

Data Needs, Availability and Opportunities for Work Zone Performance Measures

March 19, 2013

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Webinar Structure

- Introduction (FHWA)
- Guidance Development Challenges and Process
- Structure of the Guidance Document
- Mobility Measures and Data Sources
 - Q&A
- Safety Measures and Data Sources
 - Q&A
- Customer Satisfaction Measures and Data Sources
- Agency/Contractor Measures and Data Sources
 - Q&A

Work Zone Performance Measures

Metrics that help to quantify how work zones impact travelers, residents, businesses and workers.

- * Project-level metrics
- * Agency program-level metrics



Work Zone Performance Measurement

Quantifying work zone impacts

Manage work zone impacts

Guides investment decisions

Identify trends

Refine policies and procedures

Assists in public information and outreach

Work Zone Safety and Mobility

23 CFR 630.1088(c)

- States shall use **field observations, available work zone crash data, and operational information** to **manage work zone impacts** for specific projects during implementation.
- States shall continually pursue improvement of work zone safety and mobility by **analyzing work zone crash and operational data** from multiple projects to **improve State processes and procedures**.

Work Zone Performance Measurement Challenges

- Which measures are most important?
- What data are needed?
- Where and how do we get that data?
 - What is available/accessible?
 - How applicable is it?
- How do we compute the measures from that data?



Source: TTI



Guidance Development Process

- Initial list of 13 possible measurement categories
- Reduced and collated along three key dimensions
- Practitioner expert panel identified and prioritized performance measures for each category/dimension

Performance Measure Data Needs

Performance data

- Quantifies the amount of the effects
- Dimensions: mobility, safety, customer satisfaction, and agency/contractor productivity

Exposure data

- Quantifies who or what was affected
- Dimensions: counts, distances traveled, durations

Indicator data

- Specifies activities, phases, time periods, or events of interest when effects occurred

Performance Measure Selection

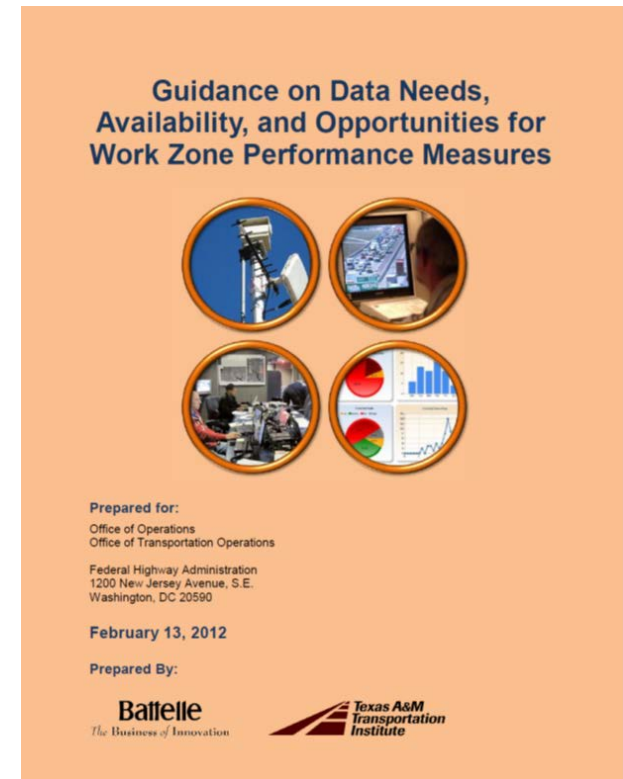
- Step 1. Determine performance measurement categories of interest
- Step 2. Decide which work zones to measure
- Step 3. Decide what work zone conditions to measure
- Step 4. Determine data sources to use
- Step 5. Compute specific measures of interest

Where Can We Get Data?

- Extract it from existing sources
- Collect it (manually, electronically)
- Interpolate it from existing or collected data

Guidance Document Structure

- Introduction
- Selecting Useful Performance Measures
- Data Sources/Methods
 - Mobility-related Performance Measures
 - Safety-related Performance Measures
 - Customer Satisfaction-related Performance Measures
 - Customer Satisfaction-related Performance Measures



Mobility-Related Performance Measures

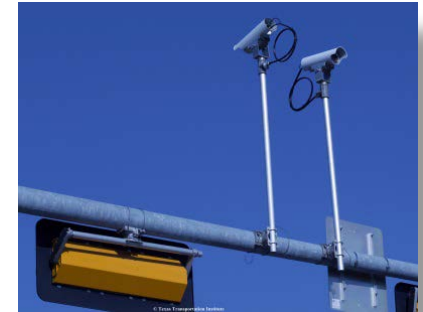
Mobility impacts commonly measured as

- Throughput
- Delays
- Travel times
- Travel time reliability
- Vehicle queues

Throughput

Existing Agency Data Sources

- TOC or traffic signal system vehicle count data
- Toll facility usage data
- Automatic traffic recording (ATR) station data
- Planning and programming AADT estimates



Source: TTI



Source: TTI

Work Zone Specific Throughput Data

- Data from work zone ITS deployment
- Temporary mechanical data collection device
- Manual vehicle count at key times & locations

Person Throughput Data

- Manual sampling of per-vehicle occupancy levels
- Manual sampling or video detection of pedestrian throughput

Throughput

Potential Future Data Source

- Connected vehicle technology
To be useful, sufficient market penetration of V2V and V2I technology is needed.

