



## Interchange Safety Comparisons Using IHSDM

Case Study: US 30 Reconstruction Program,  
Airport Road Interchange

2019 MASITE Annual  
Conference

Transportation Solutions Building Better Communities



01

Highway Safety  
Initiatives & Statistics

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02

Highway Safety  
Evaluation Tools

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03

Interactive Highway  
Safety Design Model  
Overview

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04

Case Study: US 30  
Reconstruction Projects

# Highway Safety Initiatives



**Humans Make Errors**



**Humans Are Vulnerable to Injury**



**Responsibility is Shared**



**No Death or Serious Injury is Acceptable**



**Proactive Versus Reactive**

## Vision Zero Core Elements

01

Leadership &  
Commitment

02

Safe Roadways and  
Safe Speeds

03

Data-Driven Approach,  
Transparency,  
Accountability



Managing Speed



Centering Equity



Engaging Communities

# Highway Safety Initiatives



## Traditional Approach

Traffic deaths are **INEVITABLE**

**PERFECT** human behavior

Prevent **COLLISIONS**

**INDIVIDUAL** responsibility

Saving lives is **EXPENSIVE**

**VS**

## Vision Zero

Traffic deaths are **PREVENTABLE**

Integrate **HUMAN FAILING**

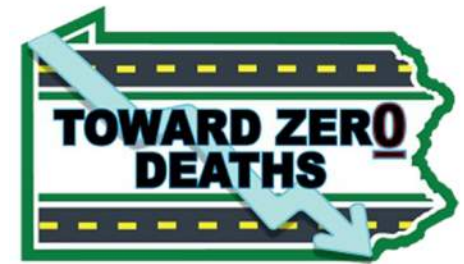
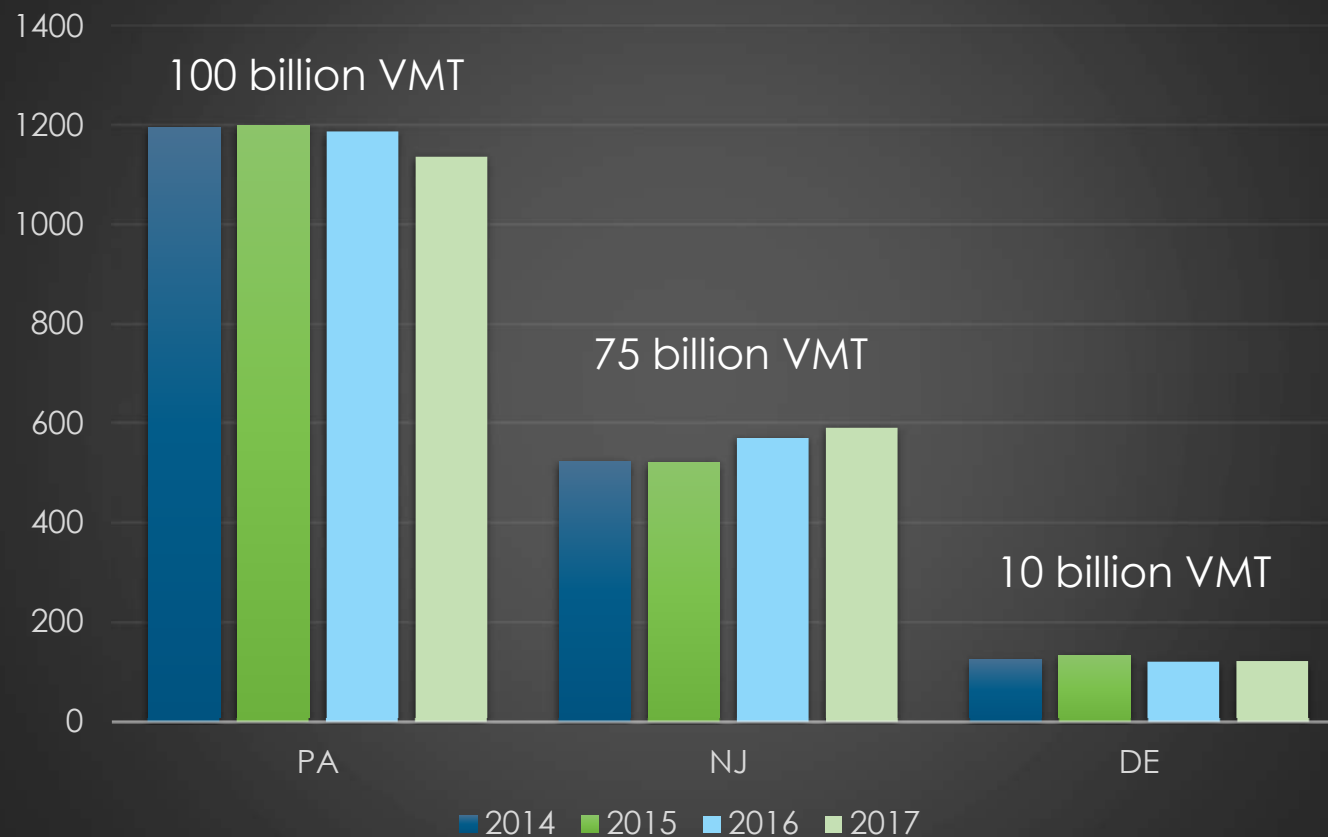
Prevent **FATAL AND SEVERE** crashes

