Virginia Polytechnic Institute and State University
Charles E. Via Jr. Department of Civil Engineering

Road Network Pavement Management Program

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Kevin McGhee, Virginia Center for Transportation Innovation and Research

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Outline

1. Background
2. Virginia Pilot Project
3. National Effort for FHWA
4. Final Remarks

1. Background

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Why do we care?

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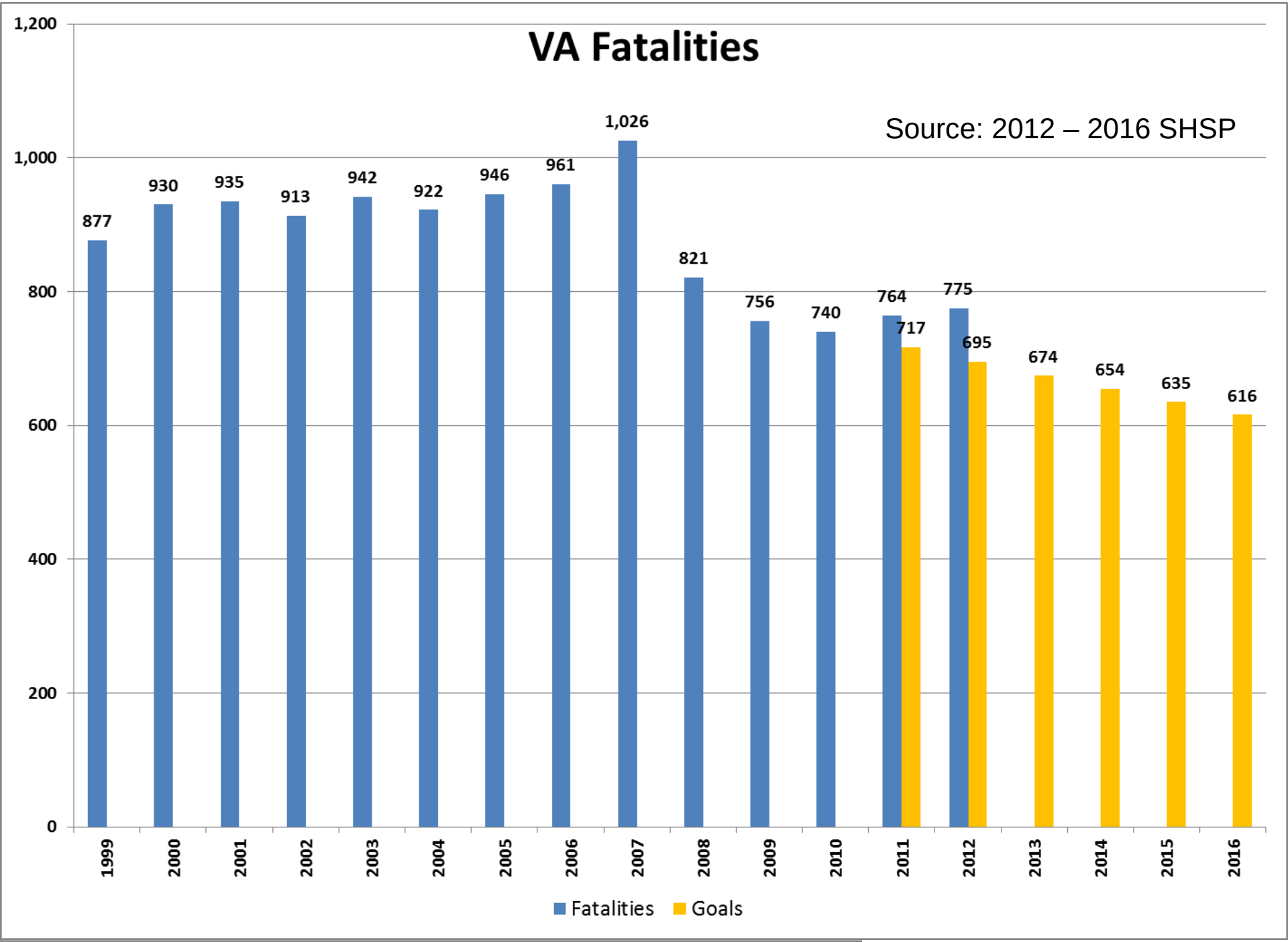
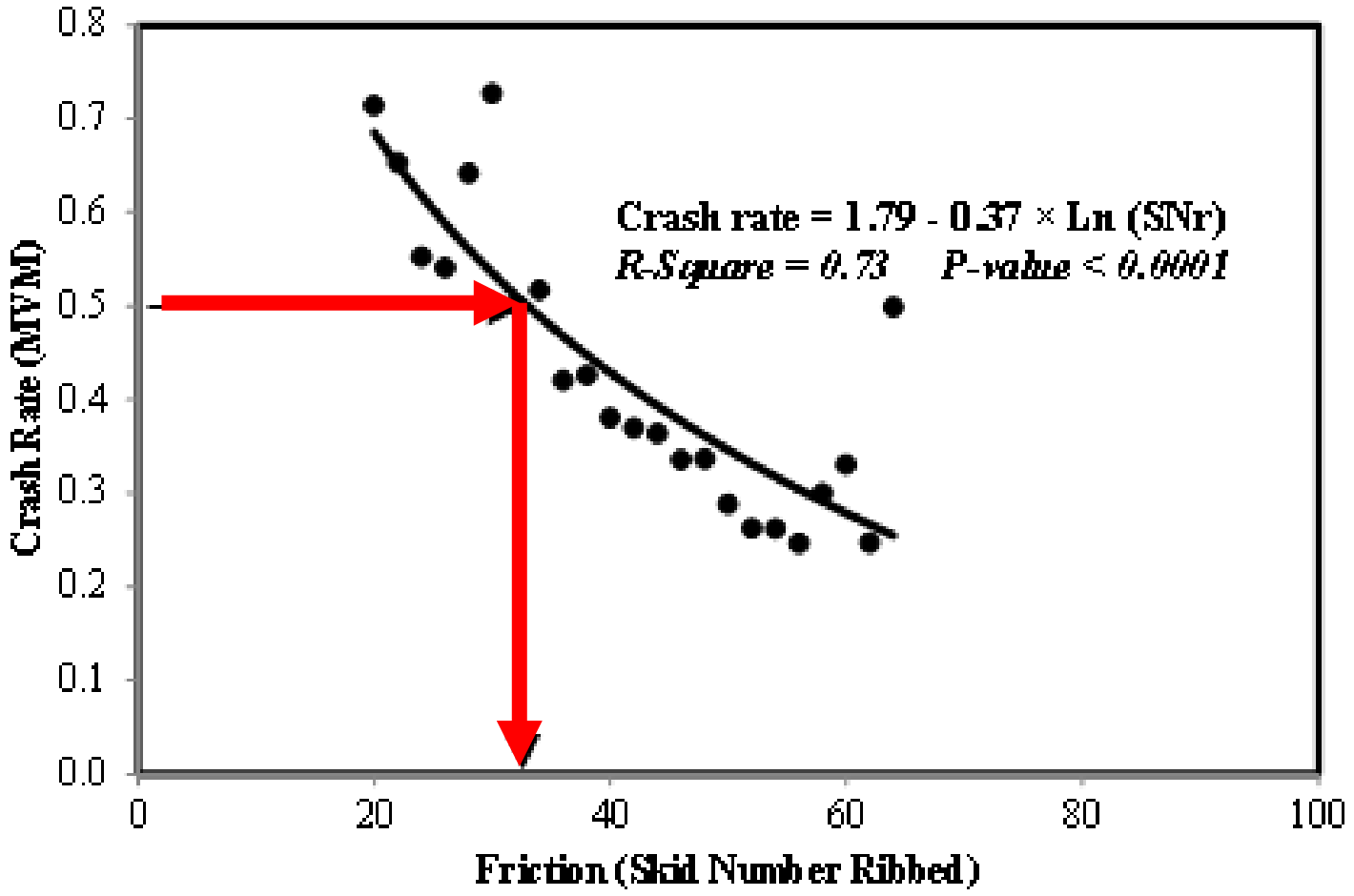

