

# **Benefits of the Different Types of Smart Work Zone Systems**

**TxDOT Transportation Short Course**

**October 11, 2017**

# What are Smart Work Zone Systems?

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- Sensors for real time data collection
- Data/information communications capabilities
- Software to process/analyze data
- Equipment to use information
  - Provide real time information to road users
  - Implement work zone management decisions

*Smart work zones are designed to provide benefits to the traveling public, to the work crews on-site, and/or to the agency.*

# Types of Smart Work Zone Benefits

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- Reduced safety impacts to travelers, workers
  - Fewer crashes
  - Less severe crashes
- Reduced traveler mobility impacts
- Reduced customer dissatisfaction/complaints
- Reduced impacts to work crew productivity

*Different smart work zone system functions deliver different types of benefits*

# Common Smart Work Zone Functions

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- Queue warning
- Travel time information/diversion advice
- Variable speed limits (VSL)/speed harmonization
- Dynamic late merge management (“zipper merge”)
- Construction access point warning
- Maintenance/enhancement of traffic surveillance and incident management functions

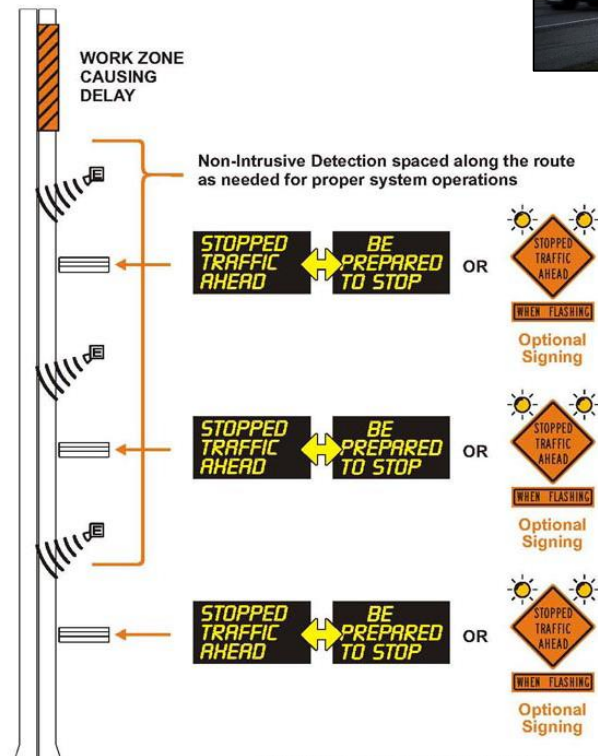
# Queue Warning Benefits

## Primary:

- Fewer crashes (primarily rear-end collisions)
- Less severe crashes

## Secondary:

- Reduced delays
- Reduced impact on contractor productivity



# Travel Time Information Benefits

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## Primary:

- Reduced customer dissatisfaction
- Reduced delay



## Secondary:

- Fewer crashes
- Reduced impact on contractor productivity



# VSL/Speed Harmonization Benefits

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## Primary:

- Fewer, less severe crashes
- Reduced delay

## Secondary:

- Reduced impact on contractor productivity



# Dynamic (Zipper) Merge Benefits

## Primary:

- Reduced customer dissatisfaction
- Fewer crashes

## Secondary:

- Reduced delay
- Reduced impact on contractor productivity





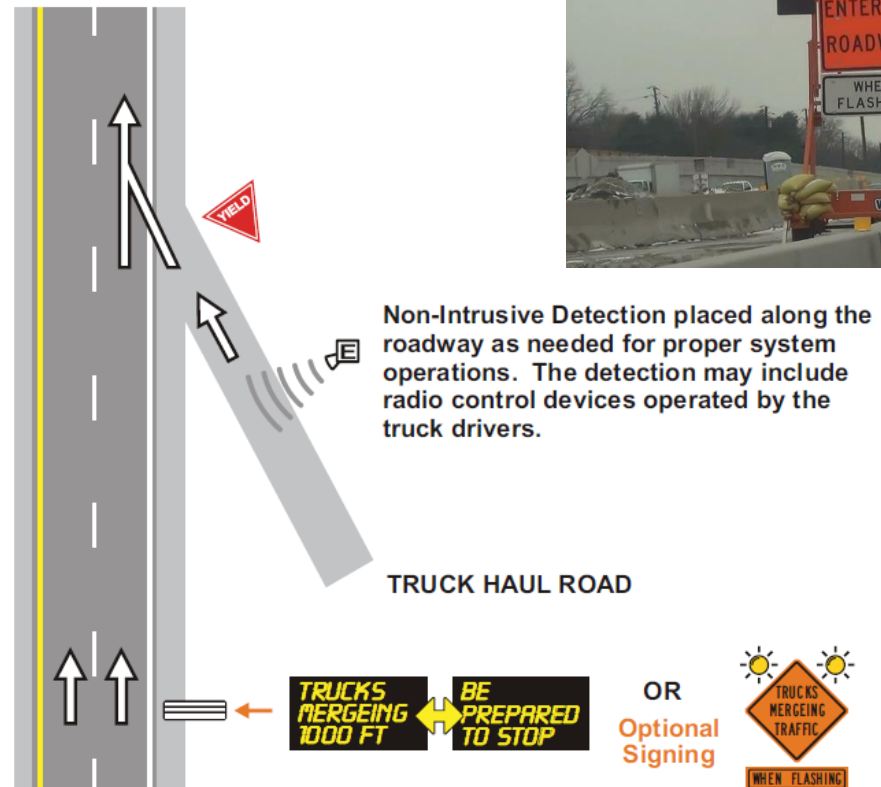
# Construction Access Point Warning Benefits

Primary:

- Fewer crashes

Secondary:

- Reduced delay
- Reduced impact on contractor productivity



# Maintenance/Enhancement of TMC Functionality Benefits

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## Primary:

- Fewer, less severe crashes
- Reduced delays
- Reduced customer dissatisfaction



## Secondary:

- Reduced impact on contractor productivity



# Evidence of Smart Work Zone Effects

| Smart Work Zone Functionality            | Examples of Benefits Observed  |
|--|--|
| Queue Warning                            | <b>14-55% reduction in crashes; % of crashes involving injuries cut by up to 2/3</b> |
| Travel Time Information/Diversion Advice | <b>16-19% diversion observed in some cases</b>                                       |
| VSL/Speed Harmonization                  | Reductions in speed variance and average speed.                                      |
| Dynamic (Zipper) Late Merge Management   | Queue lengths cut by 40%; forced/aggressive merges decreased by 85%                  |
| Construction Access Point Warning        | <i>unknown</i>   |
| Maintenance/Enhancement of TMC Functions | <b>45% reduction in response time to incidents</b>                                   |

# Quantifying Expected Smart Work Zone System Benefits

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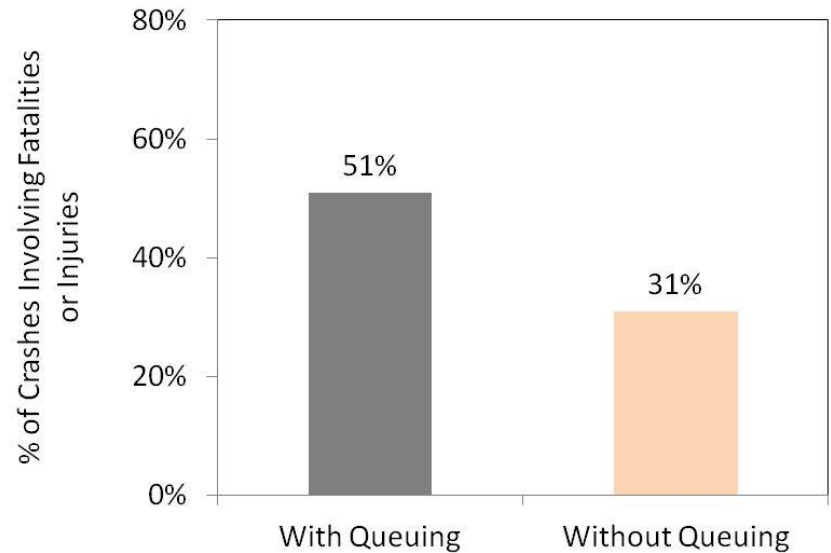
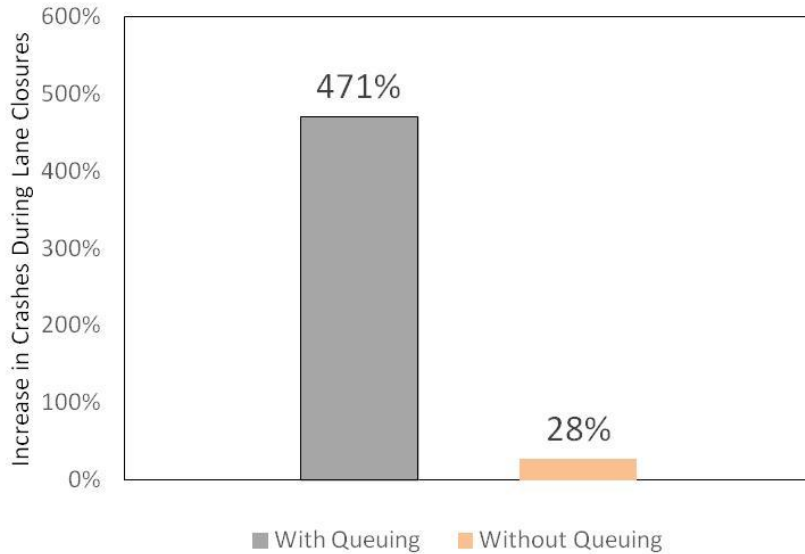
- $\sum \text{Benefits}_{\text{deployment}} > \sum \text{Costs}_{\text{deployment}}$
- Benefits depend on:
  - Frequency of system activation
  - Benefits achieved per activation
- Costs depend on:
  - Amount and type of equipment desired
  - Procurement approach used

