

Mitigating Wrong-Way Driving Crashes

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Texas Statewide
Impaired Driving Forum
February 7, 2018



What is Wrong-Way Driving (WWD)?

An event where a driver, inadvertently or deliberately, drives in the opposite direction.



Photo courtesy of TxDOT

Nationwide WWD Crashes

- 3% of all crashes on freeways
- About 270 fatal crashes per year
- Results in 360 fatalities per year

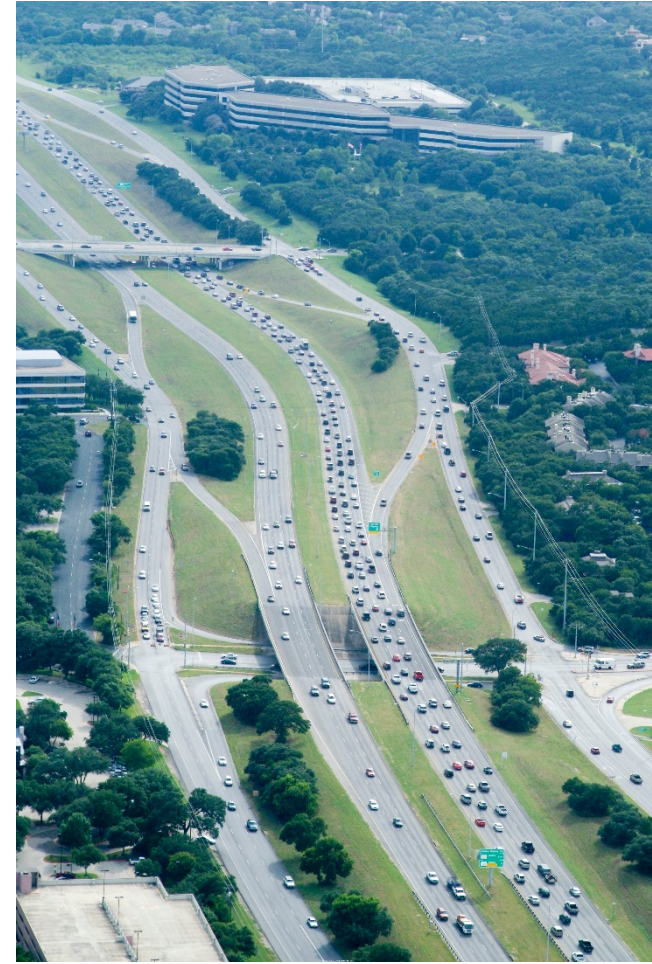


US WWD Fatalities By State (2004-2011)