VA Fatalities
Source: 2012 – 2016 SHSP
1,200
1,000
800
600
400
200
0
877
930
935
913
942
922
946
961
1,026
821
756
740
764
717
775
695
674
654
635
616
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Fatalities
Goals

Tire-pavement Friction is one of the Factors Contributing to Crashes & Fatalities

Urban Principal Arterial - Wet



Tire-Pavement Friction Testing

Then….

….Now

Evolution of the Tow Vehicles

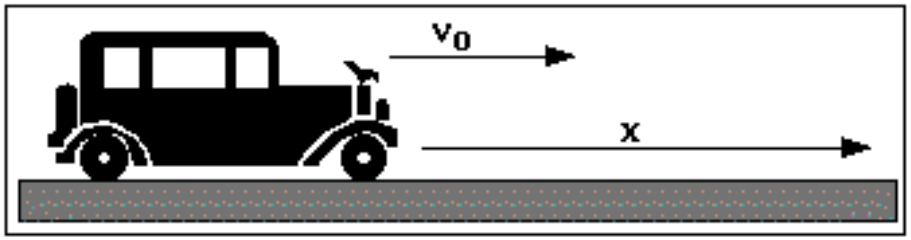
Then….

….Now: power steering, anti-lock braking, electronic stability control, etc.

Continuous Friction Measurement Equipment (CFME)

Friction Intervention Levels (VA)

- ✓ **Historical basis:**



  - **Maximum stopping distance of 133 feet from travel speed of 40 mph**

- ✓ **Investigate:**
  - **SN40S < 25**
- ✓ **Intervene:**
  - **SN40S < 20**

Investigatory Levels (UK)

Road classification definitions		Investigatory level (31 or 50 mph)							
		0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65
A	Interstate highways								
B	Divided highways w/o intersections, grade, etc.								
C	Two lane road w/o intersections, grade, etc.								
Q	Intersection (& roundabouts)								
K	Pedestrian crossings and other high risk areas								
R	Roundabout								
G1	Slope 5-10%, longer than 160 feet								
G2	Slope >10% longer than 160 feet								
S1	Curve radius < 1600 feet - divided roads								
S2	Curve radius < 1600 feet - two lane roads								

