INDOT Agency Factoids (System/Comm.)

• Number of signalized intersections- 2570
  – 200 connected by fiber
  – 300 connected by radio
  – 0 connected by twisted pair
  – 225 connected by cellular
  – 1500 not connected to communication

• Number of engineers/technicians devoted to signals. 8 engineers, 32 Technicians
  – Currently 2 vacant engineer positions (1 Engineer level, 1 Managing Engineer level)

• Central System Vendor None, Closed loop systems function as central system

• 300 signals collecting high resolution data
• Greater than 10 years collecting high resolution data
Agency Factoids (Detection)

- Length of stop bar detectors on minor movement.  **51 ft**
- Use of dilemma zone or other detection on arterial main line.  **Both stop bar detection and dilemma zone detection used (5 seconds in advance of stop bar)**
- Detection Technologies used.  **All in pavement, no above pavement**
- “Lane by Lane” or “Lane Group Detection”  **Lane by lane**
- Link to detection standard number scheme
- # of Signals with Emergency Vehicle Preemption.  **100 maint. by others**
- # of Signals with RR Preemption.  **75 with pre-empt**
Using Real-Time Probe Vehicle Data to Manage Unplanned Detour Routes

By Margaret McNamara, Howell Li, Stephen Remias, Lucy Richardson, Edward Cox, Deborah Horton, and Darcy M. Bullock

The unexpected closure of an interstate is a massive undertaking involving a variety of stakeholders. Such was the case in August 2015, when pier settlement of the Wildcat Creek Bridge on I-65 N in Indiana, USA required an unplanned closure of a 37-mile stretch of the interstate for approximately 31 days. The detour route had little existing intelligent transportation systems (ITS) infrastructure to assist engineers with managing operations. To fill this information need, real-time crowdsourced probe vehicle data were used to create real-time dashboards hosted on a website for use by Indiana Department of Transportation (INDOT) engineers and public safety officials to monitor mobility and queueing on the 62-mile detour route. This paper describes how the real-time dashboards were used to proactively identify congestion problems, as well as measure the impact of mitigation measures.

Route Diversion

The southbound bridge was too narrow to support bidirectional traffic, so the northbound traffic was diverted onto US-52 at mile marker 141 (Lebanon, IN) and returned to I-65 just north of Lafayette at Exit 193 (Figure 1a). This stretch of interstate usually carries an average annual daily traffic of 24,000 vehicles, including about 9,500 trucks, and it is an important connector between Indianapolis, IN and Chicago, IL, USA.

Figure 1 shows the area of the closure and detour, with callouts of Figure 1b marking the location of the closed bridge. The detour consisted of US-52, SR-28, and US-231, shown in Figure 1a. INDOT deployed fifteen dynamic message signs (DMS) that were used to direct drivers, advising them of turns and potential queues. Additionally, there were 40 trafficcasing signs marking the direction of the detour and 19 other signs, including warning signs for traffic lights and work zones. Figure 1b, callouts i, ii, and iv, mark temporary signals that were installed, and callout v marks a four-way stop that was converted to a two-way stop, which are discussed later in the article.

Figure 1. Maps of Detour Route

Immediately after the closure, DMS near Indianapolis (and later in adjacent states) were used to advise drivers of the closure and encourage Chicago-bound traffic to take I-74 to I-67 in Illinois.

http://tinyurl.com/indetour
Interstate Diversion

Bridge Closed on Aug 6 (AADT ~ 35000) Trucks ~ 5000

NB I-65 closed from MM 141 to 178 (~ 37 miles)

Diversion Route
Northbound I-65 Bridge Closure…
Repairs In Progress
Making Real Time Decisions and Separating Fact from Fiction

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2 years of work to clog Lafayette’s major artery

By Hannah Smith Kiefer
hannah@jconline.com

What could be worse for drivers than intermittent road closures? Try 145 in the summer, fall and spring for the next two to three years.

Big changes — and big construction headaches — are coming to a stretch of the interstate that passes through Lafayette. The project, which will continue into fall 2017, involves widening the road and adding a median.

Worried about the work extending traffic times? Don’t worry. Construction hours will be only 5:30 a.m. to 5 p.m., and crews will work from Monday to Friday.

What changes are coming:

Crews will widen 145 from two lanes in each direction to three lanes in each direction. To do this, workers will place the two new lanes in the center median space and add a center concrete barrier to separate the two directions of traffic.

Noise barriers will be added on both sides of the road. The first will be west of 145, just north of Indiana 24, and the second will be east of 145, just south of the I-70/1-65 interchange. The third will be further down the road.

The second stage of the project will widen one lane on the east side of 145, from exits 172 to 168.

