

ITS Smart Work Zones

THE Conference

Feb. 24, 2015

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Illinois Department of
Transportation

District 8 Engineer of Construction



Smart Work Zones

- ▶ What is a Smart Work Zone?
- ▶ Where is IDOT using Smart Work Zones and how is this determined?
- ▶ What drove us to this point?
- ▶ Are Smart Work Zones worth the cost?

What is a Smart Work Zone?

The use of technology via sensors, computers and message boards to automatically collect and convey real-time data to the motorist.

Possess the Following Characteristics:

1. Real-Time
2. Portable
3. Automated
4. Reliable



Smart Work Zone Components

- ▶ Doppler and Microwave Speed Detectors
- ▶ Bluetooth Technology Traffic Sensors
- ▶ Message Boards, Signs



iCone Speed Detector

SWZ Components



Radar Speed Trailers



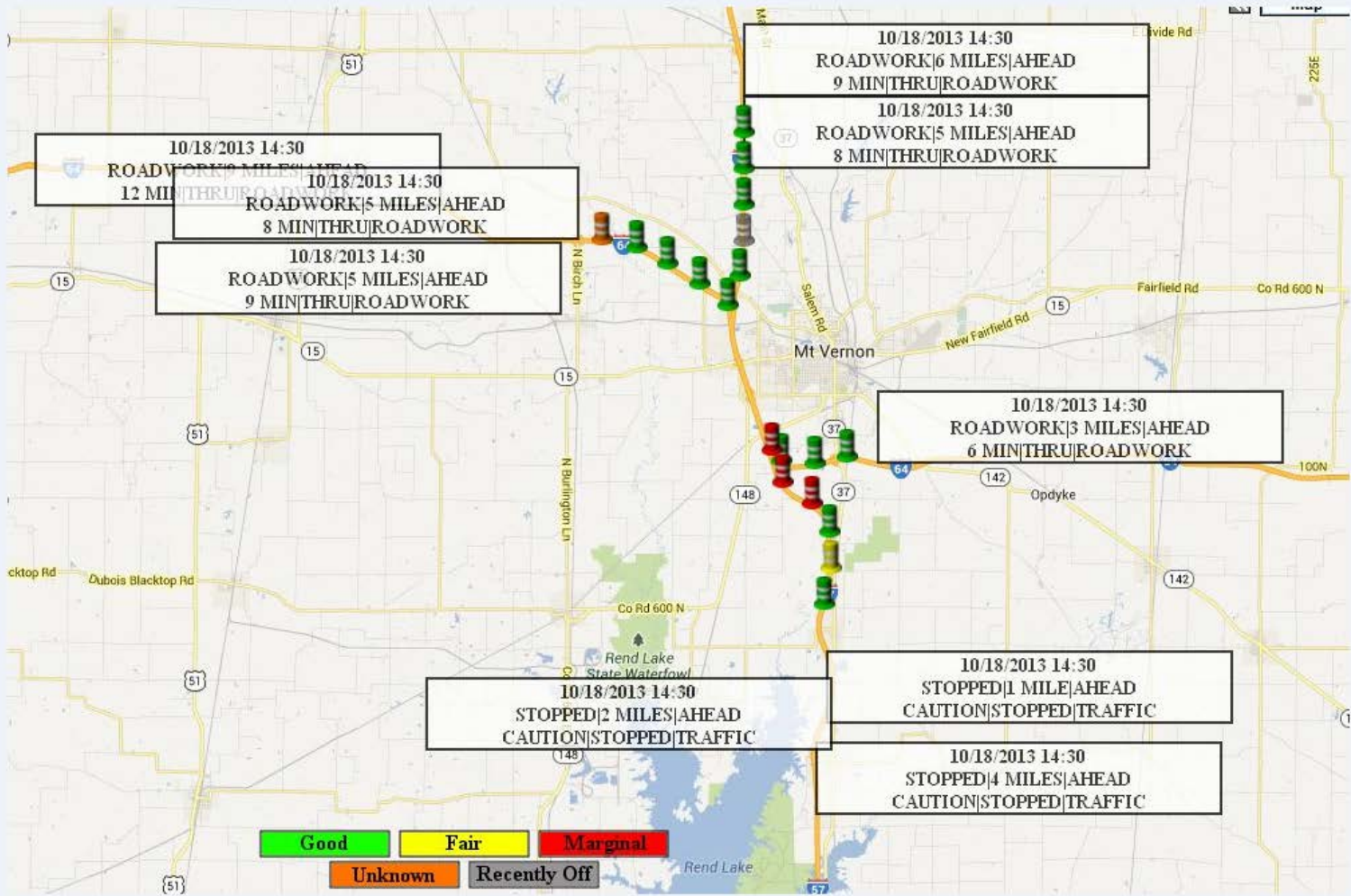
Cameras

Software Interface Component

The screenshot displays the VER-MAC software interface. At the top left is the VER-MAC logo. The top right shows the user name 'Thomas Hillmer', the server 'JamLogic Server', and a 'Log Out' button. Below the logo are navigation tabs for 'Main', 'Admin', and 'Help'. The top right corner shows the date and time '4/10/12 3:32 PM CDT'. The main header area contains 'Sign 9503', 'N03 - KL20', 'US IL I-55 NB mp 12.0', and a green 'OK' status indicator. On the left is a sidebar menu with options: Summary, Change Message, Override, Automation, Use Library, Configure, Maintenance, History, Messages, Voltages, Signal Strength, and Debug. The 'Messages' section is active, showing a list of messages with columns for Time, Status, and Message. The messages are as follows:

Time	Status	Message
Thu 1/12/12 1:15 PM CST		
Thu 1/12/12 1:11 PM CST		PREPARE TO STOP STOPPED TRAFFIC AHEAD
Thu 1/12/12 7:47 AM CST		
Thu 1/12/12 7:41 AM CST		PREPARE TO STOP STOPPED TRAFFIC AHEAD

