

THE 2008 OHIO FRICTION STUDY

OR

RELATIONSHIP BETWEEN SKID
RESISTANCE NUMBERS MEASURED WITH
RIBBED AND SMOOTH TIRE AND WET-
ACCIDENT LOCATIONS

Presented by:

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2008 Ohio Friction Study

APTech Staff

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ODOT Liaisons

- **Andrew Williams**
- **Roger Green**
- **Brian L. Schleppe**
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Ohio Safety Efforts

- **Developed base crash rates for intersections and freeways to help identify those with higher-than-average rates**
- **Developed crash reduction factors for various countermeasures**
- **Implemented a significant road safety audit (RSA) program**
- **Undertaken major research on friction qualities of various aggregates**
- **Participated in FHWA's Highway Safety Information System (HSIS)**
- **Consistently reduced highway fatality rates, as well as the number of fatalities.**

Ohio 2006 Safety Goals

Refine, refocus and respond to high crash locations

- Reduce crash frequency by 10% by 2015
- Reduce rear-end crashes by 25% by 2015
- Reduce state fatality rate to 1.0 fatality per 100 MVMT by 2008
- Reduce annual fatalities to 1100 by 2008

Research Objectives

- **Determine if a correlation exists between locked-wheel friction (FN) and wet pavement crashes and, if so:**
 - **which test tire (ribbed or smooth) is more correlated.**
 - **what the desirable or target FN values should be for different site categories / friction demand categories.**
- **Develop improved guidance on use of ribbed versus smooth tires and provide recommendations regarding minimum friction numbers for each type.**

Research Approach

- **Task 1. Literature Review**
- **Task 2. Design Experiment**
- **Task 3. Collect Data**
- **Task 4. Develop Correlations**
- **Task 5. Recommend Friction Numbers**
- **Task 6. Final Report**

Task 1. Literature Review

Conclusions

- **Friction/texture is an important surrogate for safety.**
- **Greater attention to engineering safer roads can potentially reduce fatalities and serious injuries by a considerable amount.**

Task 2. Design Experiment

Site Selection, Crash and Inventory Data

- **90 sites selected covering three categories**
 - congested freeways: 30
 - signalized intersections: 30
 - unsignalized intersections: 30
- **For each category,**
 - low wet/total crash ratio (0.15): 10
 - medium ratio (0.15 to 0.35): 10
 - high ratio (>0.35): 10
- **Representation across Districts, pavement types**

Task 3. Collect/Compile Data

- **ODOT provided:**
 - Comprehensive inventory and pavement condition data.
 - Crash data for 2003-2005.
- **Field testing by ODOT in summer/fall of 2007.**
- **At each of the 90 selected sites:**
 - Friction tests at 40 mph and one other speed (20 mph for intersections, 60 mph for freeways) with both ribbed and smooth tire (using two ODOT locked-wheel friction trailers)
 - Macrotexture measurements using a high-speed laser profiler (85 of 90 sites) (MPD later converted to MTD)
- **Develop analysis database (spreadsheet)**

Task 4. Develop Correlations

Data Analysis

- Develop plots of friction and texture statistics versus crash statistics for the 90 sites.

Independent Variable

- $FN40R_{avg}$
- $FN40R_{min}$
- $FN40S_{avg}$
- $FN40S_{min}$
- $FN20R_{avg}$ or $FN60R_{avg}$
- $FN20R_{min}$ or $FN60R_{min}$
- MTD_{avg}
- MTD_{min}



