



*UNITED STATES*  
**DEPARTMENT OF TRANSPORTATION**

# **Safety Pilot Model Deployment Transit Safety Applications**

ITS Workshop on Connected Vehicles  
Moving from Research Towards Implementation

Chicago, IL  
September 25, 2012

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Federal Transit Administration

# Topics

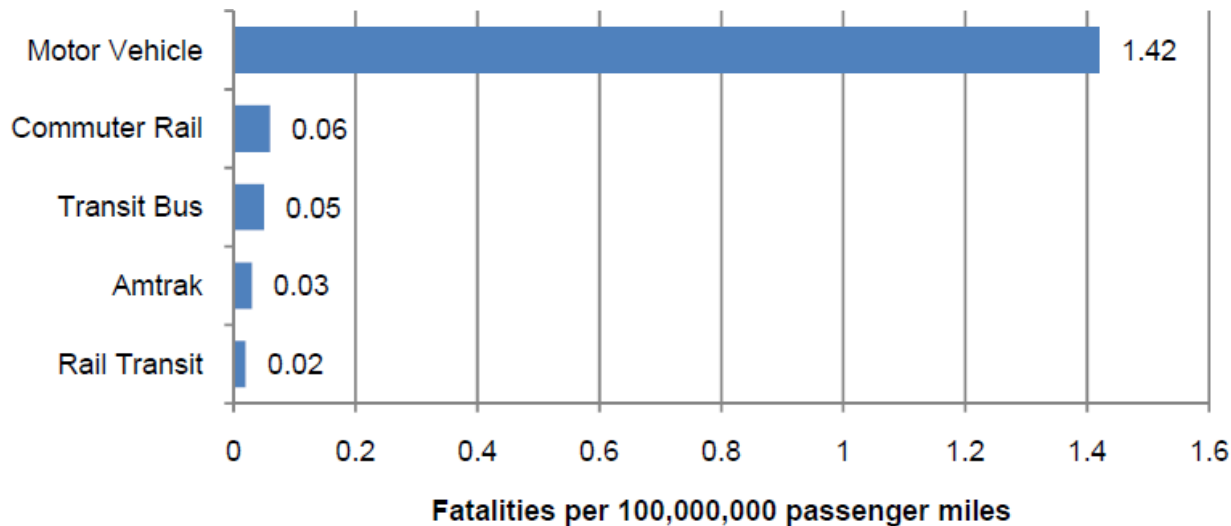
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- Transit Crash Statistics
- Safety Pilot Model Deployment – Transit Safety Retrofit Package (TRP)
- Next Steps & Potential Future Research



# Transit Crashes

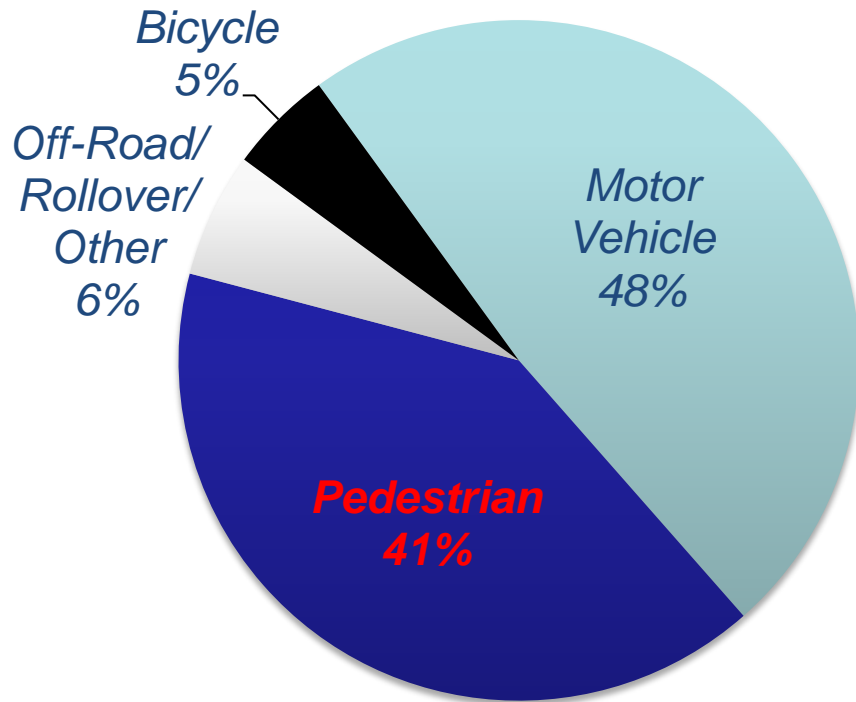
- Over \$250M in damages annually
- Over 100 fatalities with thousands of injuries annually
- Less than 1% of total traffic crash casualties, but often the front-page news