*Courtesy Ver-Mac



Courtesy iCone

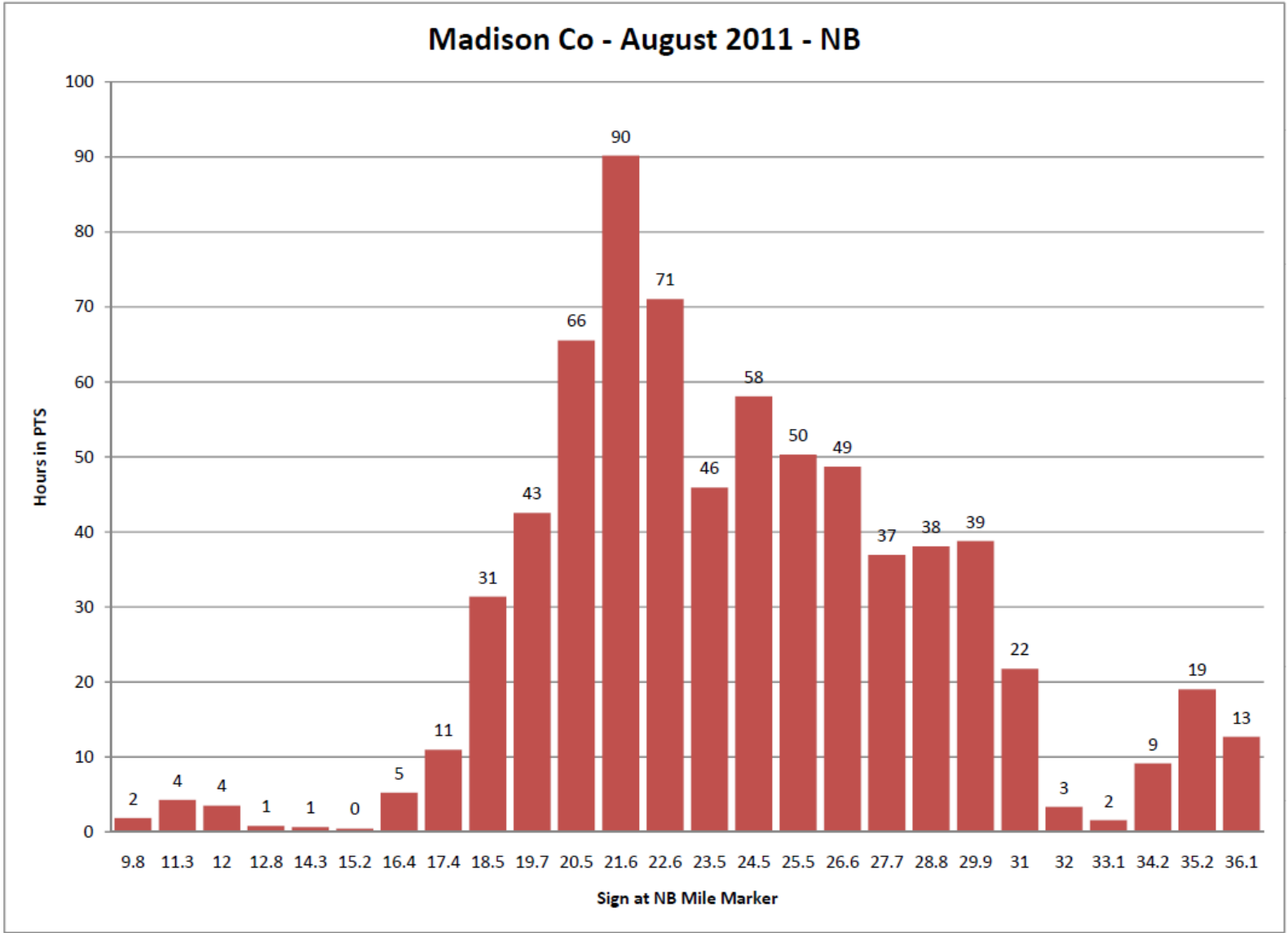
50					
52	A4, Sign 9704	EB I-270 at MM 12.2			
53		Speed < 40 mph	Delay	Max Delay	PTS Sensor A: A5
54		STOPPED TRAFFIC AHEAD	XX MIN DELAY	MAJOR DELAY NB I-55	PTS Sensor B:
55					Route:
56					
57					
58		PREPARE TO STOP	NB I-55 FOR 14 MILES	CONSIDER ALT ROUTE	Max Delay Trigger 23 min
59					
60					
61					
62		Alt Route	23 min	18.3 miles	
63					
64		Norm Route	15 min	13.8 miles	
65					
66		Sensors	NB 10 - NB 23		
67					



*Courtesy Ver-Mac

Screen Shot of Logic Decisions

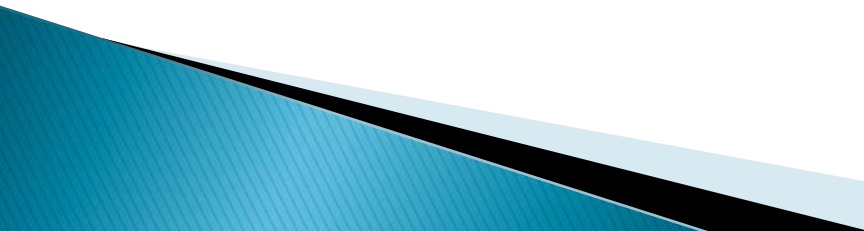
- Priority of Messages
- Triggers for Stop Cond/Alt Routes

