NCHRP 23-07: Effective Methods for Setting Transportation Performance Targets

TPM Webinar Series

Safety, June 2, 2022

ICF

With support from

HIGH STREET

applied pavement TECHNOLOGY

Agenda

- Welcome & Overview of Methods
- Presentation by Washington State DOT + Q&A
- Presentation by South Carolina DOT + Q&A
- Presentation by Michigan DOT + Q&A
- Discussion

Navigating Zoom

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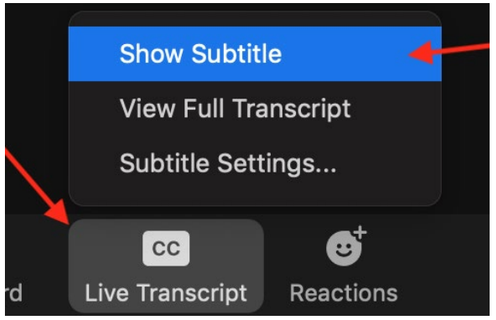
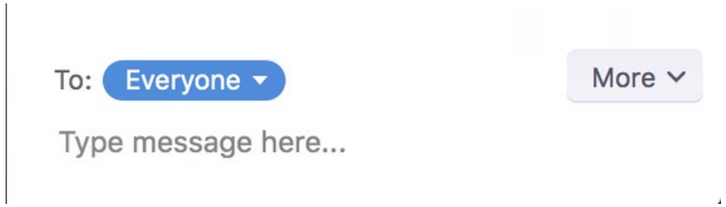


To ask a question, type the question in the chat or click “Raise Hand” to be called on.



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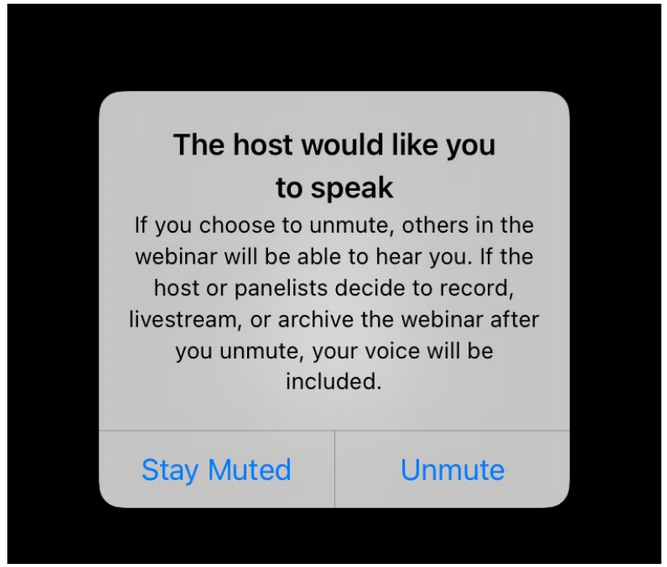


Guidebook Purpose

To help State DOTs and MPOs identify effective methods for setting transportation performance targets.

Guidebook Contents

Part I. Target Setting Overview and Tips

- Introduction to Guidebook
- Target Setting Foundations
- Practical Application Tips

Part II. A Menu of Target Setting Methods

- Target Setting Methods for Safety
- Target Setting Methods for Infrastructure Condition
- Target Setting Methods for Reliability
- Target Setting Methods for Traffic Congestion

Part III. Target Setting for Non-Required Measures

- Why Use and Set Targets for Other Measures?
- Examples of Performance Measures and Targets

Types of Target Setting Methods Used

- Policy-Based
  - E.g., annual decrease of 3%
- Historical Trends
  - E.g., based on trend over past 5 years
- Probabilistic and Risk-based Approaches
  - E.g., considering potential variability in performance
- Statistical Models that account for Explanatory Factors
  - E.g., regression model
- Other Tools and Models
  - E.g., pavement management systems

Target setting philosophies

Conservative
Help ensure the agency can attain the target

Realistic/ Predictive
Level most likely to occur

Aspirational
Reflect commitment to improved outcomes

Guidebook Part I: Target Setting Overview and Tips

What Makes a Target Setting Method Effective?

- Ease of Application
- Technical Robustness
- Ease of Communication
- Allows for Policy Consideration

Helps inform investments and strategies by providing information about factors driving performance

Motivates stakeholders and decision makers to engage in discussions about actions to meet targets

Safety Performance Measures

1. Number of Fatalities
2. Rate of Fatalities
3. Number of Serious Injuries
4. Rate of Serious Injuries
5. Number of Non-Motorized Fatalities and Non-Motorized Serious Injuries

Guidebook Part II: Target Setting Methods

SAFETY

Simpler to implement & communicate

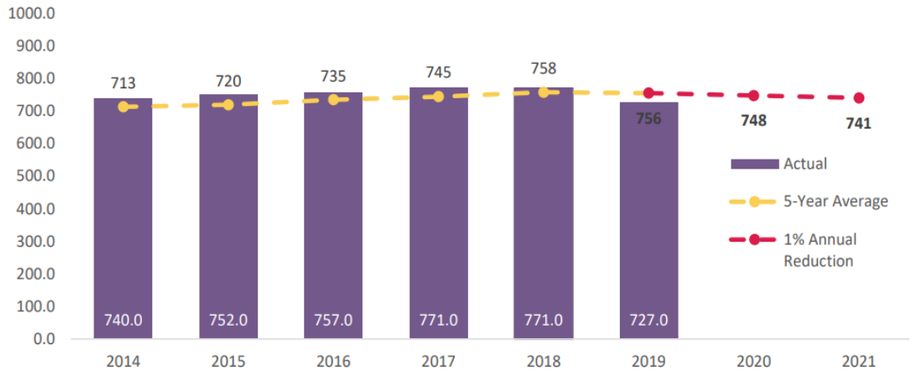
More data-heavy

Method	Strengths	Limitations	Other considerations
Targeted Reduction *A defined decrease from baseline, often based on policy or long-term "vision" goals*	Simple, easy to communicate; in line with agencies' aspirations	No insights into causes of outcomes	-
Time-Series Trend *A simple, univariable forecast based on historical trend data*	Simple while still being data-driven	No insights into causes of outcomes.	May result in a worsening target
Trend Plus Other Factors *Manual adjustment made to forecast results to account for other considerations*	Begins to bring in prominent influences on outcomes	Adjustments might be data-informed, but may stem from other motivations	May still result in a worsening target, though the agency has more ability to limit this
Multivariable Model *Regression or time-series model that incorporates explanatory variables to predict performance*	Fuller understanding of factors associated with outcomes, thereby informing decisions	Complex, time for data gathering, requires analytical and data skills, harder to communicate	May result in a worsening target

Guidebook Part II: Target Setting Methods

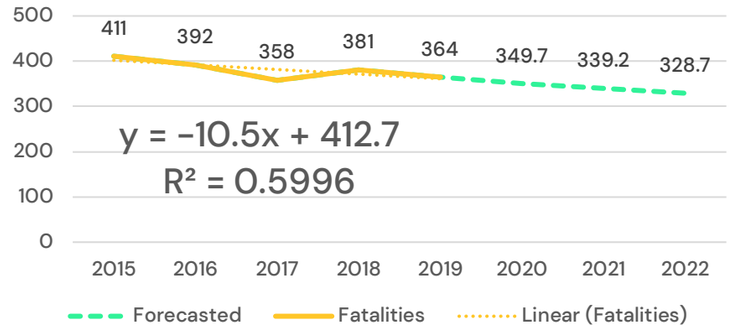
SAFETY

1. Targeted Reduction
(e.g., 1% annual reduction)



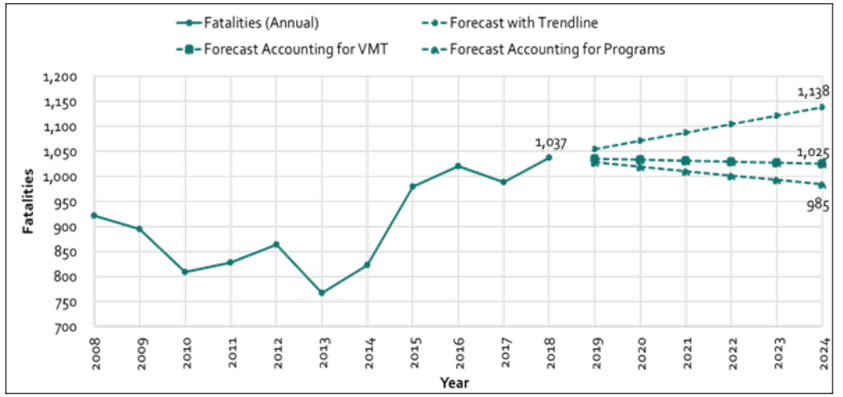
Source: Louisiana DOT

2. Time-Series Trend
(statistical analysis)



Source: NCHRP 23-07 pilot

3. Trend Plus Other Factors
(adjustments from projected trend)



Source: South Carolina DOT

4. Multivariable Statistical Model

Accounting for exogenous factors affecting performance in the model

Examples: Virginia DOT, Michigan DOT

Presenters

Washington State

Ida Van Schalkwyk

Method:

Targeted Reduction

South Carolina

Emily Thomas

Method:

Trend Plus Other Factors

Michigan

Mark Bott

Method:

Statistical Model

Safety Target Setting at WSDOT

MAP21 Safety Targets

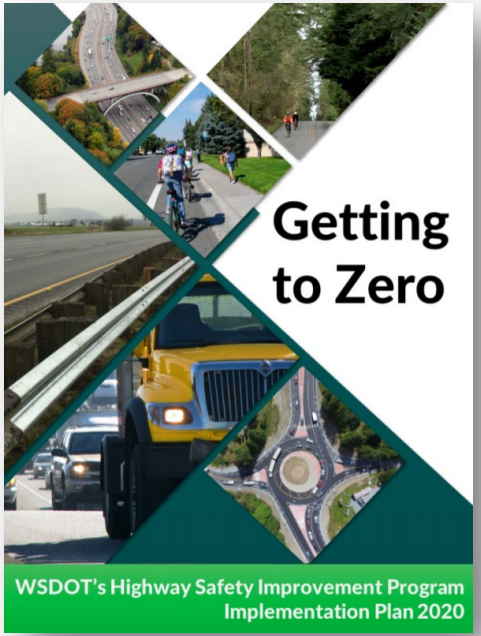
Ida van Schalkwyk, PhD, RSP2I, Safety Engineer
John C. Milton, PhD, PE, RSP2IB, PTOE, State Safety Engineer

June 2, 2022

Debate

Death and serious injuries are unacceptable

TARGET ZERO



Focus on fatalities on serious injuries in how we identify potential projects and countermeasures to reduce crashes.