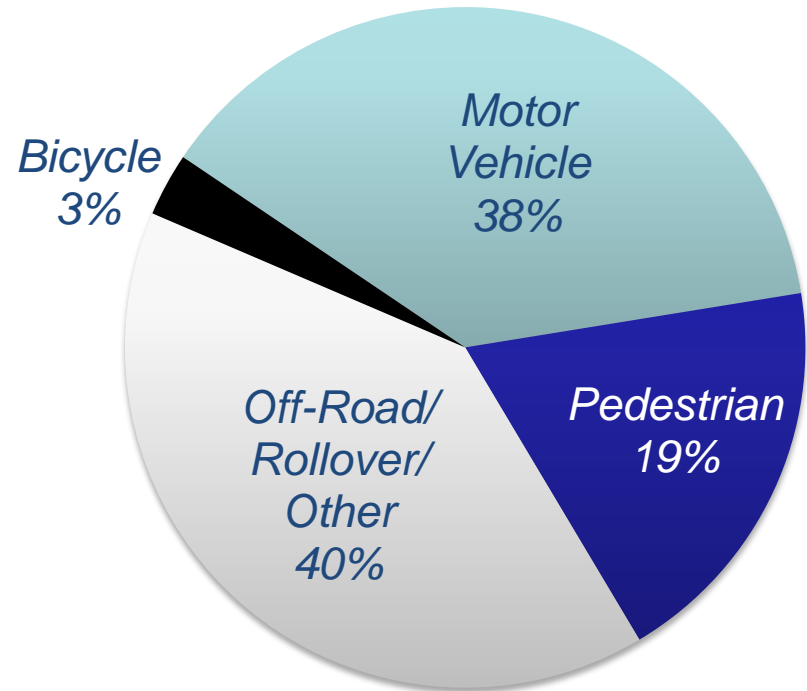
# Fatal Crash Characteristics

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## Fatal Transit Bus Crashes



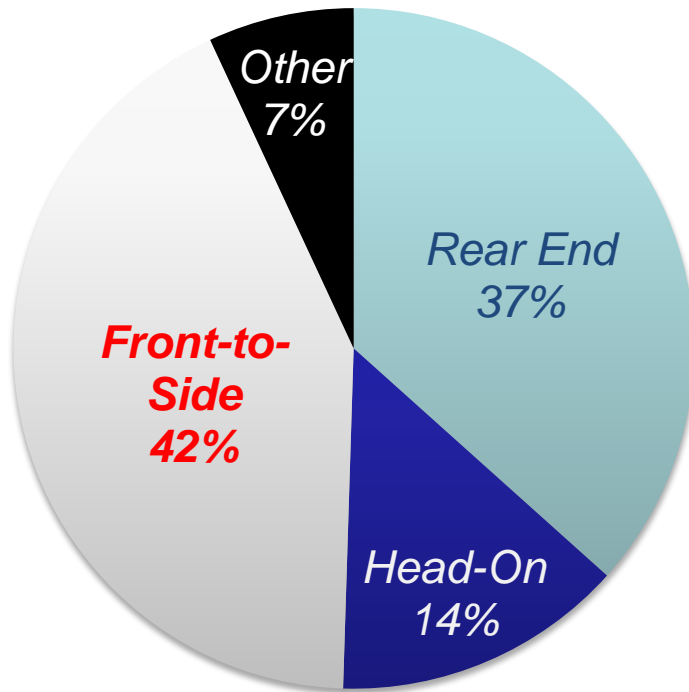
## All Fatal Crashes



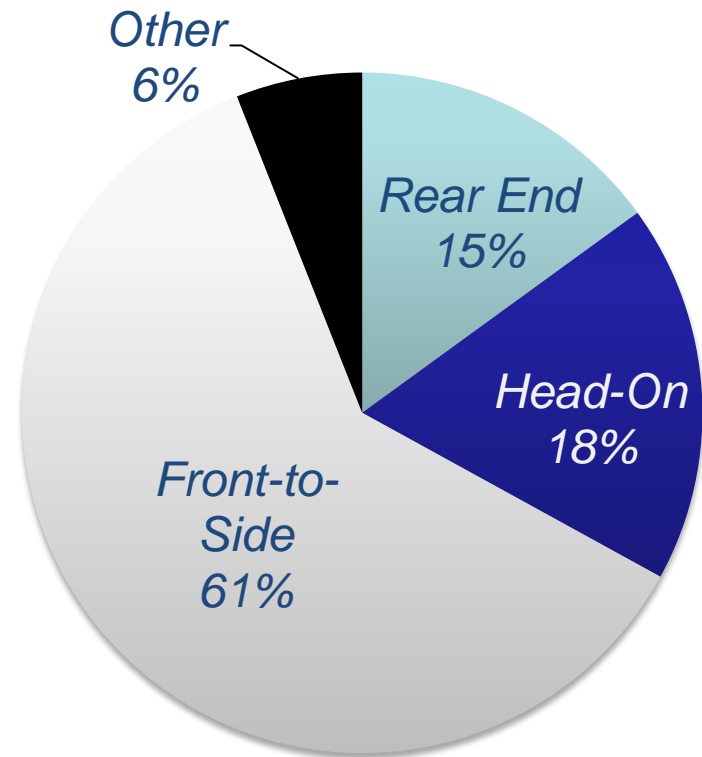
# Fatal Traffic Crash Types

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## Fatal Transit Bus Crashes



