



COMMONWEALTH of VIRGINIA

Office of the

SECRETARY of TRANSPORTATION

Transportation Performance Management Safety Measures

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Safety Performance Management Measures and Targets

- **Board challenged staff to develop a new rigorous data-driven methodology to establish targets**
 - **Understand how the system is working**
 - **Identify and examine trends**
 - **Determine the impact of current investments and strategies**
 - **Provide targets to Board**
- **Board will use information to determine degree to which current policies and investments are meeting goals**

Safety Performance Management

Refining Target Setting

Safety Performance Measures:

- **Number of fatalities**
- **Number of severe injuries**
- **Rate of fatalities per 100M vehicle miles traveled**
- **Rate of severe injuries per 100M vehicle miles traveled**
- **Number of non-motorized fatalities and severe injuries**

Safety Performance Management

Refining Target Setting

Five steps to develop new target setting methods:

- 1. Determine crash factors and causes – behavioral, infrastructure and the interaction**
- 2. Determine degree of infrastructure improvements influence on behavioral crashes**
- 3. Evaluate anticipated benefits of recent infrastructure projects**
- 4. Analyze external factors to predict 2019 baseline severe crash safety measure counts**
- 5. Combine the baseline predictions with project benefits to establish data-driven targets.**

Step 1 - Crash Factors and Causes

Refining Interaction of Behaviors (2013-2017)

- **Critical behaviors to address:**
 - Impairment
 - Distracted
 - Speeding
 - Unbelted Occupants
- **Refined definitions for Impairment, Distraction and Speeding due to variance in these behaviors**



Defining Targeted Behaviors

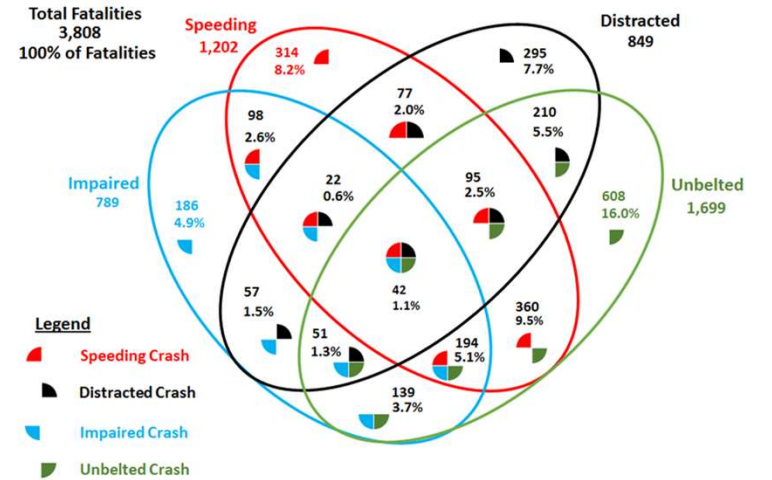


- **Based on new definitions, categorized Speeding levels and Distractions into high, medium, low and no effectiveness of the infrastructure improvements**
- **The effect (high, med, low) of each behavioral factor can be considered as a probability that the improvement expected crash reductions will be successful.**
- **In certain cases, the infrastructure improvement is presumed to have no impact in reducing crashes (i.e. obviously drunk, speeding > 20 mph over speed limit)**

Results - Crash Causes and Factors

Refined Interaction Injury Crashes

Applied New Definitions Further Refining Interaction Between Behaviors



Non-Behavioral Fatalities
1060
27.8%

	Fatalities		Serious Injuries	
Behavioral	2,748	72%	21,350	53%
Non-Behavioral	1,060	28%	18,650	47%

Results - Crash Causes and Factors

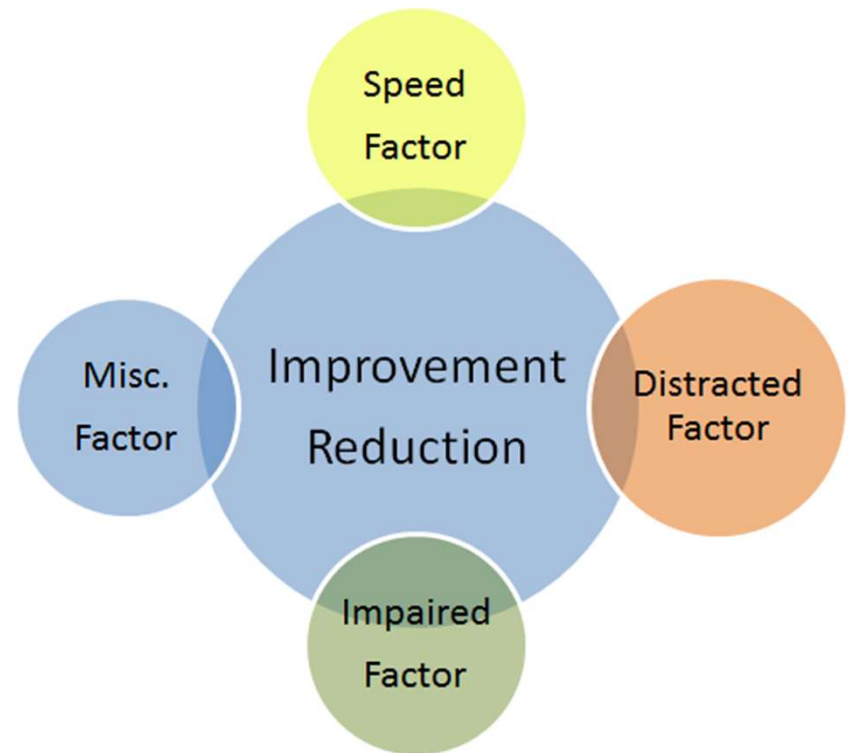
Interaction of Behavioral Factor Effects