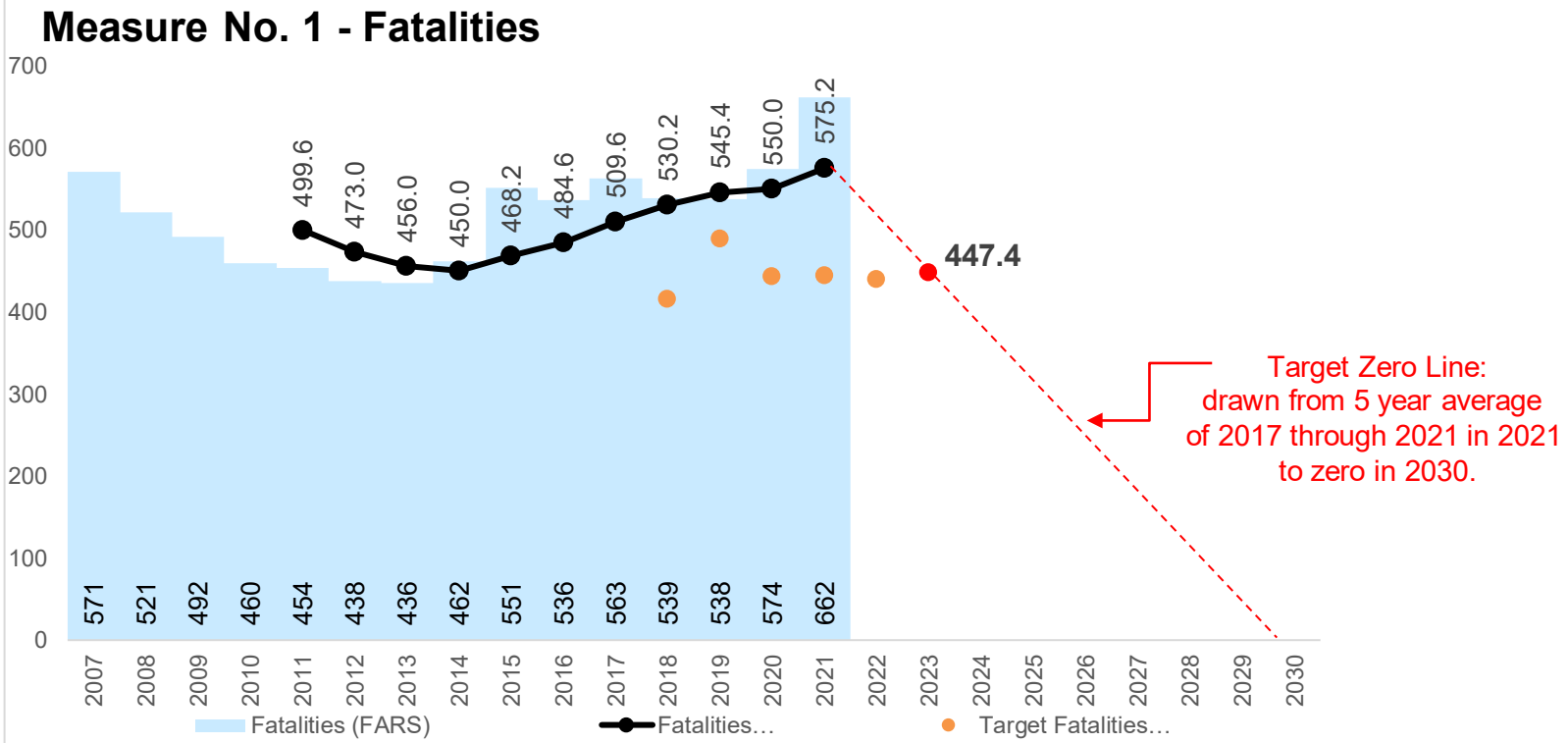
Philosophy

- **Improvement through evaluation and programmatic change as a goal** rather than meeting a target
- **What we do** as part of HSIP and projects in the mobility and preservation programs matter
- The SHSP as a **roadmap**
- **Value of the HSIP Implementation Plan**
- **Bringing about change**: authoritative documents like manuals & processes throughout agency business areas as result of evaluation/data-driven approaches

Target setting approach(es)

Year	Method
2018	Target Zero method (zero rolling average in 2030)
2019	Maintenance method
2020	Target Zero method (zero rolling average in 2030)
2021	Target Zero method (zero rolling average in 2030)
2022	Target Zero method (zero rolling average in 2030)
2023	Target Zero method (zero rolling average in 2030)

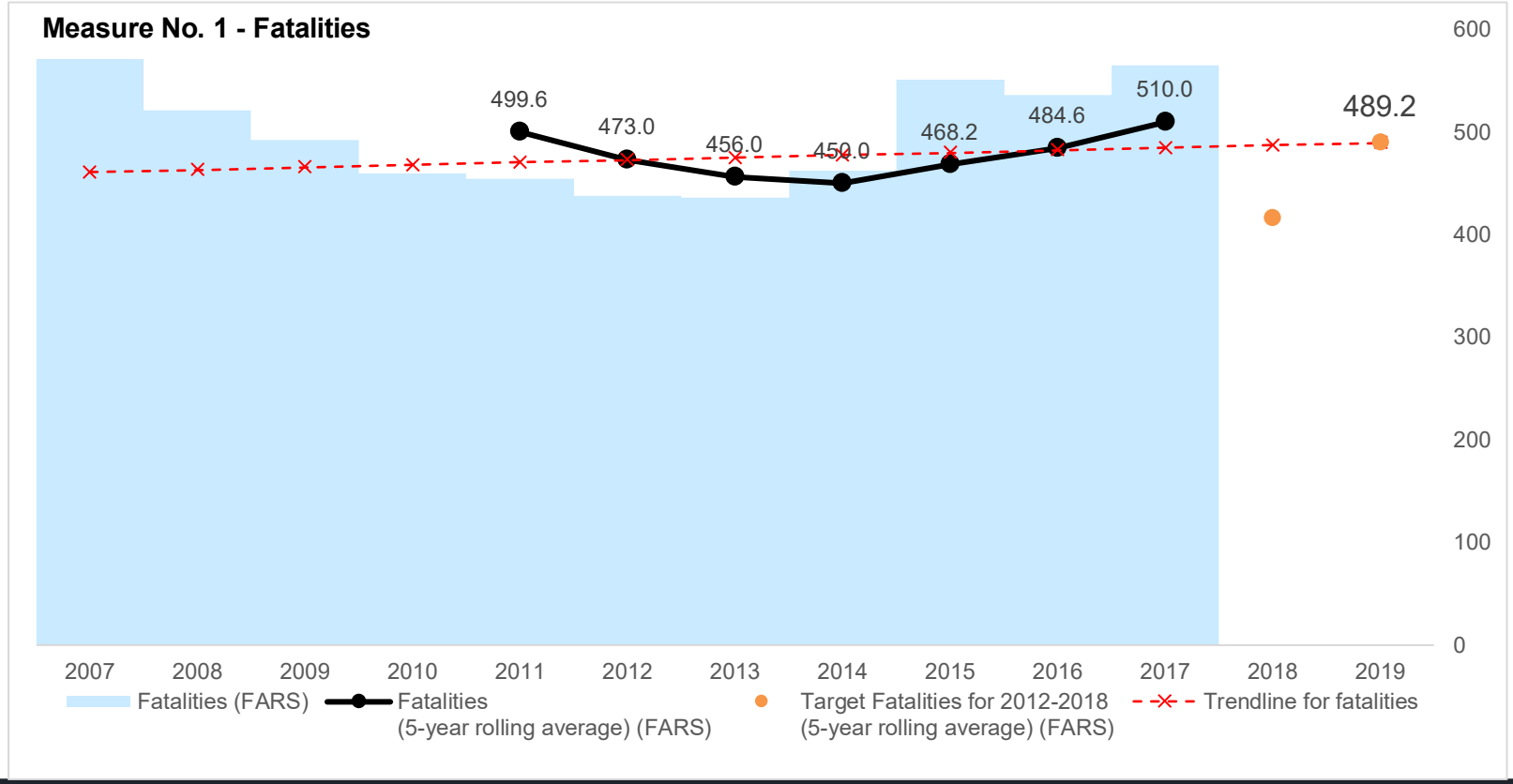
Target Zero Method



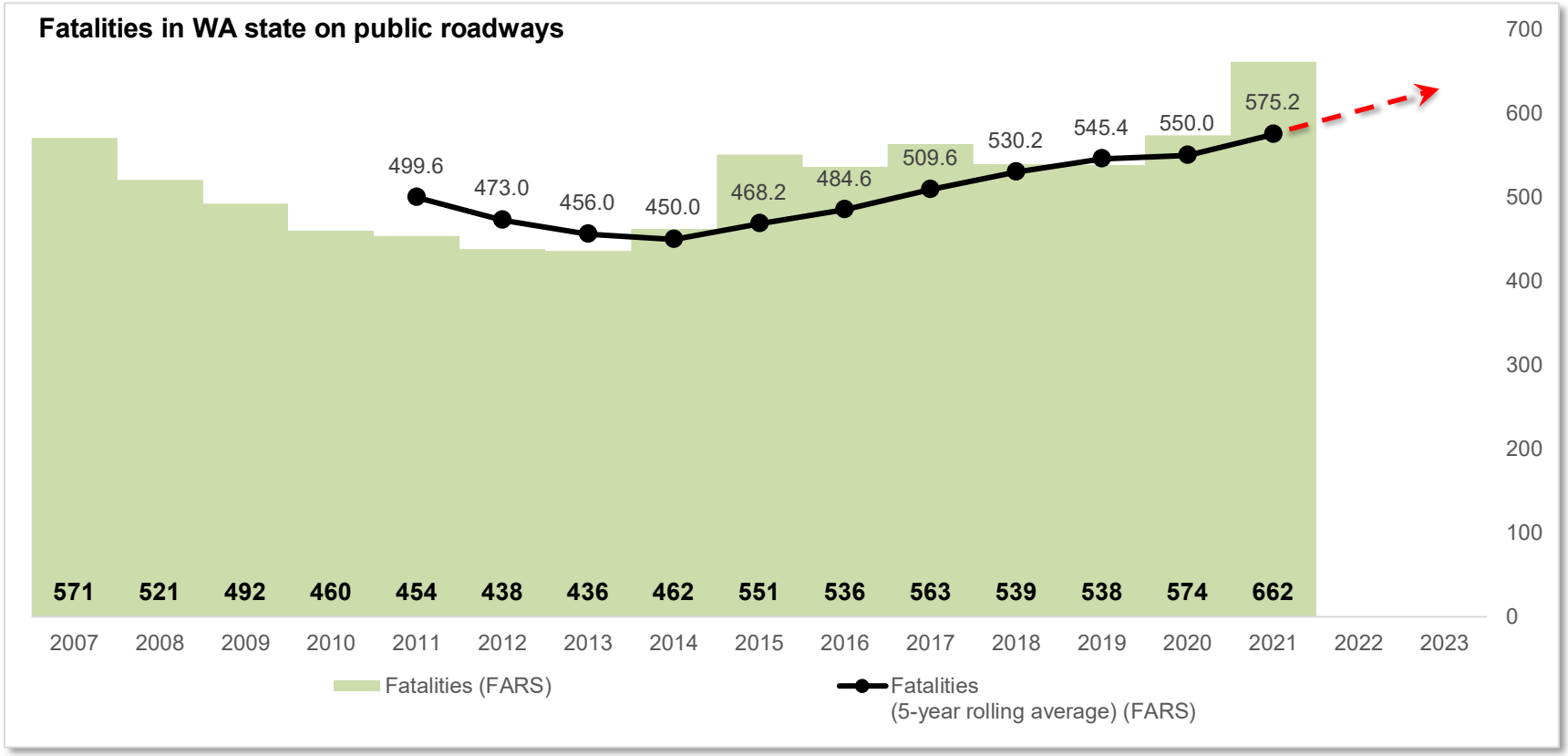
Data Source: Washington Coded Fatal Crash (CFC) data files, Preliminary 2021 Q4 release (May 2022), WTSC.

Under 23 U.S. Code § 148 and 23 U.S. Code § 409, safety data, reports, surveys, schedules, lists compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential crash sites, hazardous roadway conditions, or railway-highway crossings are not subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other

Maintenance Method

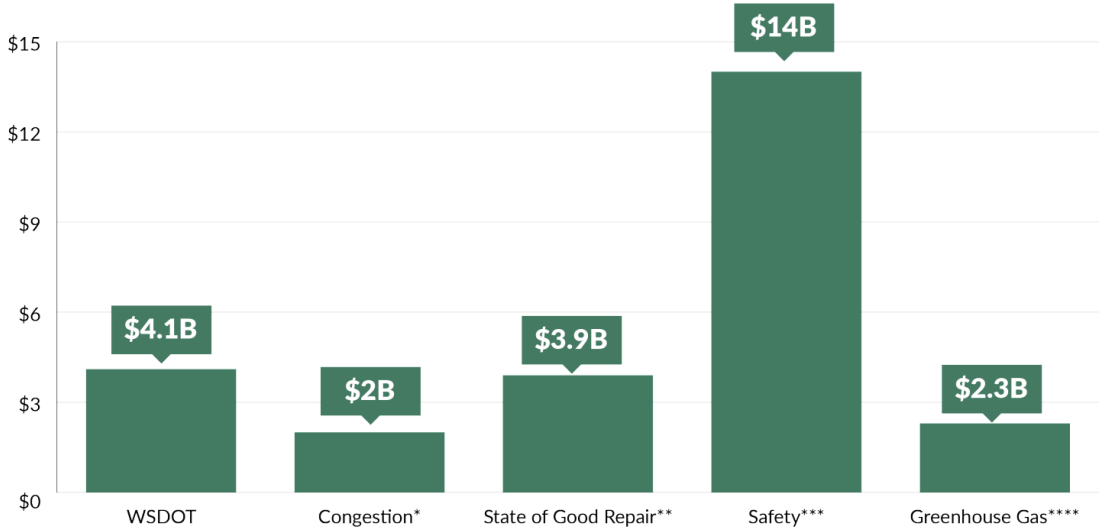


Our reality


Fatalities in WA state on public roadways
700
600
500
400
300
200
100
0
499.6
473.0
456.0
450.0
468.2
484.6
509.6
530.2
545.4
550.0
575.2
571
521
492
460
454
438
436
462
551
536
563
539
538
574
662
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
Fatalities (FARS)
Fatalities
(5-year rolling average) (FARS)