2. VDOT Pavement Friction Management Program Pilot Demonstration

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Preliminary Results

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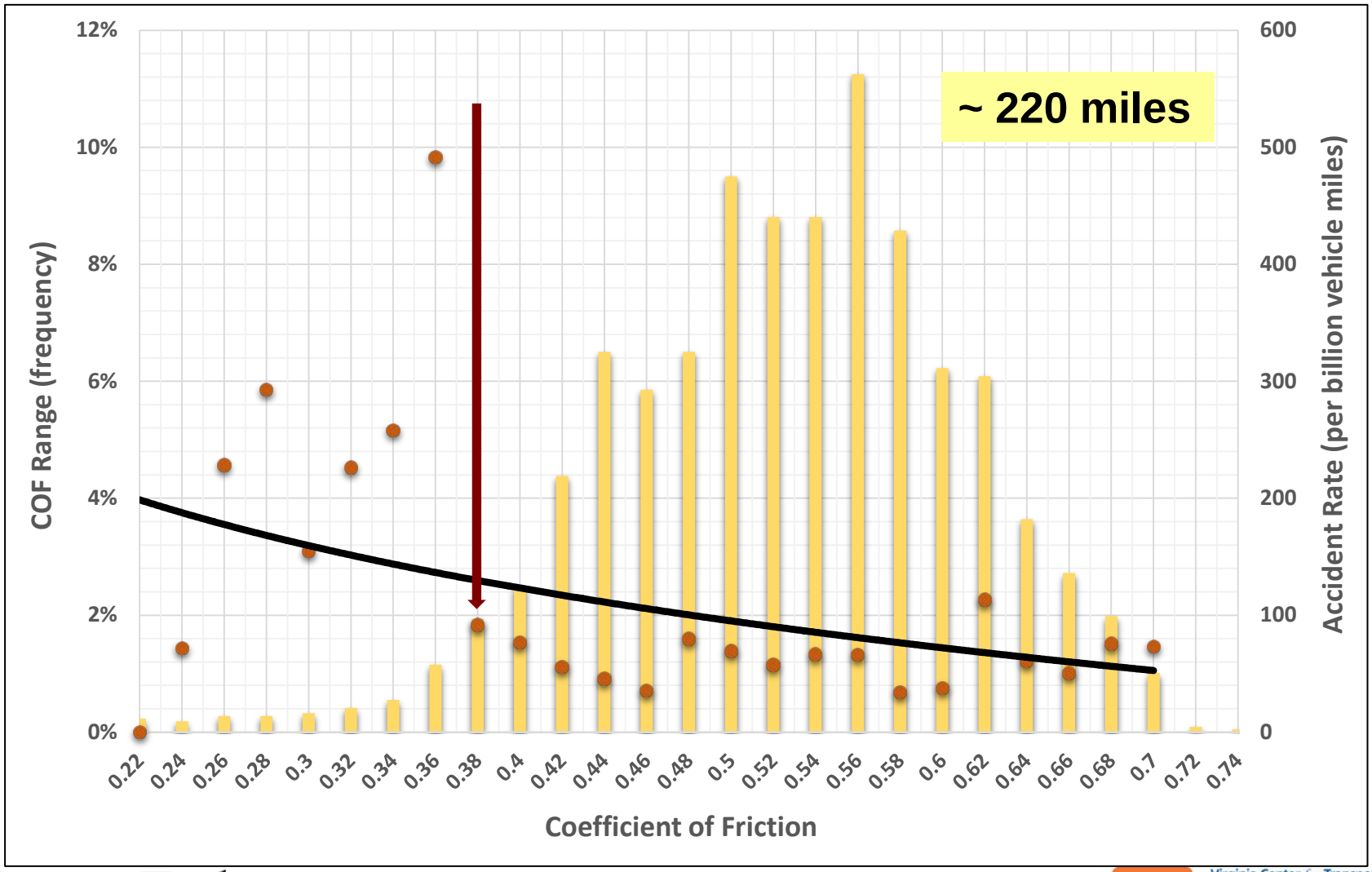
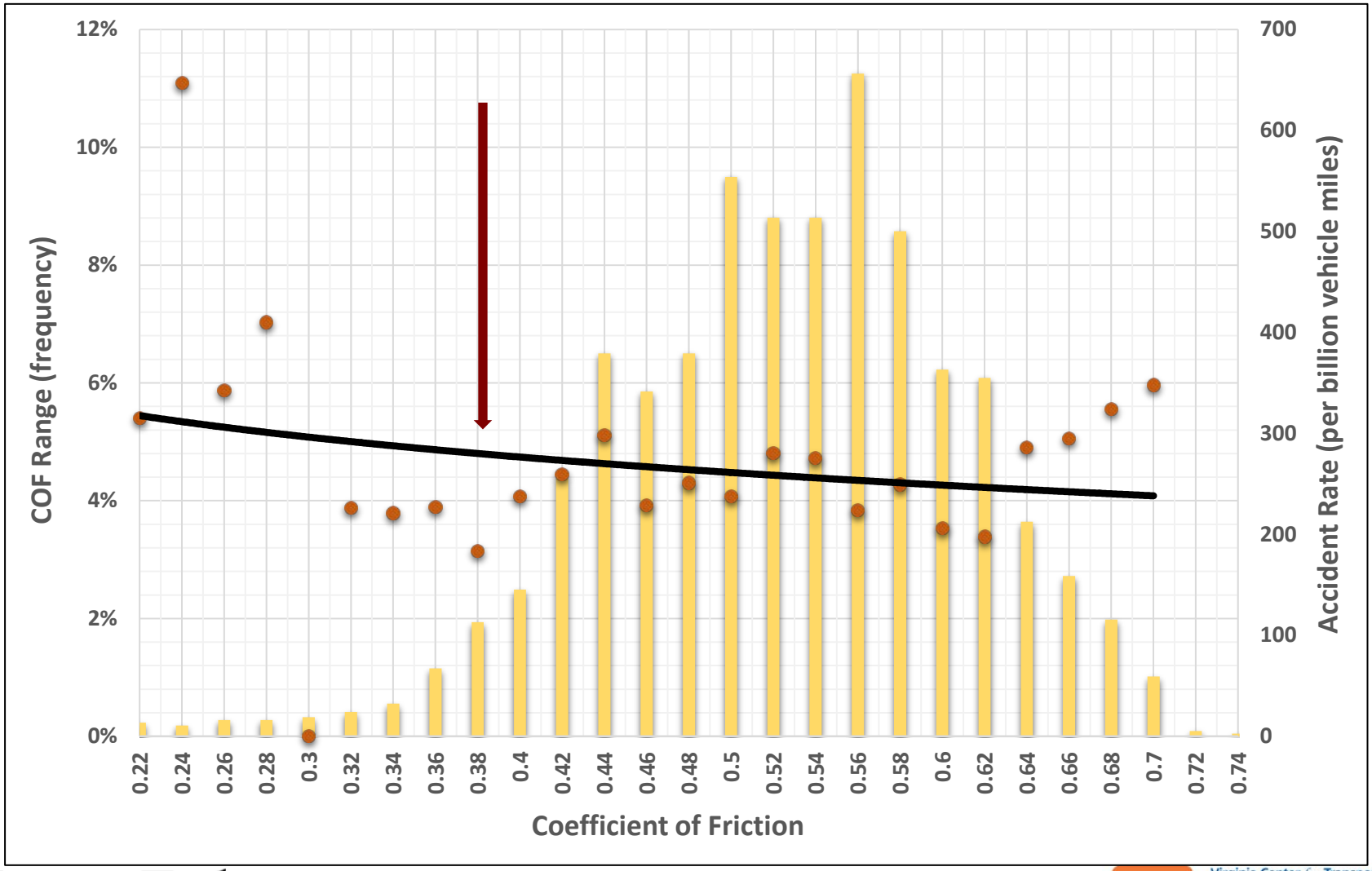
VDOT Pilot Project Objectives