Expected improvement reduction for projects is defined by the Crash Modification Factors

$$\text{CMF} = 1 - \% \text{ Reduction}$$

The average reductions are adjusted by all the behaviors present for each crash.

Behavioral factors were multiplied for interaction of effects on expected average CMF reductions.



Step 2 - Assessment of Behavioral Factors on Infrastructure Improvements

- **Conducted detailed assessment of 2,000 randomly selected fatal and serious injury crashes at intersections**
- **Stratified crashes by:**
 - **Severity (fatal or serious injury)**
 - **VDOT Construction District**
 - **Highway Functional Classification**
- **Determined potential effectiveness of countermeasures for various crash types when behavioral factors involved**
- **Developed template to quickly analyze potential improvements and identify opportunities for improvements at locations and utilized to determine expected reductions in recent projects**

Step 3: Expected Benefits of Projects

Analysis of Spot and Corridor Projects

- Reviewed 96 SMART SCALE and HSIP projects constructed or to be completed between January 2017 and March 2019
 - 20 SS projects = \$56.2 M
 - 76 HSIP* projects = \$272.2 M
- Project influence areas consistent with SMART SCALE safety scoring methodology
- Crash years 2010-2017

Projects	F+SI Crashes	F People	SI People	F Ped/Bike People	SI Ped/Bike People
96	1,098	138	1,272	5	47

* Several HSIP projects are larger corridor projects with a small portion of HSIP funds

Spot and Corridor Projects Expected Reductions

Description	F People	SI People	F Ped/Bike People	SI Ped/Bike People
2010-2017 Totals	138	1,272	5	47
Final Projection (w/ Factors)	128	1,169	4	43
Reduction	10 (1.3 / Yr)	103 (12.9 / Yr)	1 (0.13 / Yr)	4 (0.5 / Yr)
Percent of Total	7%	8%	16%	8%

Spot Example Project

- **Route 620 at Route 1 Intersection Improvements (Spotsylvania County)**
 - Add turn lanes
 - Add pedestrian signal heads, sidewalk, crosswalk, multi-use trail
 - Install intersection lighting
- **Est. cost of \$22 million**



Description	SI People	SI Ped/Bike People
2010-2017 Totals	21	1
Final Projection (w/ Factors)	15.0	0.2
Reduction	6.0 (0.75 / Yr)	0.8 (0.13 / Yr)
Percent of Total	29%	83%

Step 3: Expected Benefits of Projects Analysis of Systemic HSIP Projects

- **Low cost improvements systemically spread on network at intersections and curves or on the pavement**
 - 29 HSIP projects = \$29.5 M
- **HSIP projects constructed between January 2017 and March 2019**
- **Crash years 2010-2017**

Projects	F+SI Crashes	F People	SI People	F Ped/Bike People	SI Ped/Bike People
29	2,062	224	2,329	24	73

Systemic Projects Expected Reductions

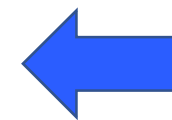
Description	F People	SI People	F Ped/Bike People	SI Ped/Bike People
2010-2017 Totals	224	2,255	24	73
Final Projection (w/ Factors)	183	1,807	20	60
Reduction	41 (5.1 / Yr)	448 (56 / Yr)	4 (0.5 / Yr)	13 (1.6 / Yr)
Percent of Total	18%	20%	17%	18%

Corridor Roadway Departure Systemic Project Example

Centerline Rumble Strips – Hampton Roads District
63.6 miles of roadway, average ADT of 2,380

Estimated cost of \$1.12M

Description	F People	SI People
2010-2017 Totals	16	47
Initial Projection (w/ Adjustment Factors)	12	28
Reduction	4 (0.5 / Yr)	19 (2.4 / Yr)
Percent of Total	25%	40%