Our reality

Annual cost to Washingtonians



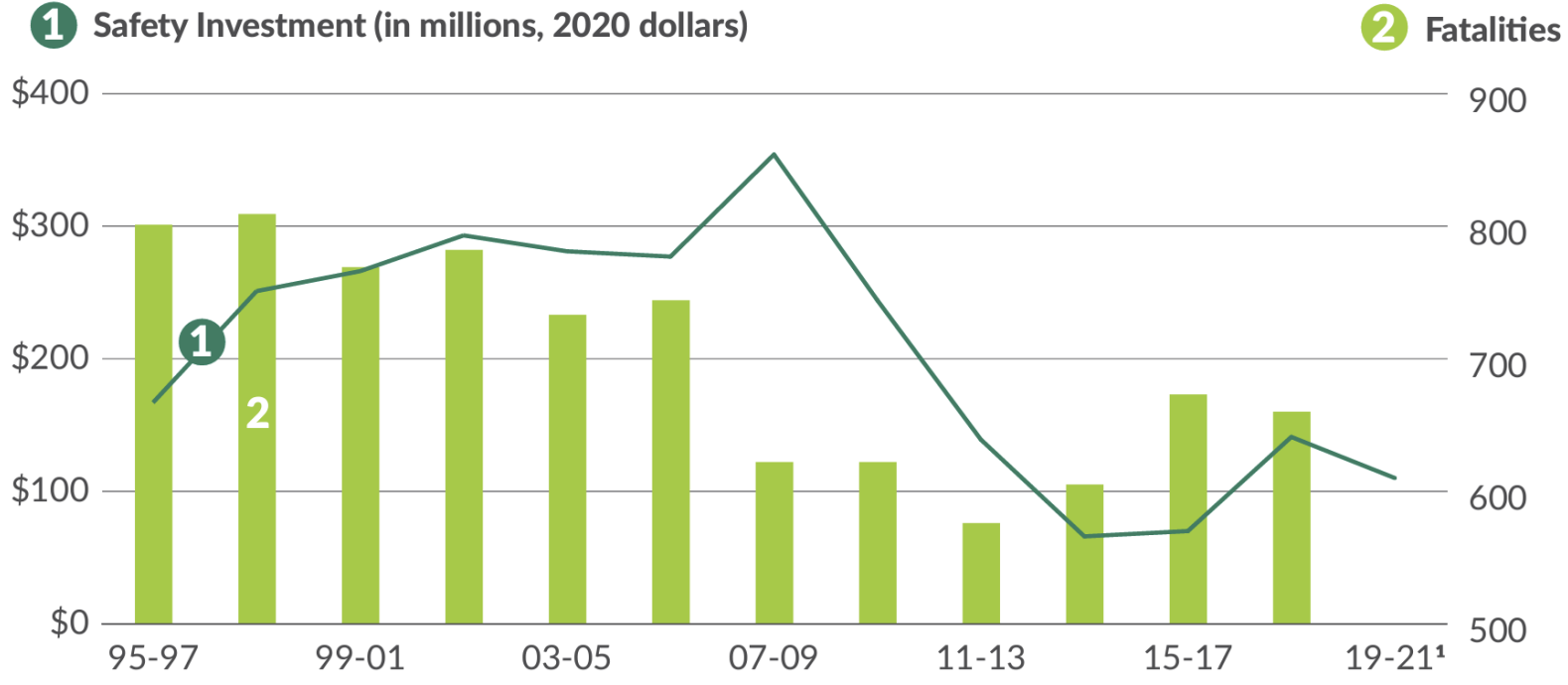
* Congestion cost source: Texas Transportation Institute's 2021 Urban Mobility Report; based on value of travel delay and excess fuel consumption statewide. 2019 congestion cost was $4.8 billion; 2020 cost includes the first year of the pandemic with a significant drop in travel.

** State of Good Repair source: ASCE 2021 Infrastructure Report Card; estimated at $659 for every Washington driver.

*** Safety source: Societal costs of crashes calculated using methods described in Crash Cost for Highway Safety Analysis (FHWA-SA-17-071), Chapter 6, Federal Highway Administration, Office of Safety, 2018. Economic cost components include: medical care, emergency services, market productivity, household productivity, legal costs, insurance administrative costs, workplace costs, property damage and congestion.

**** Source: Washington State Department of Ecology 2018 GHG Inventory.

Our reality



Note: **1** Fatality data for the 2019-2021 biennium not yet available.
Data source: WSDOT CPDM and Washington Coded Fatal Crash data files, April 2021.

Working with our partners

- WTSC as our Highway Safety Office – collaboration on 3 targets, agreement about Target Zero approach for the 3 targets as part of both HSP and HSIP Plans.
- MPOs
  - First year we presented at their technical meetings across the state;
  - ongoing regular meetings facilitated by the Multimodal Planning Division where they are engaged in discussion and updated regularly.
  - MPO “targets” spreadsheet – value of such a tool to the MPO as they work with their board

Bold action

- Our commitment
- We welcome the HSIP Implementation Plan requirement: what we do is what matters
- Complete streets legislation, executive policy, and implementation
- Continued Safe Systems, policy update and implementation

Safe System Approach

To provide separation

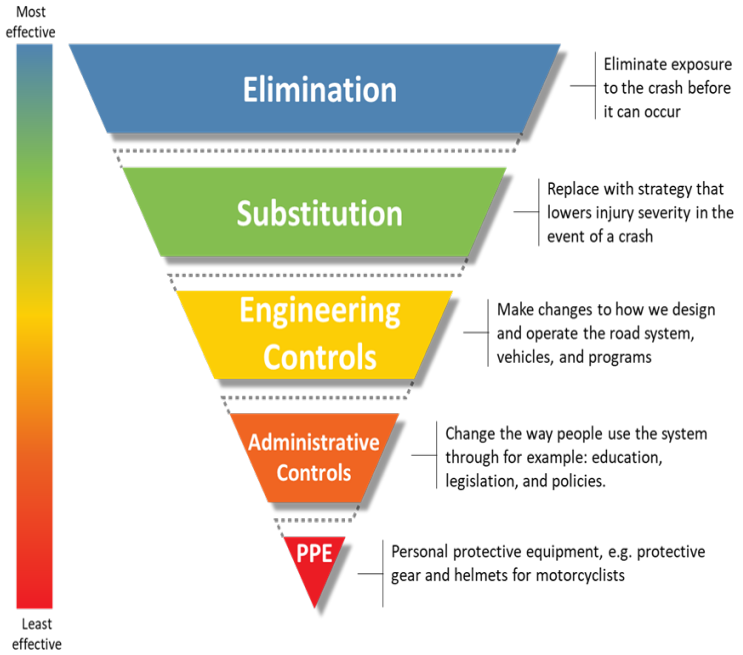
- Adopted a Sustainable Safety Policy in 2013, Practical Solutions in 2015
- To incorporate context classification and modal priority into design and operational decision making
- Allowed for reducing lane width for greater separation between walking, biking and rolling
- Lane marking, signing and channelization

To reduce kinetic energy

- Roundabouts to reduce speeds at entry/exit with angles that reduce injuries.
- Road designs and operations to accommodate target speeds for the context and modes
- Applications of self explaining and enforcing roadways (Traffic calming, e.g., chicanes)

WSDOT Implementation

- WA State Injury Minimization Speed Management Policy and Guidelines Workgroup
- Design and operate to encourage safe road user actions (Self explaining/enforcing)
- Complete Streets, with Integrated multimodal design, using the Safe System (Just passed State and Federal Legislation)
- Policy development for integrated multimodal systems and update of Sustainable Safety (now: Safe System)
- Properly evaluate, analyze and diagnosis road safety approaches: completed traffic barrier inventory, mobile lidar data collection in Summer 2022, level of traffic stress
- Initiating sidewalk, ADA, crosswalk data collection



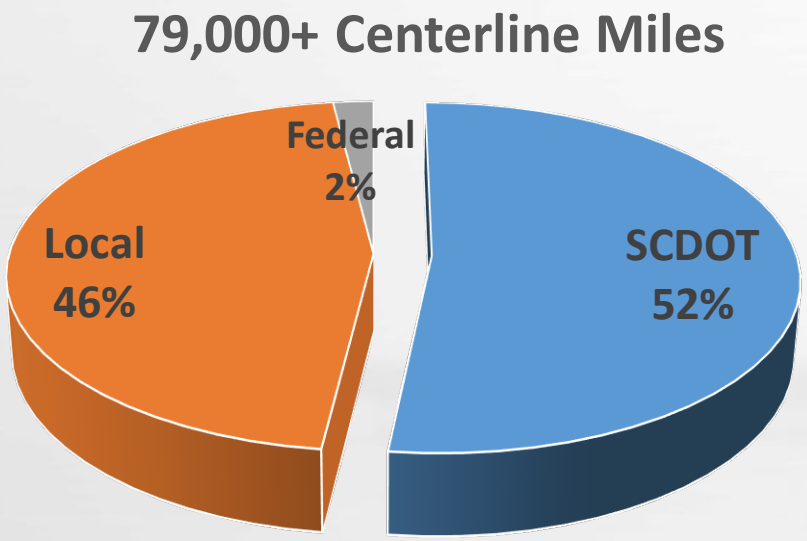
Hierarchy of Controls for Traffic Safety
adapted from Hierarchy of Controls: National Institute of Occupational Safety (2017)