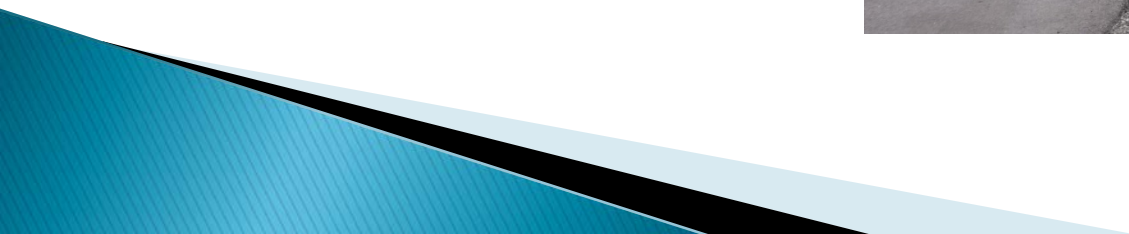


PTS - Prepare to Stop Hours for August

*Courtesy Ver-Mac





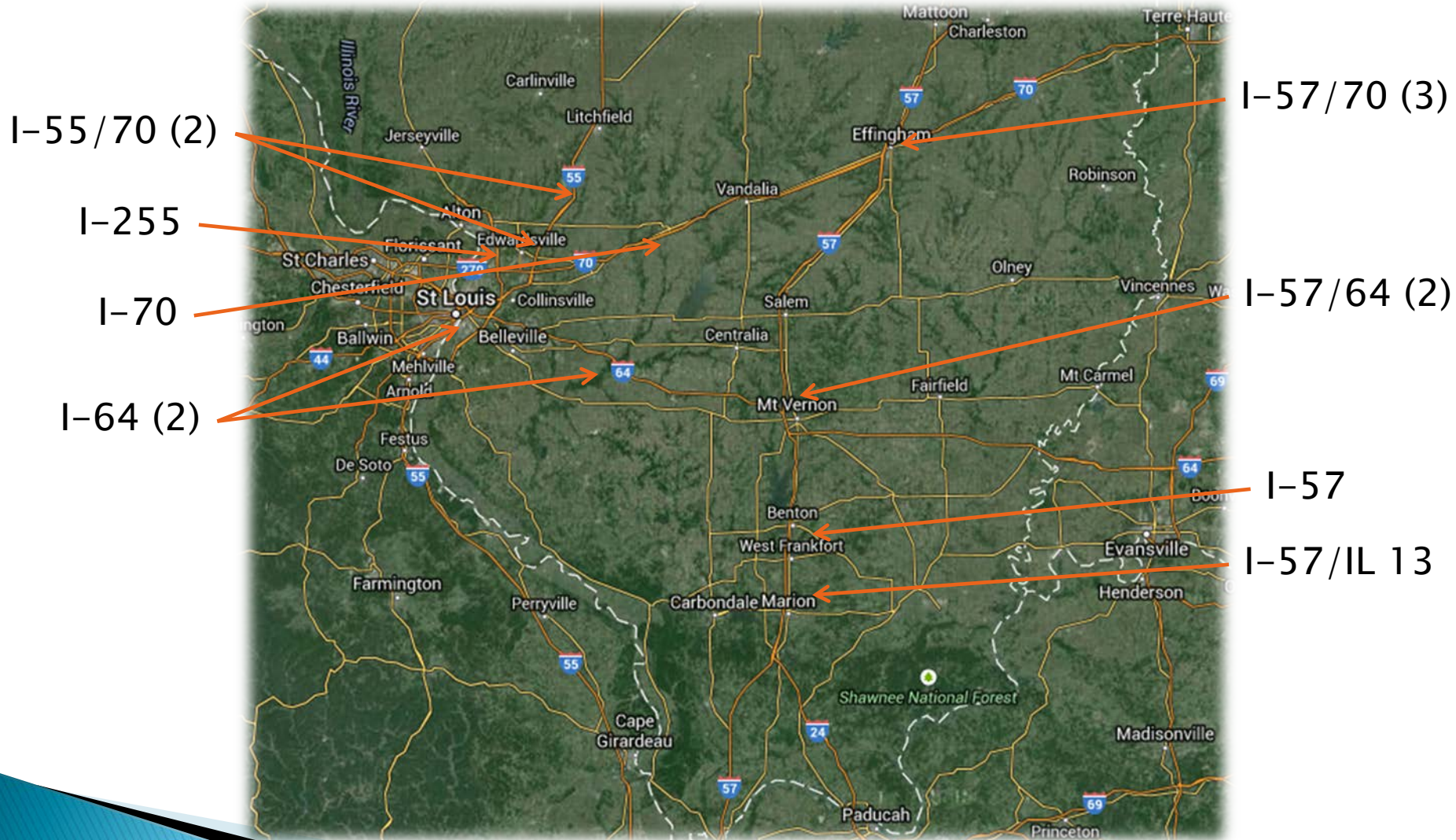




Determination of When to Use SWZ's

- ▶ Currently No Guidelines for Use of SWZ's
- ▶ Project by Project Basis
 - Based on knowledge of project area, traffic, accidents and site distance issues.
 - Queuing analysis.
 - Only used on interstate projects lasting at least one season
- ▶ Developing Policy and Tiered Statewide Contract Special Provisions
- ▶ On-Call Contract for 2015

Where Have SWZ's Been Deployed?



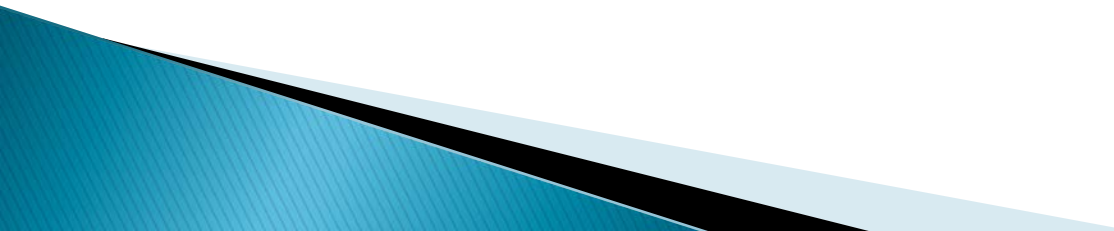
Smart Work Zone Summary in Southern IL

Location	Smart Work Zone System	Construction Years
I-64 Add Lane	ADDCO	2005-2007
I-57 Franklin Co.	iCone	2010
I-55 Edwardsville	Ver-Mac	2011
	Total	



Smart Work Zone Summary For 2012/2013 Construction in Southern IL

Location	Smart Work Zone System	Total \$
I-57/70 Effingham	Ver-Mac	\$2.5 million
I-57/64 Mt. Vernon	iCone	\$1.1 million
I-57/IL 13 Marion	ASTI	\$576,500
I-55 Hamel	Ver-Mac	\$455,000
	Total	\$4.6 million



Smart Work Zone Summary For 2014/2015 Construction in Southern IL

Location	Smart Work Zone System	Total \$
I-255 Collinsville	Ver-Mac	\$ 535,000
I-70 Bond Co.	Ver-Mac	\$ 399,000
I-64 Washington Co.	Ver-Mac	\$ 505,400
I-57/64 Mt. Vernon	Ver-Mac	\$ 403,000
I-57/70 Effingham	Ver-Mac	\$ 948,000
I-57/70 Effingham	Ver-Mac	\$1,050,000
	Total	\$3,840,400



What drove us to this point?