## All Fatal Crashes



# Transit Safety Retrofit Package (TRP)

*Battelle ♦ DENSO ♦ UMTRI ♦ Security Innovation ♦ COTA*

## ■ Five Safety Applications:

- *Pedestrian in Signalized Crosswalk Warning - V2I*
- *Vehicle Turning Right in Front of Bus Warning - V2V*
- Forward Collision Warning (FCW) - V2V
- Emergency Electronic Brake Lights (EEBL) - V2V
- Curve Speed Warning (CSW) - V2I

## ■ Phased Deployment:

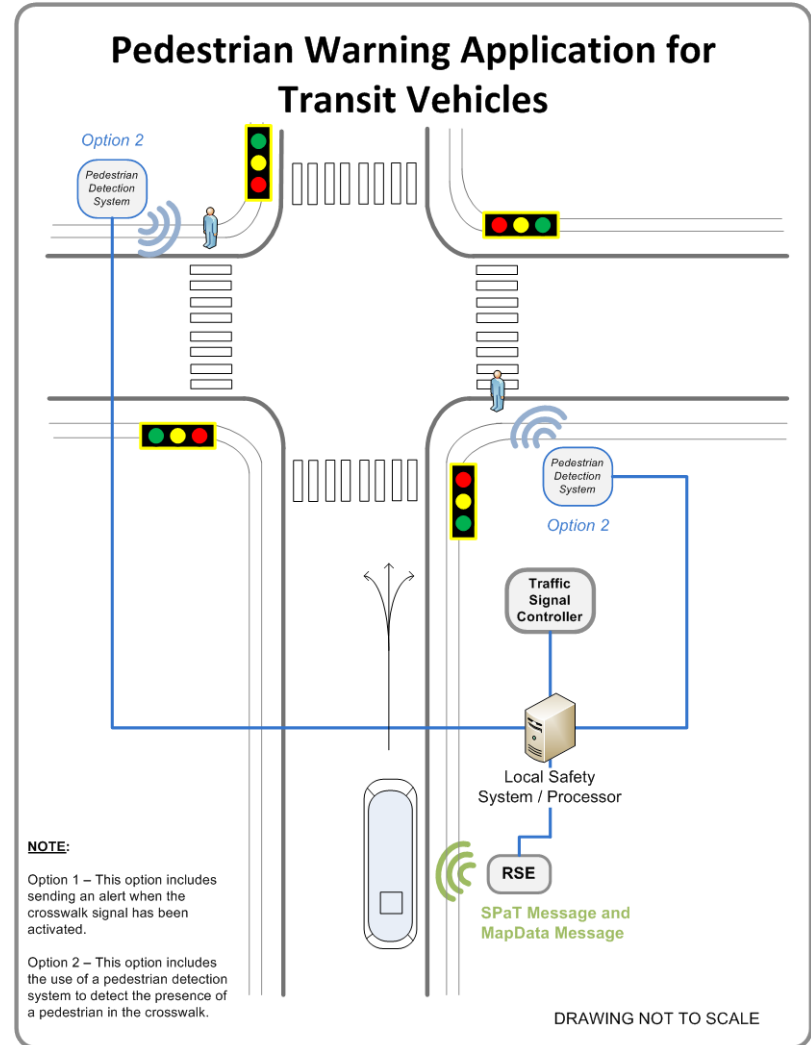
- Phase 1: FCW, EEBL, and CSW, August 2012
- Phase 2: Integrated Data Acquisition System (DAS), October 2012
- Phase 3: Remaining two applications and bus driver training, December 2012



