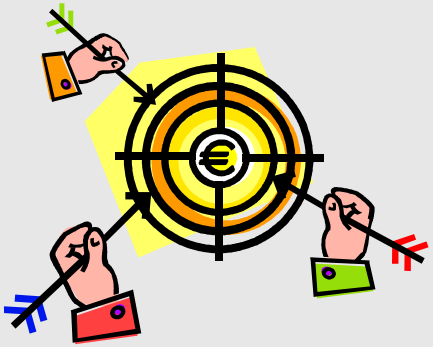
TEXAS DEPARTMENT OF TRANSPORTATION

SURFACE TREATMENTS TO ALLEVIATE CRASHES ON HORIZONTAL CURVES

2014 Traffic Safety Conference

Research Projects

- 0-5439 – Identifying and Testing Effective Advisory Speed Setting Procedures
  5-5439 – Workshops on Identifying and Testing Advisory Speed Setting Procedures
  - Criteria for setting advisory speed
  - Curve severity assessment
  - GPS Method
- 0-6714 – Surface Treatments to Alleviate Crashes on Horizontal Curves
  - Curve speed and safety trends
  - Margin-of-safety analysis framework
    - Friction supply – friction demand
    - Assess benefit of increasing supply with surface treatment



Objectives and Scope

0-6714– Surface Treatments to Alleviate Crashes on Horizontal Curves

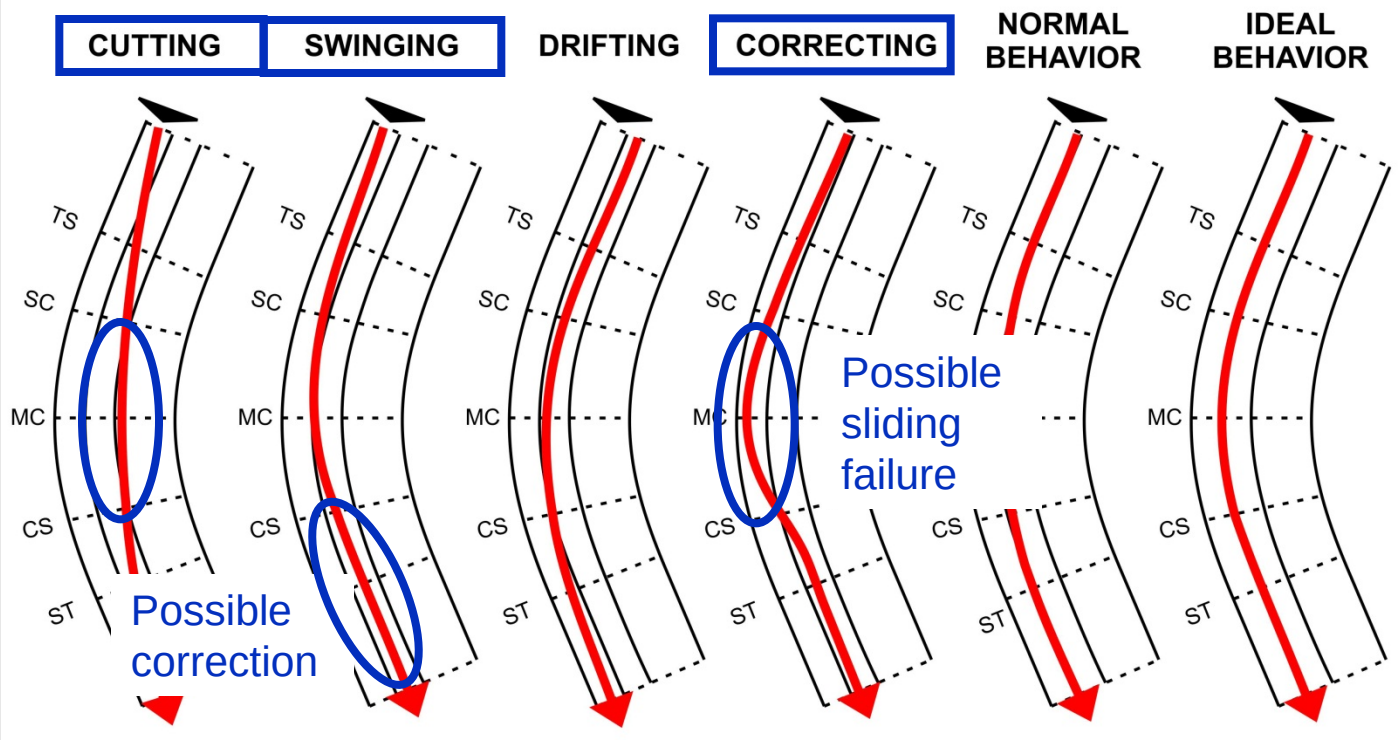
- Objectives
  - Assess effectiveness of high-friction surface treatments at improving curve safety
  - Develop guidelines for application of high-friction surface treatments
- Scope
  - Horizontal curves
  - “High”-speed roadways