It wasn't our 2006/2007 I-64 Add-Lane project near St. Louis!

Carnage on I-57

AT LEAST TWO DIE IN FIERY, SEVEN-VEHICLE CRASH



July 16, 2010 1:00 am • BY STEPHEN RICKERL THE SOUTHERN

(0) Comment:



ALAN ROGERS / THE SOUTHERN An accident involving three semi trucks and

A seven-vehicle fiery crash on Interstate 57 on Thursday afternoon claimed the lives of two people, caused a third victim to be airlifted to a hospital and closed the highway for about five hours.

Two other crash victims were taken to Franklin Hospital in Benton after the crash just after 2 p.m. in Franklin County just north of West Frankfort.

Hazmat teams were called out, as four of the vehicles involved were semitrailers, two carrying loads of asphalt and another carrying a load of vehicle batteries. Fuel and vehicle batteries were exploding in the fire, challenging firefighters to keep the fire in check.

Trooper David Sneed of Illinois State Police District 13 said

http://thesouthern.com/news/local/article_d2ba9b7a-9090-11df-b22a-001cc4c002e0.html?mode=image

Immediate Response

Implemented Truck Mounted Message Sign to Alert Traffic to Stopped Conditions



Secondary Response:

Investigated use of automated system that could be implemented immediately to alert traffic to stopped conditions

Implemented iCONE System of Speed Sensors, computer software/logic, and PCMS's

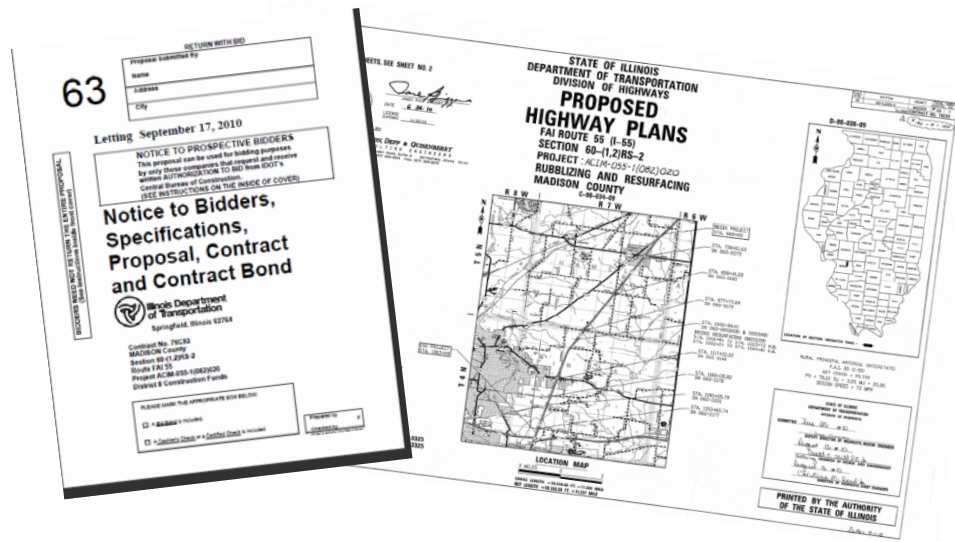




<http://www.bing.com/images/search?q=trap+doubles+photos&qpv=trap+doubles+photos&FORM=IGRE>

Two Directives for 2010/2011 I-55 Projects:

1. Do something to reduce the likelihood of an accident like that on I-57.
2. Do something to better inform the traveling public about delays and help them with options to minimize delays.



Process

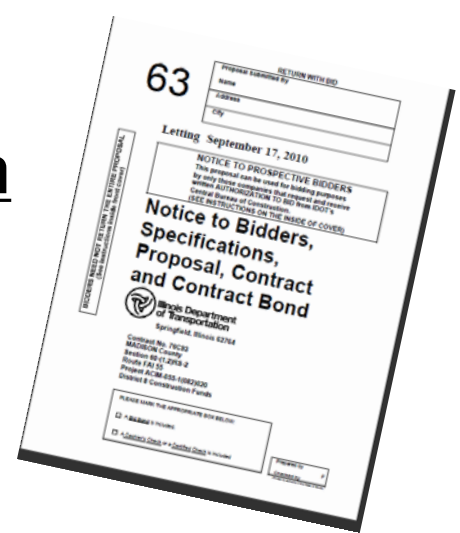
- Researched and Interviewed three ITS Smart Work Zone Companies
- Developed a 2 page Contract Special Provision and plan sheet addendum in accordance with state procurement laws allowing at least two bidders to meet the specification
- Included by Addendum with our Contract Plans

Smart Traffic Monitoring Special Provision Requirements

- Collect Real Time Vehicle Data
- Analyze Data via Control Software
- Alert Drivers of Delay Times, Stopped Traffic Conditions, and Alternate Route Options
- Included Penalty of \$2000/Hour after 4 hours

Link to Contract Plans & Special Provisions/Addendums:

<http://eplan.dot.il.gov/desenv/091710/76C93-063/>





Project Facts

Joint Venture of Keeley & Sons, Inc. and The Kilian Corporation

Awarded Contract Cost: \$42,254,835.85

Project Description: Rubblizing, Resurfacing, & Bridge Work
on I-55 from I-270 to IL 140 (11 + miles)