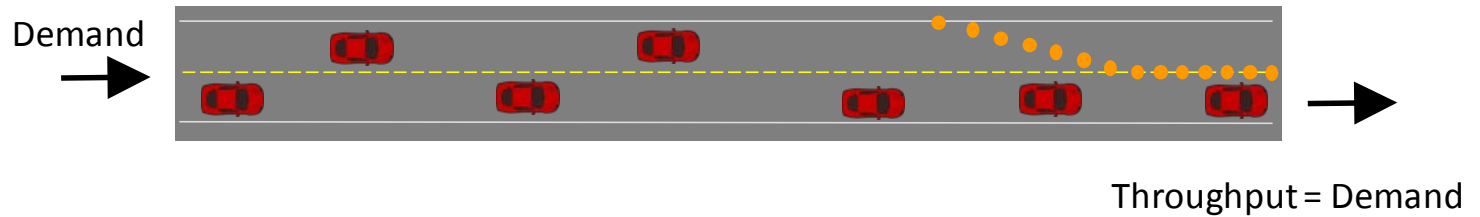


Source: TTI

Throughput

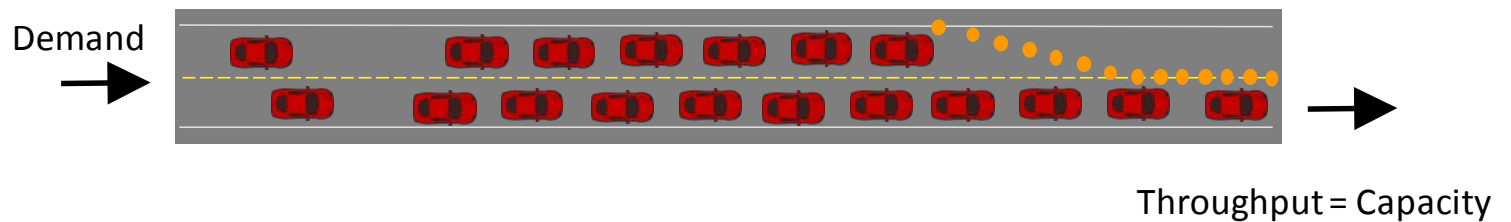
Non-congested

Demand < Capacity



Congested

Demand ≥ Capacity



Source: TTI

Considerations and Trade-Offs of Throughput Data Sources

Data Source	Key Considerations and Trade-offs
All data types	<ul style="list-style-type: none"> Depending on collection location, data is demand or throughput Multiple days of data is needed to reduce day-to-day variations
TOC sensor data and toll facility usage data	<ul style="list-style-type: none"> Important to verify data availability once work has started
ATR station data	<ul style="list-style-type: none"> Need to verify that counts are “true” values (not adjusted)
Agency AADT estimates	<ul style="list-style-type: none"> Reasonable when capacity < demand at any time during the day If diversion occurs, AADT overestimates throughput and exposure
Work Zone ITS data	<ul style="list-style-type: none"> Data must be archived and available for PM computations
Mechanical counters or manual counts	<ul style="list-style-type: none"> May not be practical for high-volume, high-speed roadways Manual counts are labor intensive
Manual collection of person/vehicle occupancy levels	<ul style="list-style-type: none"> Useful if “green” and HOV travel is part of the WZ management plan
Manual or electronic collection of pedestrian throughput	<ul style="list-style-type: none"> Useful if “green” and HOV travel is part of the WZ management plan Pedestrian and vehicle traffic peak hours may not always coincide
Connected vehicle data	<ul style="list-style-type: none"> Date of availability still uncertain

Delay, Travel Time, Travel Time Reliability

Existing Agency Data Sources

- TOC spot speed sensor data
- TOC tracking of vehicles through use of cameras
- TOC point-to-point travel time data using AVI, AVL, or license-plate recognition technology



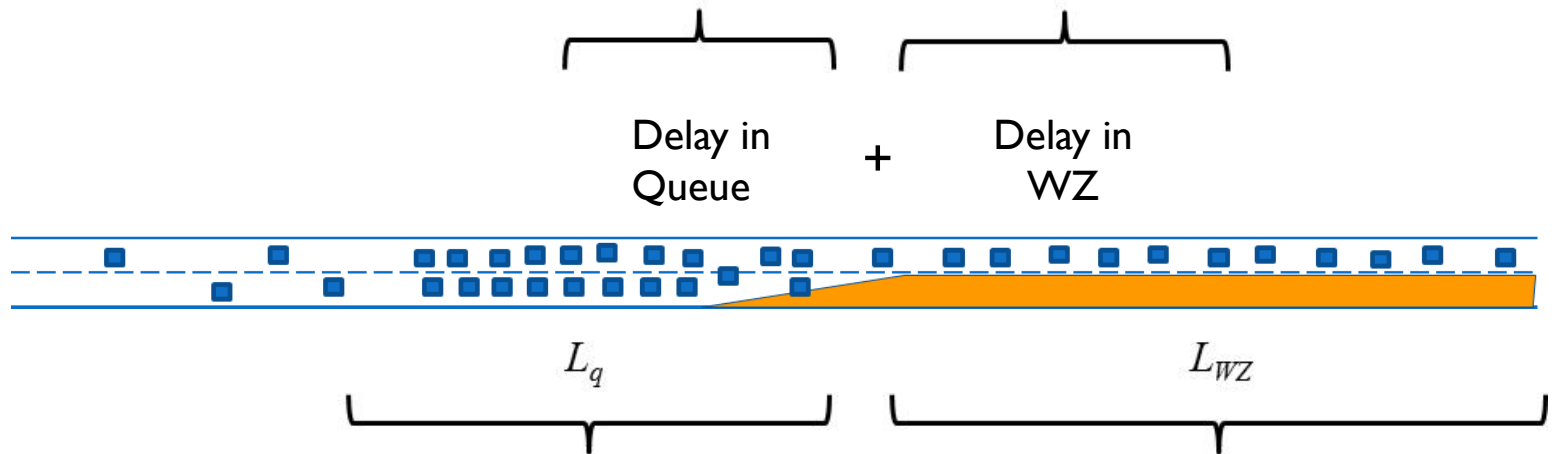
Source: TTI

Work Zone Specific Travel Time and Delay Data

- Data extracted from a work zone ITS deployment
- Portable point-to-point travel time data collection devices
- Manual spot speed sampling using radar or lidar devices
- Travel time runs through the work zone
- Estimation of travel time delays from observed queue length data

Delay Estimation from Observed Queue

$$\frac{\text{Delay}}{\text{Vehicle}} = L_q \left(\frac{1}{u_q} - \frac{1}{U_{WZSL}} \right) + L_{wz} \left(\frac{1}{\frac{u_f}{2}} - \frac{1}{U_{WZSL}} \right)$$



Average Speed in Queue (U_q)

Speed at Capacity Flow

$$\left(\frac{U_f}{2} \right) \left(1 - \left(1 - \frac{\text{WZ Capacity}}{\text{Normal Capacity}} \right)^{\frac{1}{2}} \right)$$

$$\left(\frac{U_f}{2} \right)$$

Assuming Linear Speed-Density Relationship

Delay, Travel Time, Travel Time Reliability

Potential Future Data Source

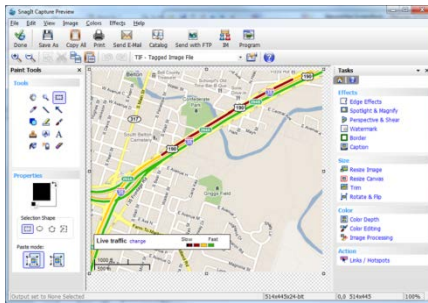
- Travel Times from Bluetooth Address Matching

Several states (e.g., Texas, Indiana) have used anonymous matching of Bluetooth devices in vehicles to track point-to-point travel times in work zones.