Treatments

- Select Treatments
  - High-friction surface treatment
  - Pavement texturing
  - Seal coat

Findings

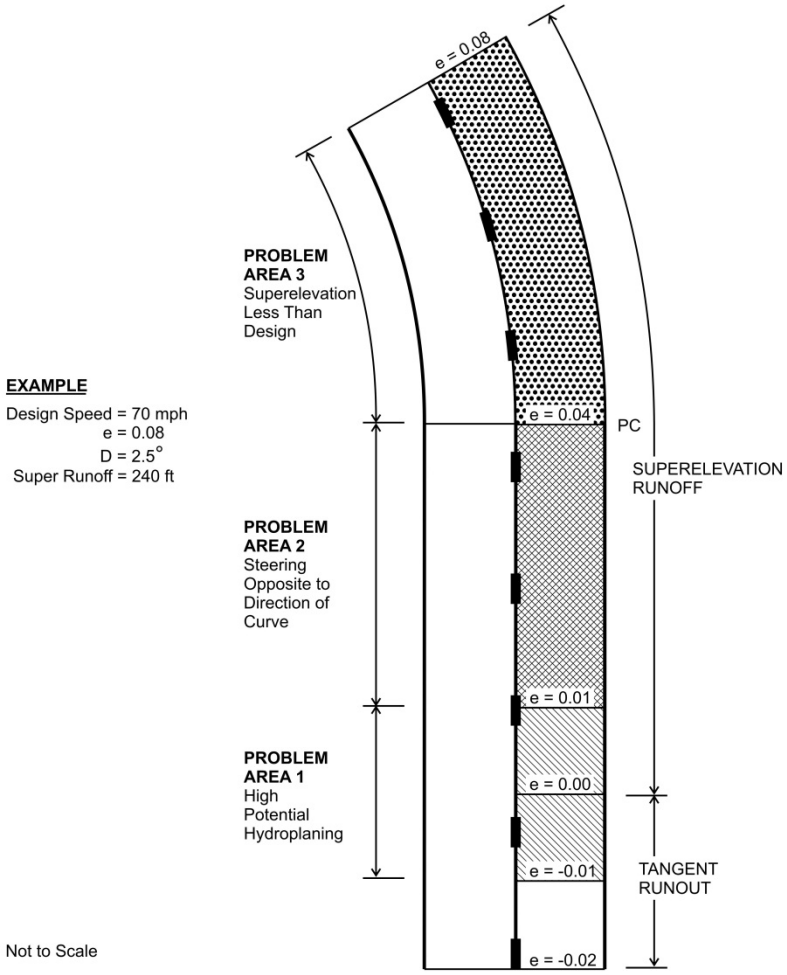
- The Issues
  - Curve tracking errors



Spacek, 2005

Findings

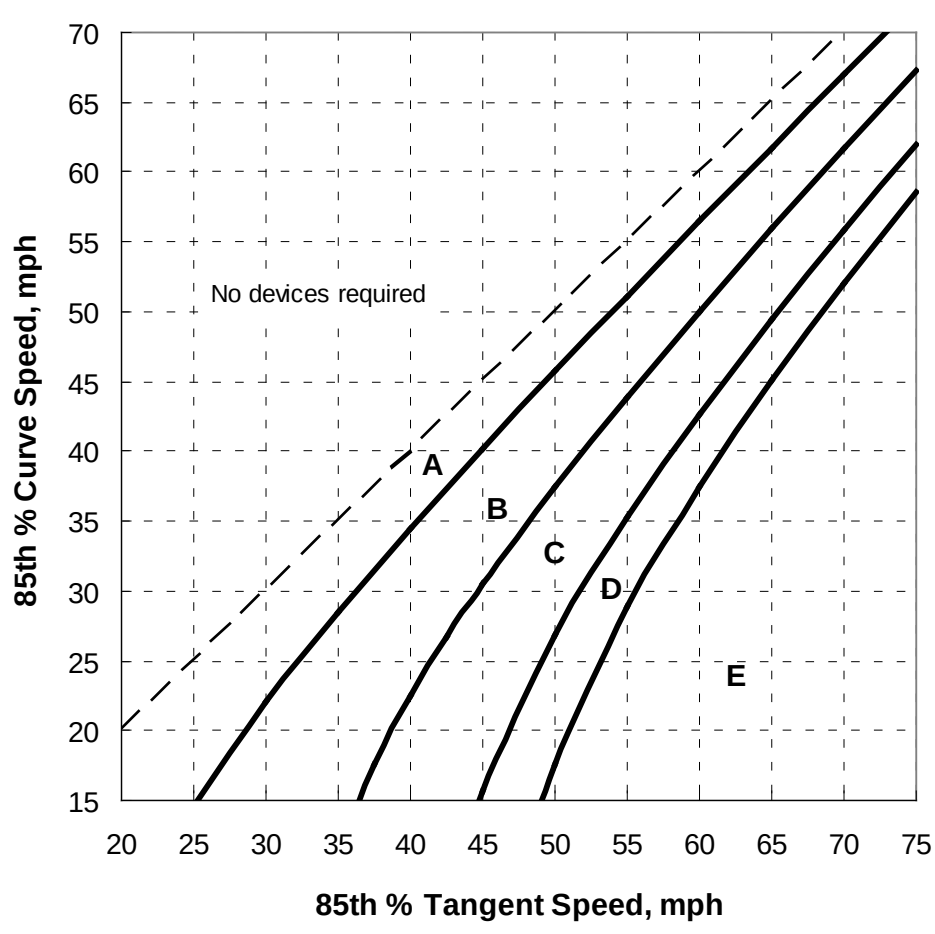
- The Issues
  - Superelevation transition issues
