

VRU Countermeasures

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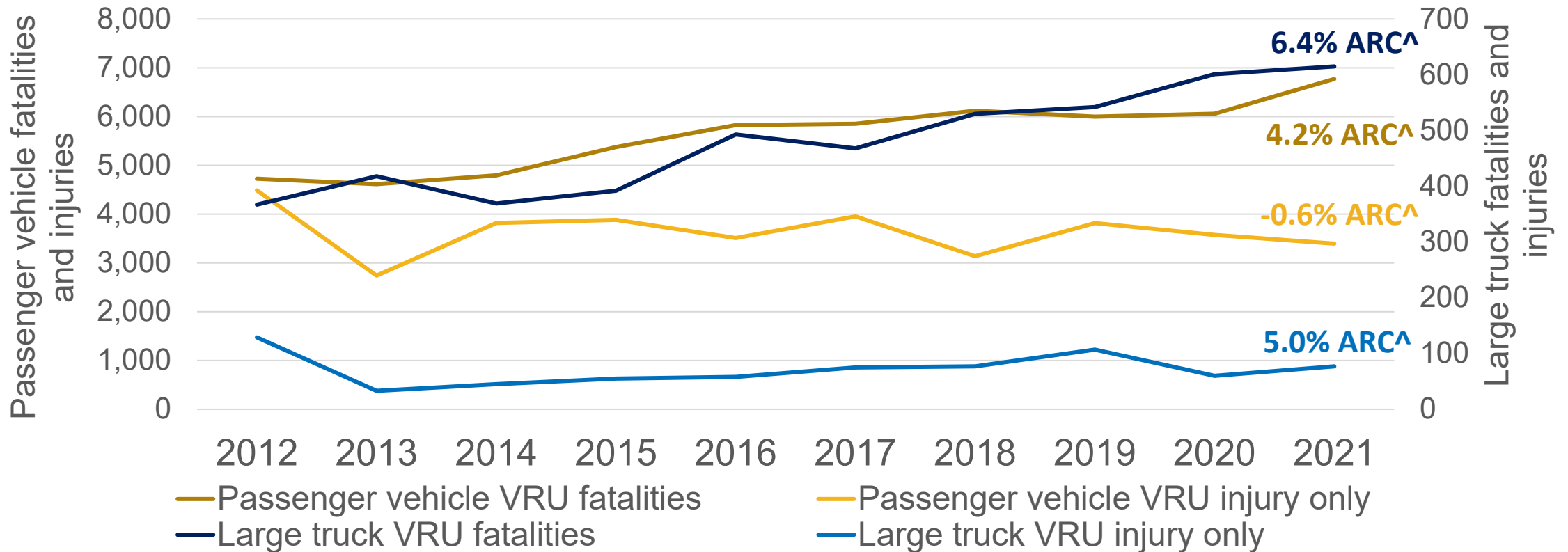
2024

SAFETY
RESEARCH
FORUM

VIRTUAL EVENT



VRU Fatalities & Injuries, 2012 – 2021



^Average Annual Rate of Change

*Based on unrounded injury numbers

Source: National Highway Traffic Safety Administration: Fatality Analysis Reporting System (FARS), Crash Report Sampling System (CRSS)

Project Objectives

1. Identify prevalent and/or risky non-overlapping crash categories
2. For each crash category, identify:
 - Crash patterns
 - Causal or contributing factors
 - Countermeasures that address the patterns and causal factors
3. Identify next steps

Process and Methodology

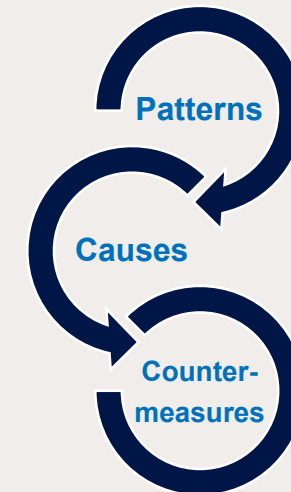
1. Literature Review

- Repository & Open Science Access Portal (rosap)
- Documents provided by modal agencies, journal articles and technical reports
- Stakeholder websites and outreach materials

2. Dataset Analysis

- Fatality Analysis Reporting System (FARS) data for 2015-2020

3. Mapping



Objective 1: Most Prevalent and Risky Crash Types

Objective 2: Patterns, Factors, and Countermeasures Specific to a Given Crash Type

Objective 3: Next Steps

Most Prevalent and/or Risky Crash Categories

Prevalent



Intersection



Ped failed to yield*



Walk/run along roadway*



Crossing expressway*



Disabled vehicle*



Work zone*

Percentage of crashes

19.40%

12.01%

10.25%

10.37%

10.37%

5.46%

Truck to non-truck ratio

0.74

0.59

0.77

2.32

2.83

3.60

$$\frac{\frac{\text{Truck crashes in category}}{\text{Total truck crashes}}}{\frac{\text{Non-truck crashes in category}}{\text{Total non-truck crashes}}}$$