Behavioral-Adj
Reduction

Step 3: All Projects Expected Reductions

Description	F People	SI People	F Ped/Bike People	SI Ped/Bike People
Spot/Corridor (w/ Factors)	128	1,169	4	43
Reduction	10 (1.3 / Yr)	103 (12.9 / Yr)	1 (0.13 / Yr)	4 (0.5 / Yr)
Systemic (w/ Factors)	183	1,807	20	60
Reduction	41 (5.1 / Yr)	448 (56 / Yr)	4 (0.5 / Yr)	13 (1.6 / Yr)
Total Expected Reductions	51 (6.4 / Yr)	551 (68.9 / Yr)	5 (0.63 / Yr)	17 (2.1 / Yr)

Step 4: Analyze External Factors to Predict 2019 Baseline

Assessed models for Fatalities and Serious Injuries, using combinations of the following external risk factors:

Statewide Risk Factors

- Annual alcohol consumption
 - Liquor licenses by type per district
- Annual GDP

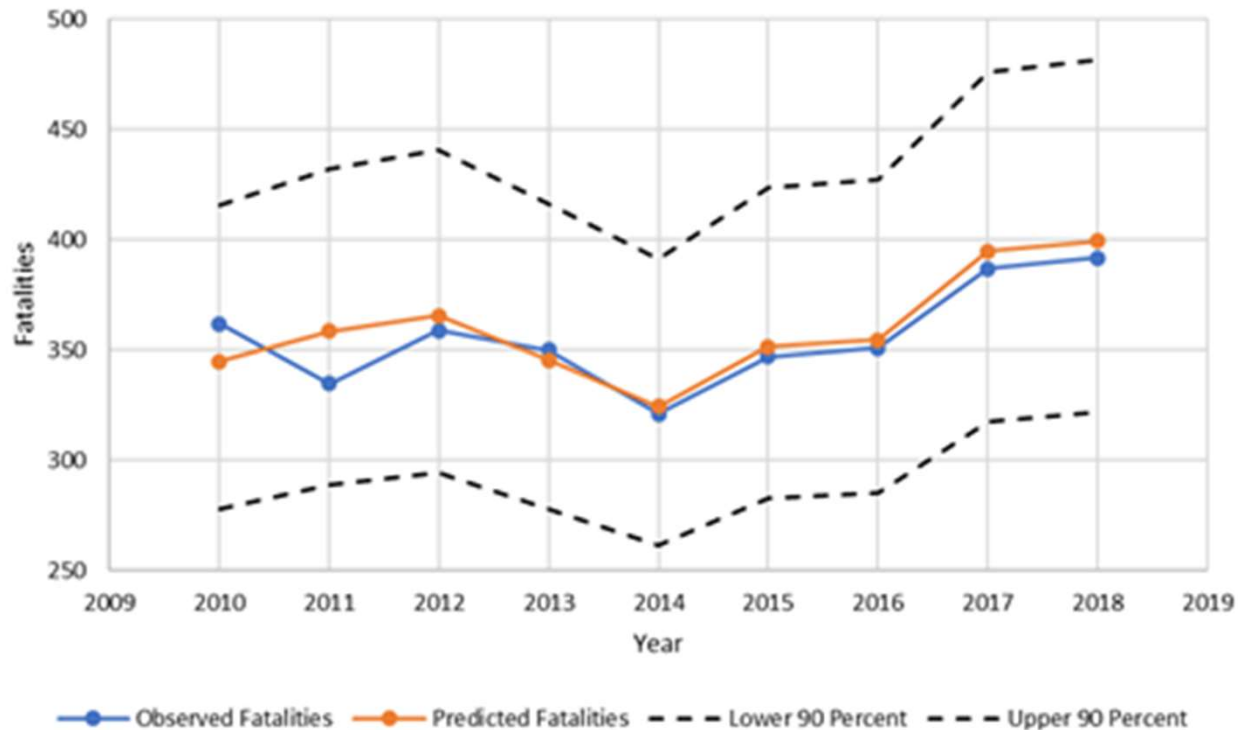
District Risk Factors

- Urban and Rural VMT
- Labor Force by age cohort
- Unemployed by age cohort (and rate of Emp)
- Licensed Drivers by age cohort
- Median Household Income by age cohort
- Total Population by age cohort
- Age of Titled Vehicles (2 year only)
- Weather Influences (Avg Precipitation, Snowfall, Temperature)

Fatality Model Validation

Predicted versus Observed Fatalities by Year
(January through June only - 2018)

Absolute and percent differences are acceptable and values are within 90 percent confidence limits.



