Northbound I-65 Bridge Closure...
April 2007 Team
Topics

1. Probe Data
2. Evolving Perspective on
   • Probe Data Dashboards (spatial) and
   • Purdue Traffic ticker (temporal)
     .... with some Iowa Examples
3. Traffic Ticker Applied to I-65 Detour
Probe Vehicle Data History
Crowd Sourced Data (Independent of Graduate Student Travel)

Probe Provides Game Changing Opportunities for Agencies
Almost 2600 hours in a year
Mobility Report Performance Measures
2012 Performance Measures: Speed Profile Diagrams

2011

Eastbound

Exit 2: US 41 S (Hammond)
Exit 15: US 6 E (Lake Station)
Exit 11: (Lake Station)
Exit 16: (Porter)
Exit 34: US 421 (Michigan City)
Exit 15: US 6 E (Lake Station)
Exit 11: (Lake Station)
Exit 2: US 41 S (Hammond)
Exit 16: (Porter)
Exit 34: US 421 (Michigan City)

No Data 0-14 MPH 15-24 MPH 25-34 MPH 35-44 MPH 45-54 MPH 55-64 MPH 65+ MPH


Congestion Hours (Max 350/Month Shown)
Mobility Report Performance Measures
2012 Performance Measures: Speed Profile Diagrams

$16 Million savings from 2011 to 2012
Indiana Delay\textsubscript{45} Summary

9.5 times as much as....

This month
National Performance Measures
Where are the Problems Nationally?

>$600 Billion in Freight to/from/through
National Performance Measures

Where are the Problems Nationally?

Performance Measures can be used to identify anomalies.
National Performance Measures

Iowa December 2012

Relative Travel Time Deficit (Hours/Mile)

Performance Measures can be used to identify anomalies

Source: timesunion.com

Iowa Interstate 80 – December 20th, 2012

Transportation officials in Iowa and Illinois, concerned with motorists' need for warnings to slow off the roads during the winter storm.

At 4:30 a.m. Thursday, December 20, Interstate 80 was closed in six separate locations because of wrecks. 108 vehicles were involved in a series of 18 crashes, including one at North Interstate 80/90/159/159 interchange because of a crash. Road conditions were expected to worsen before dawn on Friday.

High winds and blowing snow created hazardous travel conditions. Winds have an especially strong impact on lightweight and high-profile vehicles as well as those towing trailers.

Source: timesunion.com
I-80: Coast to Coast

[Graph showing traffic congestion along I-80 from Feb 12 to Feb 19, 2016]
I-80: Iowa This week
I-70 East Coast Blizzard Impact/Recovery
What an opportunity in Iowa for Integrating Iowa Plow cameras with Purdue Traffic Ticker
I-80: Concept
Indiana Freeway Dashboards aka “Traffic Ticker”
Pre-Thanksgiving Winter Weather
Temperature & Sun setting

1600-2000 (Indy Time) were most challenging

Increase in speeds >65 as sun has impact 0730-1000

Winter Weather and Traffic Ticker (LaPorte)
Thanksgiving Week Snowstorm
Low visibility

Solar radiation
Bigger Storms in January

- 500 Trucks at 1500
- 693 Trucks at 0900

Modest impact on Crawfordsville District
Greenfield
Sun (260mi), Tues(160mi)
Example Small Event
Emergency Patching Operation

INDOT Interstate System Dashboard

Dashboards Filtered by Route and District

Crawfordsville I-65
About 6 miles
\(~0745-1130\)
Speed Profile
Dec 10, 2015

Lafayette (55-64)

Lebanon (0-14mph)
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Using Real-Time Probe Vehicle Data to Manage Unplanned Detour Routes

BY MARGARET McNAMARA, HOWELL L.I, 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 9,000 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 callout 1 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 traffic甜甜圈 signs marking the direction of the detour and 19 other signs, including warning signs for traffic lights and work zones. Figure 1b, callouts 11, 11, and 14, mark temporary signals that were installed, and callout 16 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...
The Problem
Northbound I-65 Bridge Closure…
Repairs In Progress

35000 vehicles?
Making Real Time Decisions and Separating Fact from Fiction
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
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
Daily Northbound Volumes – US-231 NB approaching Lafayette