    - Lack of full superelevation in beginning of curve
    - Hydroplaning



Glennon, 1969

Findings

- The Issues
  - Curve severity assessment
    - Based on friction demand and kinetic energy
    - Category E is most severe – use “special treatments”



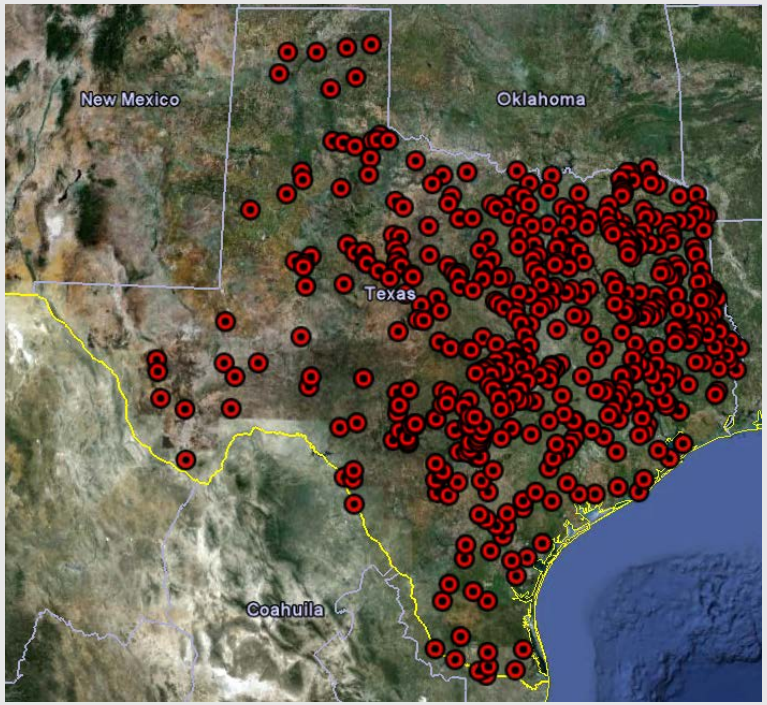
Bonneson et al., 2007 (0-5439)