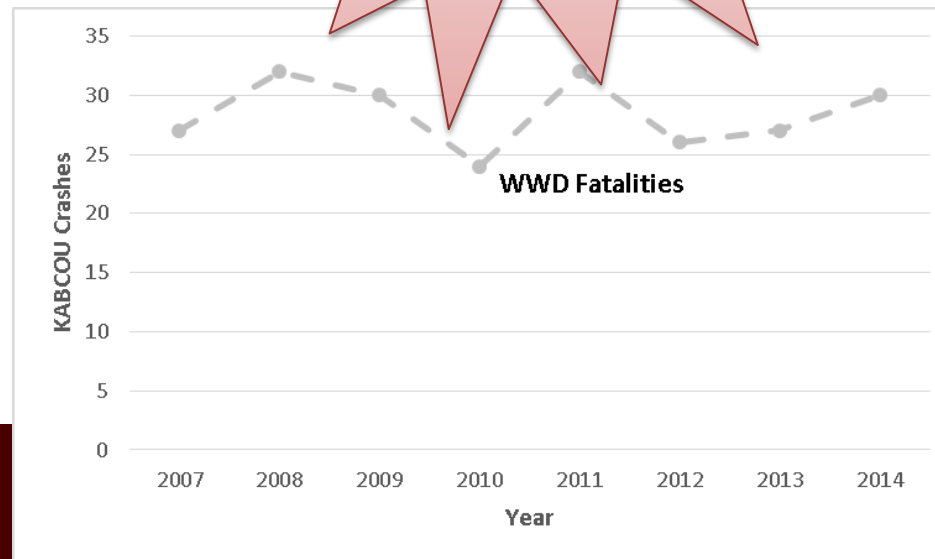
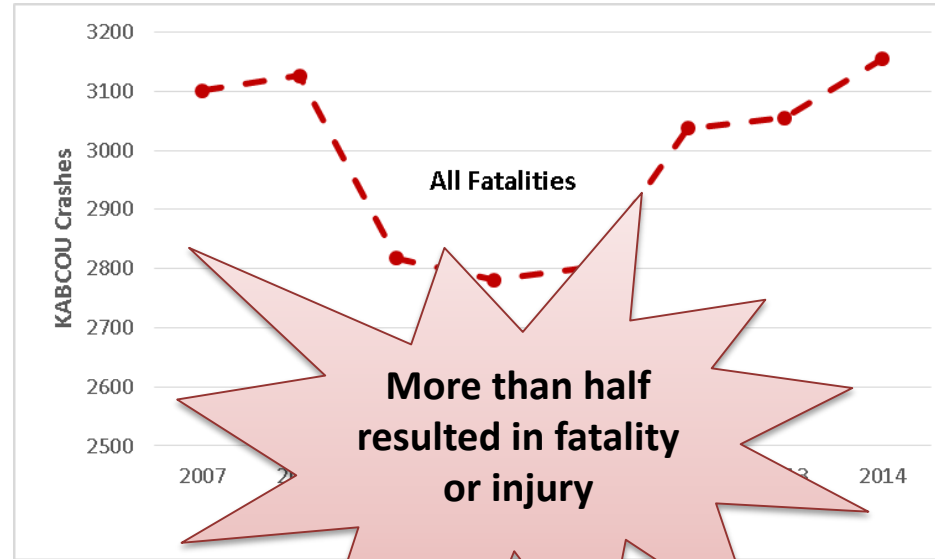
State	Average Frequency	Percent of US Total
Texas	51	14
California	35	10
Florida	28	8
Pennsylvania	14	4
Missouri	13	4
	Total	40

Texas WWD Crashes (2007-2011)

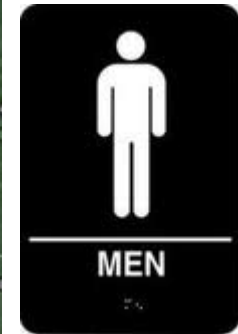