**SYSTEMS** approach

Saving lives is **NOT EXPENSIVE**

# Highway Safety Statistics

## Fatal Crash Trends



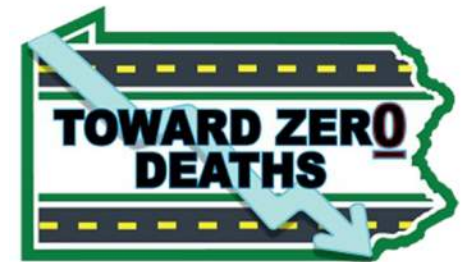
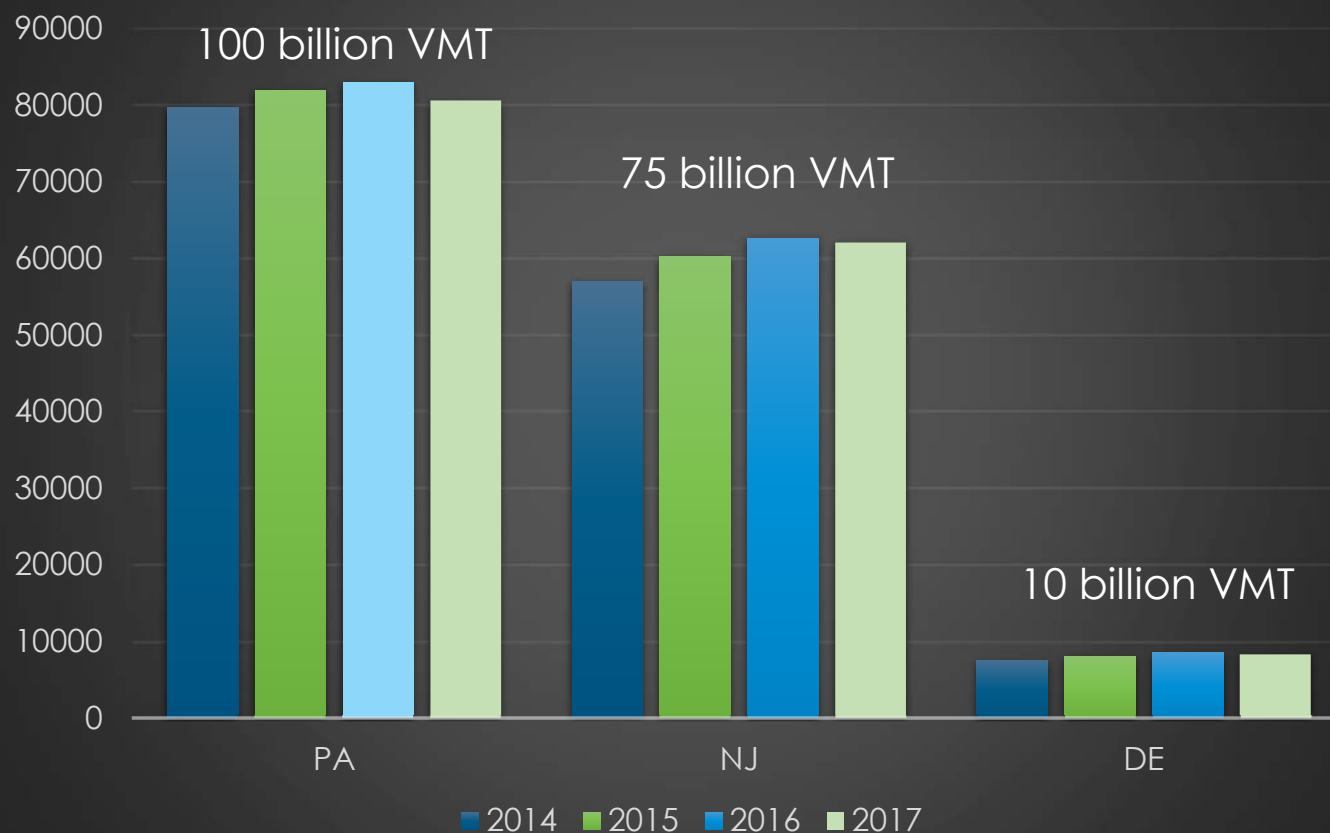
New Jersey  
Division of Highway Safety





