

Using Cloud Based Big Data for Signal Timing

Presented to 2023 ITS Heartland Annual Meeting

John Albeck, P.E., PTOE

May 2, 2023

Topics

1. Big Data Platforms
2. Corridor Prioritization
3. Before vs. After Analysis
4. Troubleshooting & Monitoring
5. Big Data vs. Floating Car



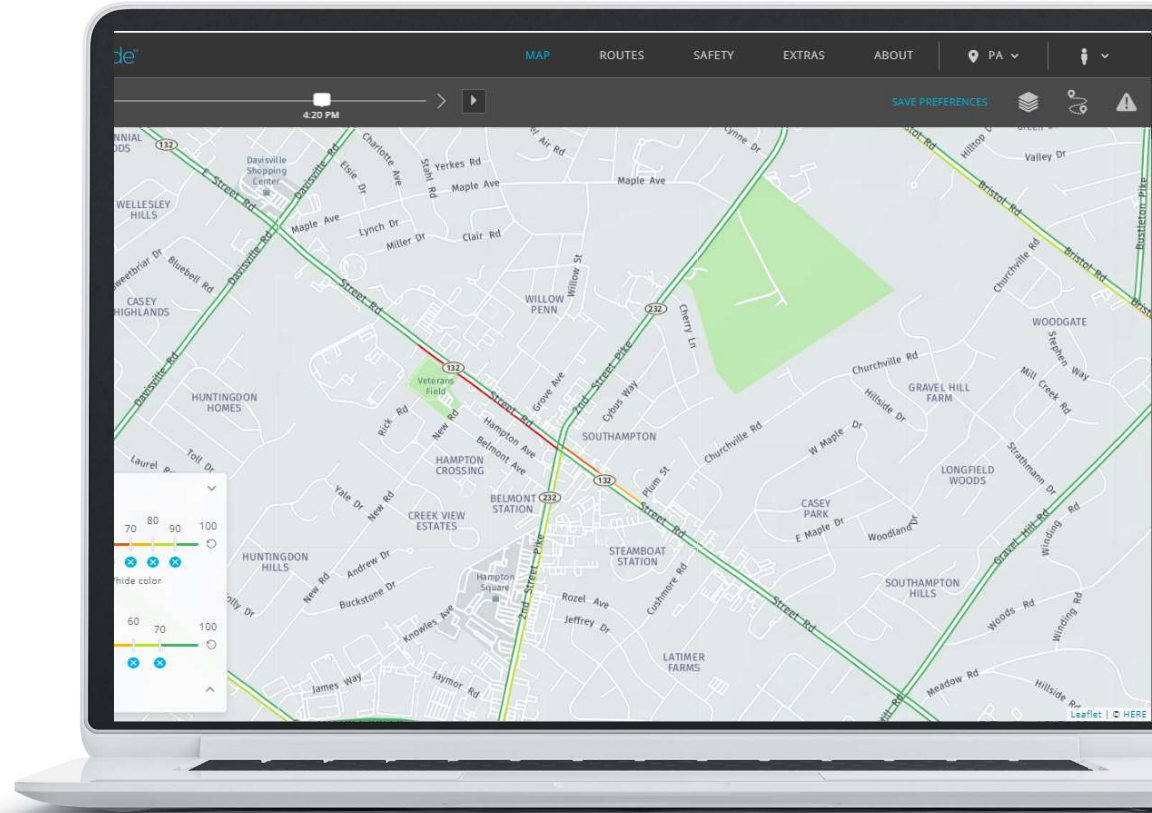
Big Data Platforms

- Third party data
- Near Real Time
- Used for data-driven decisions
 - Travel Time
 - Delay
 - Reliability
- 24/7/365 availability including in the past
- Multi platforms available



Big Data Uses For Signal Timing

- Real-time operations
- Corridor Prioritization
- Before vs. After Analysis
- Troubleshooting
- Visualize Queues and hotspots