Questions

South Carolina Safety PM Target Setting Process

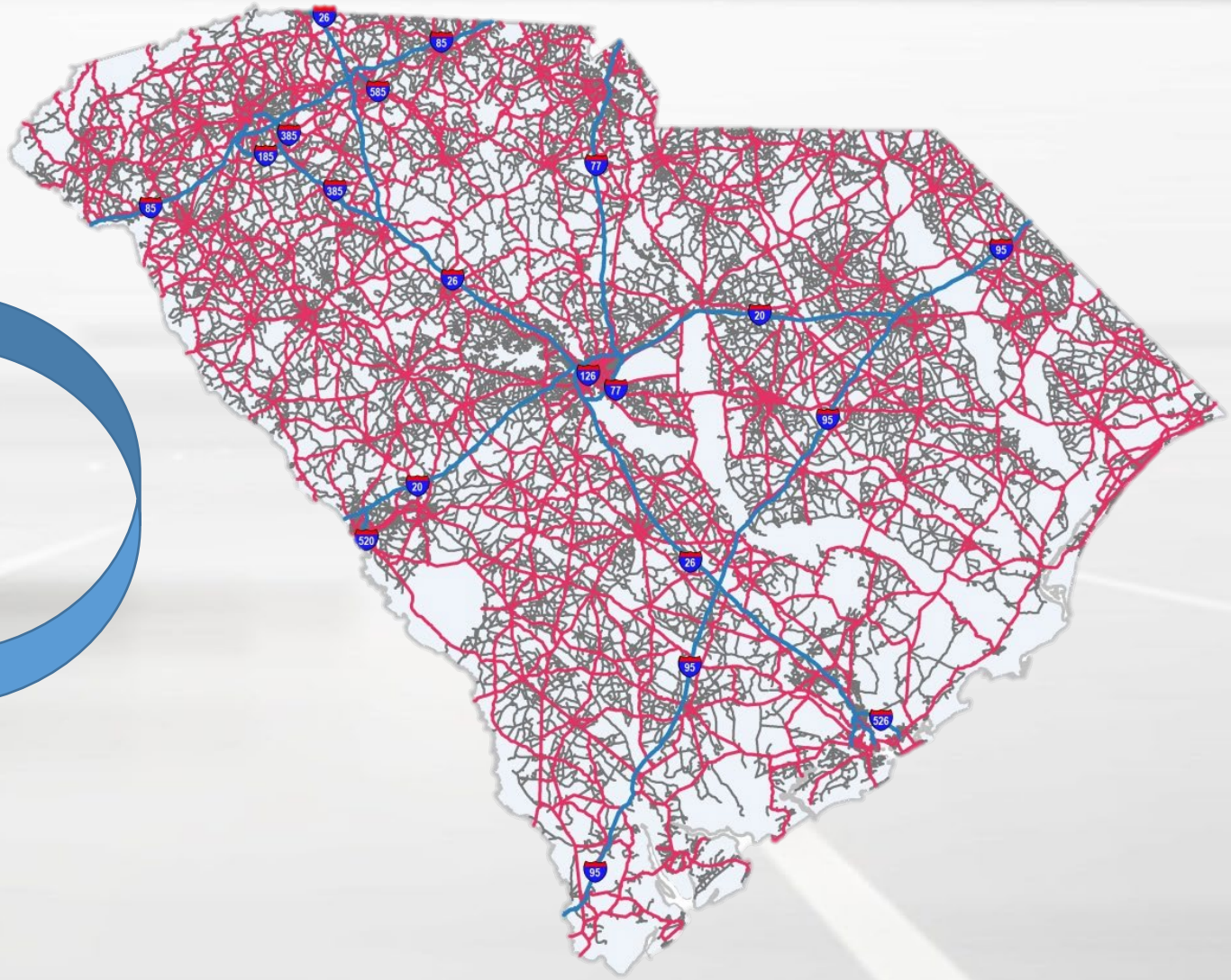
Emily Thomas

South Carolina by the numbers



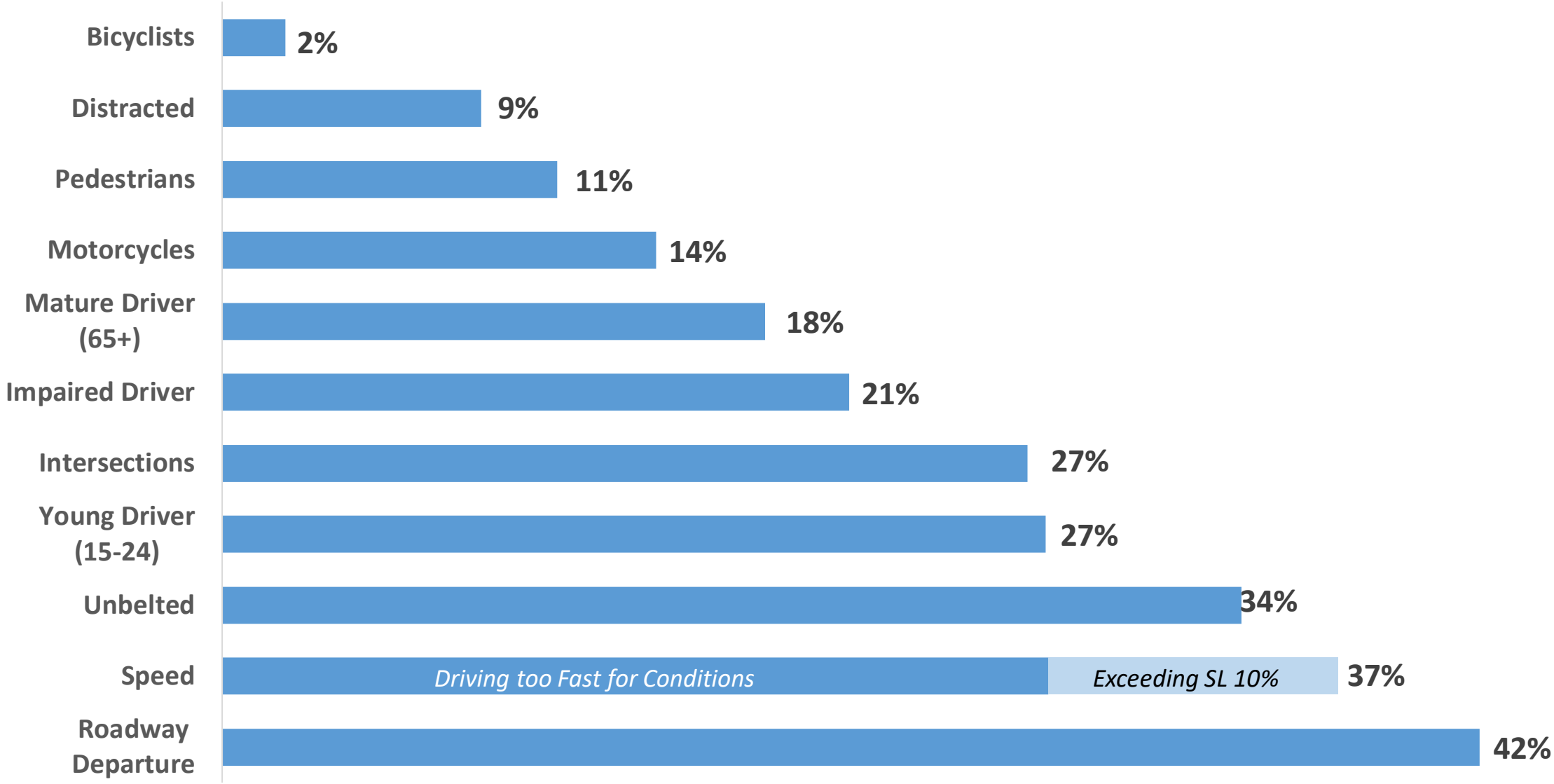
Interstate	851
Primary	9,475
Secondary	30,969
State System Total	**41,295**

As of 12/31/21

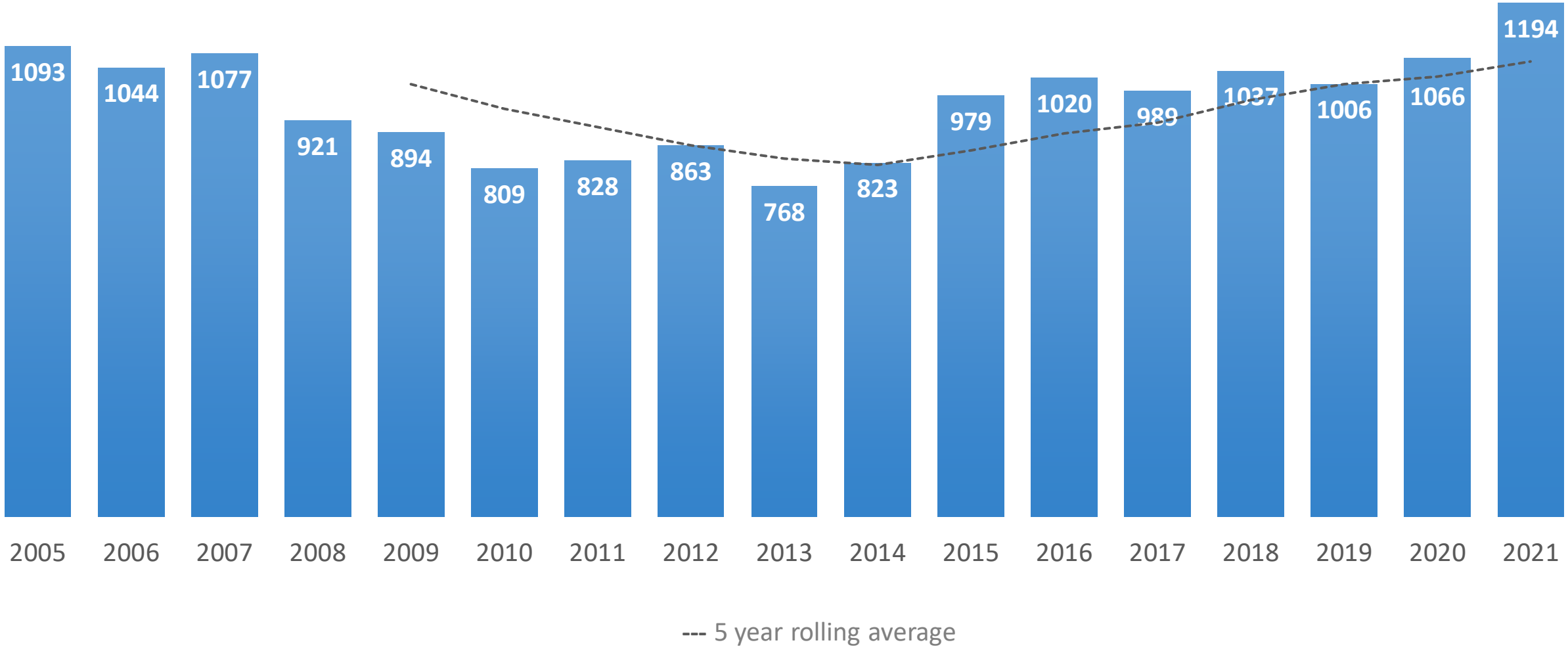


South Carolina Top Crash Type

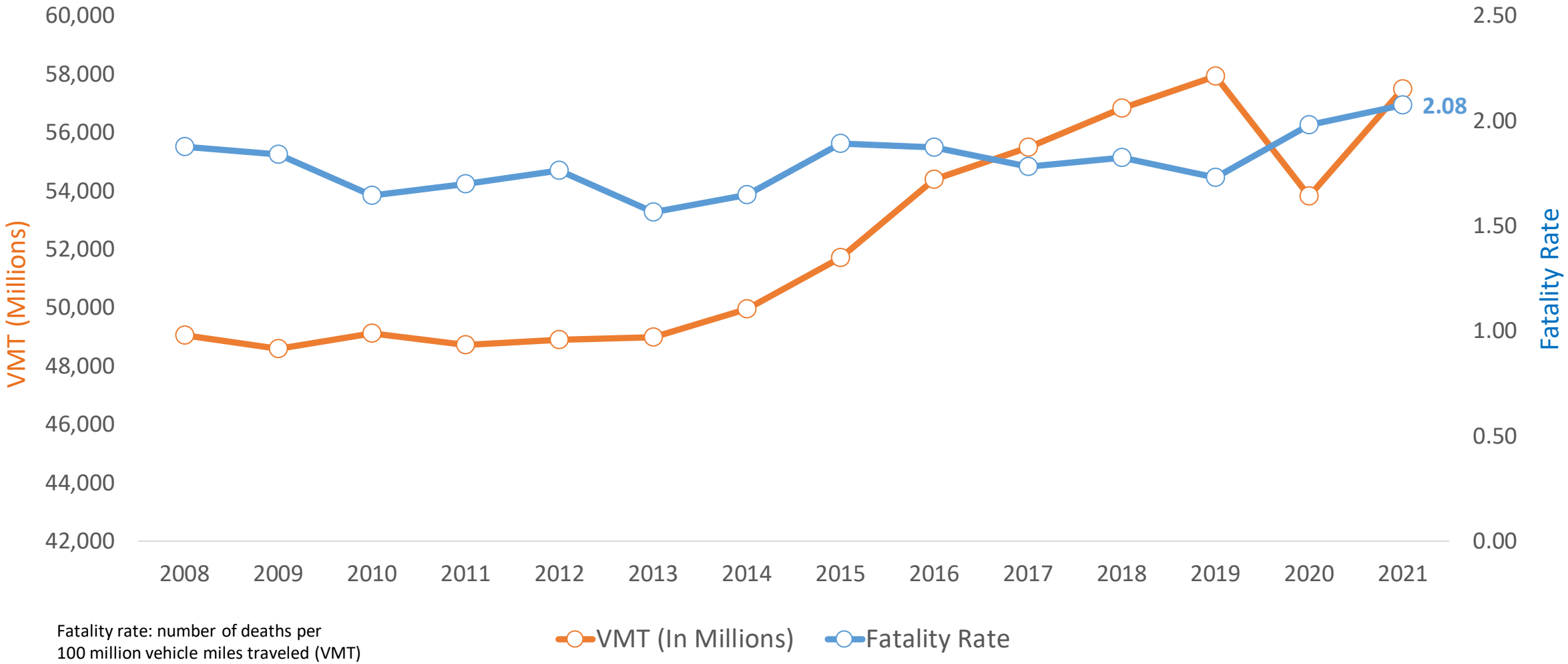
Fatal and Serious Injuries, 2017-2021



South Carolina Traffic Fatalities



South Carolina Fatality Rate & VMT



Fatality rate: number of deaths per
100 million vehicle miles traveled (VMT)

South Carolina Target Setting Approach

Trend +

- Historical data
- Trend line analysis for projected figures
- Excel models

Other Factors

- VMT
- Programmatic effects

South Carolina Target Setting Process

- **Agencies involved:**
  - SC Department of Public Safety *Office of Highway Safety & Justice Programs (GR)*
  - SC Department of Transportation *Traffic Engineering Division, Safety Office*
- Keeping in mind deadlines (Jun HSP, Aug HSIP, Feb MPO)
  - *FHWA notification of target achievement March/April*
- Coordination meeting held in March

South Carolina Target Setting Process

- **Coordination Meeting**
  - SCDPS statisticians perform extensive analysis of data related to each performance measure
  - SCDOT planning office delivers forecasts for annual VMT

Step 1: Establish estimate of current CY values

Projection based on most current statistics available

Step 2: Establish trend line to predict future values

Based on linear or non-linear equations (best fit)