Findings from Model Development and Validation

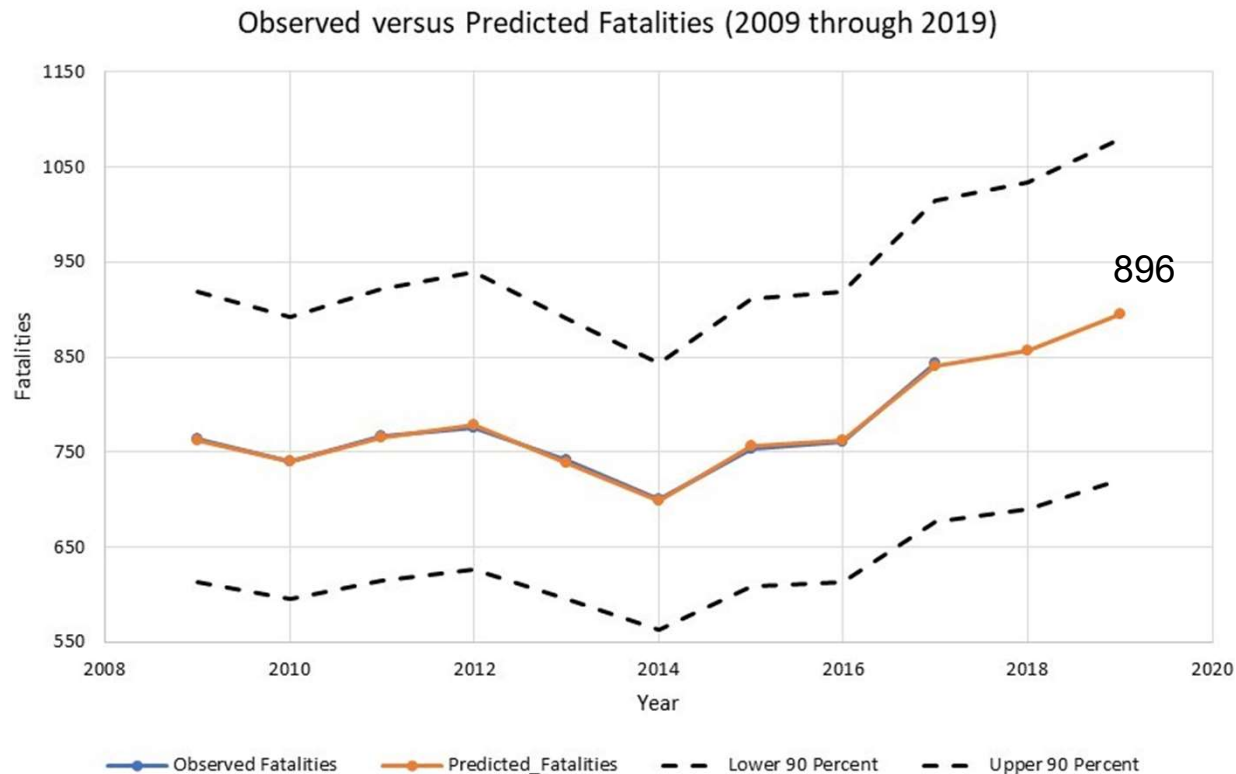
- **Local, collector and minor arterial proportion of VMT increases severe crashes**
- **Increasing young population (15-24) increases severe crashes**
- **Increasing aging population (75 plus) increases severe crashes**

- **Snowfall in month decreases severe crashes**
- **Increasing rural VMT decreases non-motorized severe crashes**



Baseline 2019 Fatality Baseline Prediction

Predicting an increase in 2018 and 2019, following recent trends, to 896 fatalities



Step 5: Results - 2019 Data-Driven Targets

Combining the baseline predictions with the expected project benefits to establish data-driven targets

Description	F People	F Rate	SI People	SI Rate	F & SI Ped/Bike People
2019 Model Target	896	1.02	7650	8.69	750
Expected Project Reductions	6.4	---	68.9	---	2.73
Revised 2019 Targets	890 ↑	---	7581 ↓	---	747 ↑
Current CTB Approved Targets	840	0.94	7689	8.75	714

Key Findings

- **Most external factors show increasing trends in fatalities**
- **Systemic safety projects provide significant expected benefits in reducing fatalities and serious injuries**
- **Distracted driving plays a significant role in the increase in fatalities**
- **While both the younger and older drivers saw increases in crashes, older drivers are a growing demographic**

Next Steps

- **Continue to evaluate project investments for consideration of changes and modifications to current proposed projects included in SYIP and future investment strategies**
- **Continue to analyze impact of behavioral programs and other external risk factors**
- **Use prediction model approach and update for observed 2018 results, future baseline conditions and development of 2020 targets**
- **Present proposed 2020 targets for CTB adoption - Spring 2019**