PennDOT District 6 Corridor Prioritization

- Districtwide Signal Timing Initiative
 - District 6 Five County Region
 - Super Critical Corridors
- RITIS Platform
 - Travel Time Speed Limit
 - Median Travel Time
 - Interquartile Range
- External Inputs
 - ADT
 - Signal Density

ADT	TTSL (minutes)	Median Before (%)	Median After (%)	Delta Median	IQR Before (%)	IQR After (%)	Delta IQR	Incidents	No. Signals	Length	Score
31,043	2	52.6	180.4	127.8	29.1	74.4	45.3	0	3	0.6	64.2
61,374	16.5	122.5	148.6	26.1	39.6	50.1	10.5	0	23	5.6	94.3
48,662	13.5	117.2	148.2	31	39.5	51.4	11.9	0	12	3.2	80.5
18,355	3.9	134.1	152.3	18.2	51.2	76.3	25.1	0	2	0.2	66.4
37,518	12.5	136.8	146.4	9.6	34.9	39.9	5	0	14	4.1	74.6
46,860	7.2	86	115.5	29.5	25.8	33.7	7.9	0	6	1.3	69.4
44,366	14.3	115.9	132.1	16.2	36	38.3	2.3	0	17	3.9	75.2
43,608	12.7	128.4	145.6	17.2	39.1	42.2	3.1	0	14	3.9	74.7
43,400	11.5	136.1	145	8.9	39.1	36.7	-2.4	0	11	2.1	79.2
46,305	7.6	148.4	157	8.6	45.5	36.8	-8.7	0	8	1.3	85.2
19,826	4.1	5.8	154.5	158.8	4.3	36	34.9	-1.1	0	1.0	37.3
46,619	7.9	129.3	137.9	8.6	26.7	26	-0.7	0	6	2.4	73.1
31,225	16.7	109.1	142.4	33.3	24.1	34.5	10.4	0	12	2.4	61.3
48,004	7.2	121.2	128.3	7.1	32.5	28.3	-4.2	0	6	2.0	74.9
21,346	6.6	84.4	117.2	32.8	19	28.1	9.1	0	3	0.2	58.5
37,338	8.1	102	128	26	23	28.2	5.2	0	9	2.5	62.2
37,338	3.3	115.5	116.9	1.4	23.2	25.3	2.1	0	3	0.6	63.6
42,981	15.8	140.7	137	-3.7	53.6	46.3	-7.3	0	12	3.7	76.6
23,075	8.1	146.2	154	7.8	46.2	48.5	2.3	0	9	2.2	64.2

E 31st St – Kansas City Before vs. After | Data Reliability



Route: E 31st St (EB) Grand to Van Brunt

MON 06/22/2020 TO FRI 12/11/2020

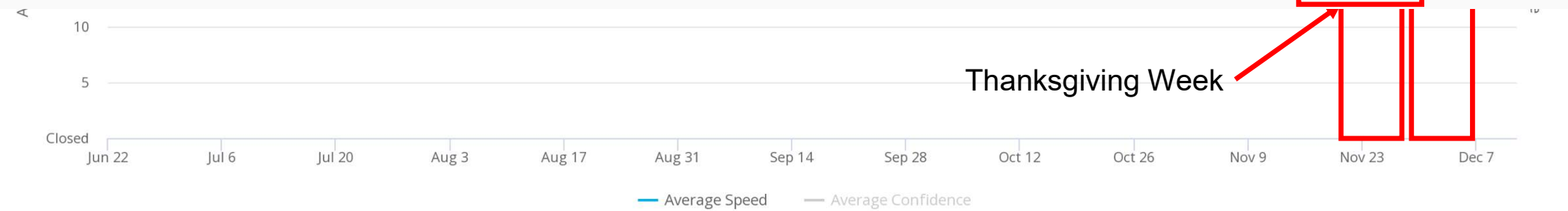
Implementation Week

35

DATE RANGE: 11/17/2020 - 11/19/2020, DATE RANGE 2: 12/08/2020 - 12/10/2020, METRIC 1: Average Speed