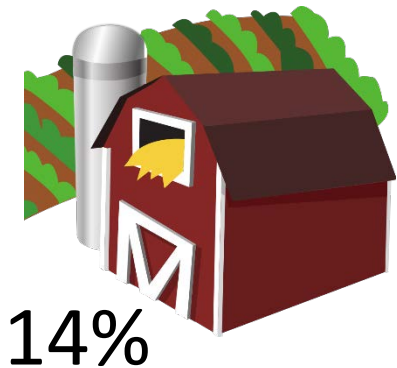
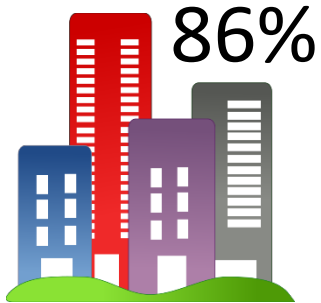
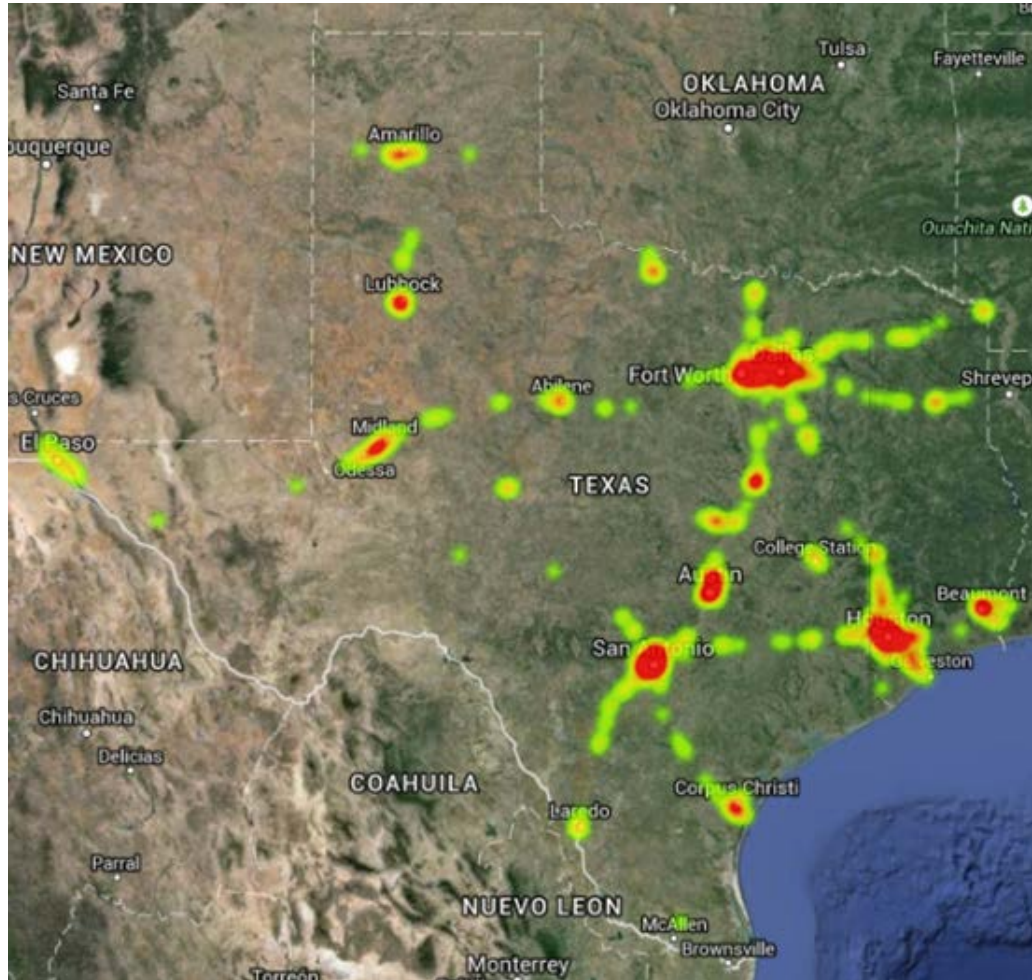
Functional Class	Number of Crashes	Percent of Crashes
Freeway	1409	21
Frontage Road	38	1
Other	4392	68
Unknown	664	10
Total	6503	100