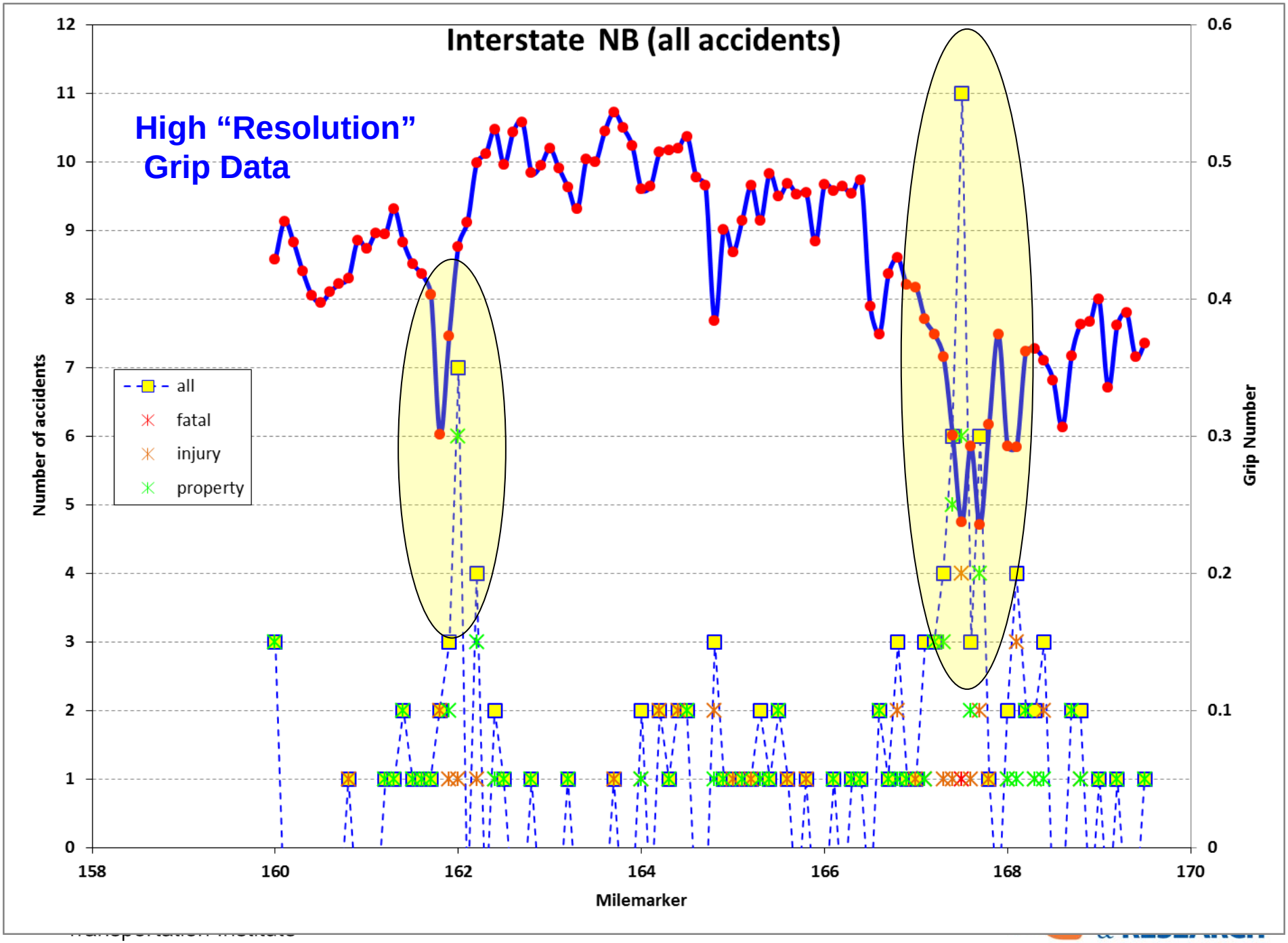
- ✓ **Introduce modern CFME for network friction data collection in VA**
- ✓ **Establish investigatory (desirable)** and/or intervention (minimum) **levels of friction based on analysis of crash data in one district in Virginia (Salem)**
- ✓ ~~Compare CFME with traditional locked-wheel skid tester used in VA~~