Source: TTI

- Private (3rd Party) Sources of Travel Time and Speed Data

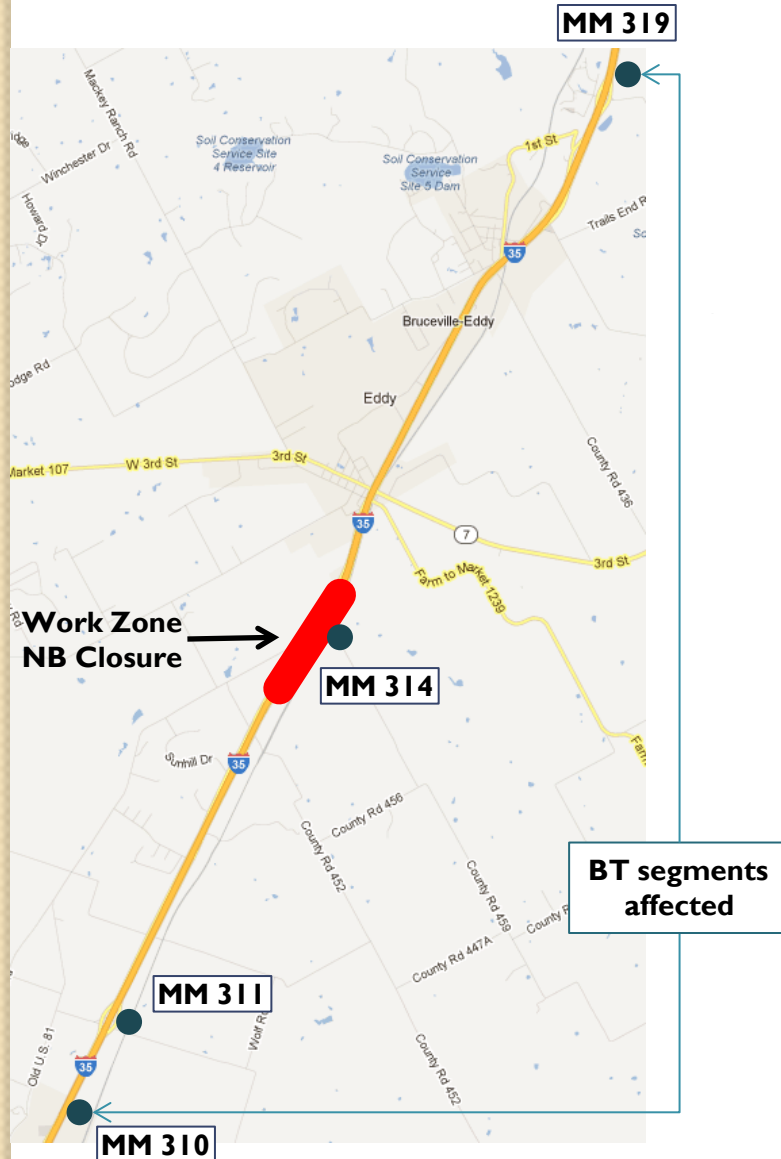


Source: Google traffic map captured with the Snagit

The Virginia Department of Transportation examined the potential of obtaining historical private-sector traffic data for the purposes of computing work zone performance metrics

- Connected vehicle technology

Example: Work Zone Delay Estimation from Bluetooth Address Matching



I-35 at Old Blevins Road

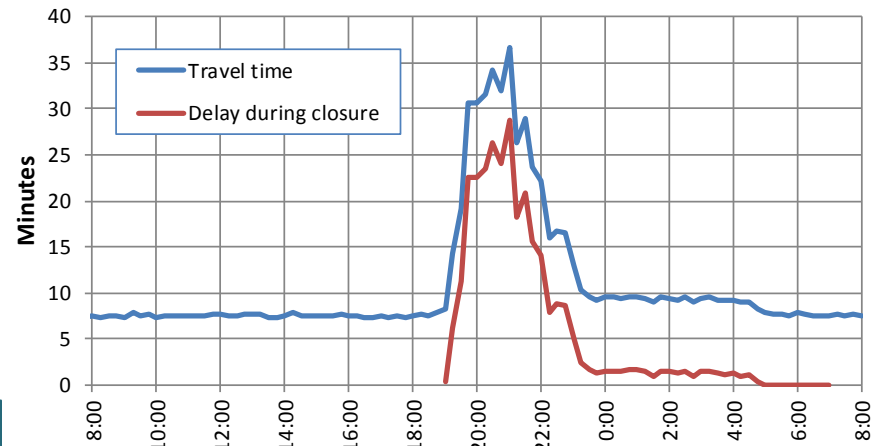
ROADWAY: I-35 Mainlanes (starting at MM 314.2)

CLOSED: All lanes closed

TIME: 2/26 - 2/27, 7PM - 7AM

ACTIVITY: Demolish the existing Old Blevins Road bridge.

Travel Time and Delay Over BlueTooth Segments Affected

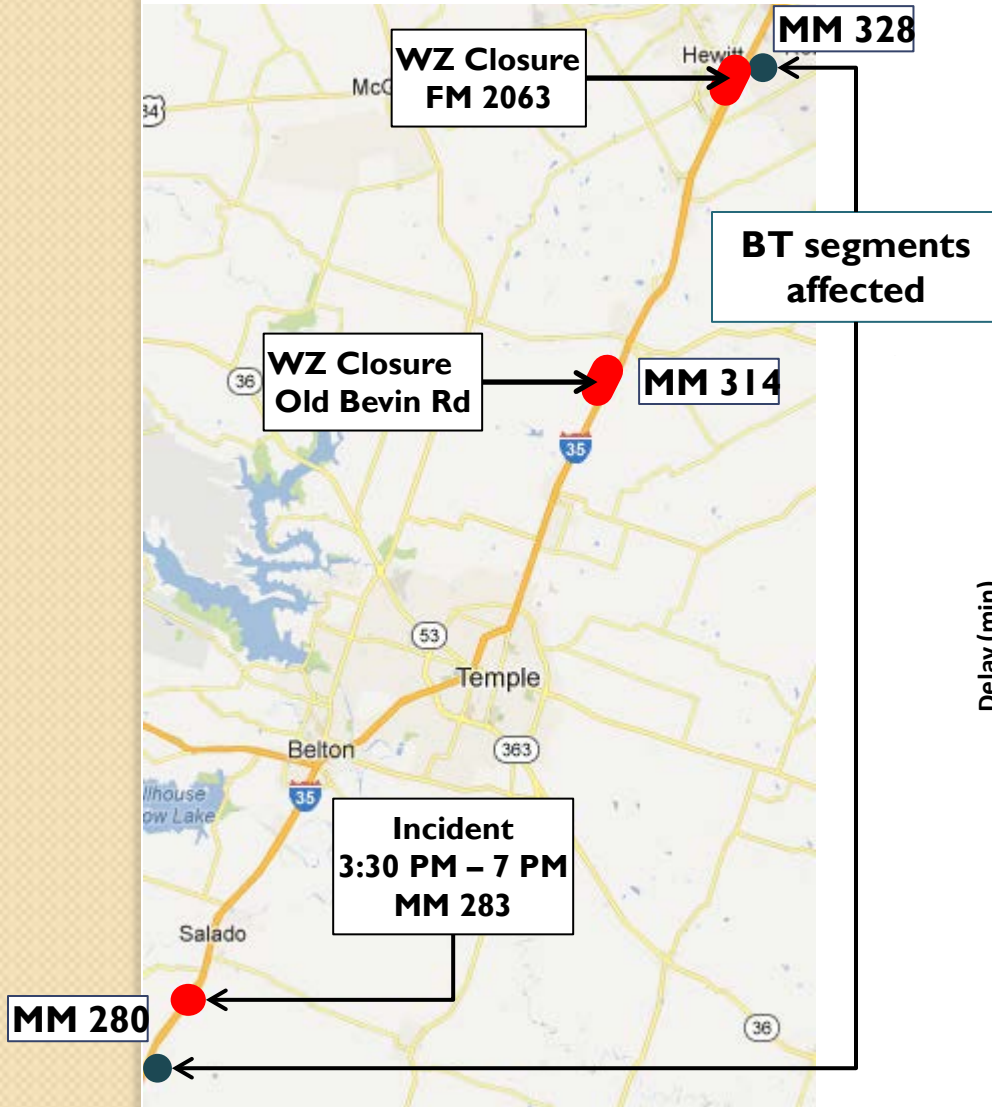


Maximum Delay = 28.6 min (assuming 65 mph free-flow speed)