Texas WWD Crashes on Freeways

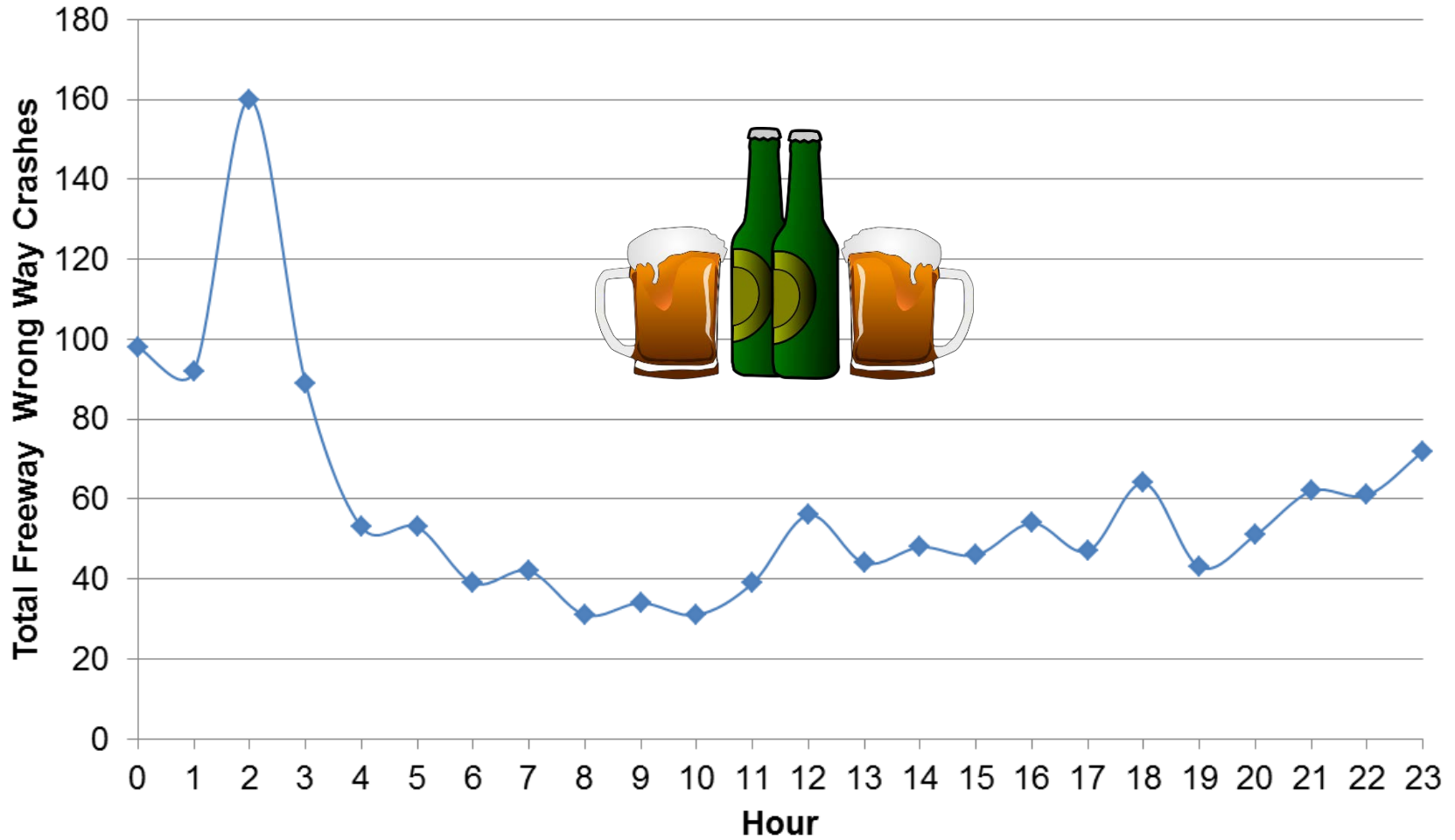


Texas WWD Crashes on Freeways*



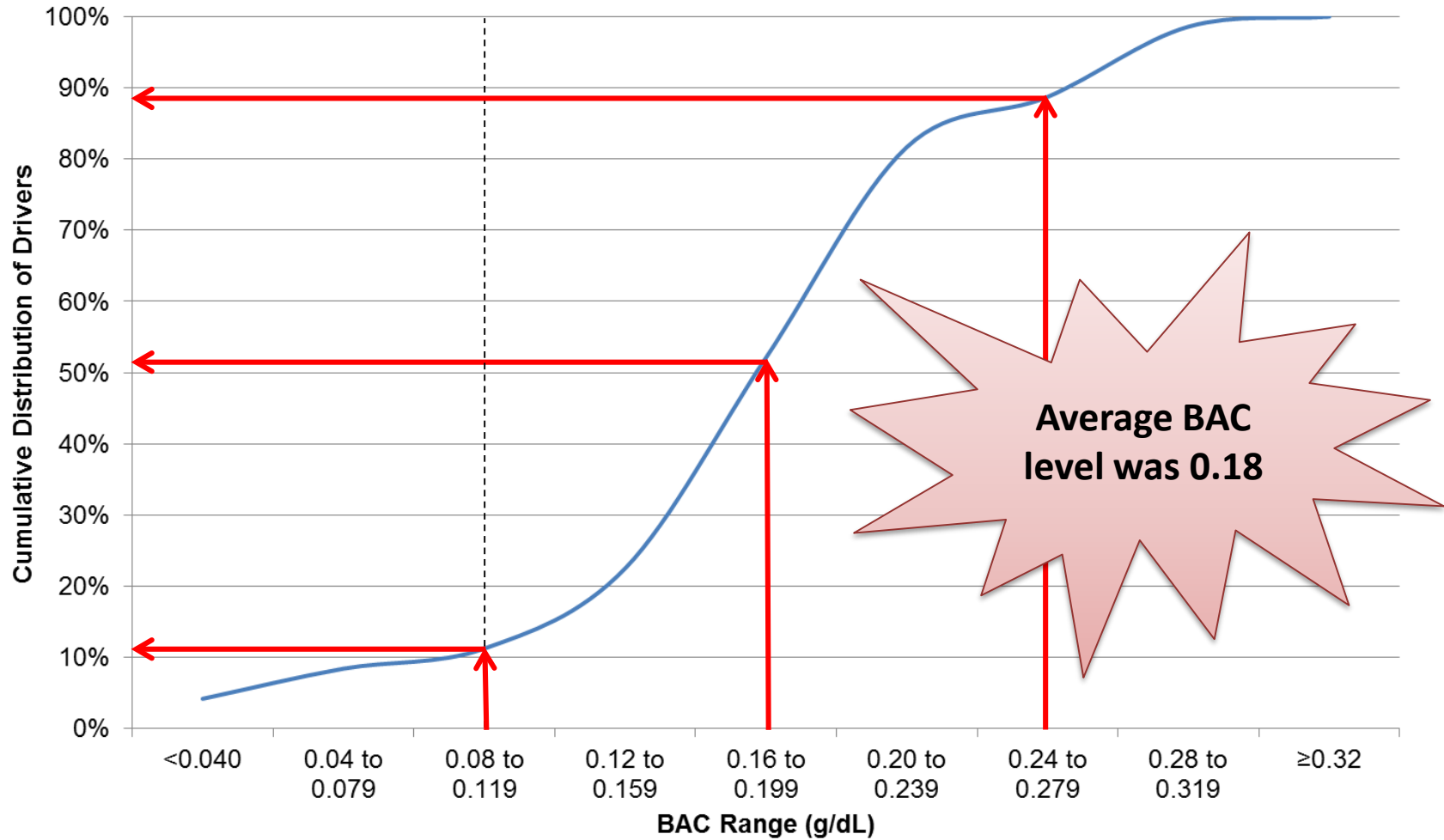
* 1187 crashes on Texas freeways from 2010 to 2014