South Carolina Target Setting Process

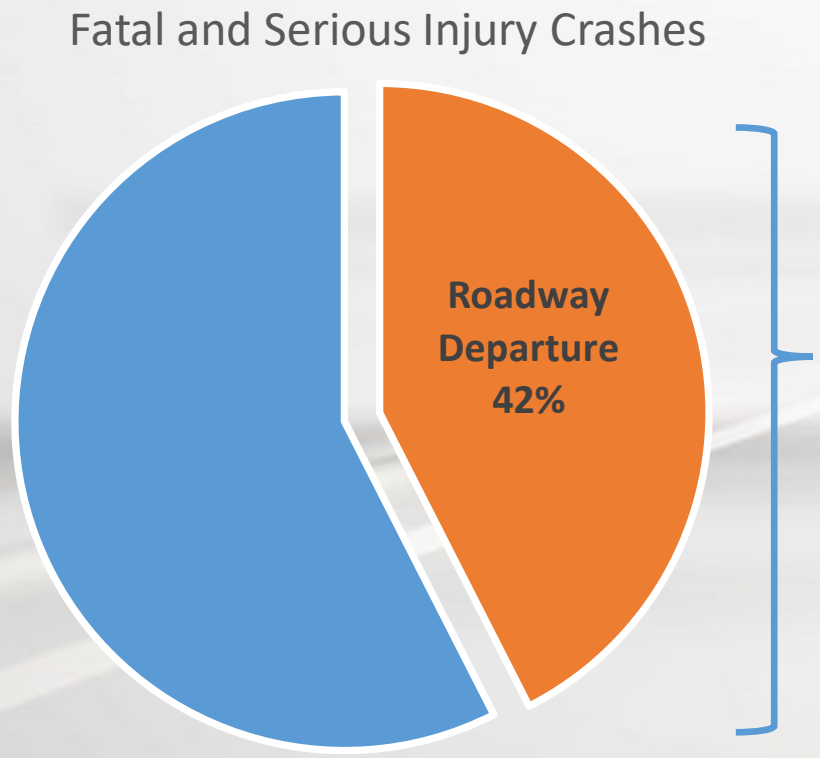
Step 3: Examine forecasted VMT values

Step 4: Examine current & planned education, enforcement, and engineering safety initiatives

- Estimate expected reductions in each performance area
- Consider how funding changes might lead to changes in number of completed projects

South Carolina Target Setting Process

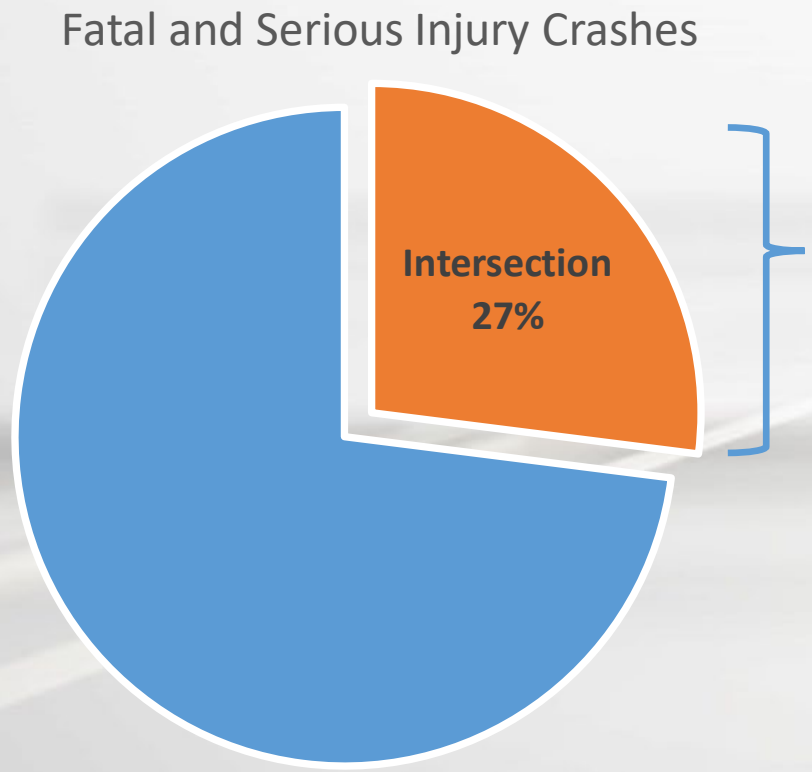
Estimate expected reductions in each performance area



1. 42% of F&SI crashes involve Roadway Departure
2. SC's **Rural Road Safety Program**, targets a percentage of F&SI crashes on rural roads in the state (~30% of state's total F&SI)
   - Keep vehicle on the roadway
   - Provide adequate space for recovery (remove fixed objects)
3. Miles treated annually
4. Percent effectiveness (CMF or your own)

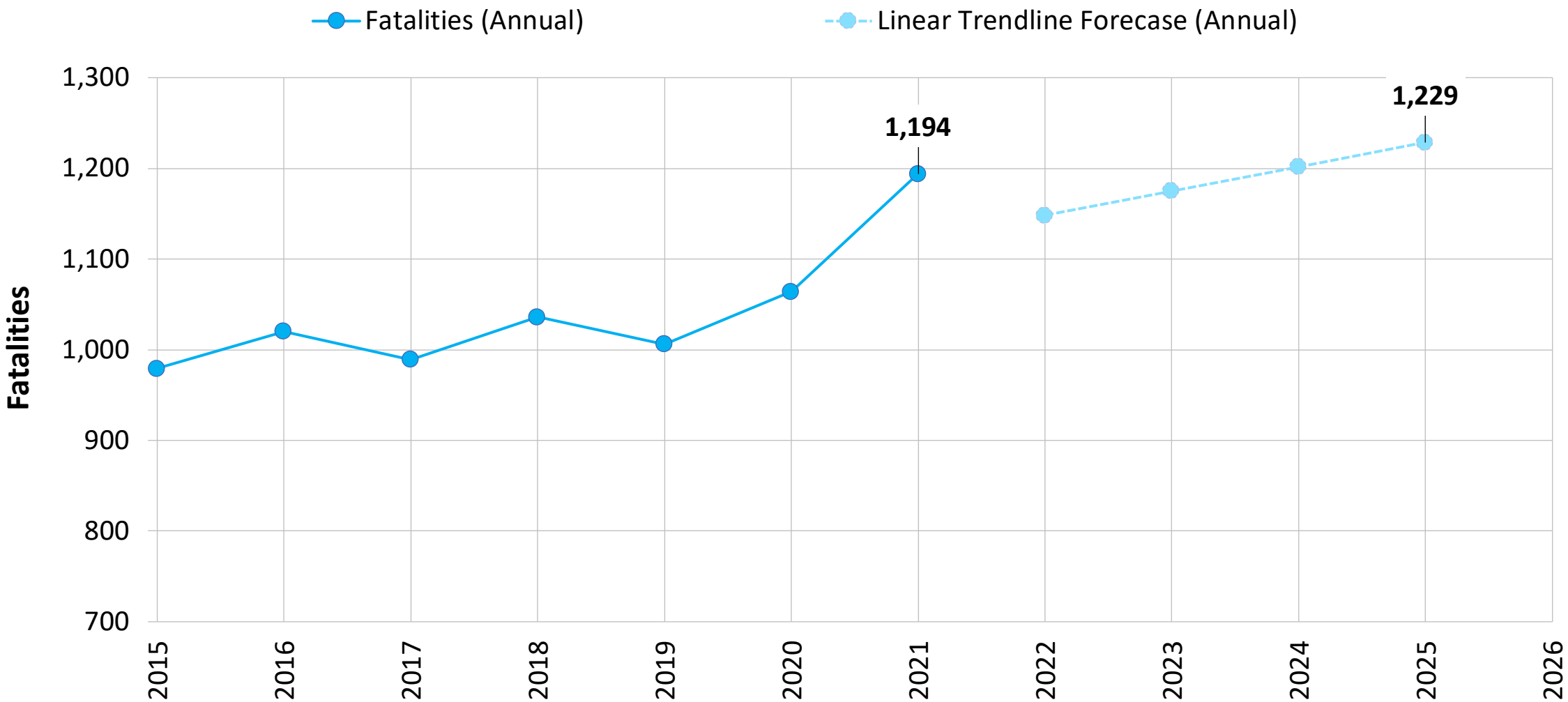
South Carolina Target Setting Process

Estimate expected reductions in each performance area

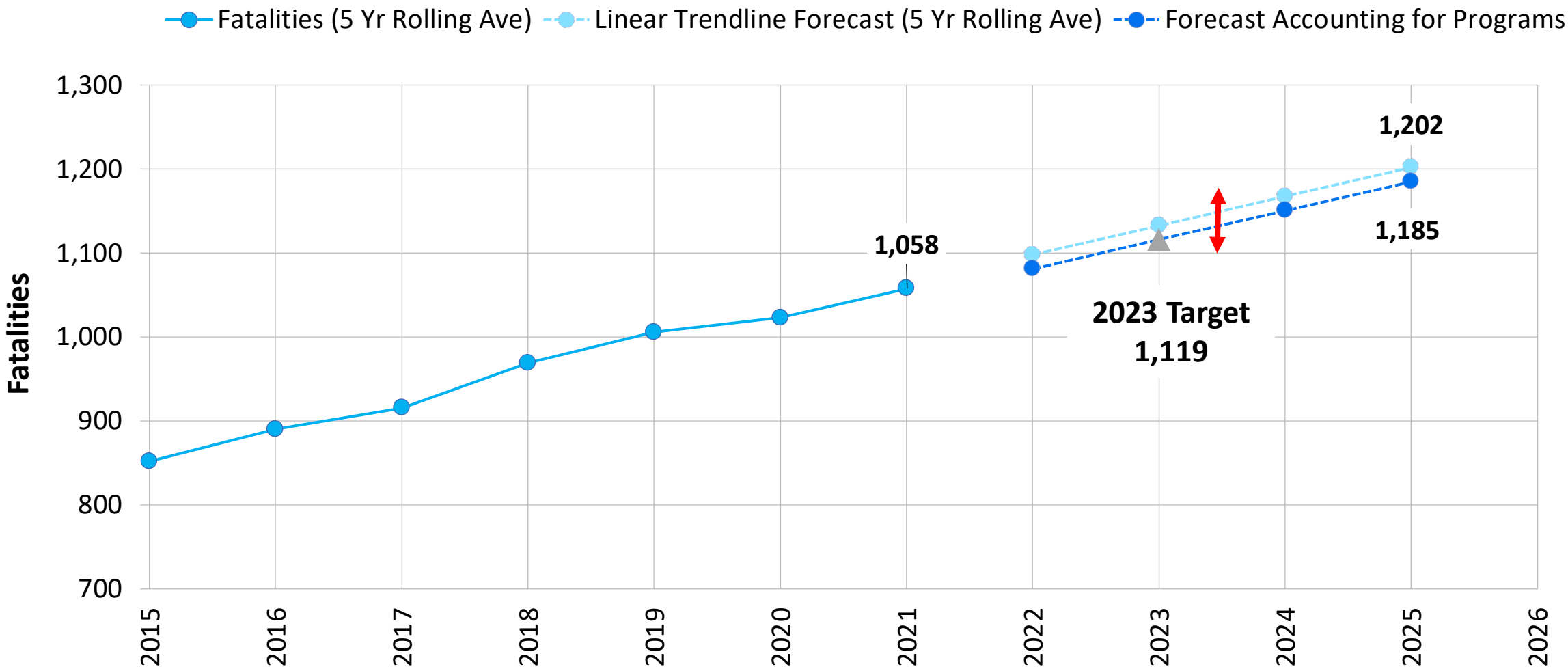


1. 27% of F&SI crashes occur at Intersections
2. 1% of intersections are improved annually through HSIP
3. Percent effectiveness (CMF or your own)

South Carolina Fatalities



South Carolina Fatalities



Bonus Step – Tie to Financial Investments

Emphasis Area: Roadway Departure	$80M Emphasis Area Allocation
Rural Road Safety Program	$50M
Interstate Safety Program	$15M
Roadway Departure Mitigation Program	$15M
Emphasis Area: Intersections & Other High-Risk Locations	**$37M Emphasis Area Allocation**
Intersection Safety Projects	$15M
Road Safety Assessments & Implementation	$17M
Railroad Safety Projects	$5M
Emphasis Area: Vulnerable Road Users	**$10M Emphasis Area Allocation**
Pedestrian & Bicycle Safety Projects	$10M
Safety Data Analytics	**$3M Emphasis Area Allocation**
Total Annual Funding	**$130M**

