other TFHRC Research

- **Development and Demonstration of AASHTO Guide for Pavement Friction:**
  1. **Phase I identified best Continuous Friction Measurement Equipment to save lives (30 % slip ratio) with smooth tire (Jim Sherwood, TFHRC)**
  2. **Phase II - Demonstrate in four States, compare to current equipment (Andy Mergenmeier, Resource Center)**
- **Asphalt Research Consortium "Mixture Design to Enhance Safety and Reduce Noise"**

  The University of Wisconsin and University of Pisa, Italy. (Eric Weaver, TFHRC)

Every Day Counts (EDC2)
High Friction Surface Treatments

Approach for this EDC2, HFST draft initiative centers on developing the following four proficiencies and procedures:

- **Awareness**
- **Target audience proficiency**
- **Standard screening procedures**
- **Site selection guides/tools.**

The deployment effort will concentrate on:

- ***Training***
- ***Outreach: communication and marketing***
- ***Knowledge and Information Exchange.***

Near Future Studies

- **FHWA, TFHRC is anticipating start (10/12) of its new study "Development of Crash Modification Factors" (DCMF) that will evaluate low to high cost safety improvements that includes pavement.**
- **TFHRC, Offices of Safety R&D and Infrastructure R&D will conduct in-house research using data received for the ELCSI-PFS, Phase VI.**

FHWA - Pavement Safety Performance

Thank You!

Roya Amjadi - Safety R&D
Jim Sherwood - Pavements R&D

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