# Pedestrian in Signalized Crosswalk Warning

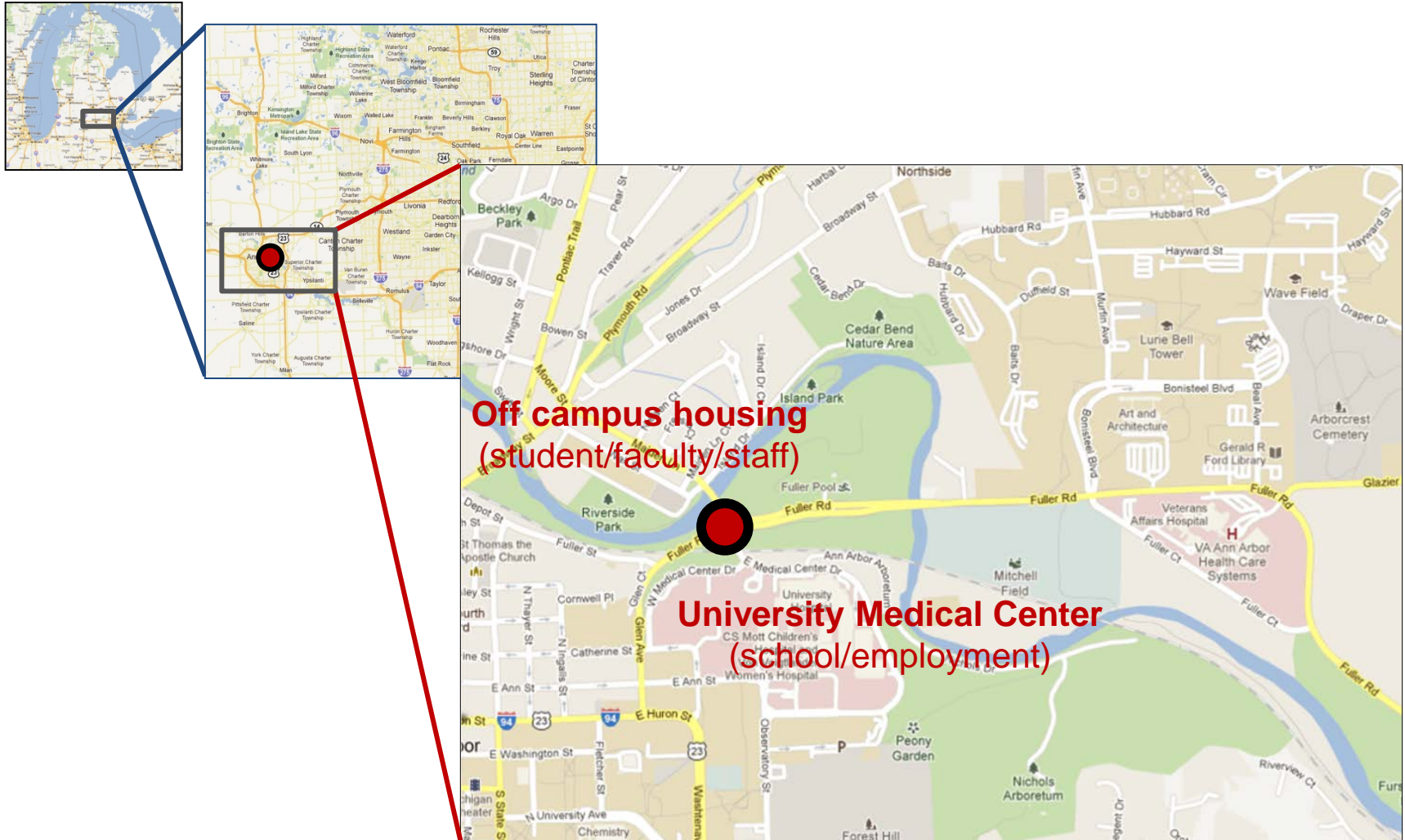
Provide bus driver a warning when a pedestrian is crossing the street as the bus is making a turn

- Application relies on infrastructure for pedestrian detection
- Pedestrians are not equipped with safety awareness devices