TIME OF DAY: 7:00 AM-7:00 PM, INCLUDE DAYS: Tue, Wed, Thu

Route Name	ID	11/17/20-11/19/20	12/8/20-12/10/20	Diff	% Diff	Length (mi)
E 31st St (EB) Grand to Van Brunt	29	22.1	20.9	-1.2	-5.43%	3.5
E 31st St (WB) Van Brunt to Grand	30	21.7	20.6	-1.1	-5.07%	3.53



E 31st St – Kansas City

Before vs. After | Data Reliability

Route: E 31st St (EB) Grand to Van Brunt

MON 06/22/2020 TO FRI 12/11/2020

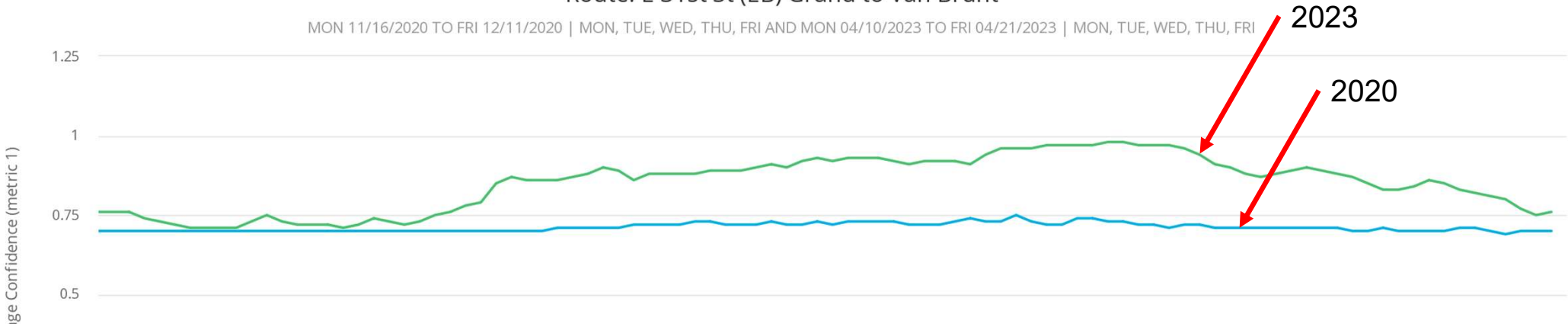


E 31st St – Kansas City

Before vs. After | Data Reliability | Today vs. 2020

Route: E 31st St (EB) Grand to Van Brunt

MON 11/16/2020 TO FRI 12/11/2020 | MON, TUE, WED, THU, FRI AND MON 04/10/2023 TO FRI 04/21/2023 | MON, TUE, WED, THU, FRI