Findings


SOFT SHOULDER
BLIND CURVES
STEEP GRADE
BIG TRUCKS
GOOD LUCK!

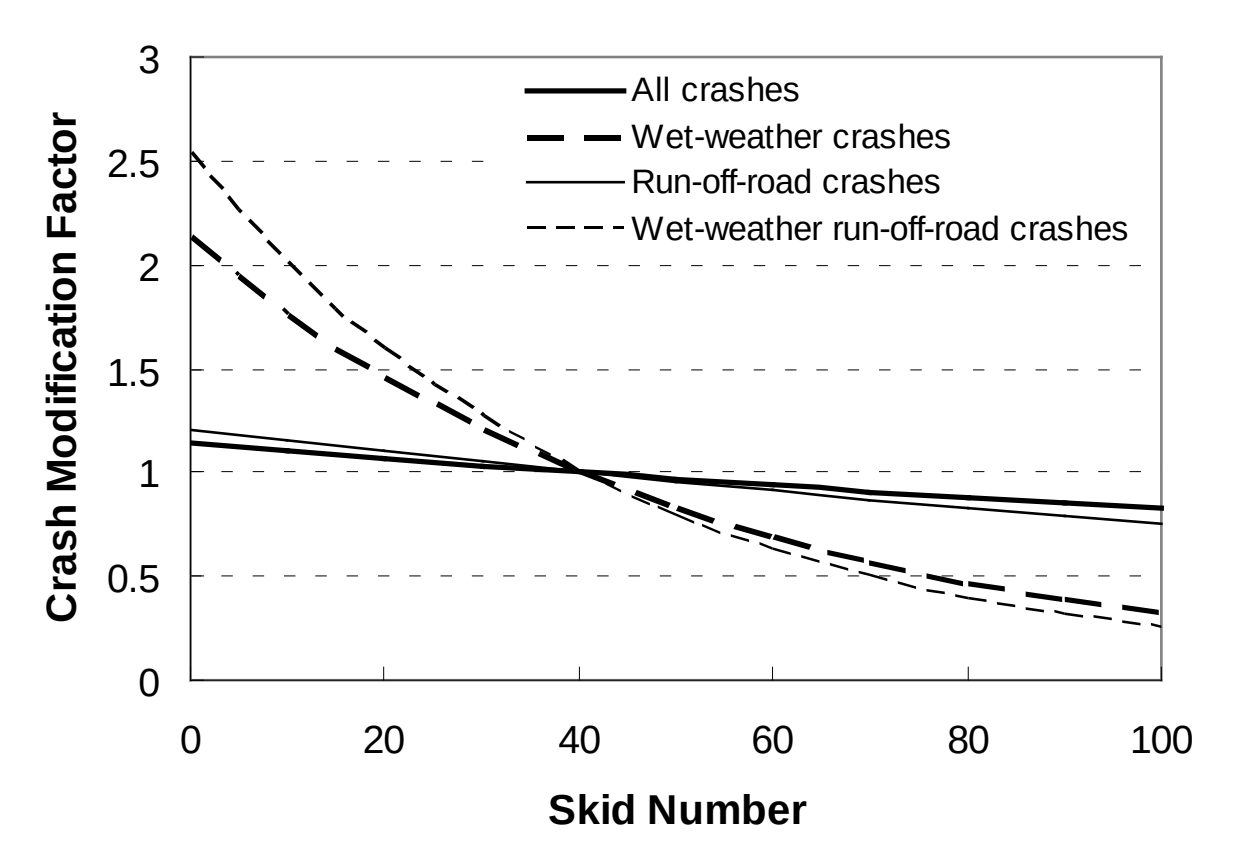
Crash Data Analysis

- Cross-sectional models
  - About 500 curve sites
  - Four models (all, wet-weather, run-off-road, and wet-weather run-off-road crashes)
  - CMF for skid number