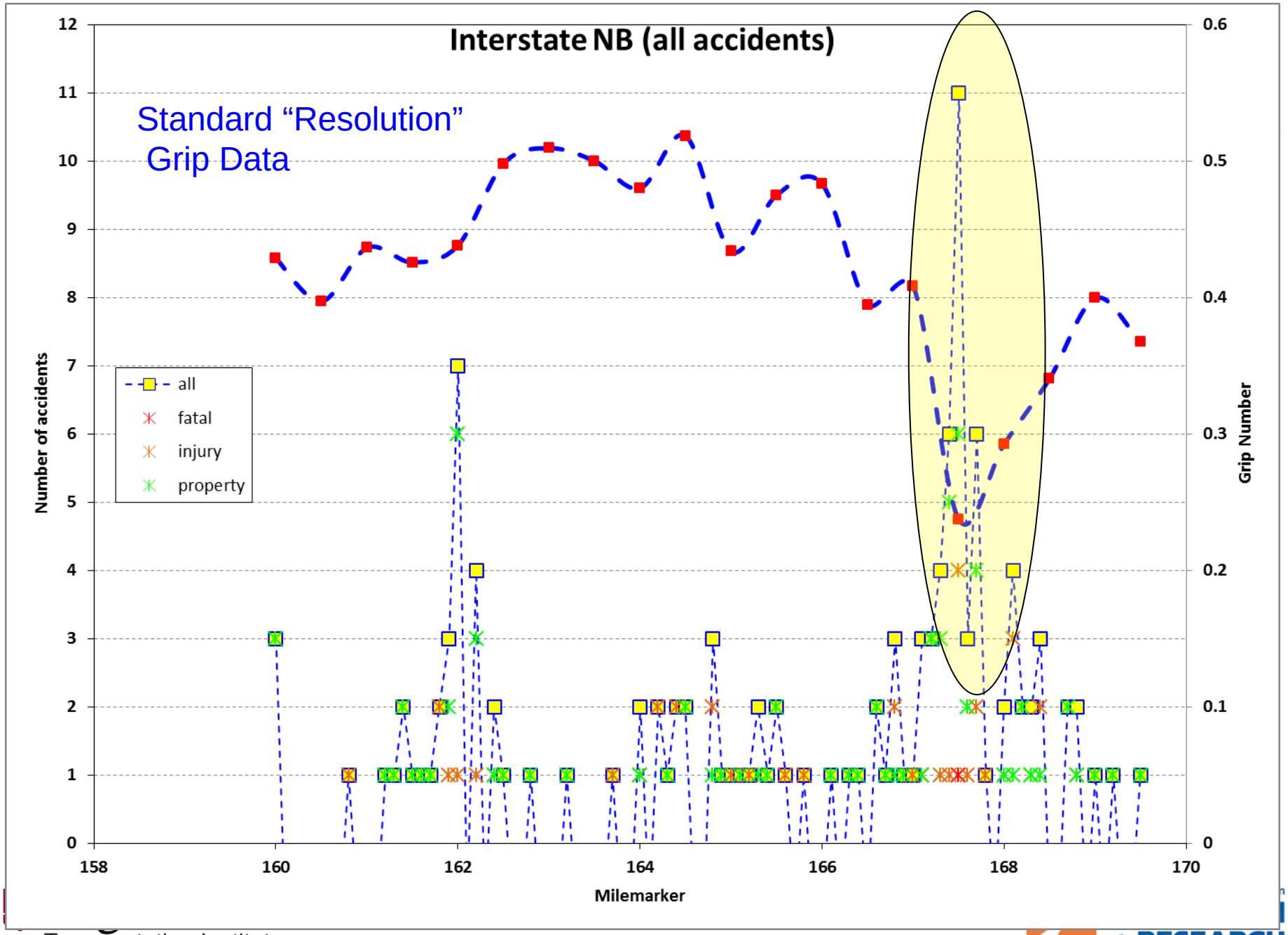
Preliminary Data: Wet Accidents (IS)