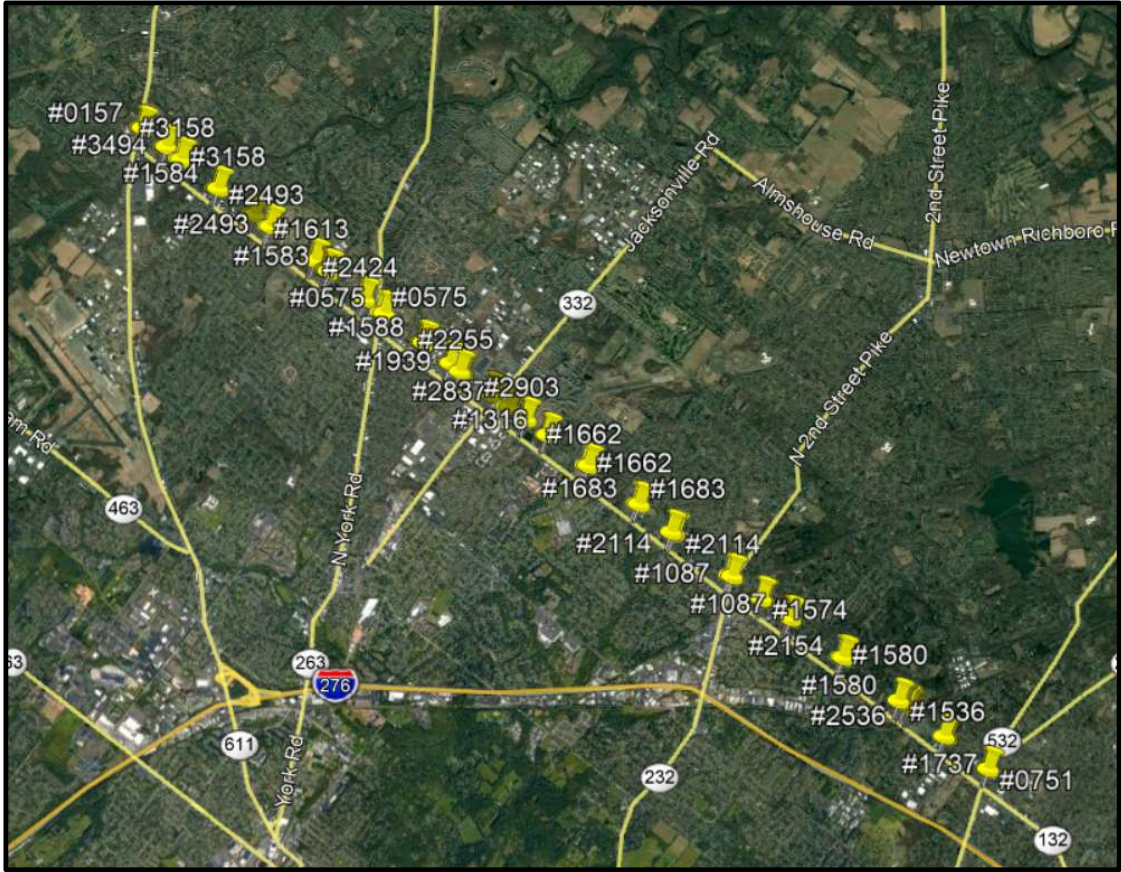


DATE RANGE: **11/16/2020 - 12/11/2020**, DATE RANGE 2: **04/10/2023 - 04/21/2023**, METRIC 1: Average Confidence
 TIME OF DAY: **7:00 AM-7:00 PM**, INCLUDE DAYS: Mon, Tue, Wed, Thu, Fri