SC's FY 2022 Apportionment ~ $52M

Challenges

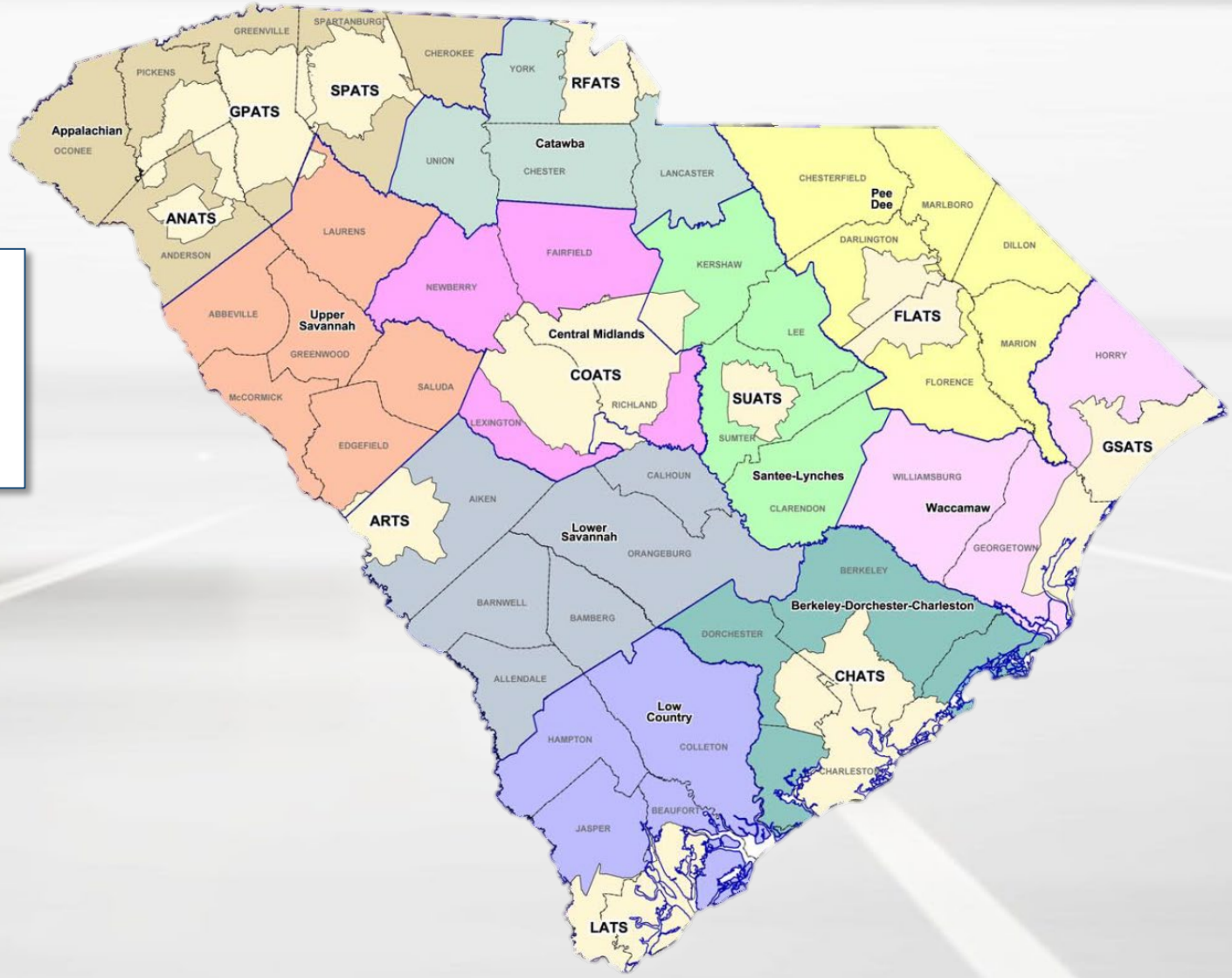
- Maintaining a Target Zero vision
- New players
- Presenting increasing targets
- Providing baseline data to MPO partners
- Keeping everyone updated on progress

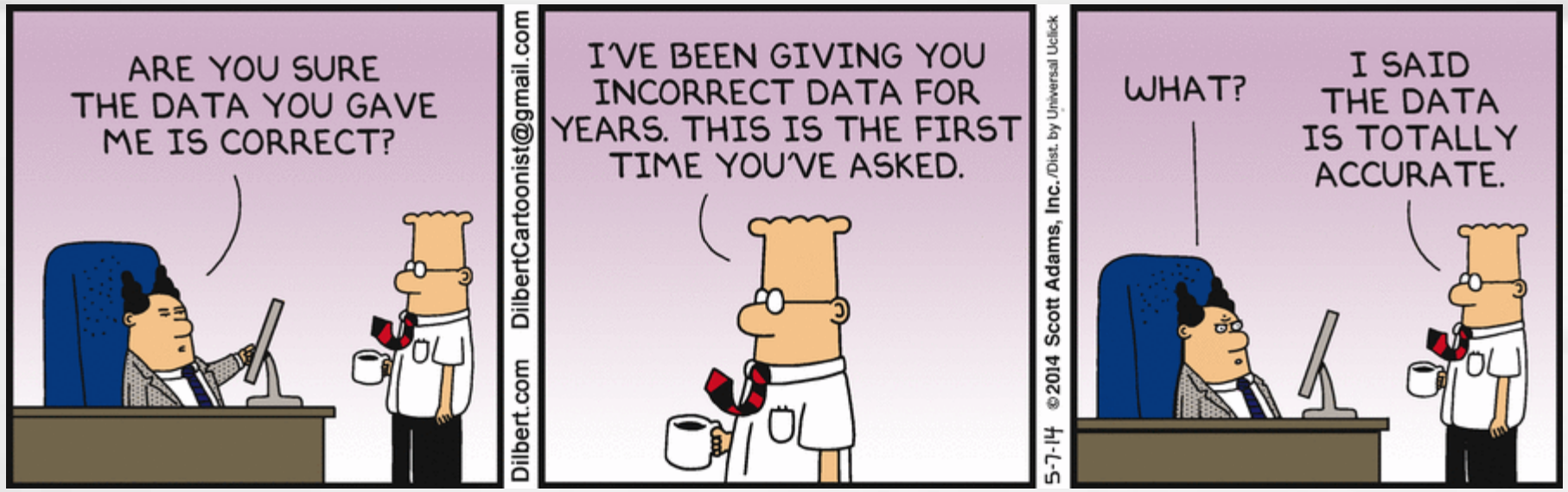
Tips for keeping the process alive

- ❑ Keep agency leadership in the loop, they can become your greatest ally
- ❑ Consider safety targets in project identification and development
- ❑ Include target setting process & progress in presentations
- ❑ Visit MPOs
- ❑ Keep your calendar open