Preliminary Data: Dry Accidents (IS)




Interstate NB (all accidents)
High "Resolution" Grip Data
Number of accidents
Grip Number
Milemarker
all
fatal
injury
property
0
1
2
3
4
5
6
7
8
9
10
11
12
0
0.1
0.2
0.3
0.4
0.5
0.6
158
160
162
164
166
168
170


Interstate NB (all accidents)
Standard "Resolution"
Grip Data
Number of accidents
Grip Number
Milemarker
all
fatal
injury
property
0
1
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10
11
12
0
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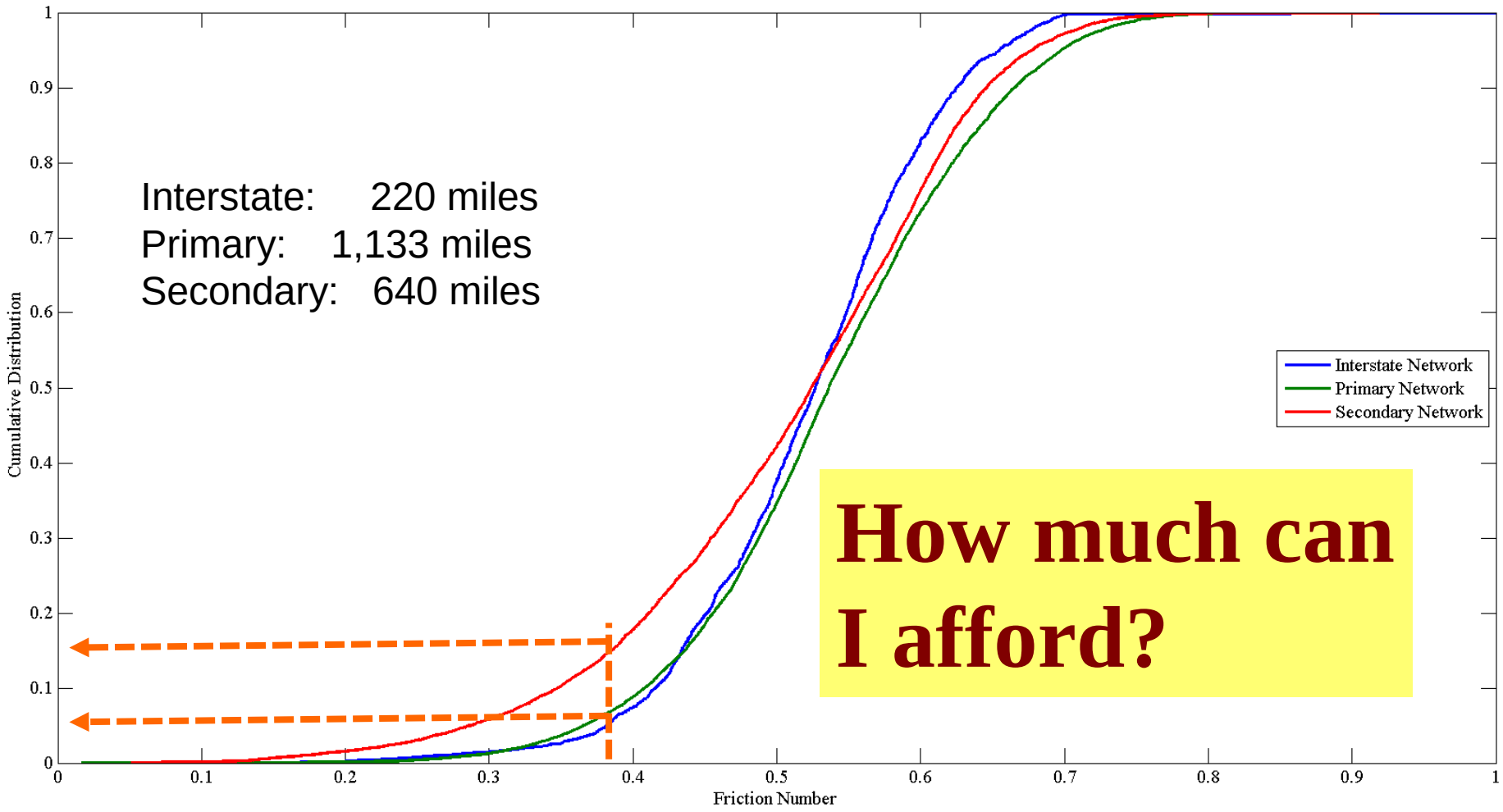
168
170

Network Friction Distribution



How much can I afford?