Texas WWD Crashes by Time of Day*



* 1409 crashes on Texas freeways from 2007 to 2011

Blood Alcohol Concentration*



* Only reported for 71 out of 228 drivers that were tested from 2010 to 2014

A Few More Things to Consider

- Majority of specific entry points unknown
 - Primary origin is entering an exit ramp in the wrong direction
 - Other origins include u-turns on main lanes, u-turns at entrance ramp, and crossing median
- More WW movements (events) than crashes



San Antonio Area WWD Data



Avg. 33 Crashes/year*



Avg. 447 Events/year**

* CRIS data from 2010 to 2014

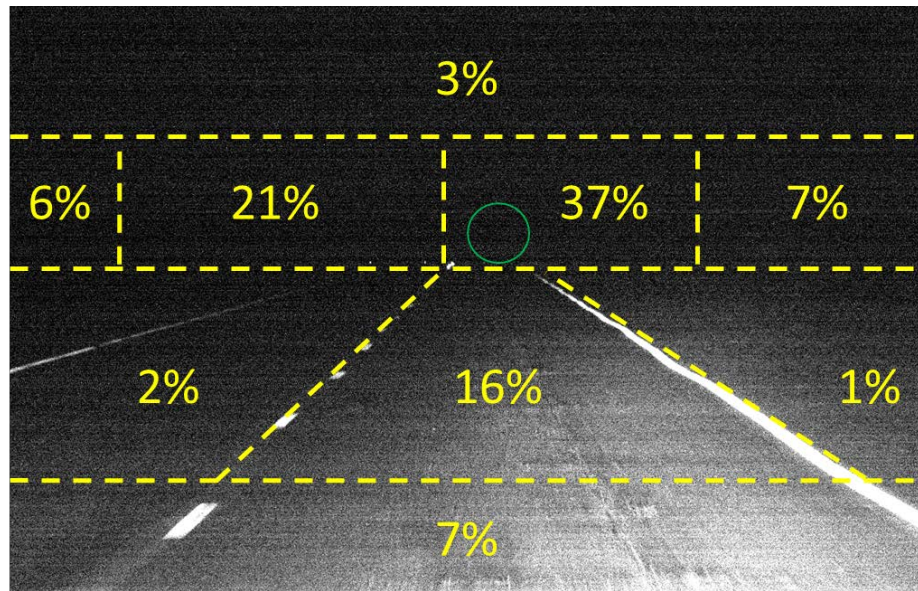
** SAPD data from 2011 to 2015

Alcohol-Impaired Driver Study

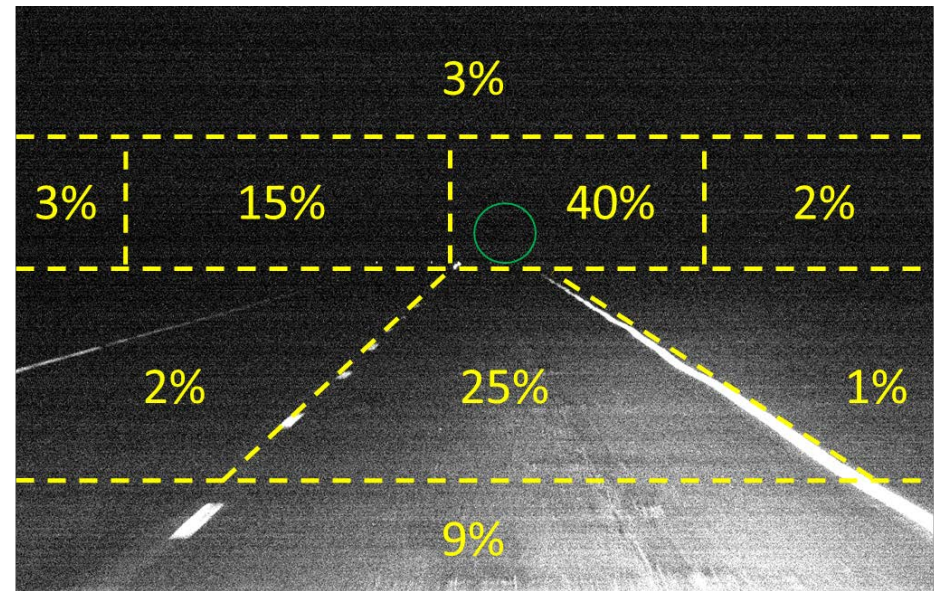
- Conducted at night on a closed-course