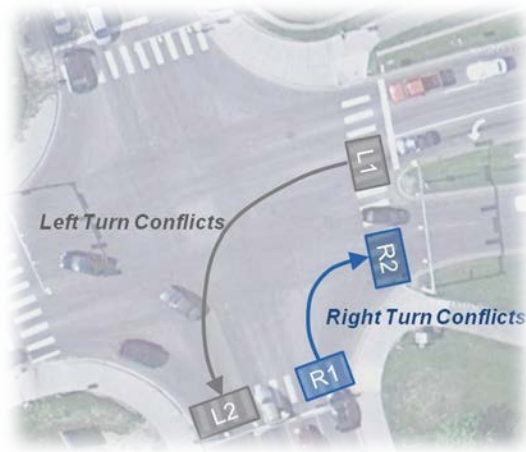


# Pedestrian in Signalized Crosswalk Warning - Location





# Pedestrian in Signalized Crosswalk Warning - Intersection Views

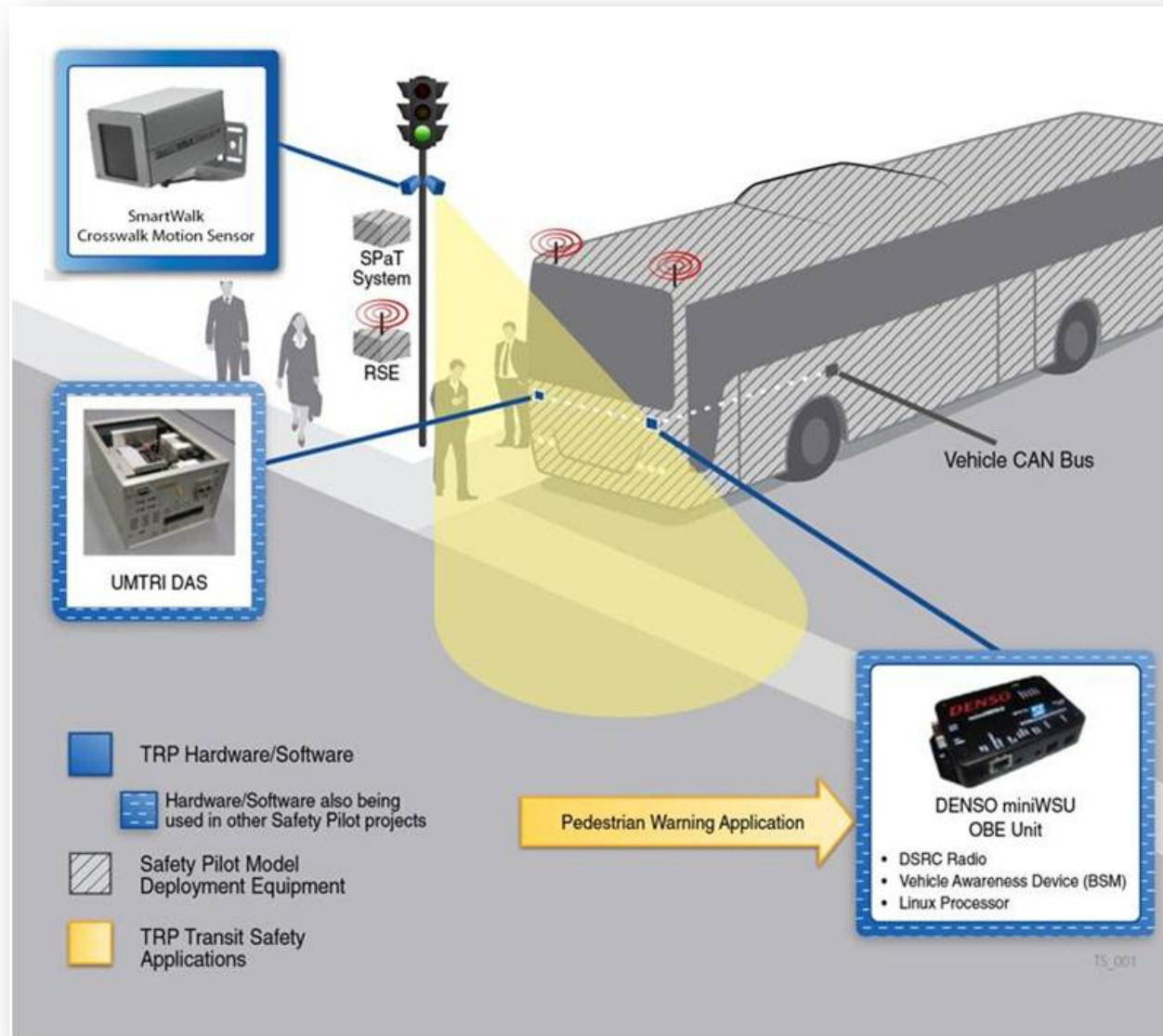


# Pedestrian in Signalized Crosswalk Warning - Intersection and Bus Route Selection

- Reviewed pedestrian accident statistics and conducted field inspection
- Fuller/Maiden fit criteria best
  - Intersection equipped with RSE and SPaT
  - Econolite signal controller
  - No installation issues
  - Multiple U of M bus routes with heavy pedestrian activity
- U of M Commuter route is best fit
  - Operates year-round
  - 6 AM – 1 AM weekdays
  - 10-15 minutes headway
  - Makes both left and right turns
  - Largest number of near-side bus stops