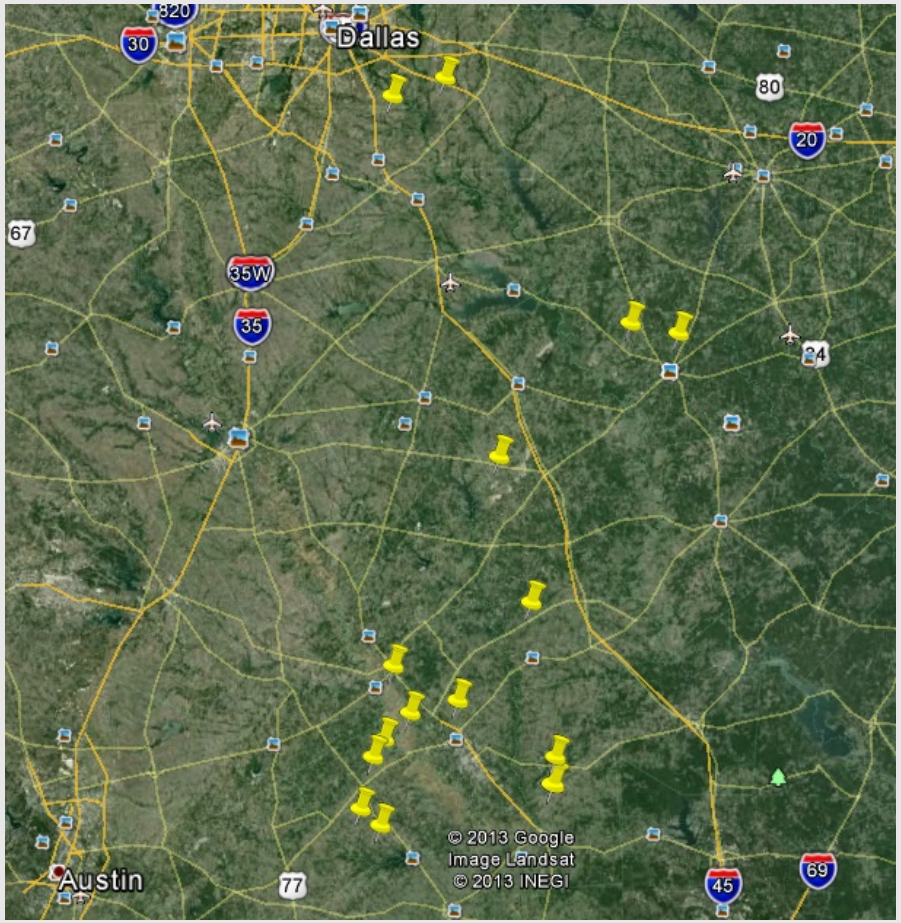
Crash Data Analysis

- Detailed Analysis
  - Skid number CMF



Field Evaluation

- Data Collection
  - 15 sites
    - Bryan, Dallas, and Tyler districts
    - 55-70 mph speed limits
    - 30-55 mph advisory speeds
  - 6000 vehicles