Contract Letting Date: 9/17/2010

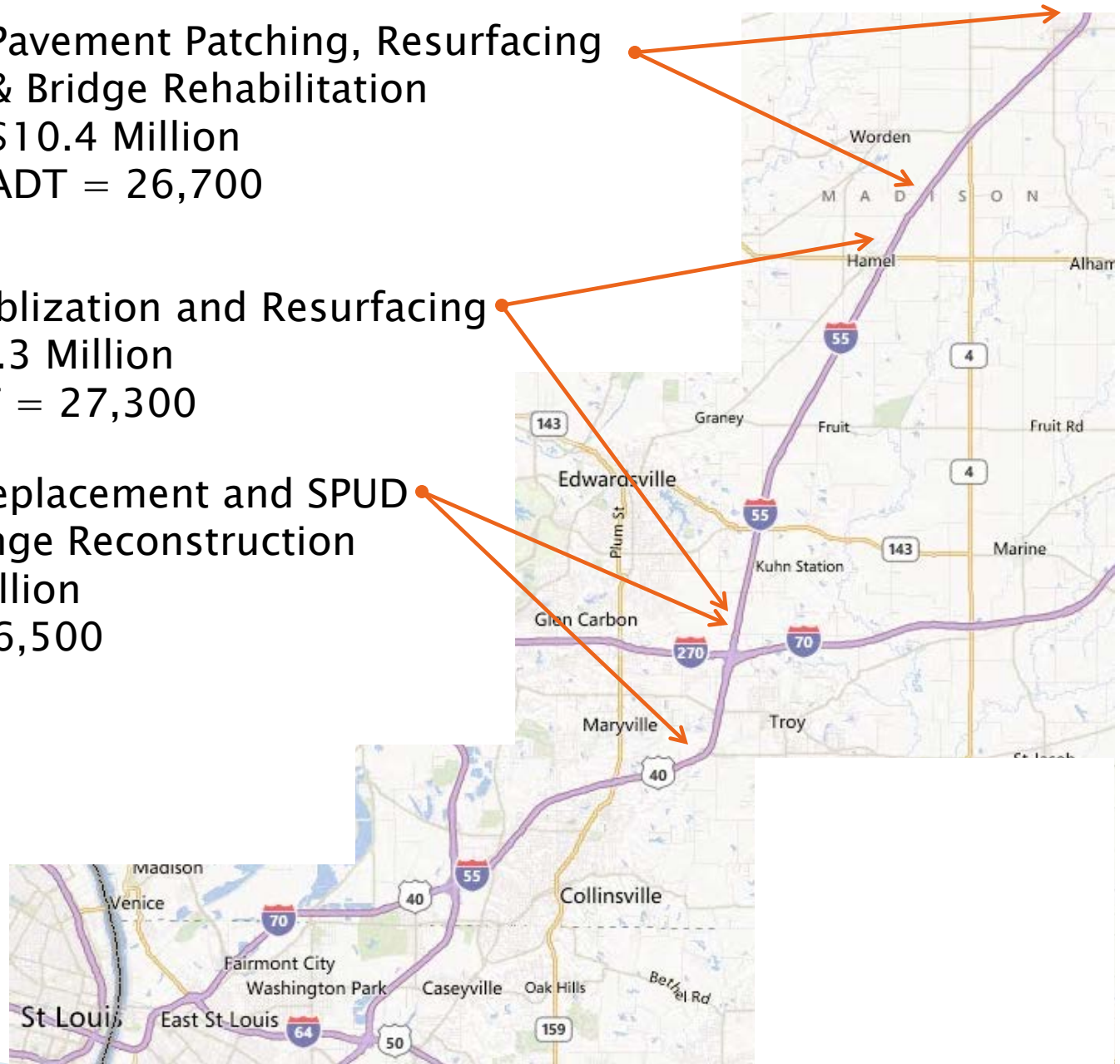
Start Date: December 2010

2011 Season

Pavement Patching, Resurfacing
& Bridge Rehabilitation
\$10.4 Million
ADT = 26,700

Rubblization and Resurfacing
\$42.3 Million
ADT = 27,300

Bridge Replacement and SPUD
Interchange Reconstruction
\$23.5 Million
ADT = 36,500



ITS Smart Work Zone Project Facts

Subcontracted to Ver-Mac of Minnesota

Subcontract Amount: \$1,150,000.00

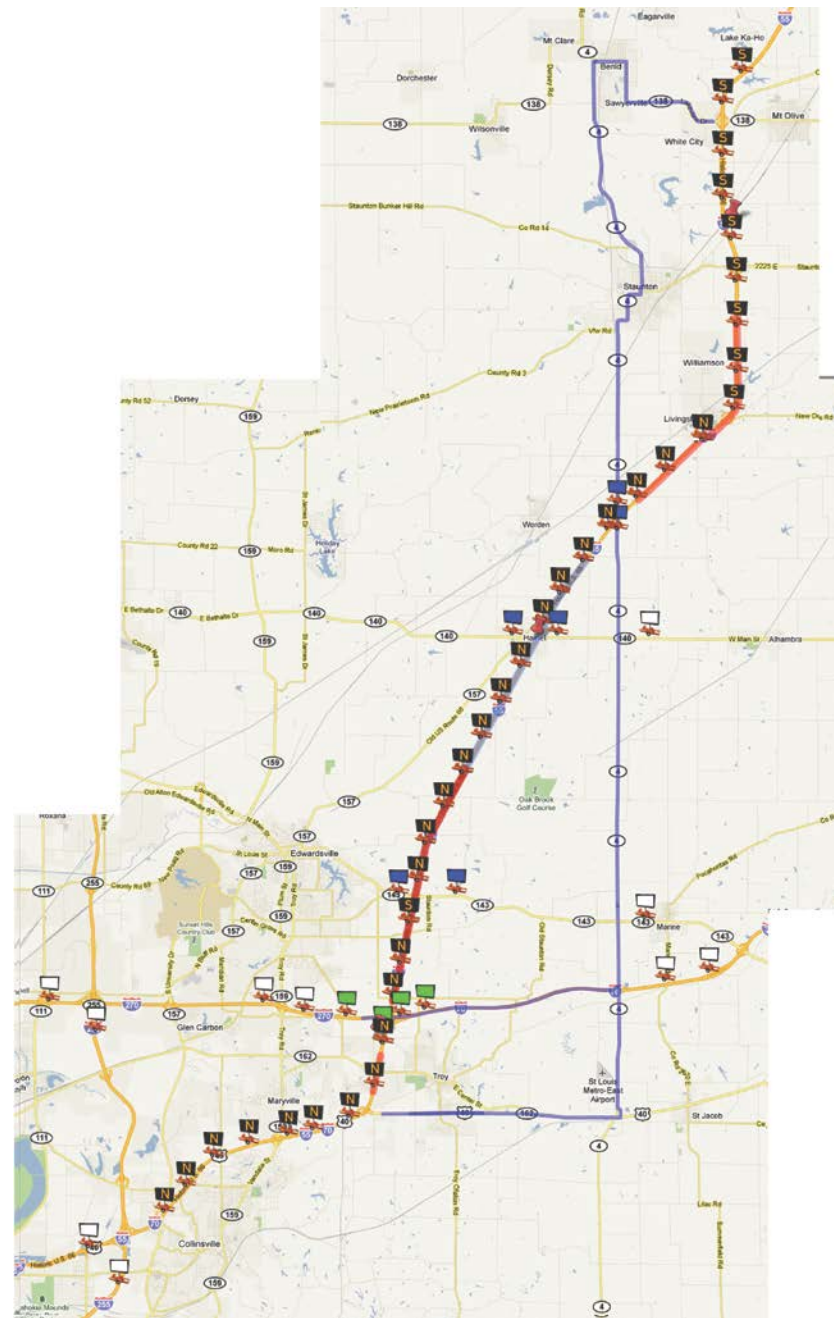
ITS System:

3 Construction Projects covering 30 miles with 6 mile lead in each way

Equipment Facts:

73 Portable Changeable Message Signs
(1 per mile each direction & @
Cross Roads)

56 Doppler Speed Sensors



Awards

- 2011 IDOT Contractor of the Year Award for “Work Zone Traffic Control”
- 2012 America’s Transportation Awards “Best Use of Innovation for Medium Project”





How Much Do SWZ's Cost?

2012/2013 Construction Seasons

2012/2013 Contracts	Contract \$	SMZ \$	% Cost
I-55 Madison Co.	\$18.4 M	\$ 455,000	2.5%
I-70 Effingham (3 contracts)	\$87.3 M	\$2,500,000	2.8%
I-57 Marion SPUD Interchange	\$40.4 M	\$ 576,500	1.4%
I57/64 Mount Vernon	\$30.6 M	\$1,100,000	3.6%
Totals	\$176.7 M	\$4.6 million	2.6%



2014/2015 Construction Seasons

2014/2015 Contracts	Contract \$	SMZ \$	% Cost
I-255 Collinsville	\$17.4 M	\$535,000	3.0%
I-70 Bond County	\$ 8.5 M	\$399,000	4.7%
I-64 Washington County	\$13.3 M	\$505,400	3.8%
I-57/64 Mt. Vernon	\$12.7 M	\$403,000	3.2%
I-57/70 Effingham	\$41.5 M	\$948,000	2.3%
I-57/70 Effingham	\$61.6 M	\$1,050,000	1.7%
Totals	\$155 M	\$3.8 M	2.5%

Are the Benefits of SWZ's Worth the Cost?

Benefits

- Communicate Delay Times and Suggest Alternate Routes
- Incident Management
- Reduction in Queuing Accidents???



Cost

Avg 2.5% of Contract Costs



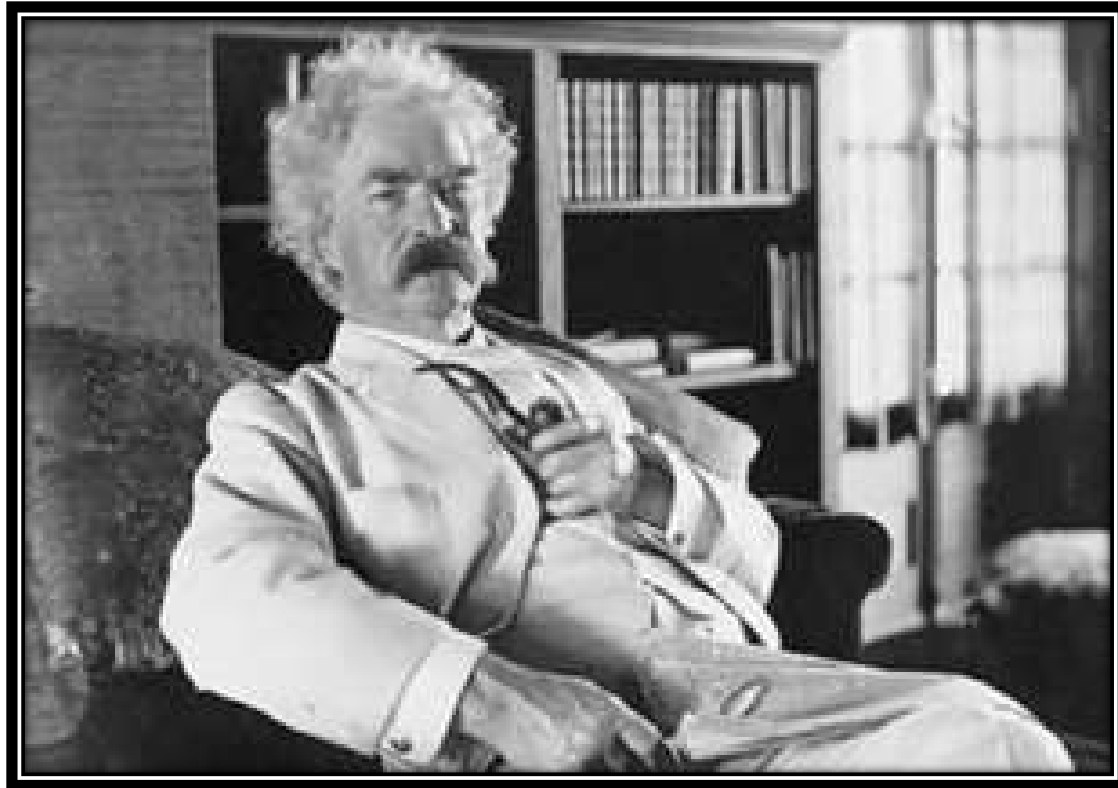
$$\text{BCR} = \frac{\text{PV}_{\text{benefits}}}{\text{PV}_{\text{costs}}}$$

where:

$\text{PV}_{\text{benefits}}$ = present value of benefits

PV_{costs} = present value of costs

“Get your facts first, and then you can distort them as much as you please. Facts are stubborn, but statistics are more pliable.” – Mark Twain