*Not intersection

Crash Category: Intersections



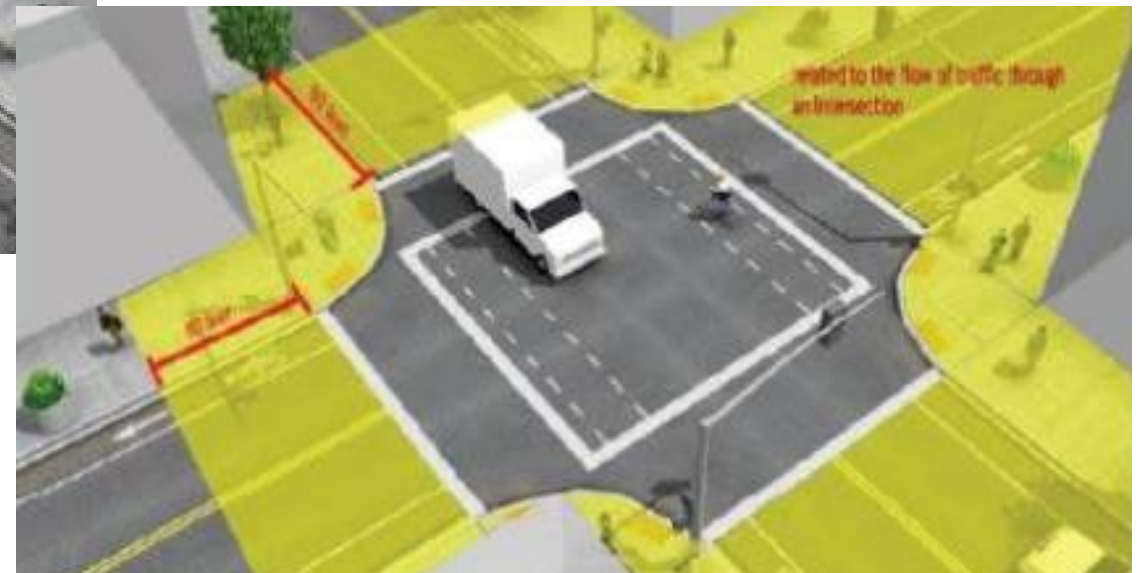
At-intersection



Includes crashes **in the intersection** and **in the vicinity** where traffic flow is affected by intersection

19.40% of fatal pedestrian crashes

47% increase 2015-2019





Intersection Causal Factors

Blind spots

- Mirror and a-pillar visual obstructions align with **8 of 9 directional patterns**

Visual scanning

- May account for crashes where blind spots are not a factor

Ped. failure to yield

- **21%** of at-intersection crashes
- **32%** of intersection-related crashes

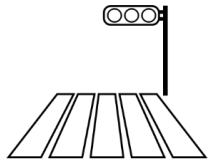
Speeding

- **8%** of at-intersection crashes
- **2%** of intersection-related crashes

Motorist failure to yield

- **<1%** of at-intersection/ intersection-related crashes

Intersection Countermeasures



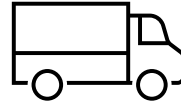
Safer Roads

Signals

- Leading pedestrian intervals
→13% CRASH REDUCTION
- All-pedestrian phasing
→34% CRASH REDUCTION
- Advance pedestrian signs
- Protected only left turns
- Pedestrian countdown signals

Hardscape

- Protected intersection
→100% YIELD TO PEDESTRIANS



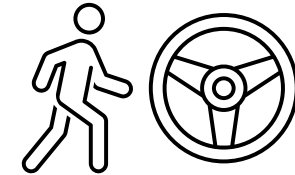
Safer Vehicles

Vehicle design

- High-vision cabs
→32-33% CRASH REDUCTION
- Truck side guards
→12-17% CRASH REDUCTION

Advanced in-vehicle technologies

- Bird's eye view cameras
- Mirror cameras
- Auto. emergency braking (AEB) with pedestrian collision warning (PCW)



Safer People

Driver resources

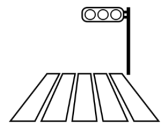
- Hazard anticipation training
→32% CRASH REDUCTION (NOVICE DRIVERS)

Pedestrian resources

- Hazard anticipation training
- Smartphone alerts
- Smart routes to schools

Summary of Countermeasures

Intersection



Pedestrian crossing signals ●
(*ex: leading ped. interval*)

Hardscape

- Protected intersection ●
- Crosswalks and pedestrian bridges ●
- Barriers ●
- Sidewalks ●

Street lighting ●●●●●

Reduce speed ●

Work zone traffic control ●

Live camera feeds ●

Ped. failed to yield

Walk/run along road



Pedestrian education ●●●

Reflective clothing ●●

Smartphone alerts ●

Smart routes to school ●

Triangle/ flares ●

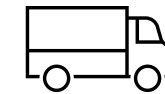


Driver education ●

Headlight maintenance ●

Crossing expressway

Disabled vehicle



Advanced in-vehicle technologies

- Bird's eye view ●
- Mirror cameras ●
- Infrared cameras ●●●●●●
- Auto. emergency braking (AEB) with pedestrian collision warning (PCW) ●●●●●●
- ELD warnings ●●

Vehicle design

- High-vision cabs ●
- Side guards ●

Work zone

Next Steps

- ➔ Prioritize countermeasures for implementation (both immediate longer term)
- ➔ Continue FARS data analysis focusing on similar areas of concern
- ➔ Increase awareness of VRU safety via FMCSA websites; multiagency partnerships; leveraging existing DOT programs and committees; and outreach to States, industry, NGOs, and others

Contact Information

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