Status of Research

- ✓ **Compiling data**
  - **Tire-pavement friction**
  - **District crash records**
  - **Geometrics & facility operating characteristics**
- ✓ **Developing intervention levels**
  - **Match demand with supply**
- ✓ **Propose proactive statewide program**
  - **“Unify” Materials, Maintenance, and Safety**

2. National FHWA-Sponsored Effort

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Development and Demonstration of Pavement Friction Management Programs - Second Phase Update

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Development and Demonstration of Pavement Friction Management Programs

Objective:

- ✓ **Determine criteria and develop methods, for establishing investigatory (desirable) level and ~~intervention (minimum)~~ levels for friction and macro-texture for different friction demand categories or classes of highway facilities for at least four states**
- ✓ **Assist at least four states in developing PFM Programs**
- ✓ **Demonstrate state-of-the-art friction (and macro-texture) measurement equipment**

→ **Including geometrics**

Phase I Completed in 2011

DTFH61-09-R-00035

Phase I

Task 1. Literature Search/Review and Theoretical Analysis Report

Development and Demonstration of Pavement Friction Management Programs

FEDERAL HIGHWAY ADMINISTRATION
DTFH61-09-R-00035

THEORETICAL RELATIONSHIPS OF VEHICLE-TIRE-PAVEMENT INTERACTIONS AND SKID CRASHES (FINAL DRAFT)

SUBMITTED: DECEMBER 15, 2011

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

and

APPLIED PAVEMENT TECHNOLOGY, INC.

Task 2. Prepare Equipment Recommendation Report

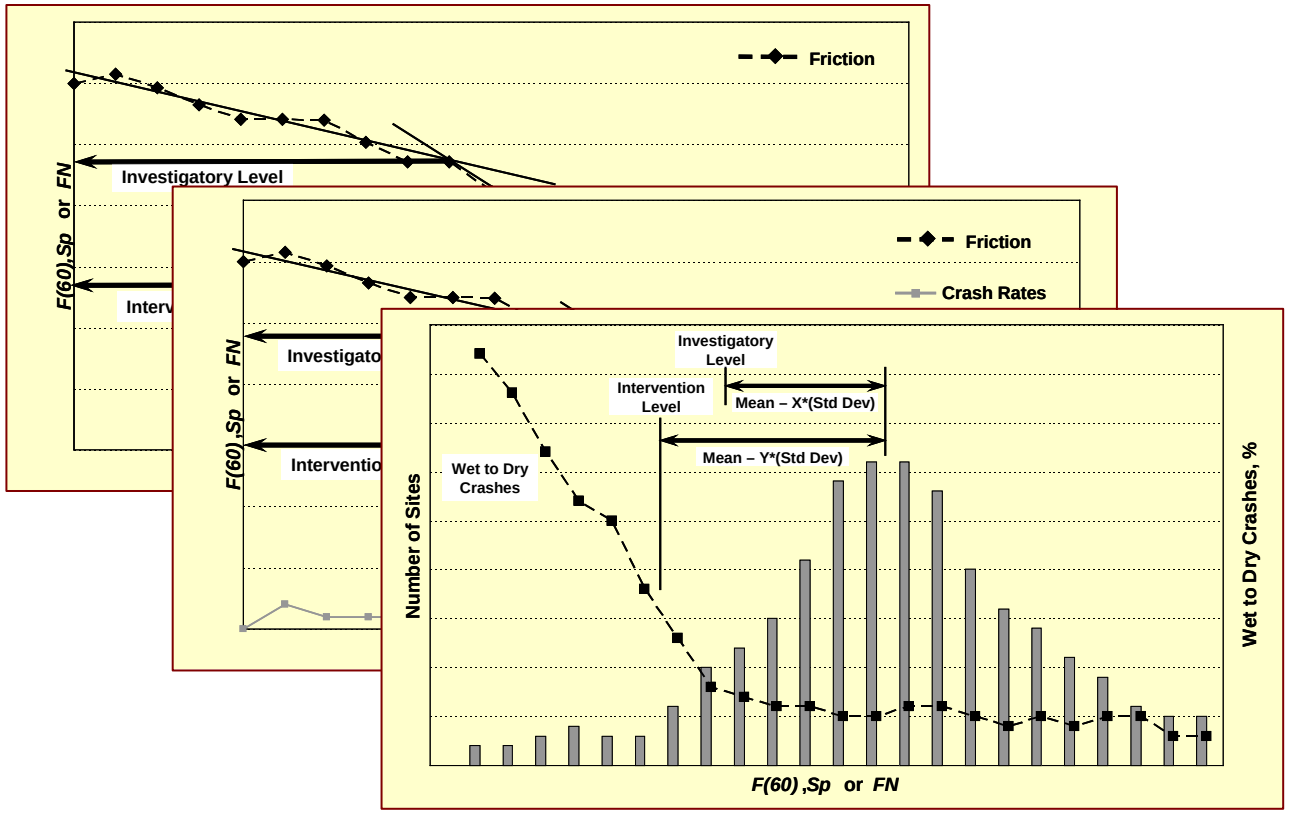
Development and Demonstration of Pavement Friction Management Programs