# Estimating Queue Warning Benefits: Example

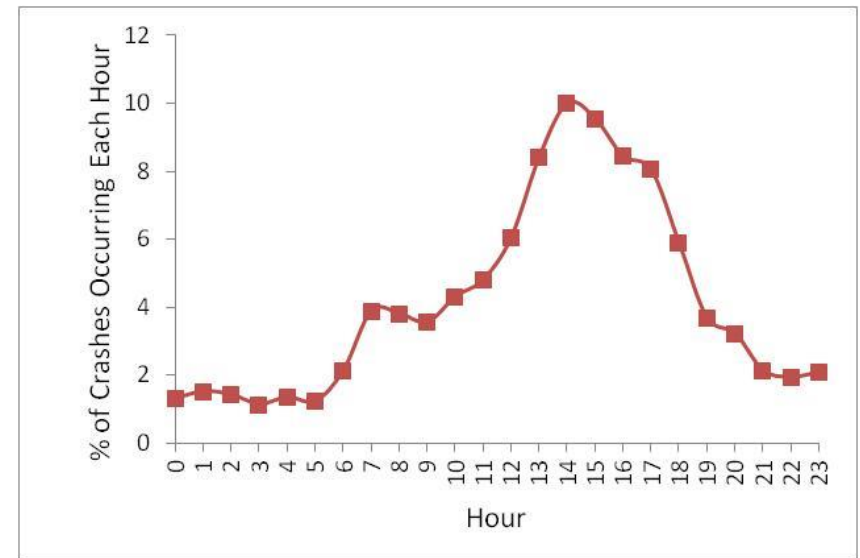
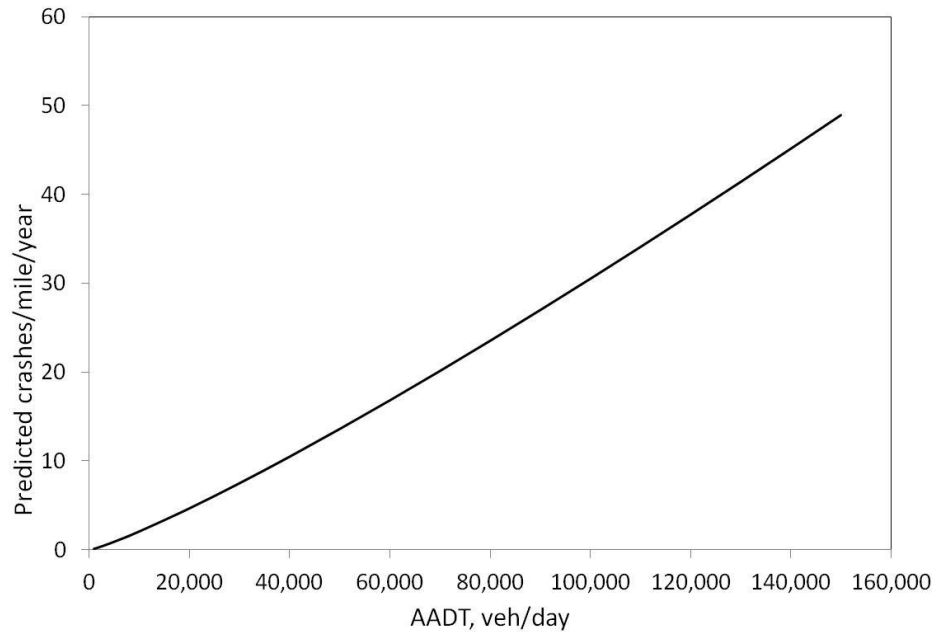
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- What conditions will create queues?
  - Lane closures
  - Crashes, stalls (especially if shoulders closed)
- How many crashes are expected if a queue occurs?
- How much will a queue warning system reduce crashes?
- What is the economic value of the crash reductions?

