WRONG WAY DRIVER COUNTERMEASURES
USING CONNECTED VEHICLE TECHNOLOGY

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Wrong Way Driver Countermeasure Challenges

• Detection

• Warning
  • Alerting the Wrong Way Driver
  • Alerting the Traveling Public in the Vicinity
  • Alerting the Authorities

• Intervention
  • Authorities
  • Traffic Management Response
Benefits of Connected Vehicle Technology

• Low-latency, high-availability communications
• Integration with vehicle’s onboard systems
• Known position and heading of CV equipped vehicles
  • No guesswork on position and direction vehicles are traveling
  • Automatically passed from the vehicle to other vehicles and infrastructure
• Future integration with transportation infrastructure
How Can Connected Vehicles Assist?

- Detection
- Warning
  - Notification to existing infrastructure
  - Infrastructure to Vehicle (I2V)
  - Vehicle to Vehicle (V2V)
  - Intelligent message propagation
- Direct Intervention
  - Vehicle disable
  - Automatic crash notification
Notification Via Existing Infrastructure

- Detection using connected vehicle components
  - Roadside Equipment (RSE)
  - Vehicle transmitting Basic Safety Messages (BSM)
- Warning using existing ITS Infrastructure
  - Communication to/from RSEs
  - Messages sent to existing message boards
  - Automated/manual lighted static signage
Advance Wrong Way Driver Alert
Infrastructure to Vehicle (I2V)

LEGEND

1. Vehicle detected going the wrong way by infrastructure sensor
2. Wrong way driver alert generated via I2V. Wrong way driver notified he is going the wrong way
3. Vehicle receives wrong way driver alert

Vehicle Entering Wrong Way On a Busy Highway (Using an Exit Ramp)
Infrastructure to Vehicle (I2V)

• Detection using connected vehicle components
  • RSE
  • Vehicles transmitting and receiving BSMs

• Warning using connected vehicle components
  • Communication to/from RSEs and vehicles
  • Message displayed to wrong way driver in vehicle
  • Message displayed in vehicles traveling towards the WWD
Advance Wrong Way Driver Alert
Vehicle to Vehicle (V2V)

**LEGEND**

1. Basic Safety Message (BSM) broadcast
2. BSM received, wrong way driver determined. Driver alerted
3. BSM received, wrong way driver determined, but not relevant to drivers

Vehicle Entering Wrong Way On a Busy Highway (Using an Exit Ramp)
Vehicle to Vehicle (V2V)

- Detection using connected vehicle components
  - Vehicles transmitting and receiving BSMs
- Warning using connected vehicle components
  - Communication to/from vehicles
  - Messages sent to vehicles traveling near the WWD
  - Vehicle determines whether message is relevant
Advance Wrong Way Driver Alert
Intelligent Message Propagation

LEGEND
1. Basic Safety Message (BSM) broadcast
2. BSM received, wrong way driver determined, but not relevant to drivers. Alert message propagated
3. Alert received, but not relevant to driver. Alert message propagated
4. Alert received well in advance of exit. Driver alerted

Vehicle Entering Wrong Way On a Busy Highway (Using an Exit Ramp)
Intelligent Message Propagation

• Detection using connected vehicle components
  • Vehicles transmitting and receiving BSMs
  • Vehicles propagating message to other vehicles

• Warning using connected vehicle components
  • BSMs sent to vehicles traveling within range of the WWD
  • Propagation of WWD message further than the reach of one vehicle can provide an earlier warning
**Advance Wrong Way Driver Alert**

**Local Wrong Way Driver – Vehicle Disable**

**LEGEND**

1. Vehicle detected going the wrong way by infrastructure sensor
2. Infrastructure sends disable command to vehicle going the wrong way
3. Vehicle disabled
4. Wrong way driver alert generated via I2V and disabled vehicle alert generated via V2V

Vehicle Entering Wrong Way On a Busy Highway (Using an Exit Ramp)
Automatic Vehicle Disable

• Detection using connected vehicle components
  • Roadside Equipment (RSE)
  • Vehicles transmitting and receiving BSMs

• Warning using connected vehicle components
  • BSMs sent to vehicles traveling within range of the WWD

• Response/Intervention
  • RSE disables WWD
    • Does create a stationary obstacle
    • May never see this occur for liability reasons
Advance Wrong Way Driver Alert
Automatic Crash Notification

LEGEND

1. Collision notification message generated V2V & V2I
2. Collision notification message generated via existing ITS infrastructure
3. Collision notification message propagated V2V

Vehicle Entering Wrong Way On a Busy Highway (Using an Exit Ramp)

Existing ITS Infrastructure

Accident Ahead on Exit Ramp 536

EXIT 536 RAMP

ACCIDENT AHEAD ON EXIT RAMP 536
Automatic Crash Notification

• Detection using connected vehicle components
  • Roadside Equipment (RSE)
  • Vehicles transmitting and receiving BSMs

• Warning using connected vehicle components
  • BSMs sent to vehicles traveling within range of the collision

• Warning using existing infrastructure
  • Communication to/from RSEs
  • Messages sent to existing message boards
Summary

• Critical to quickly warn drivers and notify the authorities about WWDs

• Connected vehicle components add a new data source to existing ITS infrastructure
  • WWDs
  • Traffic probe data

• May also assist in intervention if legalities are established
Questions?

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