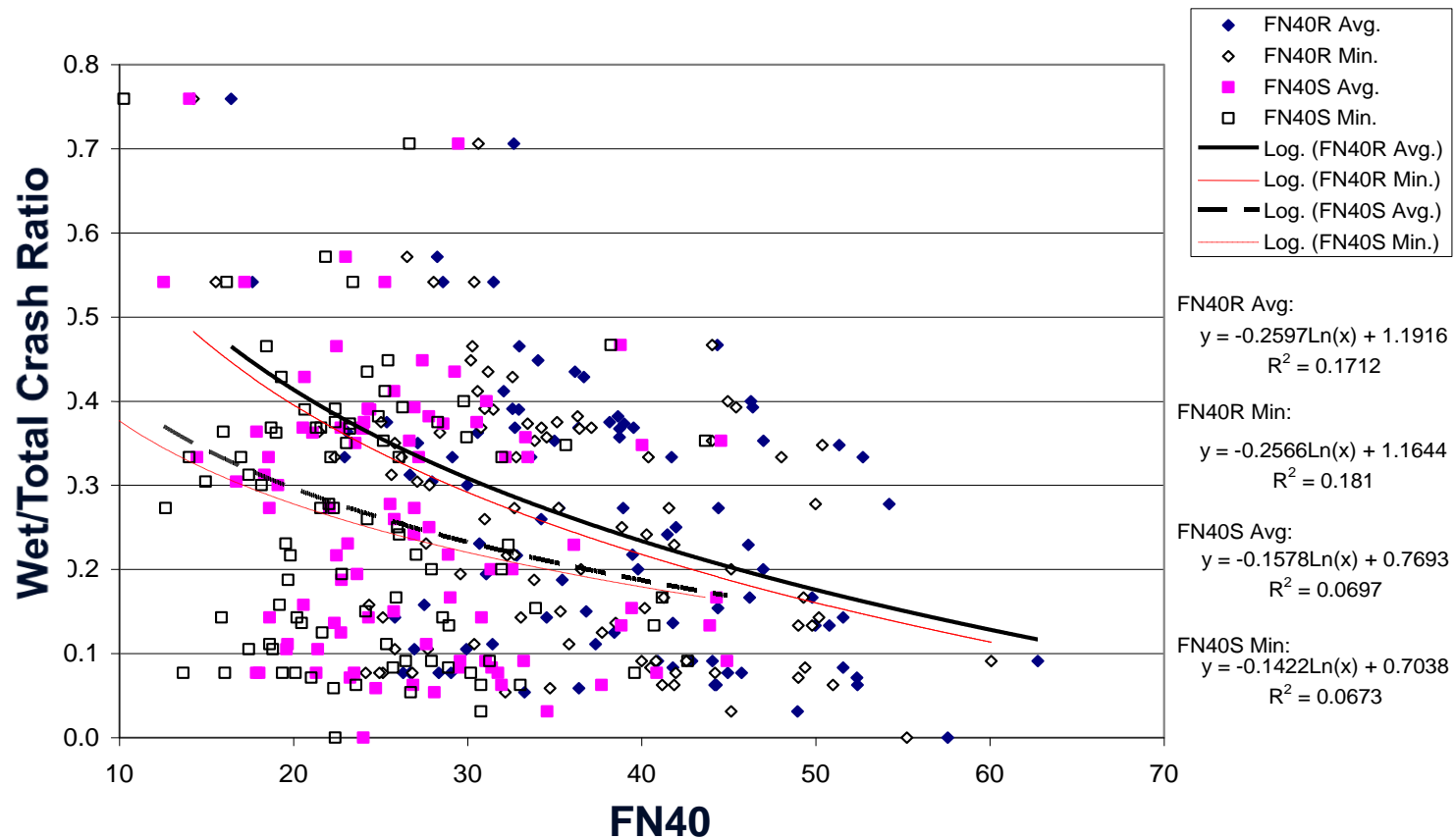
Dependent Variable

- Total crashes
- Wet/total crash ratio
- Rear-end crash rate

Task 4. Develop Correlations

Example Analysis Plot

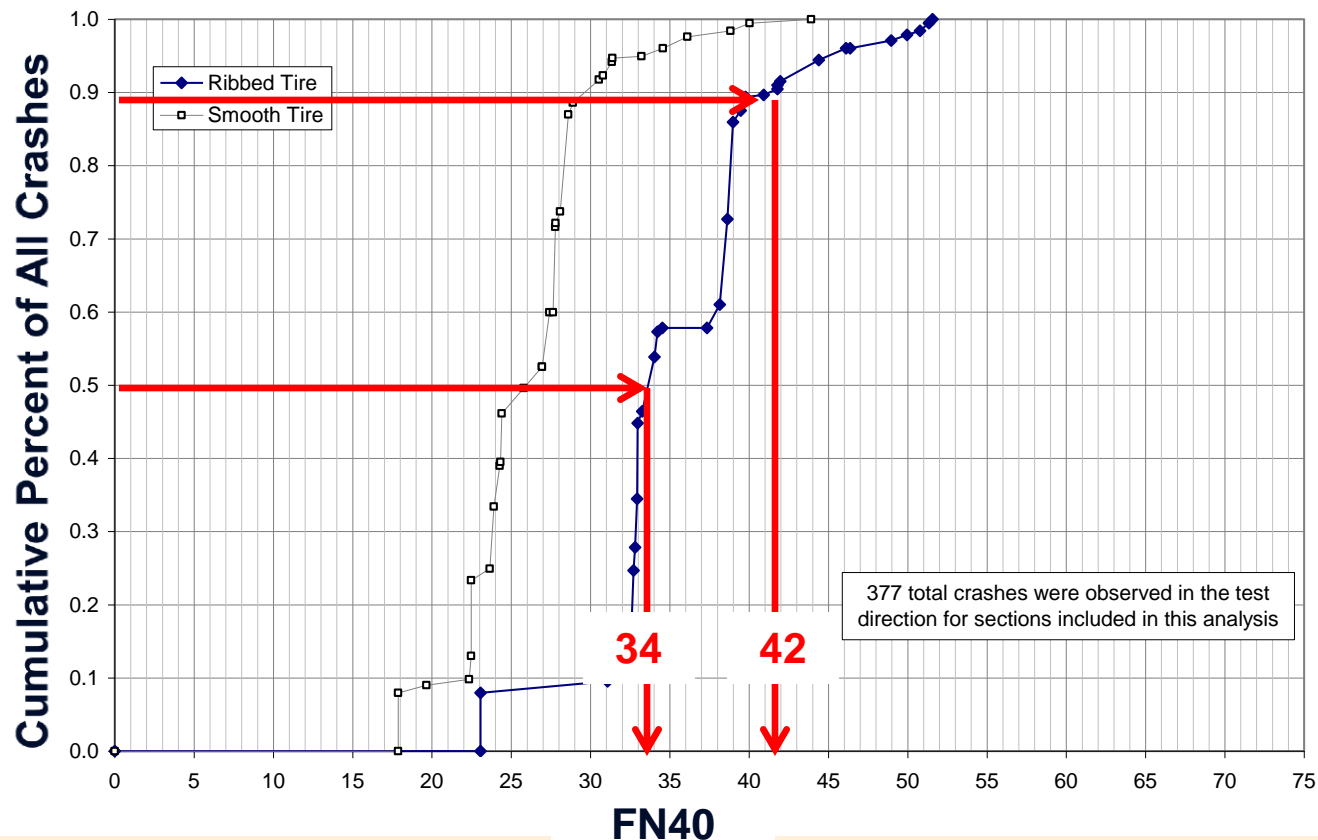
Wet/Total Crash Ratio vs. FN40 (Avg and Min) for All Sections
(Ribbed and Smooth Tires)



Task 4. Develop Correlations

Example Cumulative % Crashes Plot

Cumulative % of All Crashes (in Test Direction) Observed on Congested Freeways vs. FN40 for Ribbed and Smooth Tires



Task 5. Recommend Friction Numbers

Cumulative % Crashes vs. FN Results

% of Total Crashes	Congested Freeways		Signalized Intersections		Unsignalized Intersections	
	FN40S _{avg}	FN40R _{avg}	FN40S _{avg}	FN40R _{avg}	FN40S _{avg}	FN40R _{avg}
90	< 30	< 42	< 29	< 42	< 40	< 50
85	< 29	< 40	< 27	< 39	< 37	< 47
50	< 26	< 34	< 21	< 30	< 29	< 39
15	< 23	< 33	< 14	< 27	< 24	< 32
10	< 22	< 32	< 13	< 17	< 23	< 26

Task 6. Final Report

Key Findings

- No single variable (ribbed tire, smooth tire, macrotexture) correlates highly with crashes for each site category
- $FN_{40R_{avg}}/FN_{40R_{min}}$ better correlated than $FN_{40S_{avg}}/FN_{40S_{min}}$
- FN_{min} quite consistent and usually ~2 percentage points below FN_{avg}
- For congested freeways, rear-end crash rate drops significantly at MTD ~1.0 to 1.2 mm

Task 6. Final Report

Key Recommendations

- Continue use of FN40R
- Use New York SKARP approach for setting investigatory and intervention levels
 - 3-prong check of wet/total crash ratio, total crashes (annual), and friction
- Supplement with macrotexture check
- Establish levels for 3-5 site categories (per *AASHTO Guide for Pavement Friction*)

Thank You!!

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