- Phase 1 study objectives
 - Determine where alcohol-impaired drivers look
 - Determine impact of alcohol on sign color recognition
 - Determine impact of alcohol on sign legibility distance
- Phase 2 study objective
 - Assess conspicuity of select WWD countermeasures using alcohol-impaired drivers



Where Do Alcohol-Impaired Drivers Look?



BAC = 0.00



BAC = 0.12

- Look more at pavement in front of vehicle
- Concentrate glances in a smaller area

Other Research Findings

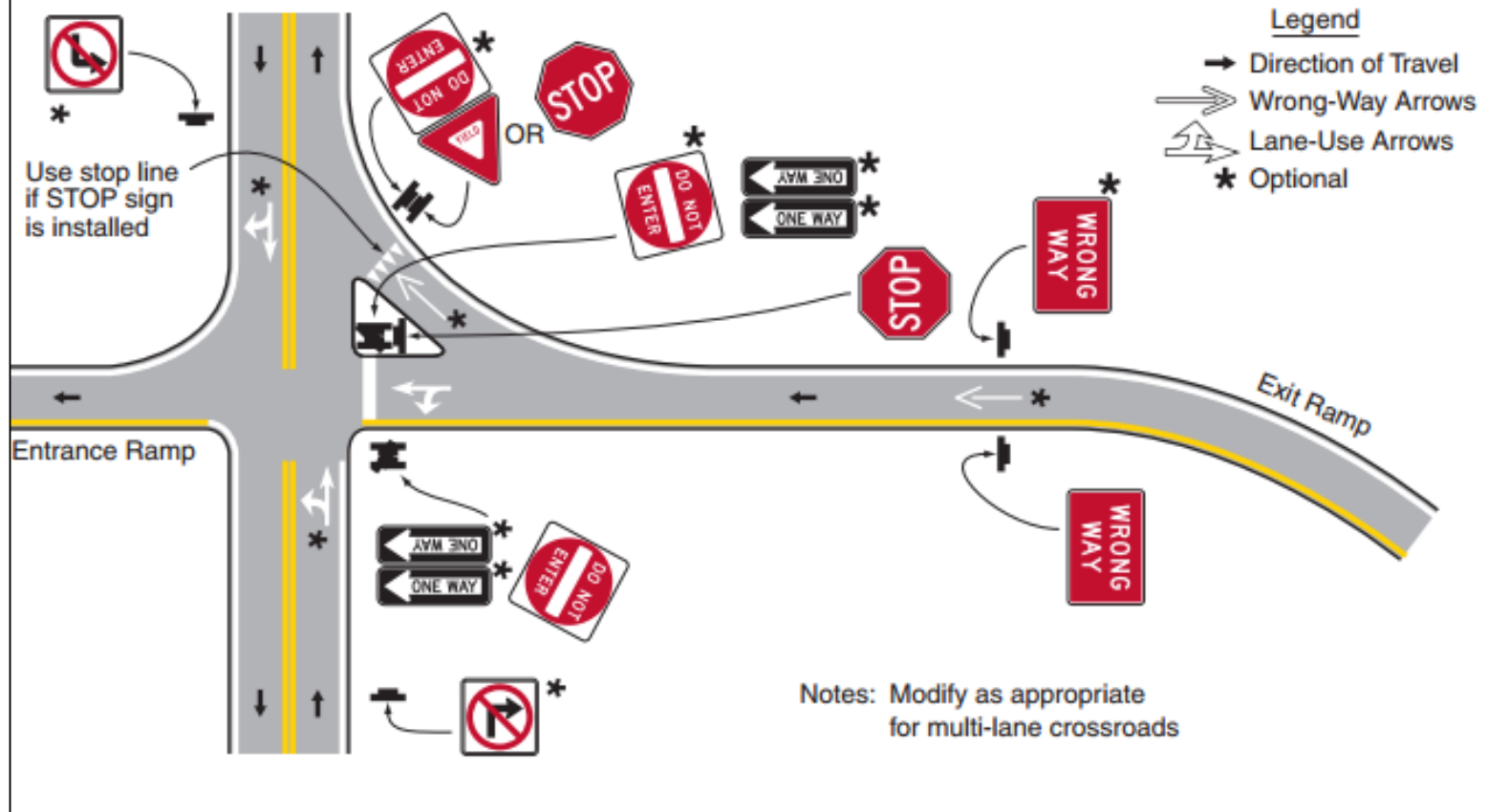
- At higher BAC levels must be closer to sign to
 - Identify sign background color
 - Read sign legend
- At higher BAC levels drivers misidentified red sign background color as orange
- At higher BAC levels takes longer to find signs and arrow pavement markings

