



**Crash Avoidance Technology  
Washington State Transit Pilot**







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**Crash Avoidance Technology - Washington State Transit Pilot**

### **Pilot Overview**

- 8 Transit systems participated
- 3 Month Pilot
- Why WSTIP, Pierce Transit, Munich RE, Rosco, Mobileye became involved
- How we became involved in the advanced safety world



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### PILOT PARTICIPANTS

The slide displays the logos of the transit agencies participating in the pilot program. The logos are arranged in a grid-like fashion. At the top left is Pierce Transit. To its right is communitytransit. Below these are Spokane Transit and INTERcity TRANSIT. The next row features Ben Franklin Transit, Kitsap Transit (with the tagline 'Connecting Communities'), and C-TRAN. The bottom row includes Munich RE, WSTIP, MOBILEYE, ROSCO, and opta.

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### THE PILOT STORY

- WSTIP is the sponsor of a pilot program for the installation, use, and testing of a collision avoidance system.
- This system included cameras, software, and warning devices that were retrofitted on thirty eight transit coaches owned and operated by the eight largest transit systems in Washington State.
- The intended purpose of the system is to alert the coach operator of danger of a collision with another vehicle, object, or pedestrian so the operator can take measures necessary to avoid the collision.
- As part of the pilot program, vendor cameras and other onboard telematics equipment were added to capture events, data and video while the transit coaches were in use. The recorded data and video segments will be analyzed and evaluated to determine the effectiveness of the program

The bottom of the slide features a row of logos: Munich RE, WSTIP, MOBILEYE, ROSCO, and opta.

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## SUMMARY OF LOSSES: 2004 - 2014

Results from:

**\$191 MM Gross Incurred Losses**

41%      59%

■ Total Loss (Claim > 100K)   ■ Total Loss (Claim <=100K)

In total \$191 Million gross incurred losses  
 \$113 Million (59%) for Claims > 100K  
 \$78 Million (41%) for Claims < 100K

We studied gross incurred claims > \$100K

*\*Fixed Route/Para Transit /Vanpool data only*

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## CLAIMS > \$100K

Majority of the losses are collision related losses at 74%.

**CLAIMS > \$100K**

■ Collision Related   ■ Passenger Related   ■ Others

**COLLISION RELATED LOSSES**

3% Other

10% Non-Preventable Losses

15% Forward Collision w/ Other Vehicle

46% VRUs (Pedestrians, Cyclists, Motorcyclists)

**Non-Preventable**

- Side Collision
- Run-Over Traffic Light
- Black Ice
- Bus was Rear-Ended
- Driver Blackout

Second largest type is passenger related loss at 21%.

- Sudden stop related
- On board related, Etc.

Source: WSTIP, KCM, Ohio and CA

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**TOP 5 LARGEST CLAIMS**

Claim Description	Summary	Gross Loss Amount	System Preventable
Bus struck pedestrian in crosswalk.	Hit Pedestrian	\$ 5,088,480.67	YES
Collision between van and motorcyclist.	Hit motorcyclist	\$ 5,067,471.54	YES
Bus left side-mirror struck pedestrian in crosswalk.	Hit Pedestrian	\$ 4,583,675.76	YES
Bus passenger bag strap caught in coach door; passenger dragged. Pedestrian attempting to aid passenger also injured	Passenger Stuck in Power Door	\$ 4,390,930.11	POSSIBLE
Bus mirror clipped pedestrian. Pedestrian fell beneath the bus tires. Expired two hours later	Hit Pedestrian	\$ 3,369,604.92	YES

- 4 Out of 5 could be prevented by a collision avoidance system
- \$18 Million could be saved (~16% among total large losses)

Source: WSTIP, KCM, Ohio and CA



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**GOALS OF THE WA PILOT**

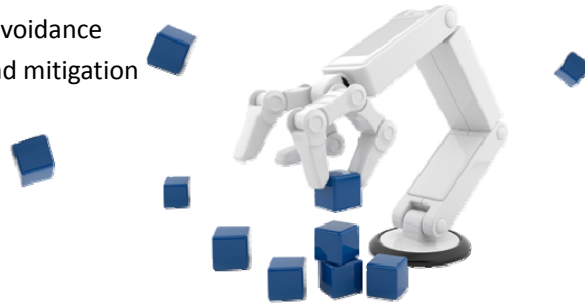
- Create a data driven robust demonstration pilot for active safety/collision avoidance
- Determine the ease of retrofit of the existing fleet
- Develop a methodology for estimating the full costs savings of avoided collisions for each agency
- Develop a methodology and evaluation process for transit operator feedback and acceptance Provide data and understanding on entrance barriers to this technology (i.e. operational acceptance and rejection issues).
- Develop and document data analysis methodologies for assessing the performance of the ROSCO Mobileye system;
- Analyze event logs, video data, and vehicle telematics data to evaluate the performance of the ROSCO Mobileye system;
- Design and apply methodologies for estimating the cost savings of avoided collisions for transit vehicles;
- Document methodologies and findings for draft and final reports