FEDERAL HIGHWAY ADMINISTRATION
DTFH61-09-R-00035

EQUIPMENT RECOMMENDATION REPORT

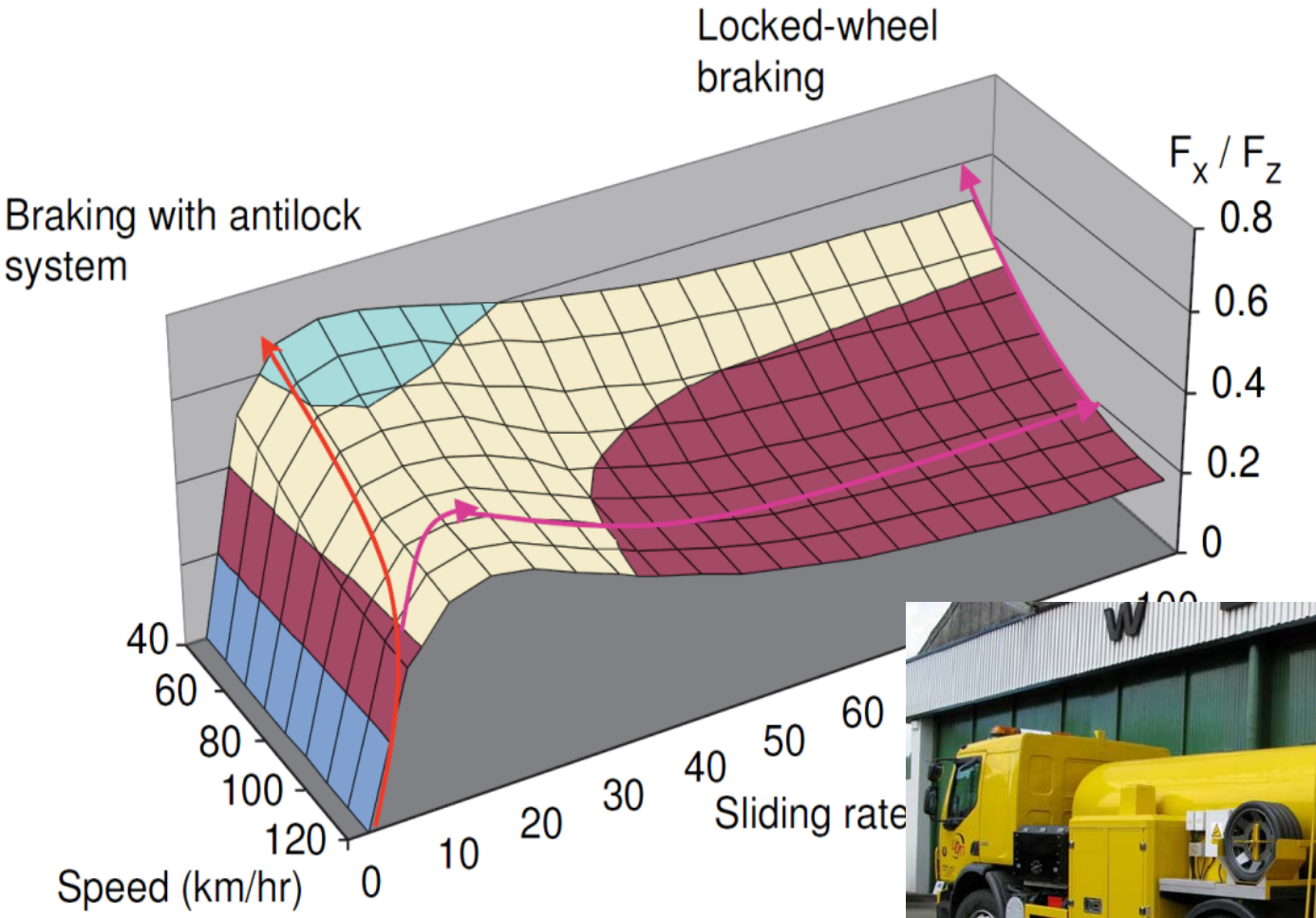
REVISED DRAFT
SUBMITTED: NOVEMBER 11, 2011

Evaluate Different Approaches for setting investigatory (desirable) level and intervention (minimum) levels for friction and macro-texture



Other appr., e.g., *Modeling the probability of wet (or wet/dry) **crashes (risk) as a function of friction number using other models used for safety analysis***

Demonstrate state-of-the-art friction (and macro-texture) measurement equipment



Phase II - The Acceptance Testing and Demonstration of the Continuous Friction Measurement Equipment

Task 1. Receive Equipment, Training & Acceptance

Task 2. Establish State Highway Agency Participation in the Development and Demonstration of Pavement Friction Management Programs

Task 3. Preliminary Data Analysis

Task 4. Data Analysis of Friction Thresholds

Phase II - The Acceptance Testing and Demonstration of the Continuous Friction Measurement Equipment (cont.)

Task 5. Develop Suggested Pavement Friction Management Programs for Participating SHAs

Task 6. Prepare Final Report and Supplement to AASHTO Guide for Pavement Friction

Task 7. Develop Promotional and Implementation Products

4. Final Remarks

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Final Remarks

- ✓ **There is a weak but statistically significant relationship between friction level and accident rate/risk**
- ✓ **VA pilot study suggests that the establishment of investigatory levels is feasible** (at least for interstate roads) **and that CFME has advantages over current practice**
- ✓ **National study to support the establishment of pavement friction management programs is seeking state participation**

Questions?

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