Big Picture

- Variety of countermeasures and mitigation methods needed to combat WWD
 - Low-cost traffic control devices are effective
 - Some WW drivers will still enter freeway
- Need capability to detect, monitor, and warn
 - Limitations with current capabilities
 - Connected vehicles (CVs) provide a new approach

2011 Texas Manual on Uniform Traffic Control Devices (MUTCD)

Figure 2B-18. Example of Application of Regulatory Signing and Pavement Markings at an Exit Ramp Termination to Deter Wrong-Way Entry



Signing Countermeasures



Signing Countermeasures, cont.



Signing Countermeasures, cont.



Marking Countermeasures



Marking Countermeasures, cont.



Marking Countermeasures, cont.



Warning Messages for DMS

- WARNING

- Conveys urgency
- Distinguishes from traffic safety messages



**WARNING
WRONG WAY DRIVER
REPORTED**

- WRONG WAY DRIVER

- Do not split phrase onto two lines
- Location implied
- Non-specific driving action implied

- REPORTED

- Validation that ongoing event



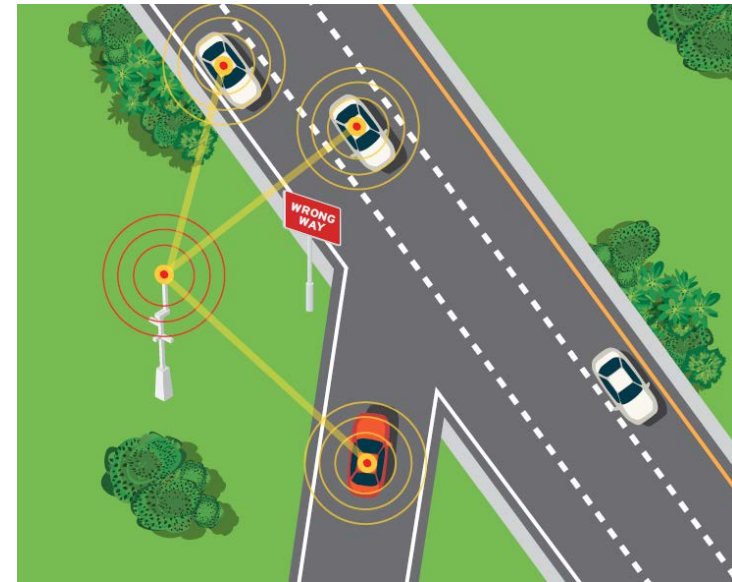
Key CV System Features

- Reduce the time from detection to alerting the right way drivers and law enforcement
- Ability to provide warning message in-vehicle in addition to broadcasting to DMS