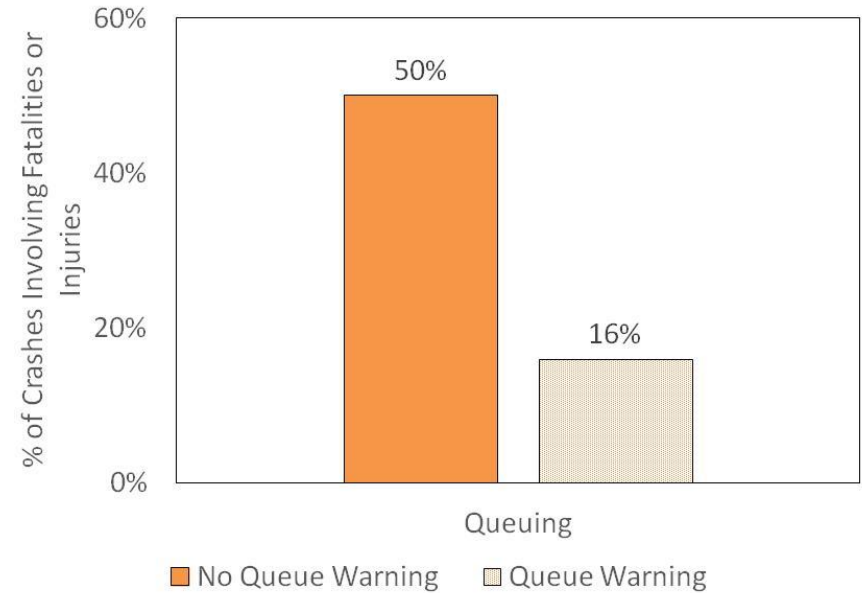
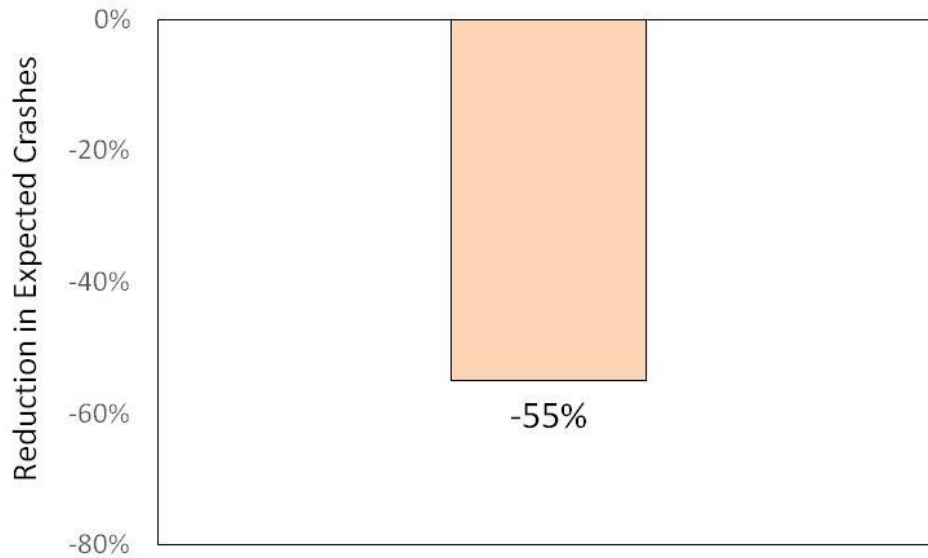
# Effect of Queues...