Success Story – MPOs Coordination

- 11 Metropolitan Planning Organizations
- 10 Council of Governments



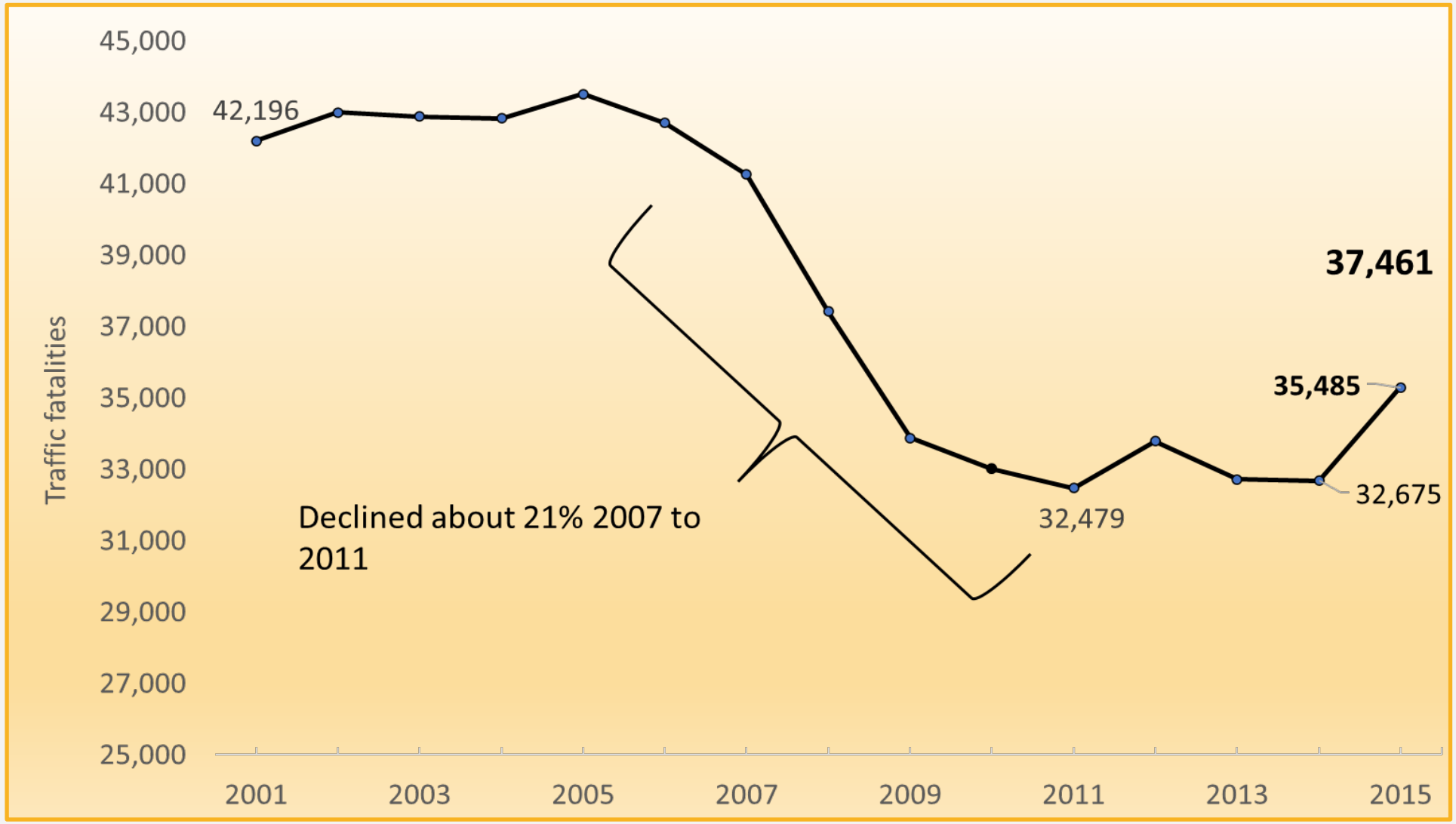


Emily Thomas
thomaseg@scdot.org

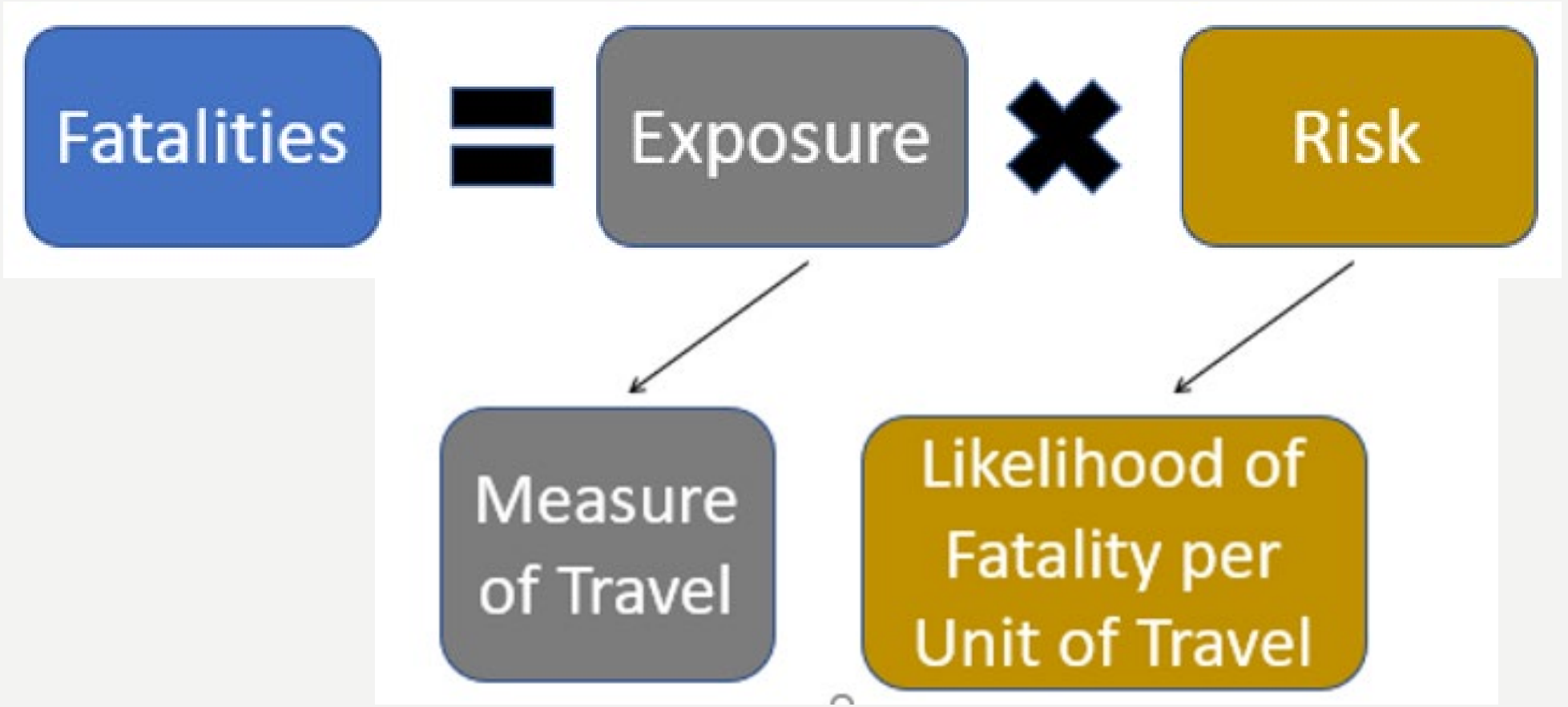
MICHIGAN PREDICTED FATALITIES

GETTING TO OUR TARGETS

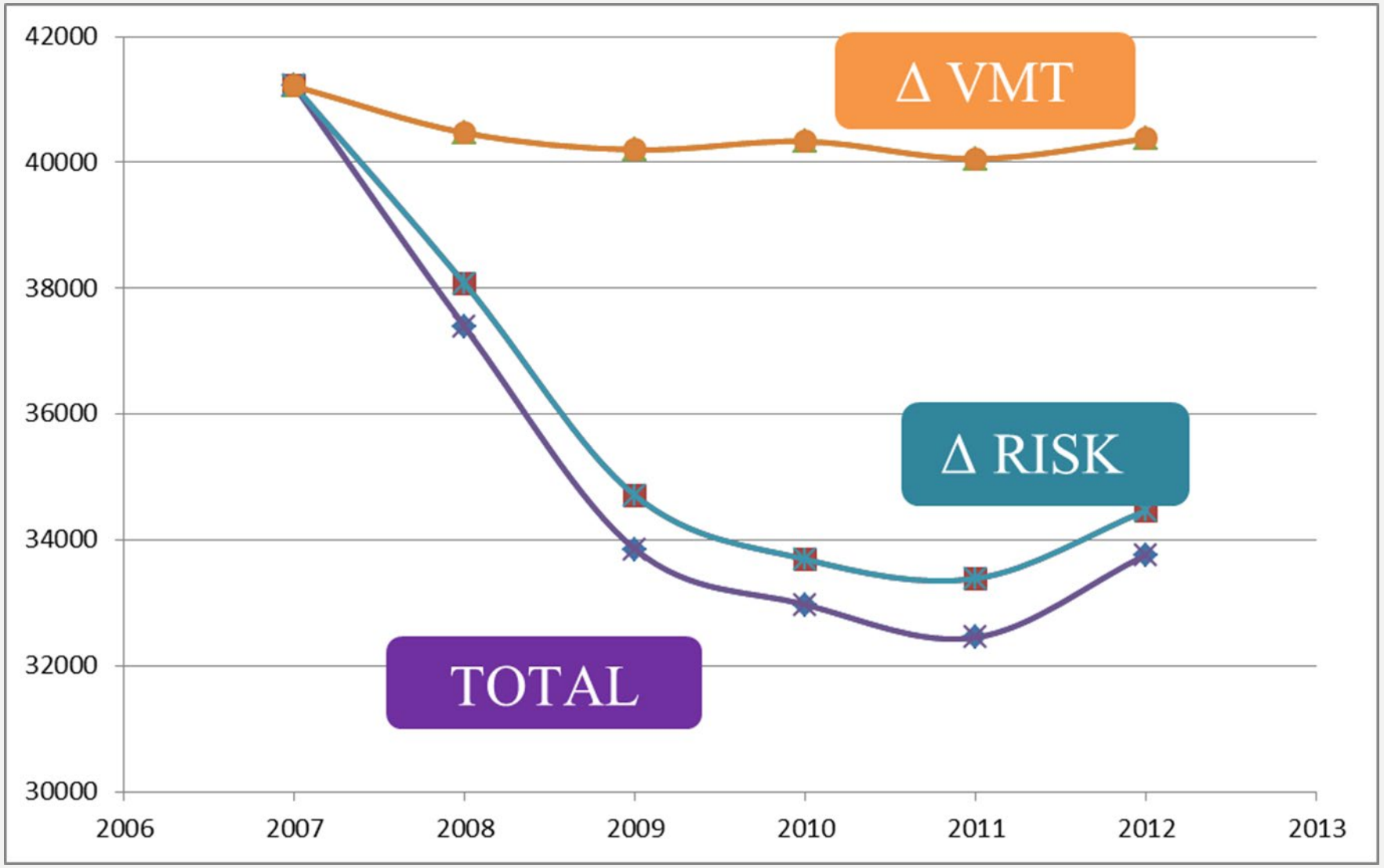
NCHRP 17-67


45,000
43,000
41,000
39,000
37,000
35,000
33,000
31,000
29,000
27,000
25,000
Traffic fatalities
42,196
37,461
35,485
32,675
32,479
Declined about 21% 2007 to 2011
2001
2003
2005
2007
2009
2011
2013
2015

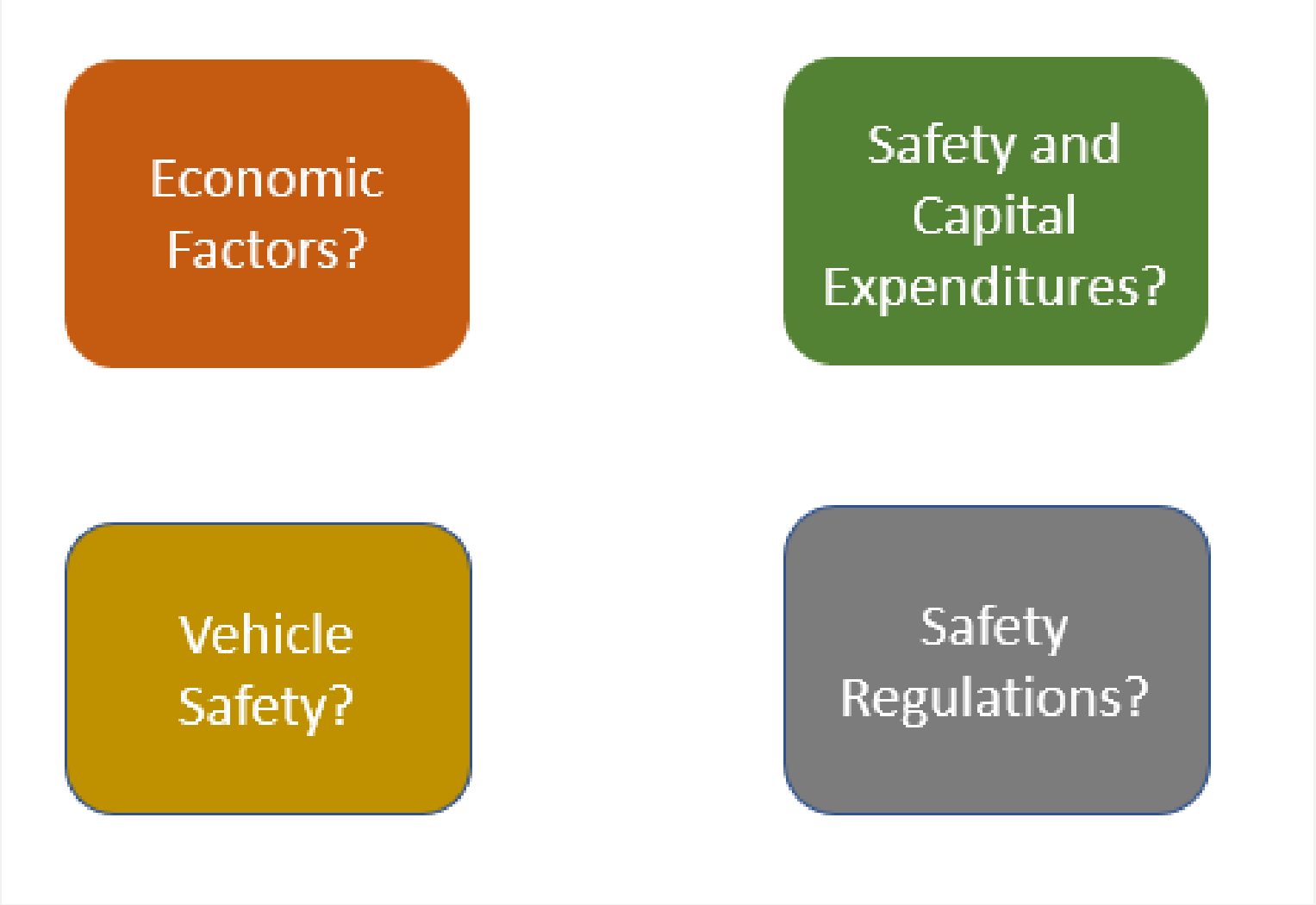
KEY COMPONENTS



CONSTANT RISK OR VMT



WHAT CAUSES RISK TO DECREASE?



PREDICTION MODEL

- UMTRI built two fatality prediction models based on all states from 2001-2012
- Change Model predicts *change* in fatalities from the previous year based on a number of predictors
- The Count Model predicts *counts* of fatalities each year

OBSERVATIONS

- The change model is tied closely to whatever happened recently.
- The count model directly predicts counts.

Fatality Model: Predicting Year-over-Year Change Most Significant Variables

≈ 6%

Safety Regulations

Strength of DUI Laws

Belt Use Rate

≈ 84%

Economic

% Unemployment 16-24 year olds

Beer Consumption

GDP/capita

Median Income

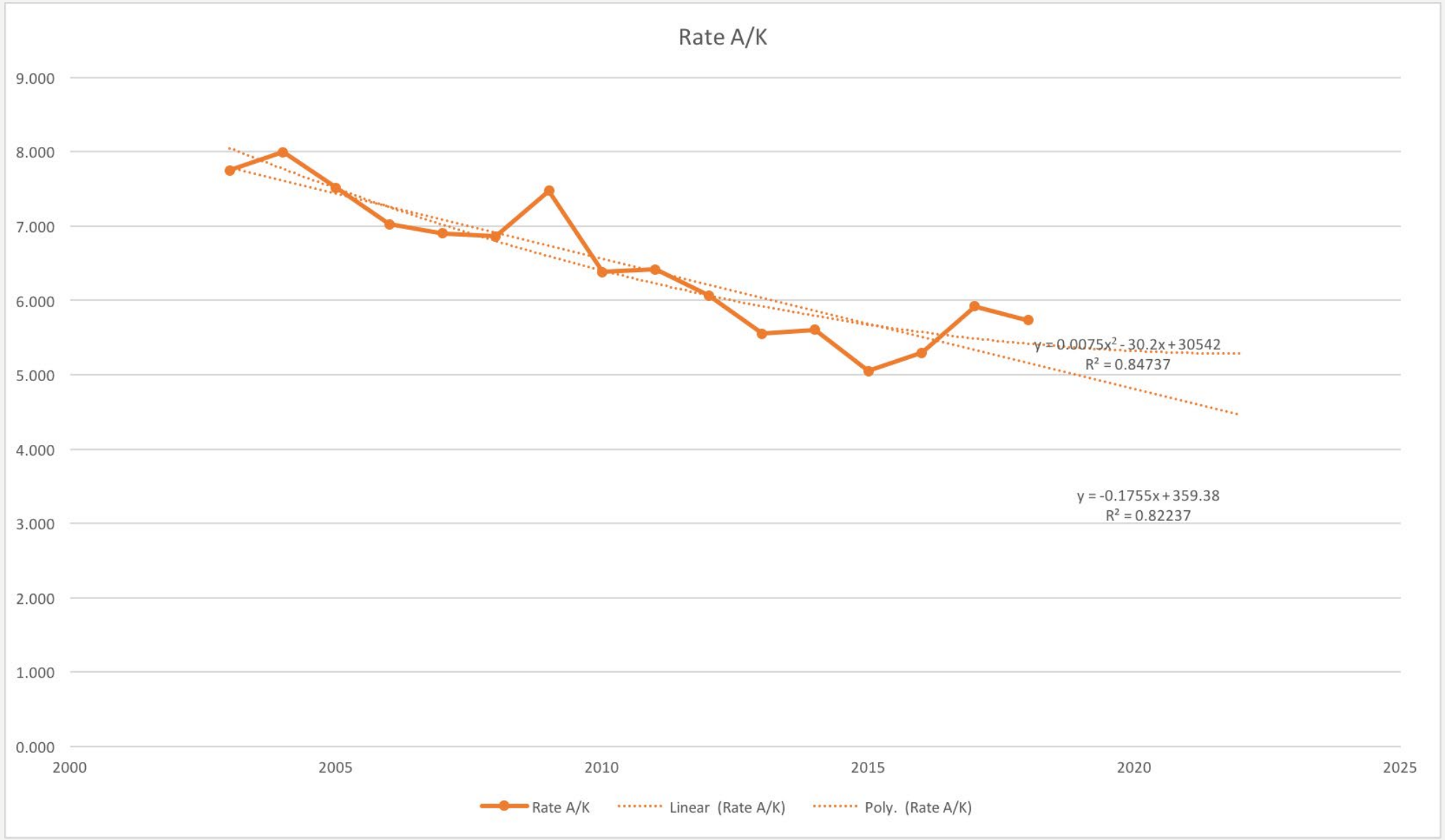
≈ 10%

Travel

Change in Total VMT

Proportion Rural VMT

A INJURIES


Rate A/K
9.000
8.000
7.000
6.000
5.000
4.000
3.000
2.000
1.000
0.000
2000
2005
2010
2015
2020
2025
y = 0.0075x² - 30.2x + 30542
R² = 0.84737
y = -0.1755x + 359.38
R² = 0.82237
Rate A/K
Linear (Rate A/K)
Poly. (Rate A/K)