# Pedestrian in Signalized Crosswalk Warning - Concept Illustration

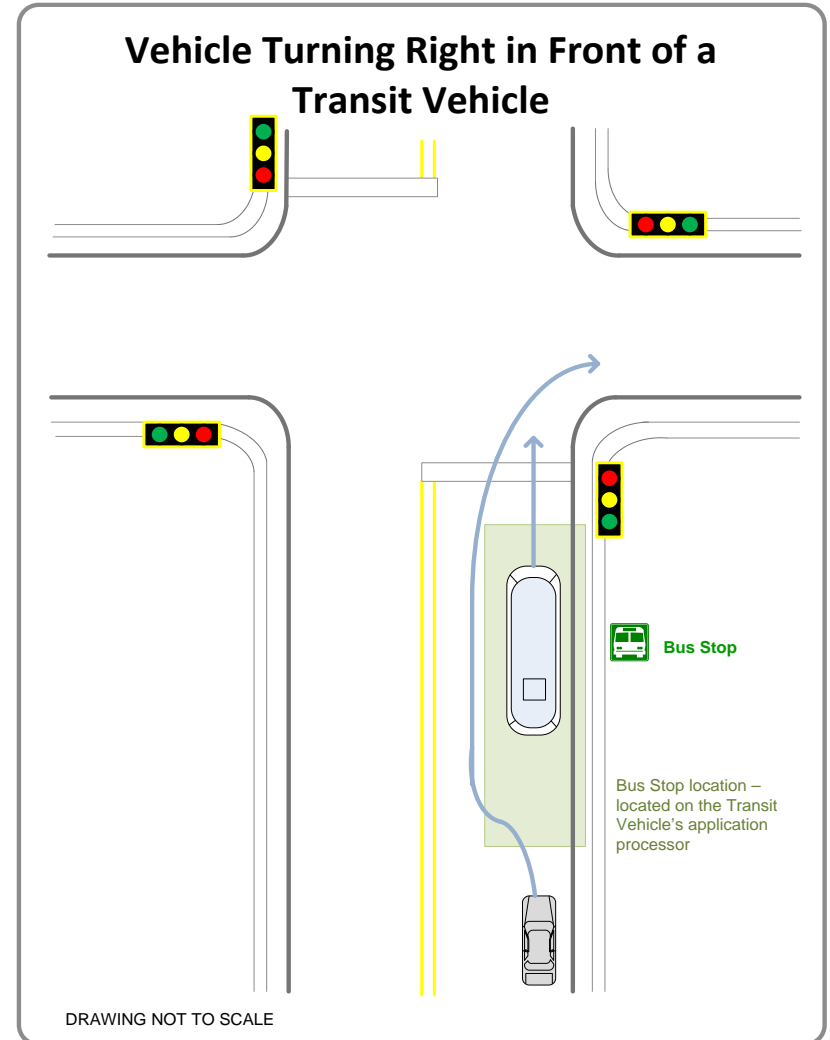


# Vehicle Turning Right in Front of Bus Warning

Provides bus driver a warning when a vehicle turns right in front of a bus as the bus pulls away from a bus stop



Source: [http://www.youtube.com/watch?v=9gXEgFw99\\_0](http://www.youtube.com/watch?v=9gXEgFw99_0)

