Safety Pilot Model Deployment
Transit Safety Applications

ITS Workshop on Connected Vehicles
Moving from Research Towards Implementation

Chicago, IL
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Topics

- 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

![Graph showing fatalities per 100,000,000 passenger miles]

<table>
<thead>
<tr>
<th>Mode</th>
<th>Fatalities per 100,000,000 passenger miles</th>
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</thead>
<tbody>
<tr>
<td>Motor Vehicle</td>
<td>1.42</td>
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<tr>
<td>Commuter Rail</td>
<td>0.06</td>
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<tr>
<td>Transit Bus</td>
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<tr>
<td>Amtrak</td>
<td>0.03</td>
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<tr>
<td>Rail Transit</td>
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Fatal Crash Characteristics

Fatal Transit Bus Crashes
- Pedestrian: 41%
- Motor Vehicle: 48%
- Off-Road/Rollover/Other: 6%
- Bicycle: 5%

All Fatal Crashes
- Pedestrian: 19%
- Motor Vehicle: 38%
- Off-Road/Rollover/Other: 40%
- Bicycle: 3%
Fatal Traffic Crash Types

Fatal Transit Bus Crashes

- Front-to-Side: 42%
- Rear End: 37%
- Head-On: 14%
- Other: 7%

All Fatal Crashes

- Front-to-Side: 61%
- Head-On: 18%
- Rear End: 15%
- Other: 6%
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

Off campus housing
(student/faculty/staff)

University Medical Center
(school/employment)
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=9gXEgFe99_0
Vehicle Turning Right in Front of Bus Warning - Locations
Vehicle Turning Right in Front of Bus Warning - Concept Illustration
TRP Architecture

Transit Safety Retrofit Package (TRP)

- In-Vehicle Display
  - Transit Vehicle Routes
  - Transit Vehicle Bus Stops
  - Intersections
  - DVI Interface
  - TRP Safety Applications
  - Basic Safety Applications
  - Vehicle Data
  - GPS
  - GPS Antenna
  - Video Cameras
  - Radars
  - DAS

Wireless Safety Unit (WSU)
- DSRC Radio
- DSRC Antennas
- Roadside Infrastructure Information
- Remote Vehicle Information
- Transit Vehicle Information
- GPS Signal

Data Acquisition System
- Vehicle Information

Transit Vehicle
- Configurations
- Driver Information

Hardware Boundary
Next Steps & Potential Future Research

- 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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