Affected BlueTooth Segments

Old Blevins Rd (MM 314)	-	Woodlawn Rd (MM 319)
Hillyard (MM 311)	-	Old Blevins Rd (MM 314)
North of Troy (MM 310)	-	Hillyard (MM 311)

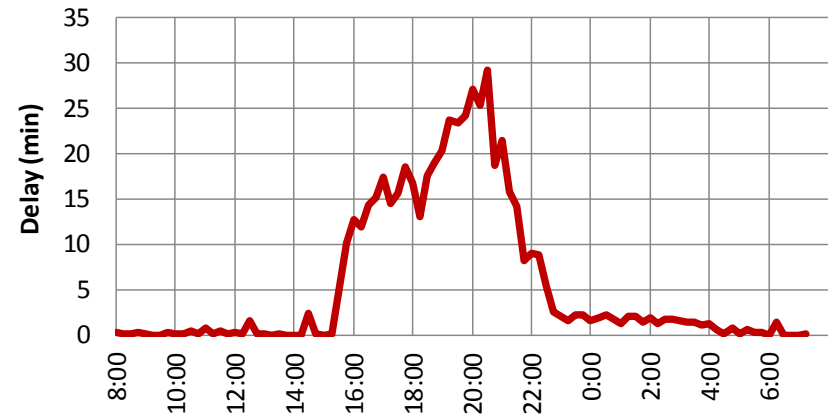
Example: Corridor Delay Estimation from Bluetooth Address Matching



Combined Impact of

- 2 work zones (7pm -7 am)
- 1 incident 4 pm-7pm

Total NB Delay (minutes)
in Section MM 280-328



Departure time from MM 280

Max. Delay = 29.2 minutes

Considerations and Trade-Offs of Delay, Travel Time, and Reliability Data Sources

Data Source	Key Considerations and Trade-offs
TOC spot speed sensor data	<ul style="list-style-type: none"> • Tend to be less accurate when congestion is present • Important to verify data availability once work has started
TOC point-to-point travel time data	<ul style="list-style-type: none"> • Important to verify data availability once work has started • Accuracy depends on market penetration of tracking technology • Represents recently completed, rather than current, trip times.
Work zone ITS data	<ul style="list-style-type: none"> • Data must be archived and available for PM computations
Portable point-to-point travel time data collection	<ul style="list-style-type: none"> • Accuracy depends on market penetration of tracking technology • Represents recently completed, rather than current, trip times.
Manual spot-speed data	<ul style="list-style-type: none"> • Labor intensive • Most useful if work zone impacts occur in a fairly small section • Most useful for assessing short time periods
Manual travel time data collection by driving through the work zone	<ul style="list-style-type: none"> • Labor intensive • Most useful for assessing short time periods • Multiple runs increase accuracy & precision of travel time estimates
3 rd party (private-sector) travel time and speed data	<ul style="list-style-type: none"> • Level of detail available may vary by vendor • Translation to agencies' data mapping protocol is needed
Bluetooth data	<ul style="list-style-type: none"> • Accuracy depends on market penetration of Bluetooth technology • Represents recently completed, rather than current, trip times.
Connected vehicle data	<ul style="list-style-type: none"> • Date of availability still uncertain

Traffic Queue Data Sources

Existing Data Sources

- Speed data extracted from a work zone ITS deployment
- Observation of queues from a permanent or work zone TOC
- Observation of queues by field personnel at the work zone

Queue Length Estimation from Spot-Speed Sensors

Step 1: Divide the Roadway into Regions of Assumed Uniform Speed

Step 2: Examine Speeds and Volumes Hour-by-Hour at each Sensor Location

Step 3: Compare Hourly Speed/Volume Profiles across Sensors to Identify Length of Queue

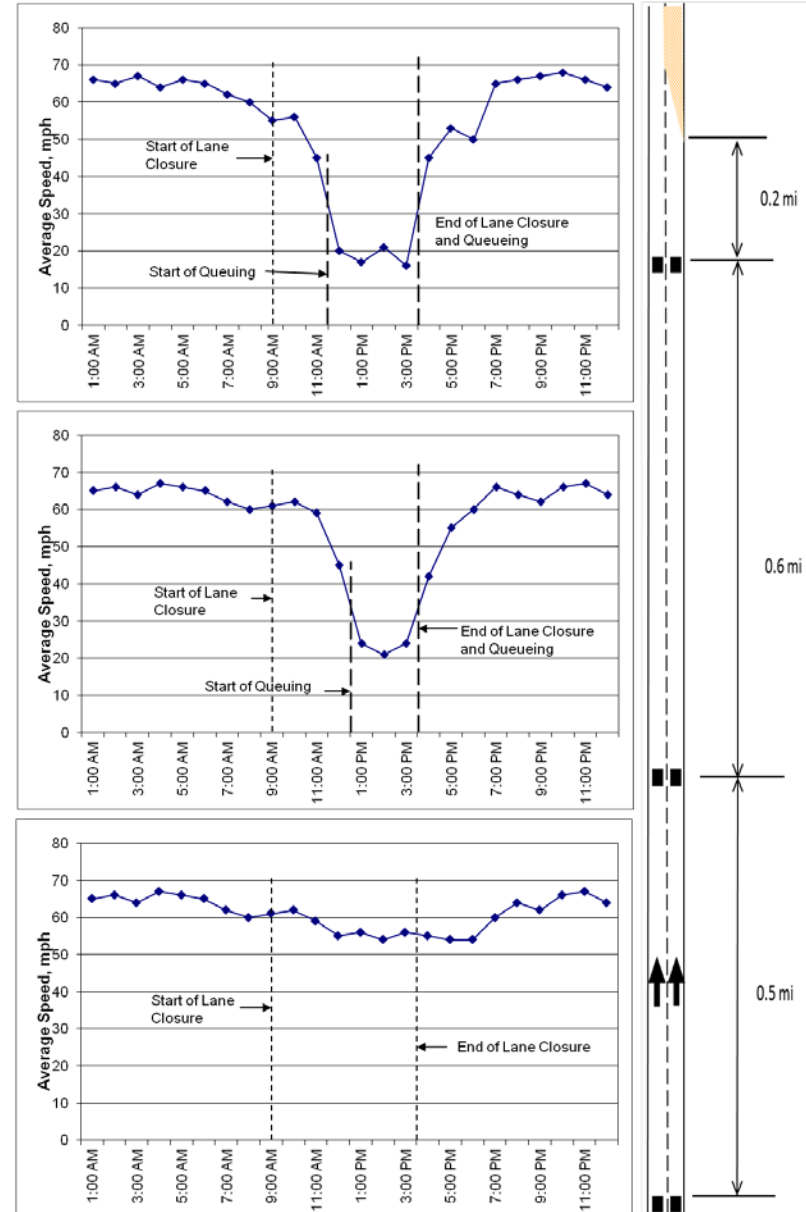
Step 4: Sum Region Lengths where Speeds are below Thresholds

Queue Estimation

Example:

- Spot traffic sensors are located 0.2 mile, 0.8 mile, and 1.3 miles upstream of the temporary lane closure.
- Project diary information indicates that a lane closure began at 9:00 AM and ended at 3:30 PM.