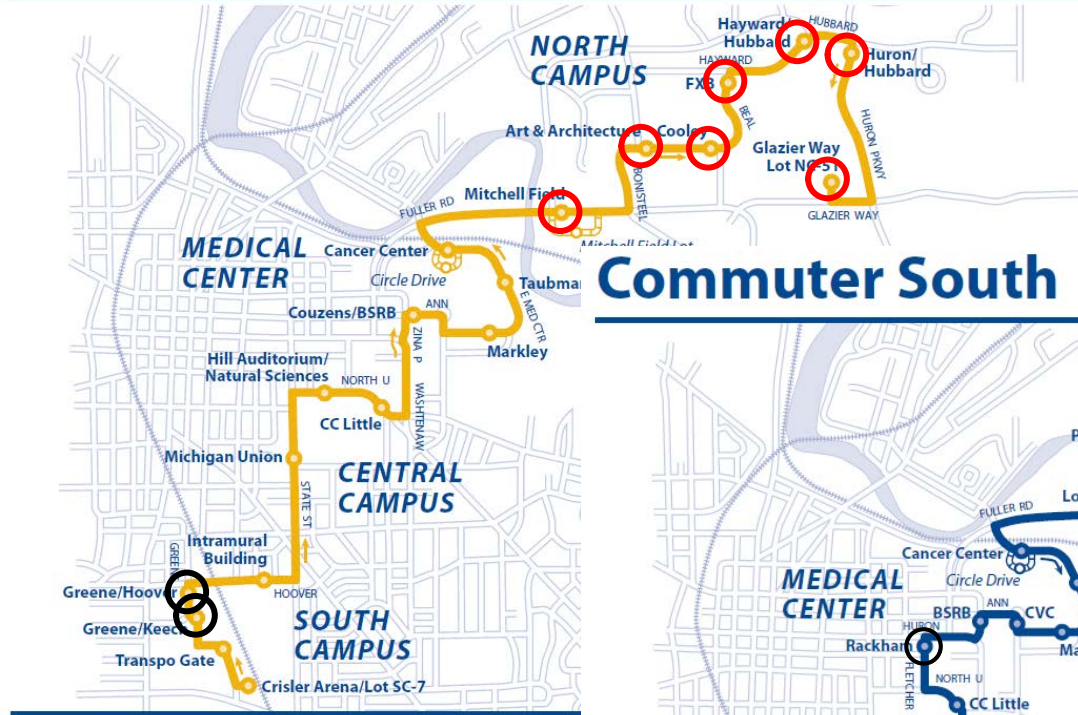




# Vehicle Turning Right in Front of Bus Warning - Locations

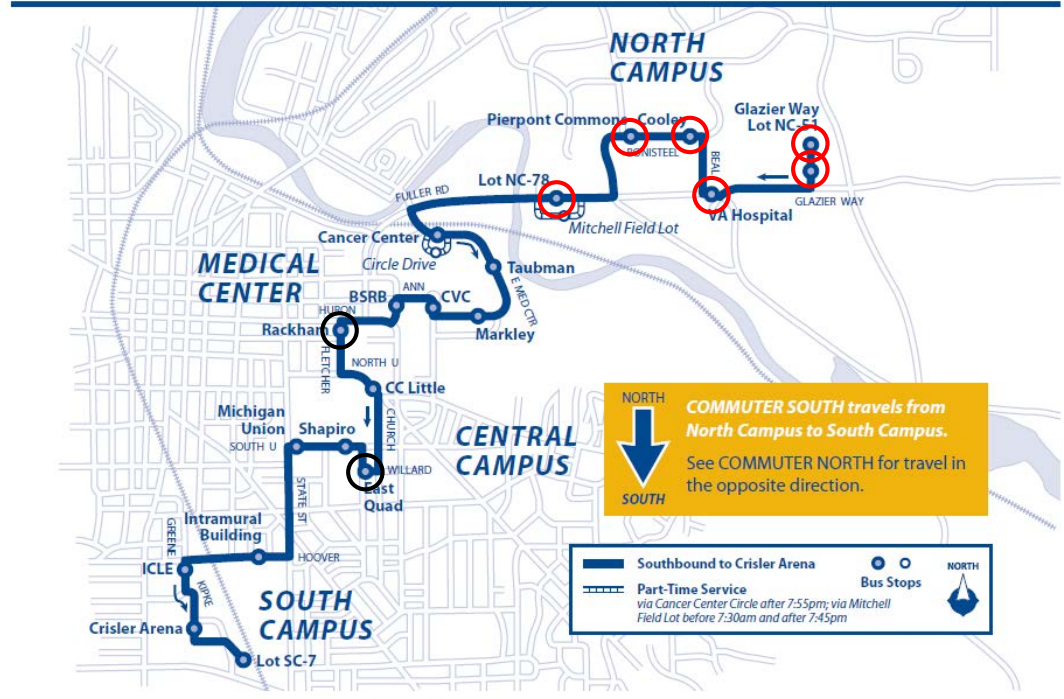
## Commuter North

MON-FRI  
YEAR-ROUND

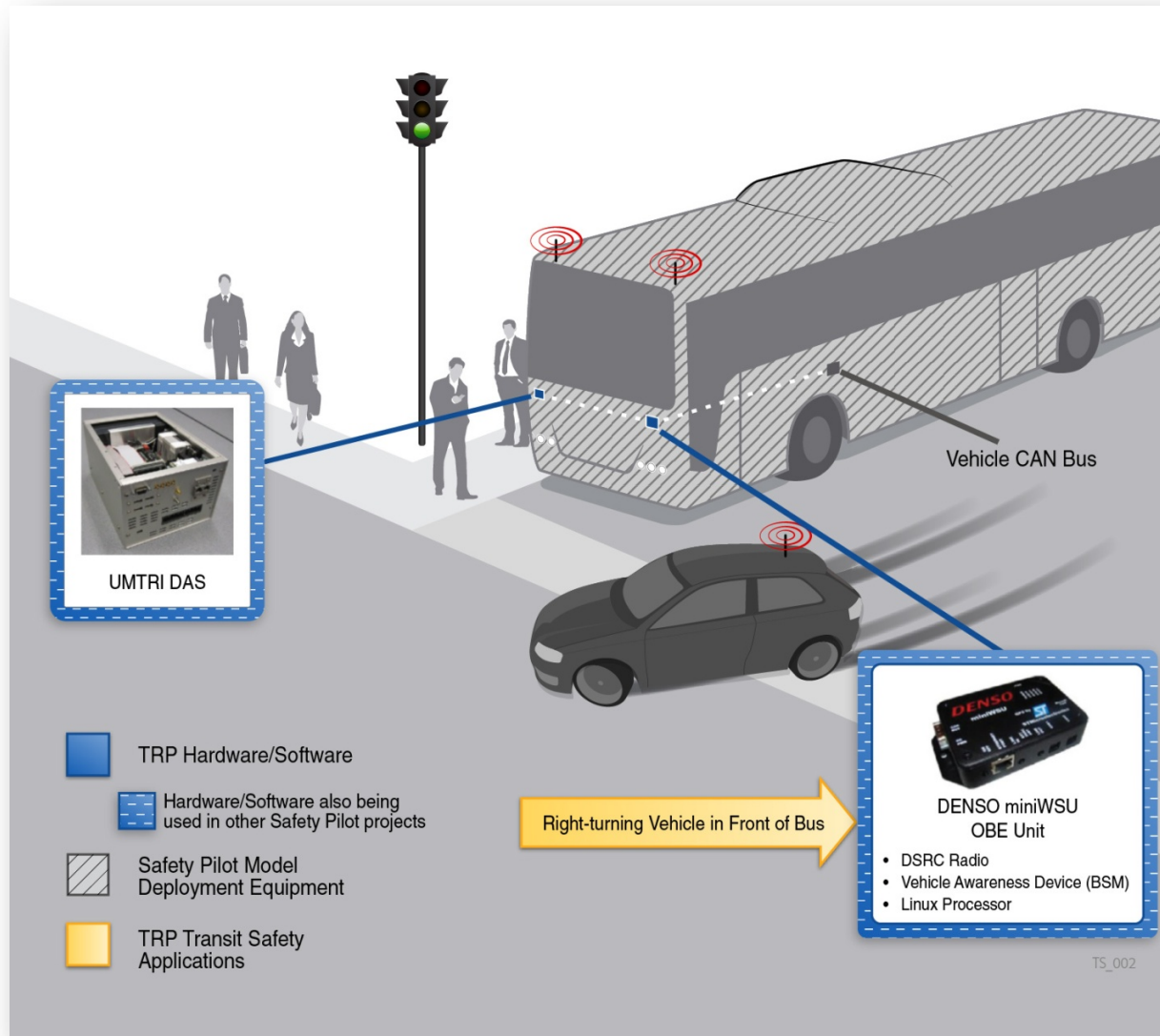


## Commuter South

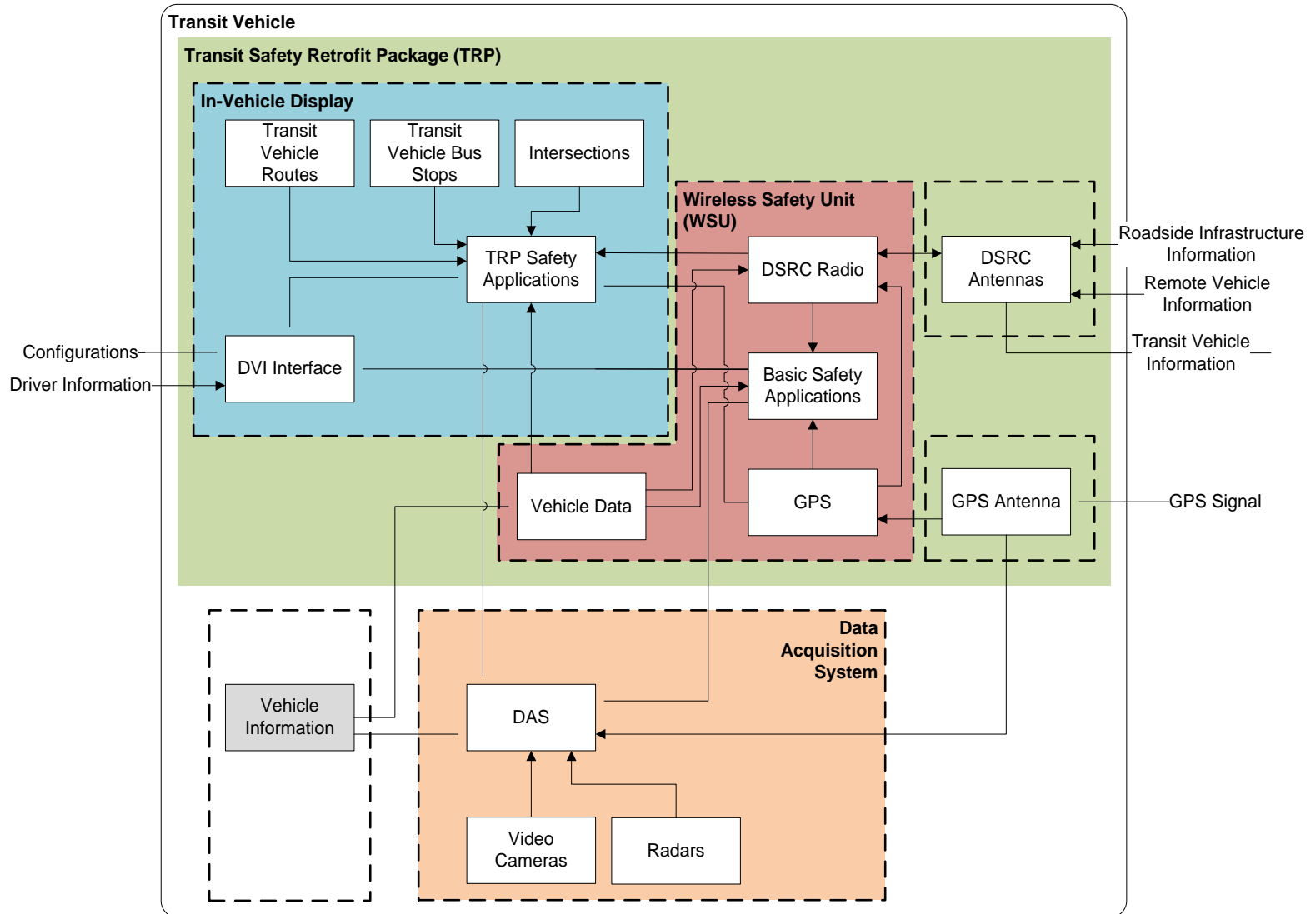
MON-FRI  
YEAR-ROUND



# Vehicle Turning Right in Front of Bus Warning - Concept Illustration



# TRP Architecture





# Next Steps & Potential Future Research

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- Safety Pilot

- Complete TRP phases 2 and 3
- Evaluate TRP applications

- Potential Future Research

- Adapt light vehicle V2V safety applications to transit
  - Blind Spot Warning + Lane Change Warning
  - Intersection Movement Assist
- Collaborate with existing and future V2I safety research
  - Red Light Violation Warning
  - Stop Sign Violation Warning
  - Railroad Crossing Violation Warning
- Develop applications for crashes near transit stops
- Pursue vehicle-to-pedestrian (V2P) safety research



# For More Information.....

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