# Estimating Additional Crashes Due to Queuing



# Estimated Effect of Queue Warning Systems



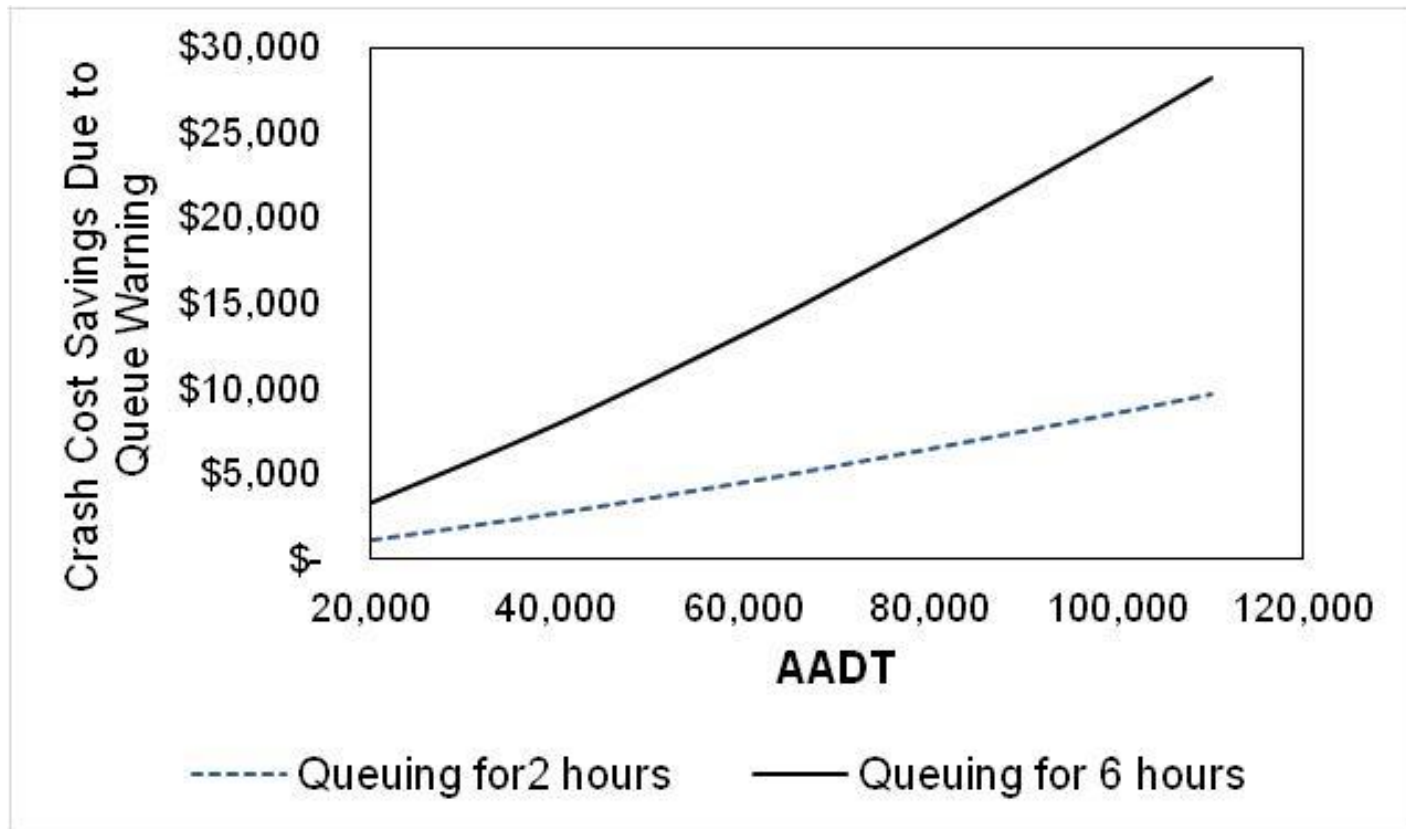


# Economic Costs of Crashes

| Crash Severity Level | Crash Costs<br>(Highway Safety Manual) |
|----------------------|--|
| Fatality (K)         | \$4,509,991                            |
| Disabling Injury (A) | \$242,999                              |
| Evident Injury (B)   | \$88,875                               |
| Possible Injury (C)  | \$50,512                               |
| Property Damage Only | \$8,325                                |

| Crash Severity Level | Crash Costs<br>(FHWA-HRT-05-051) |
|----------------------|----------------------------------|
| Fatality + Injury    | \$254,789                        |
| Property Damage Only | \$9,642                          |

# Crash Cost Savings Per 11-hr Nighttime Lane Closure



# Questions?

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