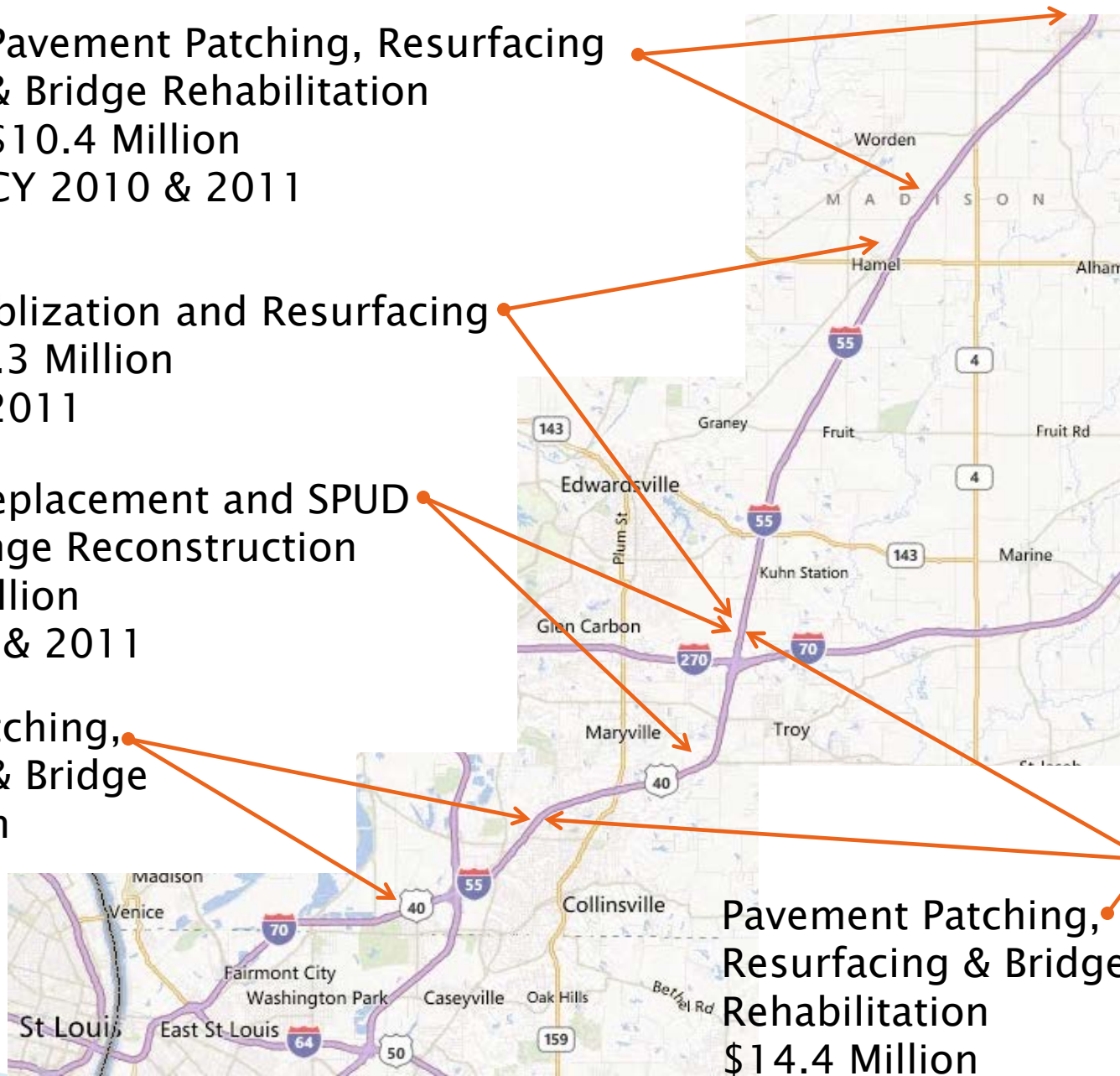
2010 & 2011 Seasons

Pavement Patching, Resurfacing & Bridge Rehabilitation
\$10.4 Million
CY 2010 & 2011

Rubblization and Resurfacing
\$42.3 Million
CY 2011

Bridge Replacement and SPUD Interchange Reconstruction
\$23.5 Million
CY 2010 & 2011

Pavement Patching, Resurfacing & Bridge Rehabilitation
\$9.6 Million
CY 2010



Pavement Patching, Resurfacing & Bridge Rehabilitation
\$14.4 Million
CY 2010

2010 Season

Pavement Patching, Resurfacing
& Bridge Rehabilitation
\$10.4 Million
ADT = 26,700

Smart Work Zone not utilized during 2010

Bridge Replacement and SPUD
Interchange Reconstruction
\$23.5 Million
ADT = 36,500

Pavement Patching,
Resurfacing & Bridge
Rehabilitation
\$9.6 Million
ADT = 39,700



Pavement Patching,
Resurfacing & Bridge
Rehabilitation
\$14.4 Million
ADT = 35,550