# Highway Safety Statistics

## Total Injury Crash Trends



New Jersey  
Division of Highway Safety



## SafetyAnalyst

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## Interactive Highway Safety Design Model

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## PennDOT HSM Tools

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## NJDHTS Crash Analysis Tool



Published in 2010, Freeway  
Supplement Published in 2014



## IHSDM



More Informed  
Decision Making



Better Targeted  
Investments



Fewer Fatalities  
& Serious Injuries

## IHSDM

# Six Modules

- 01 Crash Prediction
- 02 Design Consistency
- 03 Intersection Review
- 04 Policy Review
- 05 Traffic Analysis
- 06 Driver/Vehicle

## IHSDM

**Why use the  
IHSDM CPM to  
implement HSM  
Part C methods?**

Applies to all facility types

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Import CAD

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Segments highways per  
HSM rules

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Empirical-Bayes Process

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HSM calibration procedures

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Allows user-defined SPMs

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Graphical outputs

Traditional  
Diamond  
Interchange

01



Single Point  
Urban  
Interchange

03



Modified Diamond  
Interchange  
(Loop)

02



Diverging  
Diamond  
Interchange

04



## Alternatives Evaluation Factors

- |    |                          |
|----|--------------------------|
| 01 | Purpose & Need           |
| 02 | Traffic Operations       |
| 03 | Environmental Impacts    |
| 04 | Section 4(f) Involvement |
| 05 | Archaeological Impacts   |
| 06 | Property Acquisition     |
| 07 | Constructability         |
| 08 | Construction Cost        |

**PENNDOT DISTRICT 6 - ADD SAFETY**

## IHSDM Lessons Learned

**IHSDM User  
Guide**

**AVERAGE**

**IHSDM User  
Support**



**01** Import LandXML files for individual alignments (horizontal and vertical)

**02** Clip ramp alignments at the gore points along the freeway.

**03** Accel/Decel lanes for ramps should not be defined as a lane unless > 1600 feet

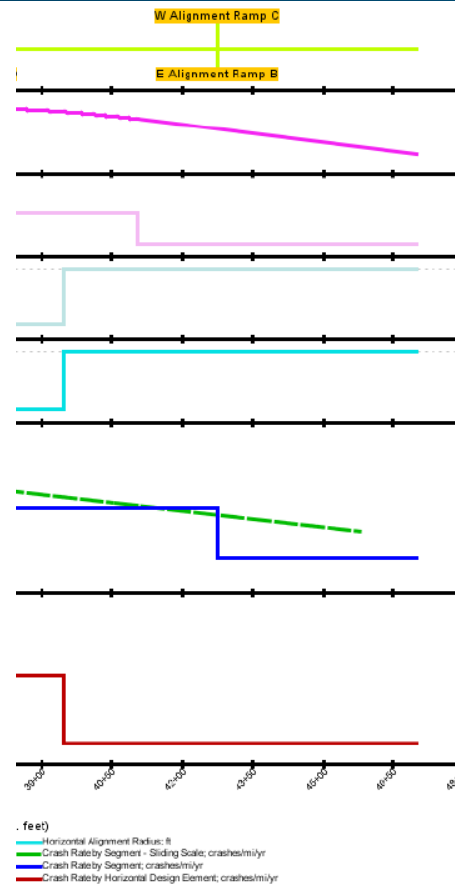
**04** Lane tapers only change the visual and do not factor into the CPM