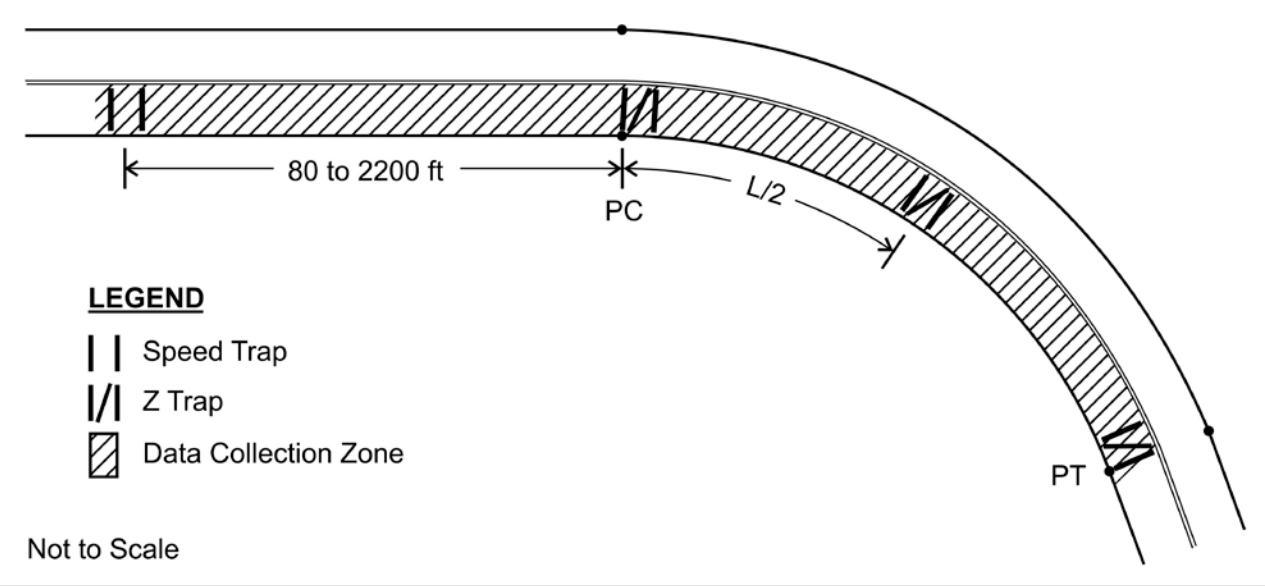


Field Evaluation

- Cross-Sectional Database
  - Data collection plan

Field Evaluation

- Operational Data
  - Speed
  - Lane placement
- Friction Data
  - Skid number



Field Evaluation

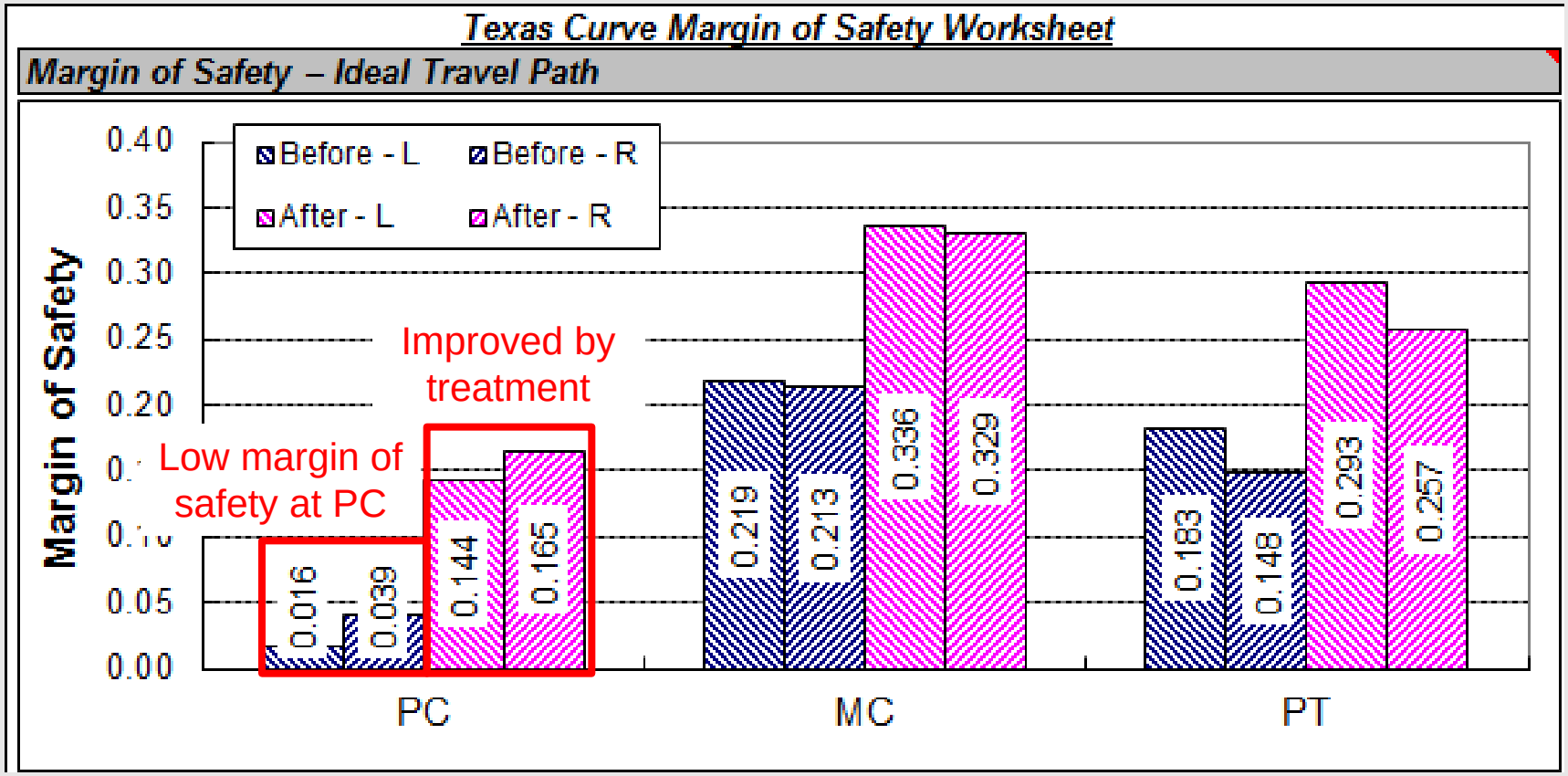
- Models
  - Mid-curve speed model
  - Speed differential models
    - PC-MC, MC-PT
    - Used to compute side friction demand along the entire curve
  - Lane placement models
    - Probability of different track types

Texas Curve Margin of Safety (TCMS)

- Input data
  - Curve geometry
  - Traffic volume
  - Skid number
  - Speed limit

- Output
  - Margin of safety calculations
  - Curve CMFs

Margin of Safety



Crash Modification Factors (CMFs)

Crash Prediction Model Calculations		
Predicted Crash Counts in Analysis Period		
	Before	After
All	1.406	1.386
Wet-weather	0.025	0.021
Run-off-road (ROR)	1.426	1.389
Wet-weather ROR	0.022	0.018
Predicted Change in Crash Count		
All		-3.1%
Wet-weather		-17.2%
Run-off-road (ROR)		-4.6%
Wet-weather ROR		-20.8%

Overall Crash Modification Factors (CMFs)		
Curve radius	9.432	
Lane width	1.066	
Shoulder width	1.287	
Skid number	1.033	1.000
Combined	13.368	12.947
Wet-Weather CMFs		
Lane width	1.095	
Skid number	1.208	1.000
Combined	1.322	1.095
Run-off-Road CMFs		
Curve radius	12.825	
Lane width	1.064	
Shoulder width	1.328	
Skid number	1.048	1.000
Combined	19.006	18.133
Wet-Weather Run-off-Road CMFs		
Lane width	1.101	
Skid number	1.262	1.000
Combined	1.390	1.101

2013 New Highway Safety Improvement Program Work Codes

High Friction Surface Treatments

Closure

- Questions or comments?
- Thank you for your time!