## LEVEL 2 AUTOMATION

### POTENTIAL IMPACT FOR TRANSIT CLAIMS REDUCTION

- Adaptive Cruise Control
- Autonomous emergency braking
- Blind spot monitoring (for vehicles and pedestrians)
- Driver fatigue and attentiveness monitoring
- Lane keeping assistance
- Obstacle detection and avoidance
- Rear collision warning and mitigation



## System Configuration - Alerts and Warning Displays

### CENTER DISPLAY & EYEWATCH



- Center Display
- Contains the Pedestrian Display and EyeWatch.
- The EyeWatch readouts and explanations can be found below on this document.



- Yellow illumination with no sound
- Indicates a pedestrian or cyclist is in front of the moving bus or coming towards the moving bus.
- Operator should exercise additional caution until verifying that the danger of collision has passed.



- Red flashing with beeping sound
- Indicates a pedestrian or cyclist is in front of the moving bus or coming towards the moving bus and collision is imminent.
- Operator should take action to carefully stop bus to avoid collision.



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Center indicator illuminates as pedestrian crosses in front of moving bus during testing



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## Telematics - Monitoring System Performance

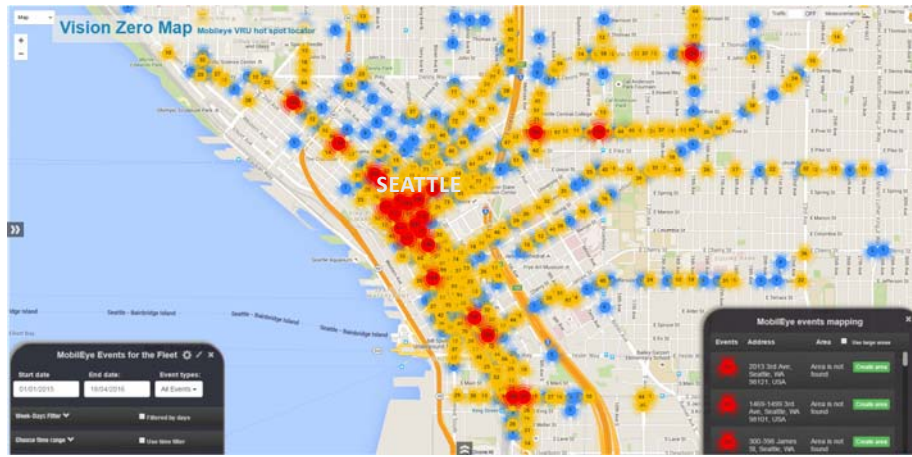
- The CAS does not record video
- Additional cameras record video of events
- Additional technology is used to generate data that can be used to evaluate the systems' effectiveness
- Telematics unit captures and transmits data





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## TELEMATICS DATA



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### Data Collection

April 1, 2016 – June 30, 2016

- 352,129 operating miles
- 23,798 operating hours
- 250 driver surveys returned
- 178 comments received
- 16,600 hours of video
- 10,000 events logged
- 19 TB of video storage
- **No pedestrian or forward collisions**



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## Pierce Transit's Continuing Research in Collision Avoidance

- Pierce Transit receives \$1.66 million grant from Federal Transit Administration (FTA) to install bus safety technology
- 176 buses will be equipped with Shield+ CAWS
- Buses will be operated and data recorded for a full year
- Some buses will also be equipped with Automated Emergency Braking for testing



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## Lessons Learned

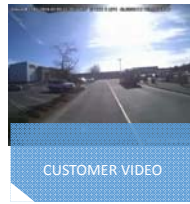
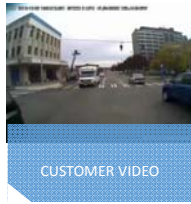
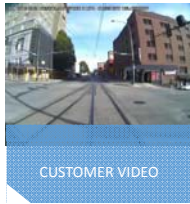
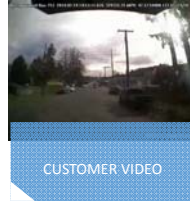
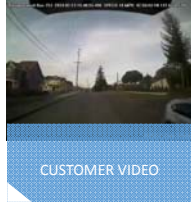
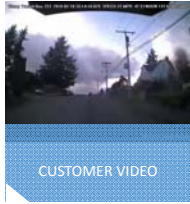
- Collision avoidance technology is not a substitute for defensive driver training, it is a redundancy for ***“practical drift”***
- Take time to explain to operators what to expect and what is needed when piloting or first using the collision avoidance system
- Have system in place and communicate to all participants avenue for providing feedback
- Keep everyone in the communication loop from the beginning: Vendor, Maintenance, Operators, Safety and Training, Procurement
- Provide timelines and share data with all stakeholders once pilot is completed





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**SHIELD+ PILOT VIDEOS**



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**Thank You**

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