Time	Estimated Location of Upstream End of Queue	Estimated Queue Length
11:00 am	None	0
12:00 pm	Between Sensors 1 & 2	$0.2 + (0.6/2) = 0.5$ mile
1:00 pm	Between Sensors 2 & 3	$0.2 + 0.6 + (0.5/2) = 1.05$ mile
2:00 pm	Between Sensors 2 & 3	1.05 mile
3:00 pm	Between Sensors 2 & 3	1.05 mile
4:00 pm	None	0



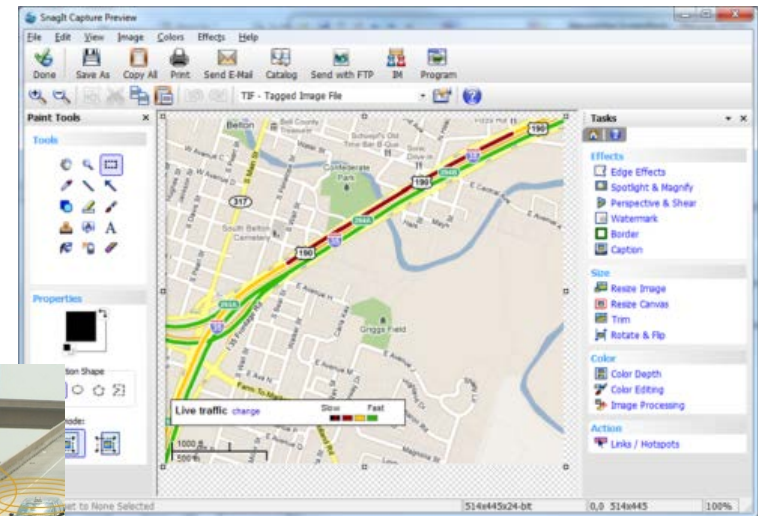
Traffic Queue Data Sources

Potential Future Data Source

- Screenshot Captures from 3rd Party Traveler Information Providers
- Private (3rd Party) Sources of Travel Time and Speed Data
- Connected vehicle technology



Source: TTI



Source: Google traffic map captured with the Snagit

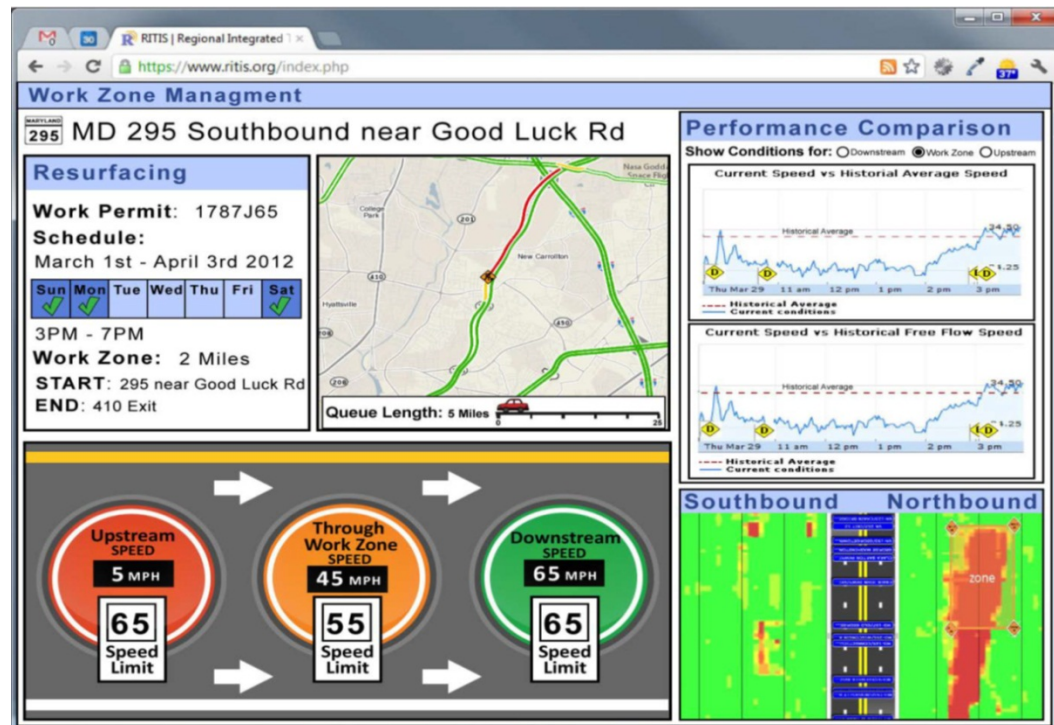
Considerations and Trade-Offs of Traffic Queue Data Sources

Data Source	Key Considerations and Trade-offs
All data types	<ul style="list-style-type: none"> • Definition of queues (e.g., min speed threshold) is critical • Both queue duration and queue length over time are important
TOC or work zone ITS data using spot speed sensors	<ul style="list-style-type: none"> • Requires detailed speed data analysis on sensor by sensor basis • Important to verify data availability once work has started
Visual queue identification by TOC operators	<ul style="list-style-type: none"> • Requires adequate camera coverage upstream of work zone
Collection of queue data by field personnel	<ul style="list-style-type: none"> • Data collection protocol training is needed • May be difficult to accurately monitor the end of queue • Ensure that field personnel understands its importance
Screenshot of real-time traffic condition maps	<ul style="list-style-type: none"> • Required screen resolution depends on max. expected queue length • Time-lapse capabilities do not exist in most screen capture software.
3 rd party traveler information data	<ul style="list-style-type: none"> • Level of detail available may vary by vendor • Translation to agencies' data mapping protocol is needed
Connected vehicle data	<ul style="list-style-type: none"> • Date of availability still uncertain

Identifying and Computing Specific Mobility Measures of Interest

Once work zone mobility-related data sources are identified, a jurisdiction will have to make its own decisions as to what performance measures it chooses to track.

Example: In some jurisdictions with TOCs, efforts are underway to develop simple-to-use computer dashboards that can provide current traffic conditions in and around a work zone



Source: Paracha, J. Work Zone Performance Measurement using Probe Data. Presentation of Maryland Work Zone Performance Measurement Project

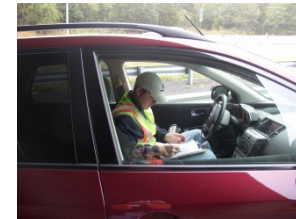
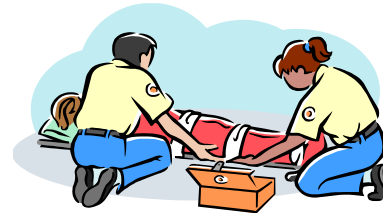
Q&A



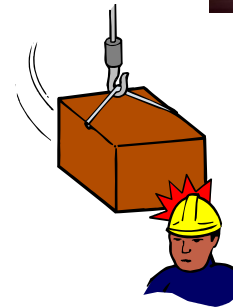
Safety-Related Performance Measures

Safety impacts commonly measured as

- Crashes
- Safety Surrogates
- Worker Accidents



Source: TTI



Crashes

Existing Agency Data Sources

- Statewide traffic crash records database entries
- Crash report forms (hard-copy or electronic)
- TOC incident database entries
- Emergency response/service patrol dispatch logs