Weekly Volume Trends:
- Week -4
- Week -3
- Week -2
- Week -1
- Week 0
- Week 1
- Week 2

Key Events:
- Initial I-65 Closure
- Second I-65 Closure
- I-65 Reopened
- Weekend

Daily Volume (veh)

X-axis dates:
- 7/5/2015
- 7/12/2015
- 7/19/2015
- 7/26/2015
- 8/2/2015
- 8/9/2015
- 8/16/2015
- 8/23/2015
US-231 @ River Road – Typical Week Before and After (Week of 7/25 vs. Week of 8/15)

![Graph showing traffic volume comparison between before and after interventions on a specific road. The graph displays data for different days of the week with a clear distinction between 'Before' and 'After.' The x-axis represents time from 0:00 to 0:00, and the y-axis represents traffic volume in vehicles per hour (veh/h). The graph highlights the changes in traffic patterns, with a notable reduction in traffic volume after the intervention.]
Detour Route Dashboard

- Temp Signals
- Cong shifts to 231
- 231/18 Flasher change
- 231 Signal Timing
- Several Incidents

I-65 N Detour Route

- > 10 Miles 0-14 mph
- Most measures implemented
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
Impact of change from 4 way stop to 2 way stop (Aug 11)

Change from 4 way to 2 way stop
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
Temporary Signal at US 231 & SR 28

“All roads lead to Romney”
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
Before the Detour

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 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 Route

Before Retiming

*Data logging issue corrected after retiming

After Retiming

O = signal on detour

*Data logging issue corrected after retiming
Public Safety Dialog

I-65 N Detour Route
Temp Signals Installed
Cong shifts to 231
231/18 Flasher change
231 Signal Timing
Exit 193 Tanker Roll Over
Boone County Mobile Home
Boone County Fatal
Public Safety Workshop: August 13, 2015
Blue Tooth Data Collection Locations to assess route choice and validate INRIX...
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
Travel Time, BT vs algorithm

Out of 20 periods examined, 18 periods had less than 3.5% error

Trajectory reconstruction using INRIX

Queue at US231 and SR28

Spike at 150 minutes, 8:18:00 on 8/18/2015
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.
Thank you

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• [@darcybullock](https://twitter.com/darcybullock) (Twitter)
Questions?

Thank you!!

- Contact:
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    - jsturdevant@indot.in.gov
  - Ed Cox
    - Ecox@indot.in.gov
Route Builder and Trajectory Analysis

Map images from Open Street Map (openstreetmap.org)
Detour Route Dashboard

I-65 N Detour Route

Temp Signals
Cong shifts to 231
231 Signal Timing
Most measures implemented

> 10 Miles 0-14 mph

Miles < 15 mph
Miles


> 65 55 to 64 45 to 54 35 to 44 25 to 34 15 to 24 0 to 14
Interstate Diversion

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

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

Diversion Route
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The Problem
SR 28/US 231 Temporary Signal
SR 28/US 52 Temporary Signal
Temp Signals Installed

Cong shifts to 231

231/18 Flasher change

Boone County Fatal

Exit 193 Tanker Roll Over

Boone County Mobile Home
Impact of change from 4 way stop to 2 way stop (Aug 11)

Change from 4 way to 2 way stop
Back of Queue Crash
8 hour closure
More 4 way stop queueing
Conversion to flashing yellow
Police waving vehicles through
Free flow conditions
Ohio Traffic Ticker

Ohio Interstate System Dashboards

Routes
- Eastbound
  - State Line to I-70
  - I-70 to I-270
  - I-70 to I-77

- Westbound
  - I-70 to State Line
  - I-270 to I-75
  - I-77 to I-77

- Northbound
  - State Line to I-70
  - I-70 to Sidney
  - Sidney to Findlay
  - Findlay to I-475
  - I-475 to State Line

- Southbound
  - I-70 to State Line
  - Sidney to I-70
  - Findlay to Sidney
  - I-475 to Findlay
  - State Line to I-475

Display
- Miles
- Percentage
- Axis Maximum
- Set y-axis maximum
- Congested Speed
- Speed limit for congestion:
  - > 45 mph

Date Range
2015-11-30 to 2015-12-10

15-Minute Summary:
2015-12-11 01:45 UTC

Purdue INRIX