**05** Convert Microstation headings to 0 to 360-degree decimal format



Interactive Highway Safety Design Model

Crash Prediction Evaluation Report



February 4, 2019

U.S. Route 30 | AIRPORT

ALTERNATIVE 1

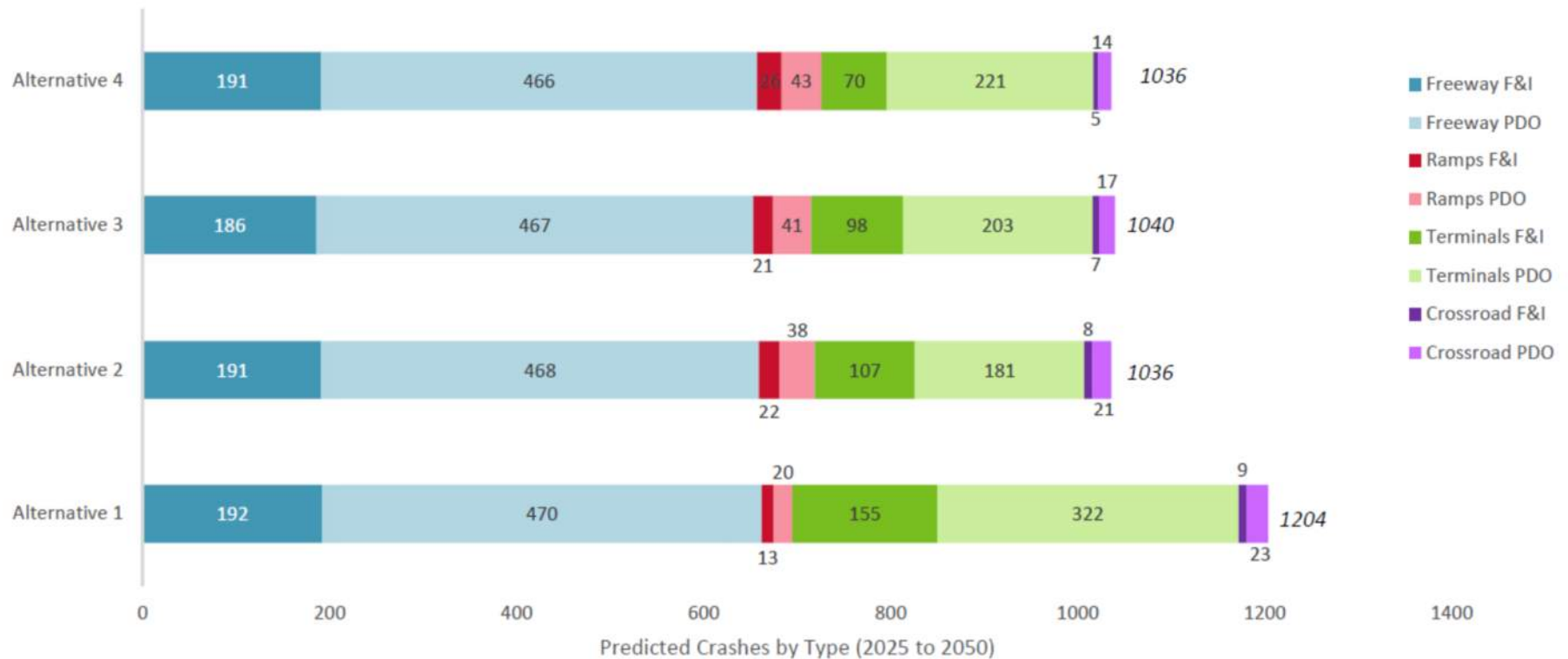
Airport Road

1 Summary (Section 1)

## Crash Rates and Frequencies (Section 1)

First Year of Analysis	2025
Last Year of Analysis	2050
Evaluated Length (mi)	0.3220
Average Future Road AADT (vpd)	16,038
Predicted Crashes	
Total Crashes	32.18
Fatal and Injury Crashes	8.80
Property-Damage-Only Crashes	23.38
Total Predicted Crashes	
Percent Fatal and Injury Crashes (%)	27
Property-Damage-Only Crashes (%)	73
Predicted Crash Rate	
Crash Rate (crashes/mi/yr)	3.8444
FI Crash Rate (crashes/mi/yr)	1.0513
PDO Crash Rate (crashes/mi/yr)	2.7931
Travel Crash Rate	
Total Travel (million veh-mi)	49.00
Crash Rate (crashes/million veh-mi)	0.66
Crash Rate (crashes/million veh-mi)	0.18
Crash Rate (crashes/million veh-mi)	0.48

**Table 1. U.S. Route 30: Airport Interchange  
Predicted Crashes from 2025 to 2050**



	ALT 1 Diamond	ALT 2 Loop	ALT 3 SPUI	ALT 4 DDI
<b>IHSDM Predicted Crashes</b>	Total: <u>1204</u> F+I: 369 PDO: 835	Total: <u>1036</u> F+I: 328 PDO: 708	Total: <u>1040</u> F+I: 312 PDO: 728	Total: <u>1036</u> F+I: 292 PDO: 744
<b>Fatal + Injury Results</b>	Highest predicted F+I crashes due to two signalized ramps and heavy left-turn movement from WB Off-Ramp	Lower predicted F+I crashes vs ALT 1 with elimination of one signal and heavy WB Off-Ramp left-turn converted to right-turn	Lower predicted F+I crashes vs ALT 1 due to single ramp terminal intersection resulting in less conflict points	Lowest predicted F+I crashes due to reduction in conflicting turning movements
	---	-11 percent	-15 percent	-21 percent

Traditional  
Diamond  
Interchange

01  
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**Preliminary  
Construction Costs**

Single Point  
Urban  
Interchange +6.5%

03



02 Modified Diamond  
Interchange  
(Loop)  
+2.4%



04

+0.8%

Diverging  
Diamond  
Interchange



## **IHSDM User Group** [ihsdm.support@dot.gov](mailto:ihsdm.support@dot.gov)

- Collect input from IHSDM users
- Communication between users
- Forum for discussions & presentations
- Beta test group

**IHSDM User Group SharePoint Site**  
<https://collaboration.fhwa.dot.gov/default.aspx>