Source: Las Vegas FAST

Future Sources

- Agency-collected work zone crash information
- Connected vehicle initiative data

Considerations and Key Trade-offs

Data Source	Key Considerations and Trade-offs
Statewide Crash Records Database	<ul style="list-style-type: none">• Limited work zone features and activities information• Time lags in obtaining crash data for a given work zone
Electronic or hard copy crash report forms	<ul style="list-style-type: none">• Limited work zone features and activities information• Requires manual coding• May need to work with multiple enforcement agencies
TOC operator incident logs	<ul style="list-style-type: none">• Includes non-reported as well as reported crashes• Includes non-crash events
Dispatch Logs of Emergency Response or Service Patrols	<ul style="list-style-type: none">• Likely to include non-traffic crash events as well• Potential privacy concerns
Agency-collected crash and work zone database	<ul style="list-style-type: none">• Significant agency effort required• Requires upper agency support and emphasis
Connected vehicle data	<ul style="list-style-type: none">• Date of availability still uncertain

Safety Surrogates

Existing Agency Data Sources

- Speed data collected by hand-held devices
- Speed data extracted from ITS sensors
- Travel times
- Videotaped traffic behaviors at key locations
- Work zone inspection scores

2012 WORK ZONE SAFETY AUDITS - EVALUATION FORM

PROJECT NAME: _____ DATE: _____

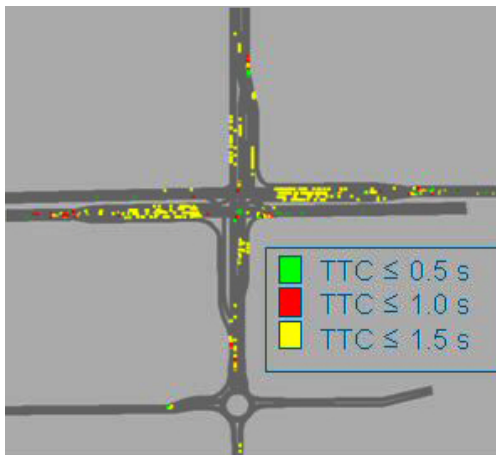
PROJECT NUMBER: _____ PROJECT LOCATION: _____

GENERAL NOTES: _____

Only score Devices you witnessed at the Project. If a certain device was not present, do not score it.

CATEGORIES	SCORE					NOTES	
	1	2	3	4	5		
TEMPORARY SIGNING (Signs, Flags, Support)							
CHANNELIZATION DEVICES (Water Markers, Cones, Drums, Barricades)							
PAVEMENT MARKINGS (Paint, Tape, Reflective & Plastic Markers)							
CONCRETE BARRIER							
IMPACT ATTENUATORS (Drum Arrays, Membrane-Side & TRM)							
PORTABLE CHANGEABLE MESSAGE SIGNS (PCMS)							
SEQUENTIAL ARROW PANEL (Arrow Board)							
TEMP. TRAFFIC SIGNALS							
BICYCLE, PEDESTRIAN & ADA FACILITIES (Note: Facility facilities affected by construction)							
FLAGGERS							
PILOT CARS							
MOBILITY							
WORKER GARMENTS & EQUIPMENT							
SITE HOUSEKEEPING							
POLICE ENFORCEMENT							
DRIVER-FRIENDLY WORK ZONE							
GRAND TOTAL =					÷	N = The Number of Scored Categories	

Source: Oregon DOT



Source: Gettman et al. FHWA-HRT-08-051

Future Sources

- Microscopic traffic simulation output
- Connected vehicle initiative data

Considerations and Key Trade-offs

Data Source	Key Considerations and Trade-offs
All data types	<ul style="list-style-type: none"> • Correlation to crashes not yet fully verified • Most can be obtained relatively quickly
TOC or work zone ITS speed sensor data	<ul style="list-style-type: none"> • Value of data depends on the locations of the sensors. • Need to verify data availability and archival once work starts
Speed data collected with hand-held radar or lidar	<ul style="list-style-type: none"> • Data collection easy to accomplish • Useful for assessing speed behaviors • Inconspicuous data collection techniques required
Travel times through the work zone	<ul style="list-style-type: none"> • Speed change locations can indicate problems • Can be used to assess compliance with wz speed limit
Videotaped traffic behavior	<ul style="list-style-type: none"> • Can be difficult to find a unobtrusive viewing point • Data analysis is labor intensive • Requires precise definition of behaviors of interest
Work zone inspection scores	<ul style="list-style-type: none"> • Requires significant effort to establish scoring/ratings • Correlation of scores to actual safety levels not yet verified
Traffic simulation output (analyzed with SSAM)	<ul style="list-style-type: none"> • Significant coding and calibration effort required • Correlation to actual work zone safety conditions not yet verified
Connected vehicle data	<ul style="list-style-type: none"> • Date of availability still uncertain

Worker Accidents

Existing Agency Data Sources

- Agency or contractor worker injury records
- State worker compensation commission accident statistics
- Bureau of Labor statistics database



Source: TTI

Future Sources

- Connected vehicle initiative data

Key Considerations and Trade-offs

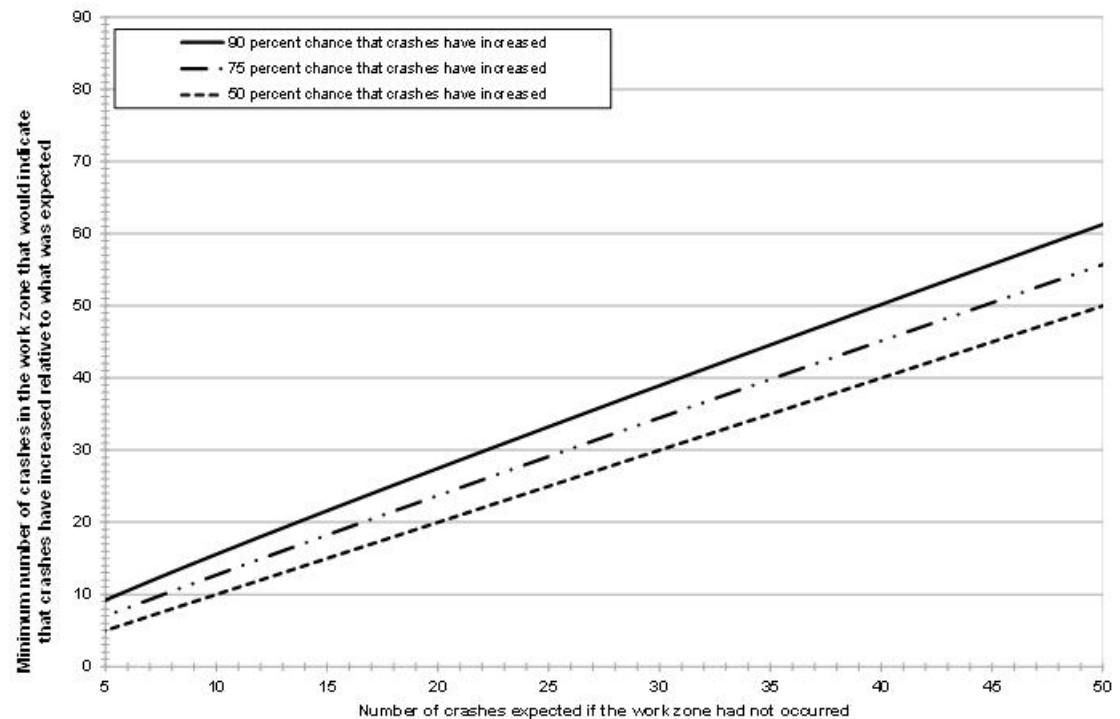
Data Source	Key Considerations and Trade-offs
Agency or contractor worker injury records	<ul style="list-style-type: none">• Use must be monitored due to privacy concerns• Small sample size for many companies will make it difficult to identify trends
State worker compensation commission statistics	<ul style="list-style-type: none">• Useful for comparisons to agency or contractor accident trends• Level of detail will be limited
BLS, OSHA worker accident statistics	<ul style="list-style-type: none">• Useful for comparisons to agency or contractor accident trends• Level of detail will be limited
Agency-collected work zone crash and accident database	<ul style="list-style-type: none">• Significant effort required• Requires upper agency support and emphasis• Use of accident reports must be monitored carefully due to privacy concerns