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NIGHTMARE ON INTERSTATE 65

WHAT THEY’RE DOING
Lanes eventually will be reduced in size to 11 feet lane with 2-foot shoulders. Drivers in vehicles pulling heavy loads will be restricted during construction.

CAUTION!
The speed limit in the work zone will decrease from 70 to 45 mph during active construction. Typically, the 3-mile stretch between Indiana 25 and Indiana 36 will be reduced to four lanes in each direction.

OVERSIZE LOAD
Lanes eventually will be reduced in size to 11 feet lane with 2-foot shoulders. Drivers in vehicles pulling heavy loads will be restricted during construction.

SPEED LIMIT 45

GETTING AROUND IT
Going north, I-65 will be reduced to a single lane. Drivers should use exit 176 to Harrisburg Road. Then take I-70 west to exit 169 and then backtrack onto I-65 at exit 169.

NOISE BARRIERS
The first will be west of 145, just north of Indiana 24, and the second will be east of 145, just south of the I-70/1-65 interchange. The third will be further down the road.

STAGE 2
2016 to 2017

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USA TODAY
ISIL leader killed
U.S. troops carried out a raid inside eastern Syria. USA TODAY, 18

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JCONLINE.com
Facebook.com/JournalAndCourier

The immediate care you can trust for life’s minor injuries, illnesses and accidents.

LAFAYETTE - Open Daily Noon - 10 pm
1001 Harvest St. (St. Elizabeth Central Campus)

WEST LAFAYETTE - Open Daily 8 am - 8 pm
1135 Sagarine Pkwy West (Across from WJ Fields Dept.)

Franciscan ExpressCare
FranciscanExpressCare.org
How Bad? Ineffective, Absurd…
Using Metrics to change the narrative.

- Reporter drove official detour right after the closure, wrote article for local newspaper
- Took 4 hours to drive ~60 miles
- Said “Moral of the story is that the INDOT detour route is essentially ineffective.”
- “Plan for it to take an absurd amount of time.”
Traffic Summary
US-52 N (I-65 to SR-28)

Segment Speed Profile

Cumulative Traffic Ticker
Traffic Summary
SR-28 (US-52 to SR-231)

Segment Speed Profile

Cumulative Traffic Ticker
Traffic Summary
US-231 (SR-28 to US-52)

Segment Speed Profile

Cumulative Traffic Ticker
Traffic Summary

Segment Speed Profile

Cumulative Traffic Ticker
Traffic Summary
US-231 N (US-52 to SR-18)

Segment Speed Profile

Cumulative Traffic Ticker
Traffic Summary
US-231 N (SR-18 to I-65)

Segment Speed Profile

Cumulative Traffic Ticker
Traffic Summary

Total

Segment Speed Profile

Cumulative Traffic Ticker
Daily Northbound Volumes – US-231 NB approaching Lafayette

Week -4  Week -3  Week -2  Week -1  Week 0  Week 1  Week 2

Daily Volume (veh)

0  2000  4000  6000  8000  10000  12000  14000  16000  18000

- Initial I-65 Closure
- Second I-65 Closure
- I-65 Reopened
- Weekend
US-231 @ River Road – Typical Week Before and After (Week of 7/25 vs. Week of 8/15)

![Graph showing traffic volume comparison before and after a certain week. The graph is labeled with days of the week and time of day. The data is represented with two lines: one in green for 'Before' and one in blue for 'After'.]
Detour Route Dashboard

Temp Signals

Cong shifts to 231

I-65 N Detour Route

231/18 Flasher change

231 Signal Timing

Several Incidents

> 10 Miles 0-14 mph

Most measures implemented
Temp Signals Installed
Cong shifts to 231
231/18 Flasher change
Boone County Fatal
Boone County Mobile Home
Exit 193 Tanker Roll Over

I-65 Detour Route

Routes

Display
Axis Maximum
Congested Speed
Date Range
15-Minute Summary:
2015-08-26 22:15 UTC

Purdue
Signalization Impact

ISP Dispatch, Mon INDOT changed from 4 way stop to 2 way stop

Temp signal at 52/28 addressed

Temp signal at 28/231 addressed

Now chasing second order effects
SR 28/US 231 Temporary Signal
Sunday, August 9, 2015
Ed Cox / Jim Sturdevant @ 231/28
SR 28/US 52 Temporary Signal
Temporary Signal at US 231 & SR 28 - Romney

- 2 phase signal
- Installed cell modem for remote access
- Monitored remotely and adjusted splits based on INRIX/Google traffic queuing
INRIX/Google traffic was monitored continuously throughout the day. If queue on detour route was seen past CR 100E, pattern was changed remotely to give more time to E/W phase. Resulting in…
Temporary Signal at US 231 & SR 28