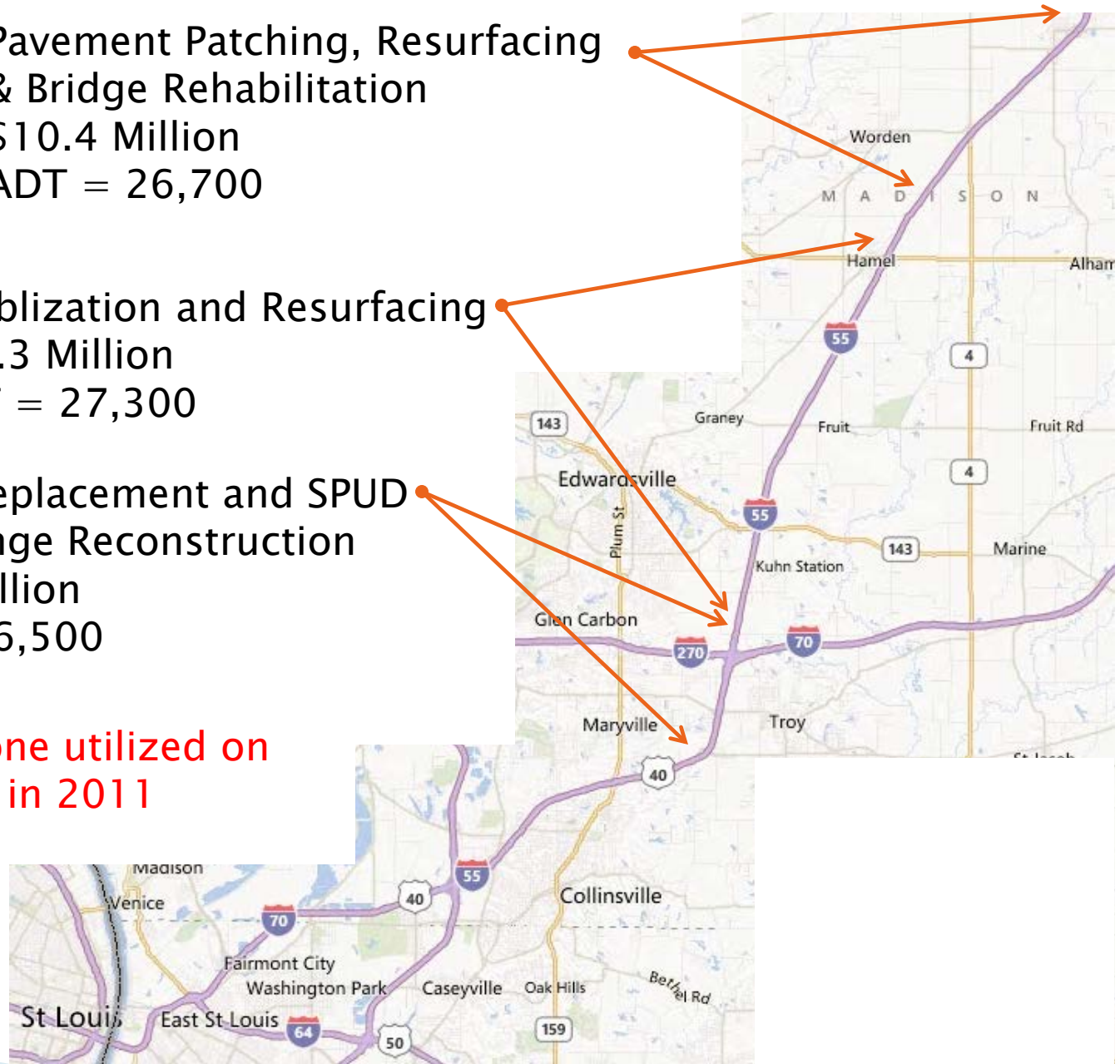
2011 Season

Pavement Patching, Resurfacing
& Bridge Rehabilitation
\$10.4 Million
ADT = 26,700

Rubblization and Resurfacing
\$42.3 Million
ADT = 27,300

Bridge Replacement and SPUD
Interchange Reconstruction
\$23.5 Million
ADT = 36,500

Smart Work Zone utilized on
all 3 contracts in 2011



2011 Accident Data (Facts)

I-55 Smart Work Zone Accident Analysis 2011 Data

MP	Collision Type	Injury Type	Fatal	Injury	Surf Cond	Weather	Lighting	Vehicle Direction	
								1	2
6.21	rear end	pd	0	0	dry	clear	daylight	s/w	s/w
6.21	rear end	pd	0	0	dry	clear	daylight	s/w	s/w
8.74	rear end	pd	0	0	dry	clear	dark	n/e	n/e
10.64	rear end	pd	0	0	wet	rain	dawn/dusk	s/w	s/w
10.76	rear end	pd	0	0	dry	clear	dark	n/e	n/e
10.86	rear end	pd	0	0	wet	rain	dark	n/e	n/e
11.34	rear end	fatal	1	0	dry	clear	daylight	n/e	n/e
11.35	rear end	pd	0	0	dry	clear	daylight	n/e	n/e
11.45	rear end	pd	0	0	dry	clear	daylight	n/e	n/e
11.68	rear end	pd	0	0	dry	clear	daylight	n/e	n/e
11.85	rear end	pd	0	0	dry	clear	dark	n/e	n/e
11.9	rear end	c-injury	0	1	dry	clear	daylight	n/e	n/e
14.1	rear end	pd	0	0	dry	clear	daylight	n/e	n/e
14.48	rear end	pd	0	0	dry	clear	daylight	n/e	n/e
14.5	rear end	pd	0	0	wet	rain	daylight	s/w	s/w
15.36	rear end	pd	0	0	dry	clear	daylight	n/e	n/e
15.44	rear end	pd	0	0	wet	rain	daylight	n/e	n/e
15.45	rear end	pd	0	0	dry	clear	daylight	n/e	n/e

2011 Construction Compared to 2010 (Statistics)

	2010	2011	Difference	% Change
Total Miles I-55 Construction	19.5	20.2	+0.7	+3.6%
Total Lane Closure Days	355	540	+185	+52%
*Total Vehicle Exposure (ADT x Lane Closure Days)	13,031,750	16,346,800	+3,315,050	+25.4%
Property Damage Accidents	75	64	-11	-14.6%
Injury Accidents	18	16	-2	-11%
Fatalities	1	1	0	0%
Total Queuing Accidents	94	81	-13	-13.8%

*Does not account for ADT using Detours



Lessons Learned

1. Develop statewide tiered special provisions that will allow for competition between all SWZ systems.
2. Establish guidelines for utilization of tiered SWZ systems.
3. Address our Technology vs. Sole Source Issues.
4. Recognize that no system is perfect at this point.
5. Use feedback from motorist constructively.



U.S. Department of Transportation
Federal Highway Administration

Work Zone Intelligent Transportation Systems Implementation Guide

Use of Technology and Data for Effective
Work Zone Management

January 2014



Figure 4. Overview of the implementation process.

Source: Iahselle

SUPPORT AND AVAILABLE TOOLS

- 2014 FHWA WORK ZONE IMPLEMENTATION GUIDE
- FHWA INTELLIGENT TRANSPORTATION SYSTEM WORKSHOPS
- FHWA EVERY DAY COUNTS 3 INITIATIVE: EDC-3 SMARTER WORK ZONES WEB PAGE
- FHWA WORK ZONE MOBILITY AND SAFETY PROGRAM – WORK ZONE ITS & TECHNOLOGY WEBSITE



Thank you!
Questions?

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