Identifying/Computing High Priority Safety Measures

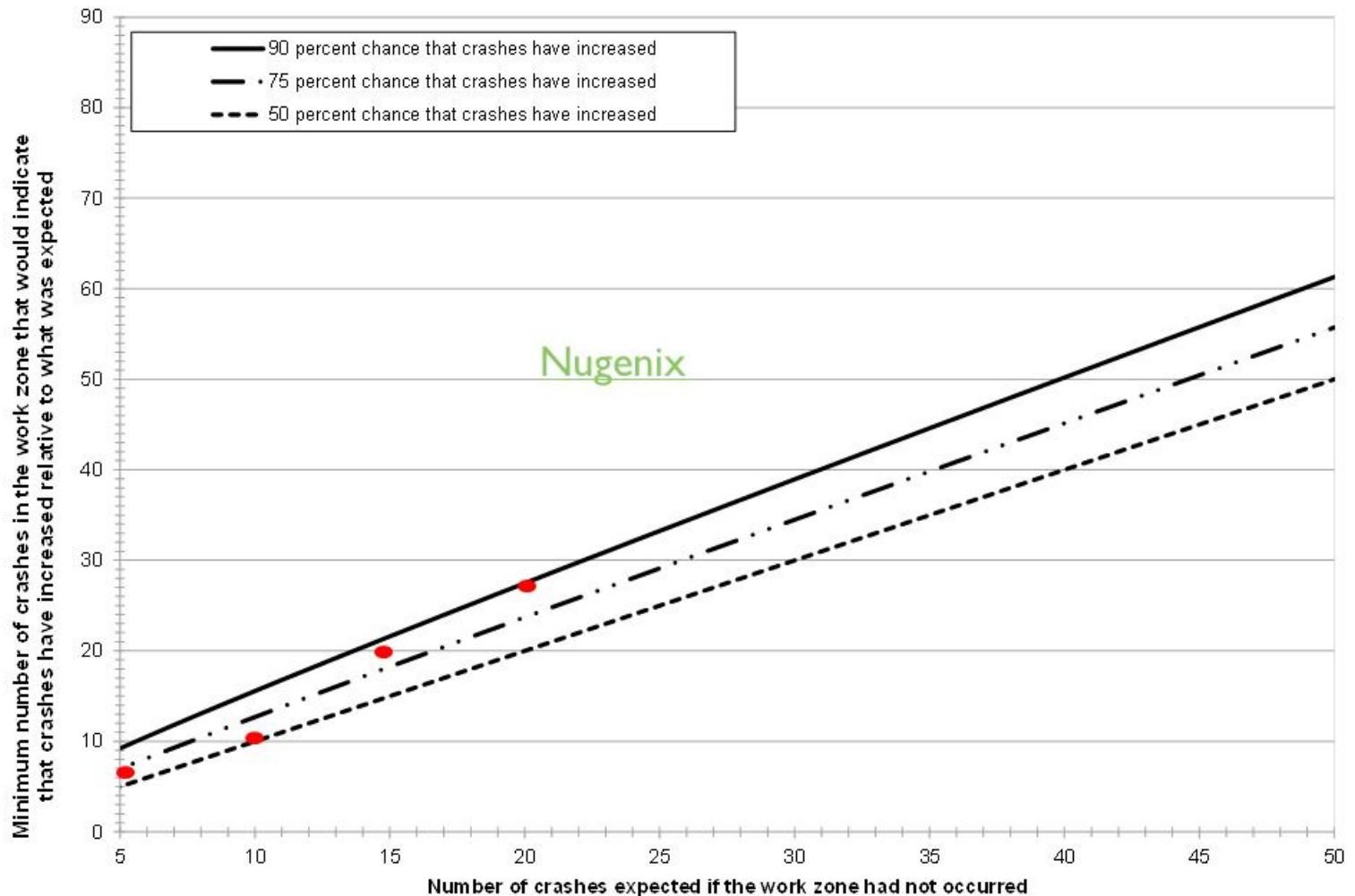
- Change in crash frequency (by type)
- Change in crash rate per vehicle-miles-traveled (for a given time period)
- Compliance with work zone speed limit
- Speed variance at a location
- Frequency of worker accidents
- Worker injury rate per hours worked
- Injury type, severity, contributing factor distributions

Example: Tracking Crash Frequency Trends at a Work Zone

- Work zone on roadway that normally experiences 5 crashes per month
- Have had 7, 3, 10, 7 crashes in past 4 months during work zone



Example: Tracking Crash Frequency Trends at a Work Zone



Q&A



Customer Satisfaction Performance Measures

Who are our customers?

- Travelers, residents, and businesses



Impact of Work Zones?

- Delays, congestion, and inconveniences are challenging for maintaining good relationships with customers

Why are measures necessary?

- Infrastructure is largely publicly-owned and funded

Therefore...

Measuring customer satisfaction associated with work zones is critical to an agency's or contractors set of work zone performance measures

Existing Customer Satisfaction Data Sources (1 of 3)



Source: TTI

- **Focus Group Transcripts**
 - Participants opinions, experiences, and suggestions
 - Not representative of overall driving population
 - Anecdotal findings
- **In-Person or Telephone Interview Responses**
 - Responses may vary at location over time
 - In-person interviews require short surveys
 - Fairly labor intensive to administer

Customer Satisfaction Data Example

PART II. DRIVING CONDITIONS
 For my next series of questions I'd like you to think about recent highway conditions you have experienced.

14. How often in the past three months have you encountered highway work such as construction or maintenance in South Dakota? Would you say...[READ LIST]

- Always
- Almost always
- Occasionally
- Very seldom, or
- Never
- [DO NOT READ] Don't know

15. Do you think the level of HIGHWAY CONSTRUCTION AND MAINTENANCE this year increased, decreased or stayed about the same as compared to last year?

- Increased
- Decreased
- Stayed about the same
- Don't know

16. How often do you feel you slow down for highway work zones when there is no visible work zone? Would you say it occurs always, almost always, occasionally, very seldom or never?