...alleviating the queue on the detour. This would increase the queues to the north and south, so splits were always being monitored and adjusted to try and balance the queuing, although queues on the detour route were of more importance.
Temporary Signal at US 52 & SR 47

- Safety concern at US 52 & SR 47
  - 2 way stop controlled E/W
  - High crash history prior to closure
- Signal installed to increase safety
  - Constructed overnight, ~12 hours
- Special detection installed to limit dilemma zone issues, red light running
Temporary Signal at US 52 & SR 47

- Installed speed sieve detection to extend phase safely for all vehicles travelling 40-70mph
- NB phase ran free with long min and longer max
- Eventually would gap out when no vehicles were approaching, serve SR 47 vehicles safely
3 signal system coordinated all day, but coordination was for US 52 E/W.

5 signal system coordinated only during AM and PM peaks.

All 3 signals south of Wabash River weren’t running in coordination due to distance between signals and light volume on 231.

Was 2-way stop controlled E/W. A temporary 2-phase signal was constructed during the I-65 closure.
During the Detour

- Coordinated all signals and ran the same plan 24/7. 150 second cycle, large split for NB. Offsets were aligned solely for northbound progression.

- Temporary signal was programmed with progressive splits allowing more time for WB interstate volume, changed during day based on traffic monitored remotely.
Retiming the Greater Lafayette Corridor

- All signals were retimed during the first week of the closure
- Coordinated every signal, only caring about northbound progression
- 150 second cycle length, heavily favoring northbound phase, (or westbound on north end)
- Adjusted offsets with goal of all signals having > 90% arrivals on green
I-65 Detour

Before Retiming

*Old controller prior to retiming

Free with 75s NB Max

No data*

After Retiming

Free with 75s NB Max

*Old controller prior to retiming
I-65 Detour Route

*Data logging issue corrected after retiming

Before Retiming

US 52 @ US 231 (East Jct)
AOG: 5819/9887 (58.86%)

US 231 @ Lindberg Rd (CR 200 N)
AOG: 8679/12489 (69.49%)

US 231 @ SR 26 (State St)
AOG: 13709/14612 (93.82%)

After Retiming

US 52 @ US 231 (East Jct)
AOG: 9226/10242 (90.08%)

US 231 @ Lindberg Rd (CR 200 N)
AOG: 12531/14712 (85.18%)

US 231 @ SR 26 (State St)
AOG: 13709/14612 (93.82%)

No data*
Public Safety Dialog

I-65 N Detour Route
Queue
Forms

Back of Queue Crash

8 hour closure

More 4 way stop queueing

Conversion to flashing yellow

Police waving vehicles through

Free flow conditions

Queue Crash

8/8/2015 (Saturday)

8/9/2015 (Sunday)

8/10/2015 (Monday)

8/11/2015 (Tuesday)
Public Safety Workshop: August 13, 2015
I-65 Diversion Scenario

Bridge Closed on Aug 6 (AADT ~ 35000) Trucks ~ 5000

NB I-65 closed from MM 141 to 178 (~ 37 miles)

We saw the overall route performance… What were the details?
Blue Tooth Data Collection Locations...
Did Motorists Favor the Detour Route?

- Signed Detour: 65.6% (Median = 64 min)
- Alternate #2: 13.2% (Median = 65 min)
- Alternate 1: 21.2% (Median = 65 min)
Using Metrics to change the narrative.

- Improvement to drive ~60 miles from 4 hours to about 64 minutes
- Bad news stories stopped being published
- Many reports of driving detour with zero to one stop!
- Media advocating use of the detour.

Detour Diary: How bad was the detour really?

By Hannah Smith Kiefel

As the queues of construction stories at the Journal & Courier, reports on detour issues and road closures increase, a lot of Interstate 65 detour caused by the closure of the Wabash Creek Bridge on Wednesday. So I decided to drive that route. I thought it would take about two hours tops.

I was wrong. It took four. I documented the experience on Twitter, through photos, videos, and blog posts. I tagged a worker multiple times asking if I should turn around. But I didn’t — I drove the whole way from U.S. 52 in Lebanon, Ind., 28 U.S. 231.

12:44 p.m. See you all in like ten hours when I get through this detour.

1:53 p.m. I'm going to kick something.

2:33 p.m. It would be faster to take one of these guys!

2:33 p.m. I'm actually getting close to the detour, still feeling the stress.

3:11 p.m. Oh my god, we're almost there.

3:22 p.m. Tired, but feel a wave of relief.

3:58 p.m. It's over.

Check out the whole, maddening journey on my Twitter feed: @hannsmith.
Questions?

Thank you!!

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    Ecox@indot.in.gov