OBSERVATIONS

- COVID really broke the relationship between VMT and fatalities embedded in both models
- Essentially, VMT dropped a lot and so both models predicted a big drop in fatalities that wasn't seen
- It is as though only safe miles were removed from the total VMT
- For 2021, VMT was still down, then in 2022 and beyond it is predicted to be more typical

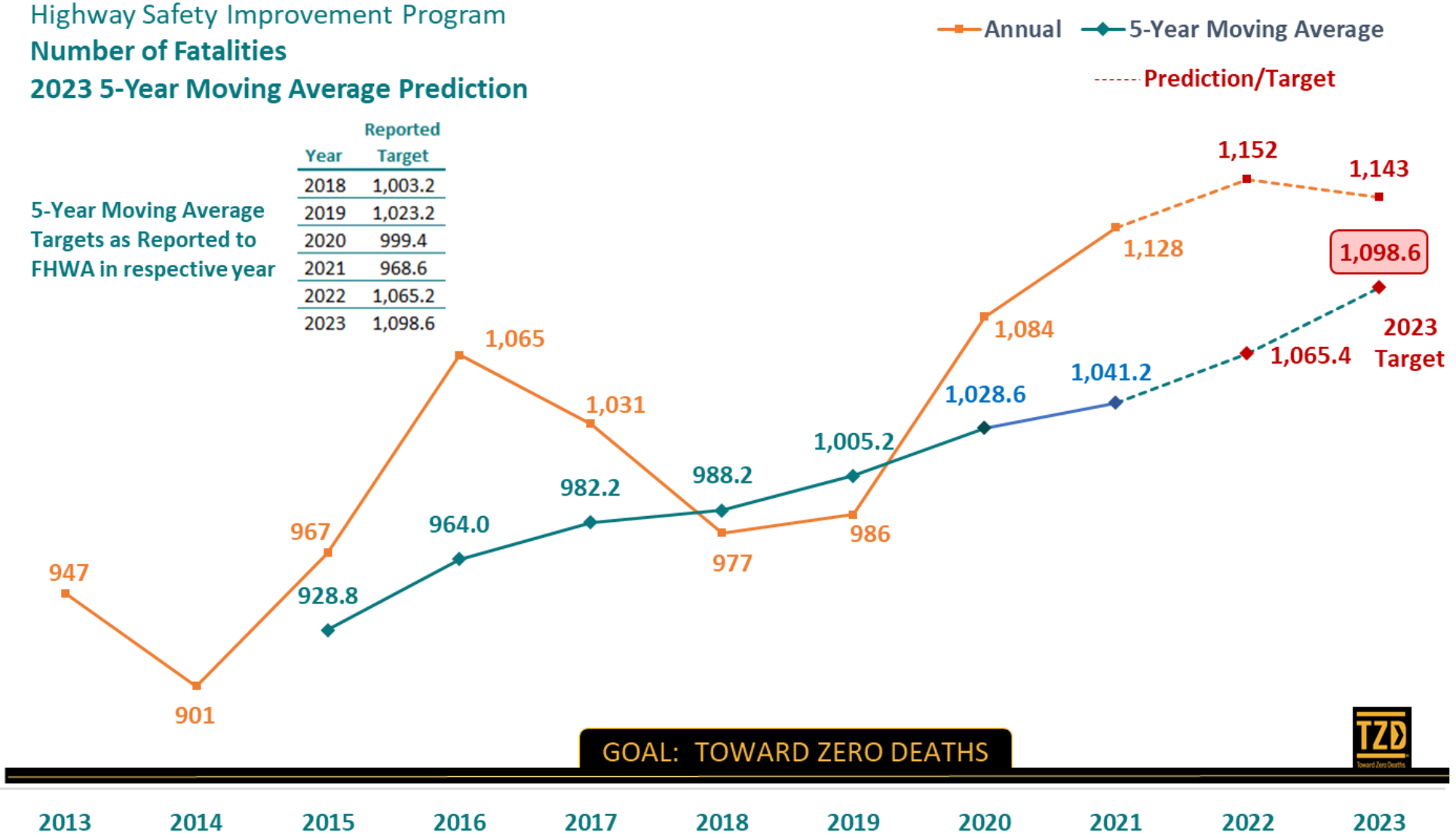
Highway Safety Improvement Program

Number of Fatalities

2023 5-Year Moving Average Prediction

5-Year Moving Average Targets as Reported to FHWA in respective year

Year	Reported Target
2018	1,003.2
2019	1,023.2
2020	999.4
2021	968.6
2022	1,065.2
2023	1,098.6

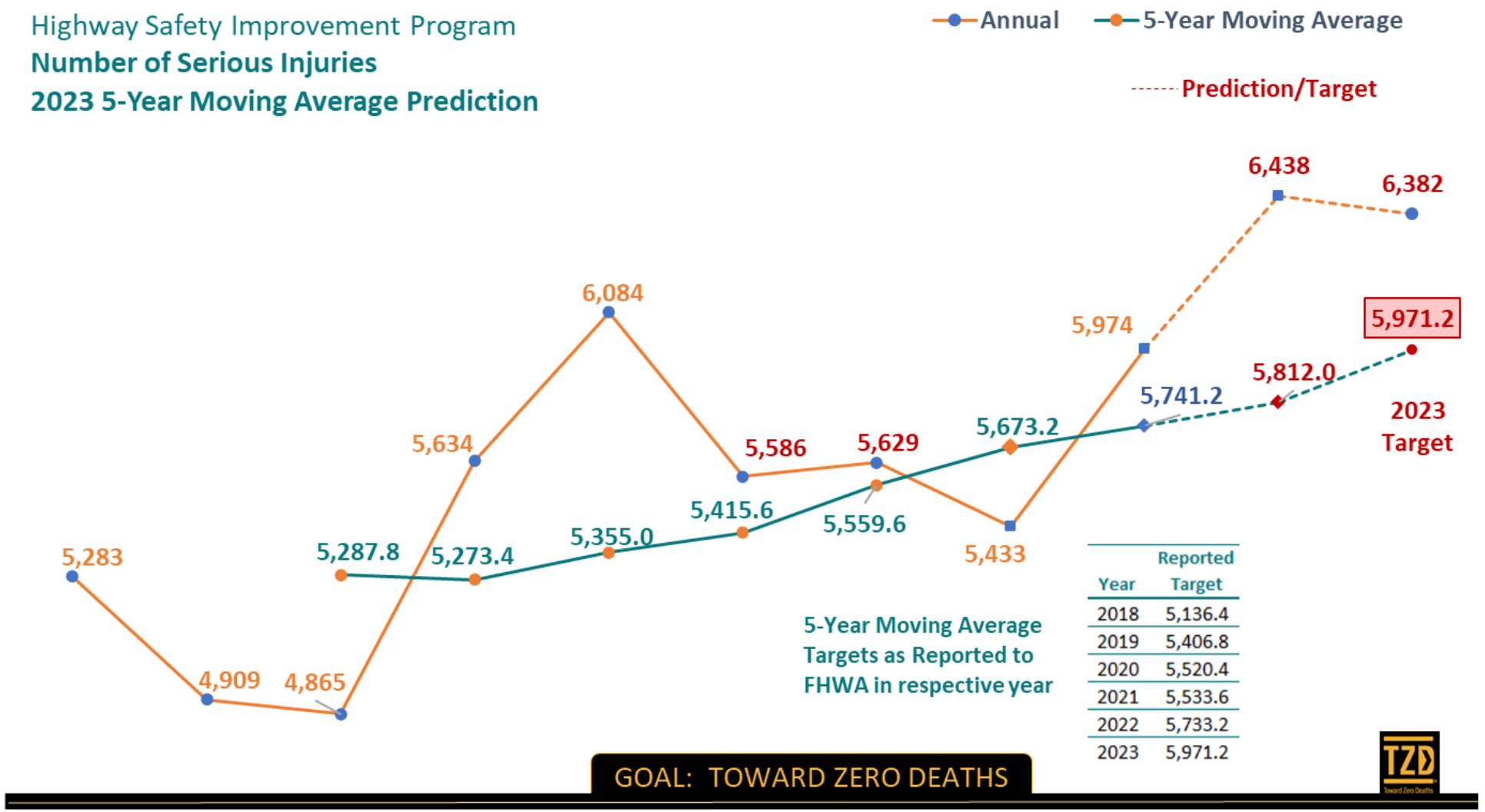


NOTE: 2022 and 2023 forecasted values are based on (1) 2017-2021 5-year rolling average, (2) UMTRI Change-Model prediction for establishing the CY 2023 target, and (3) accounts for exogenous factors and safety programming outcomes

All Michigan public roads

Highway Safety Improvement Program

Number of Serious Injuries
2023 5-Year Moving Average Prediction



Year	Reported Target
2018	5,136.4
2019	5,406.8
2020	5,520.4
2021	5,533.6
2022	5,733.2
2023	5,971.2

NOTE: 2022 and 2023 forecasted values are based on (1) 2017-2021 5-year rolling average, (2) UMTRI Change-Model prediction for establishing the CY 2023 target, and (3) accounts for exogenous factors and safety programming outcomes

All Michigan public roads

TARGET SUMMARY - PRELIMINARY

Measure (5-year rolling average)	Baseline Condition (2017-2021)	2023 Targets (2019-2023)
Number of Fatalities	1,041.2	1,098.6
Rate of Fatalities per 100 million VMT	1.070	1.129
Number of Serious Injuries	5,741.2	5,971.2
Rate of Serious Injuries per 100 million VMT	5.877	6.119
Number of Non-motorized (Pedestrian and Bicycle) Fatalities and Serious Injuries	752.0	738.6

OBSERVATIONS

- Presenting to MPO's has opened the discussion on safety with locals
- Platform for discussion on Safety
- By using DDSA these are predictions not targets
- The HSIP Implementation Plan is a tool that should be utilize no matter what

2020 SAFETY PERFORMANCE MEASURES

Performance Measure	2016-2020 Target	2016-2020 Outcome	2014-2018 Baseline	Met Target?	Better Than Baseline?	Met or Made Significant Progress
Fatalities	999.4	1,028.6	988.2	No	No	NO
Rate of Fatalities	0.970	1.052	0.991	No	No	
Serious Injuries	5,520.4	5,673.2	5,415.6	No	No	
Rate of Serious Injuries	5.340	5.783	5.425	No	No	
Non-Motorized Fatalities and Serious Injuries	735.8	762.4	746.0	No	No	

WHERE DO WE STAND TODAY?

May 31, 2022 - 35 people died on Michigan roadways since last week making a total of 376 this year. In addition, 117 more were seriously injured for a statewide total of 1,693 to date.

Compared to last year at this time there are 32 fewer fatalities and 69 fewer serious injuries.

Numbers are provided by the Michigan State Police.


THE SUM OF ALL OUR EFFORTS IS
ZERO
What will be your effort?
Toward Zero Deaths®
National Strategy on Highway Safety
TowardZeroDeaths.org
www.michigan.gov/zerodeaths

Discussion

- What challenges or benefits have you found with your method of target setting?
- Do you or your agency wish to use a different method but face a barrier?
- Have you been able to leverage the target setting or performance review process to bring about new actions to address performance?
- What elements have made the process more effective/ meaningful?
- Have agencies set increasing (worsening) targets and still missed them?
- How have you successfully communicated your targets to your MPOs? Leadership? The public?