- Always
- Almost always
- Occasionally
- Very seldom, or
- Never
- Don't know

17. Do you feel the length of delays caused by highway construction and maintenance this year has increased, decreased, or stayed about the same as compared to last year?

- Increased
- Decreased
- Stayed about the same
- Don't know

18. Please describe your level of tolerance for the length of delays you generally experience. Using a scale of 1 to 10 where "1" means you really don't mind and "10" means that the delays are intolerable: what number represents how you feel about the length of delays you experienced this past year?

Don't mind Intolerable

1 2 3 4 5 6 7 8 9 10 DK

19. Please describe your level of tolerance for the length of time it generally it takes to clear dead animals from roadsides of state highways. Using a scale of 1 to 10 where "1" means you really don't mind and "10" means that the delays are intolerable: what number represents how you feel about the length of delays you experienced this past year?

Don't mind Intolerable

1 2 3 4 5 6 7 8 9 10 DK

Example of a Script Used during a Telephone Interview of South Dakota Motorists

Existing Customer Satisfaction Data Sources (2 of 3)

- **Mail, Email, or Website Survey Responses**
 - Quantitative statistical analysis
 - Qualitative assessments
 - Predetermined options
 - Statistically significant findings
 - High cost
 - Slight negative bias

- Very satisfied
- Satisfied
- Neutral
- Dissatisfied



Customer Satisfaction Data Example

ROAD WORK AHEAD **MoDOT Work Zone Customer Survey**

Like 34

Your Name:

MoDOT strives to provide excellent customer service. If you wish to be contacted with regards to any comments/questions you provide with this survey, please submit your phone number and/or email allowing a staff member to respond.

Phone Number:

Email Address:

Are you a MoDOT Employee? YES NO

County:
If county is unknown, type Unknown in the field above.

Road/Highway Name & Direction:

Nearest Intersection:

Date Traveled: Time: AM PM

1. Did you have enough warning before entering this work zone?
YES NO

2. Did the signs provide clear instructions?
YES NO

3. Did the cones, barrels, or striping guide you through the work zone?
YES NO None Present

4. Did you make it through the work zone in a timely manner?
YES NO

If no, please explain: (2000 characters max)

5. Were you able to travel safely in the work zone?
YES NO

If no, please explain: (2000 characters max)

Agency Websites are a Common Venue Used for Customer Surveys/Questionnaires

Existing Customer Satisfaction Data Sources (3 of 3)

Travelers, residents, or nearby businesses may embellish conditions somewhat when making a work zone-related complaint

- **Customer complaint database entries**

- Databases track complaint arrivals and disposition
- Some complaints easily associated with a work zone
- Some complaints may be more indirect
- Complaints effective for identifying operational or safety problems
- Not indicative of overall driver satisfaction
- Small sample sizes

Those who are not unhappy generally do not contact the agency to indicate their general satisfaction

Future Customer Satisfaction Data Sources

- **Social Media Technologies**

- Facebook



- Twitter

- Selection biases and similar traditional survey techniques issues
- Responses negatively skewed

- **Web-Based Tools to Conduct On-Line Focus Groups**

- System capabilities may include:
 - Polling group
 - Private chat sessions
 - “Groupthink” area



Considerations and Trade-Offs of Customer Satisfaction Data Sources

Data Source	Key Considerations and Trade-Offs
Focus groups	<ul style="list-style-type: none"> • Best for gathering opinions, perceptions • A properly trained facilitator is critical • Data from multiple groups may be needed
One-on-One Interviews	<ul style="list-style-type: none"> • Best for obtaining responses during or right after drivers have passed through a work zone • May need to do surveys multiple times as conditions in the work zone change
Surveys/ Questionnaires	<ul style="list-style-type: none"> • Multiple dissemination mechanisms (mail, email, website) possible • Potential to reach a larger sample size more efficiently • Properly designed surveys can yield statistically significant results
Complaints	<ul style="list-style-type: none"> • Work zone effects may trigger complaints directly or indirectly • Customers may embellish the magnitude of the problem • Statistical analyses are usually not possible with the data
Social Media Uses	<ul style="list-style-type: none"> • Important to rely on trained survey designers for these applications • Responses will be biased towards younger, more technology-savvy users
On-Line Focus Groups	<ul style="list-style-type: none"> • Allows participants to remain at their computers to participate • Effectiveness of on-line efforts to mimic the interactions that occur in face-to-face focus groups is unknown

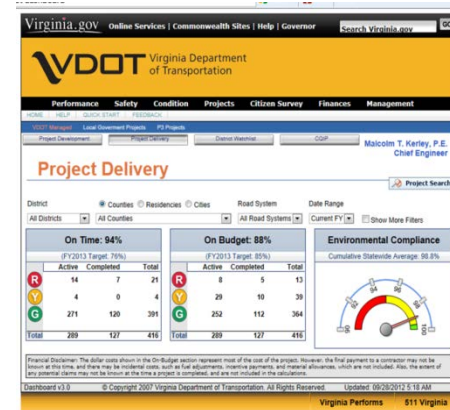
Identifying/Computing High Priority Customer Satisfaction Measures

- Ratings of the quality of work zone features seen while driving through a work zone
 - Signs
 - Information provided regarding delays, queues, work activities
- Satisfaction ratings with travel conditions through multiple work zones
 - Multiple work zones
 - Corridor in a region or network
- Frequency/rate of complaints
- Satisfaction ratings for traveling through work zone

Agency/Contractor Productivity Performance Measures

Existing Agency Data Sources

- Construction management system databases
- Lane closure request/approval databases
- Daily project diary notes



Source: Virginia DOT



Future Sources

- Mobile data collection applications of work activities
- Electronic maintenance work databases

Key Considerations and Trade-Offs

Data Source	Key Considerations and Trade-offs
Construction management system databases	<ul style="list-style-type: none">• Focus mainly on contract-related data• Data elements of interest are often narratives in the system, with minimal consistency in entries across projects
Lane closure request and approval databases	<ul style="list-style-type: none">• May include closures across multiple agencies and contractors• Normally limited to high-volume roadways only• May contain a large number of “phantom” closures that need to be removed prior to analyses
Daily project diaries	<ul style="list-style-type: none">• Amount and type of data entered often varies by project
Mobile applications for project activity entry	<ul style="list-style-type: none">• Use of mobile devices in the field may cause costs and durability of the devices to become an issue• An application of this type may not yet exist
Maintenance management system databases	<ul style="list-style-type: none">• Requires detailed recordkeeping of activities by all maintenance crews and crew members



Identifying/Computing High Priority Agency/Contractor Productivity and Efficiency Performance Measures

- % of allowable or total days worked
- % of lane closure hours occurring outside of allowable “work windows”
- Production rates

Resources

- Guidance on Data Needs, Availability, and Opportunities for Work Zone Performance Measures
- A Primer on Work Zone Safety and Mobility Performance Measurement
- Work Zone Performance Measures Pilot Test
- Domestic Scan on Work Zone Assessment, Data Collection, and Performance Measurement

Available at

http://www.ops.fhwa.dot.gov/wz/decision_support/performance-development.htm

Q&A