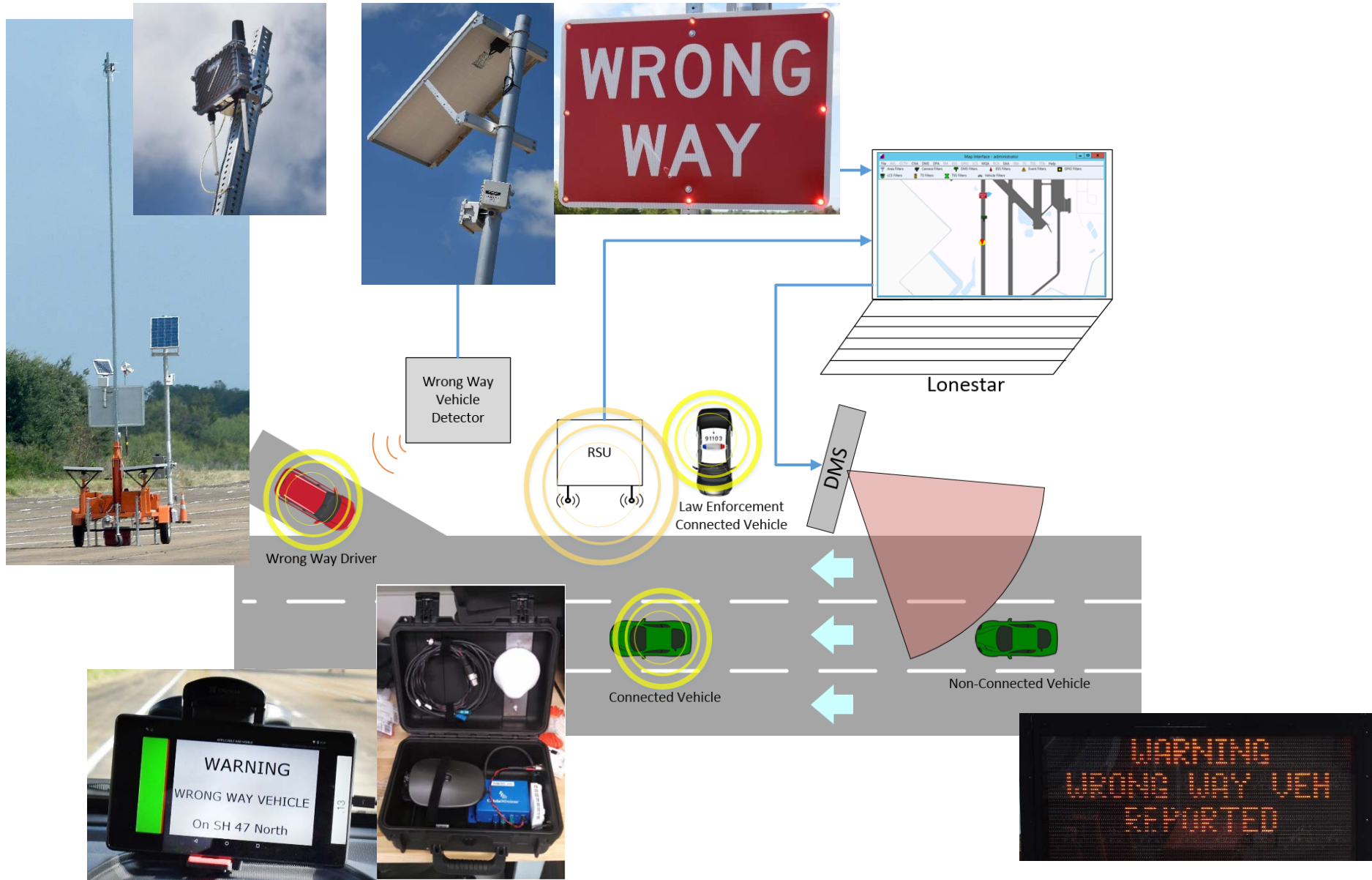


How Do CVs Work?

- Dedicated short range communication (DSRC)
 - Roadside unit (RSU)
 - Onboard unit (OBU)
- Basic safety message (BSM)
 - Position
 - Direction
 - Speed
- Roadside alerts (RSA)
- Map message



TxDOT CV System Architecture



Types of In-Vehicle Messages



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