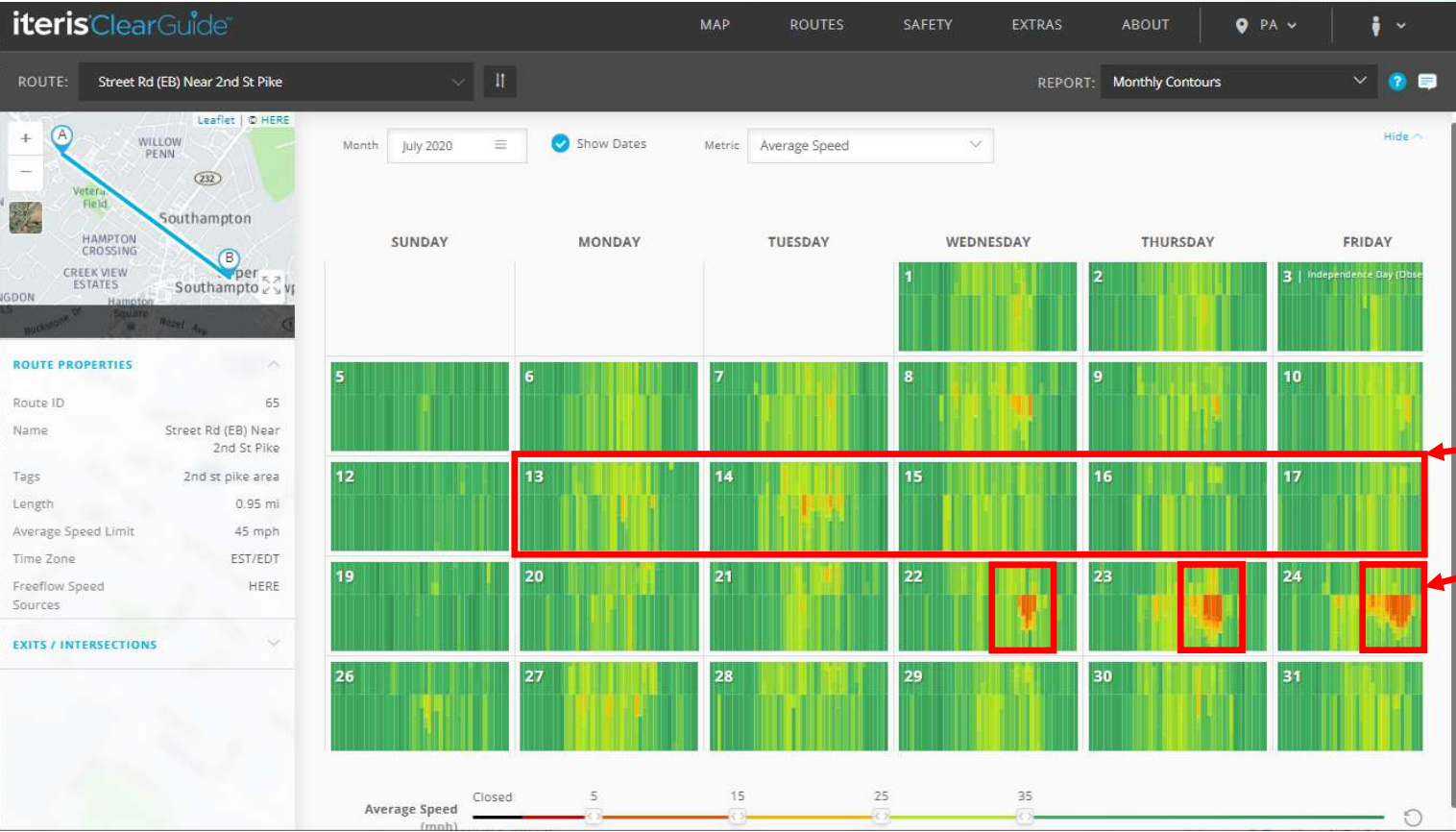
Route Name	ID	11/16/20-12/11/20	4/10/23-4/21/23	Diff	% Diff	Length (mi)
E 31st St (EB) Grand to Van Brunt	29	0.72	0.92	0.2	27.78%	3.5
E 31st St (WB) Van Brunt to Grand	30	0.72	0.92	0.2	27.78%	3.53

Street Rd (SR 0132)

INTID	INTNAME
157	Easton Rd & Street Rd
3494	Valley Sq Blvd & Street Rd
3158	Paul Valley Dr/Neshaminy Ave & Street Rd
1584	Valley Rd & Street Rd
181	St David's Ave/Cooper Dr & Street Rd
2493	Delmont Ave & Street Rd
1613	S. Norristown Rd & Street Rd
1583	N. Norristown Rd & Street Rd
2424	Center Point Plaza/Commercial Driveway & Street Rd
575	York Rd & Street Rd
1588	Mearns Rd & Street Rd
1939	Madison Ave & Street Rd
2255	Lois Dr & Street Rd
1315	Jacksonville Rd & Street Rd
2837	Centennial Village Access & Street Rd
2903	Johnsville Blvd & Street Rd
1316	S. Newtown Rd & Street Rd
1662	Centennial Rd/Reeves Lane & Street Rd
1683	Davisville Rd & Street Rd
2114	Willopenn Drive & Street Rd
1087	Second Street Pike & Street Rd
1574	Churchville Road/Knowles Avenue & Street Rd
2154	Kutcher Rd/Morelyn Plaza Drive & Street Rd
1580	Gravel Hill Rd & Street Rd
1536	Buck Rd/Millcreek/Lakeside & Street Rd
2536	Buck Rd/Millcreek/Lakeside & Street Rd
3536	Buck Rd/Millcreek/Lakeside & Street Rd
1737	Pennsylvania Blvd & Street Rd
751	Bustleton & Street Rd



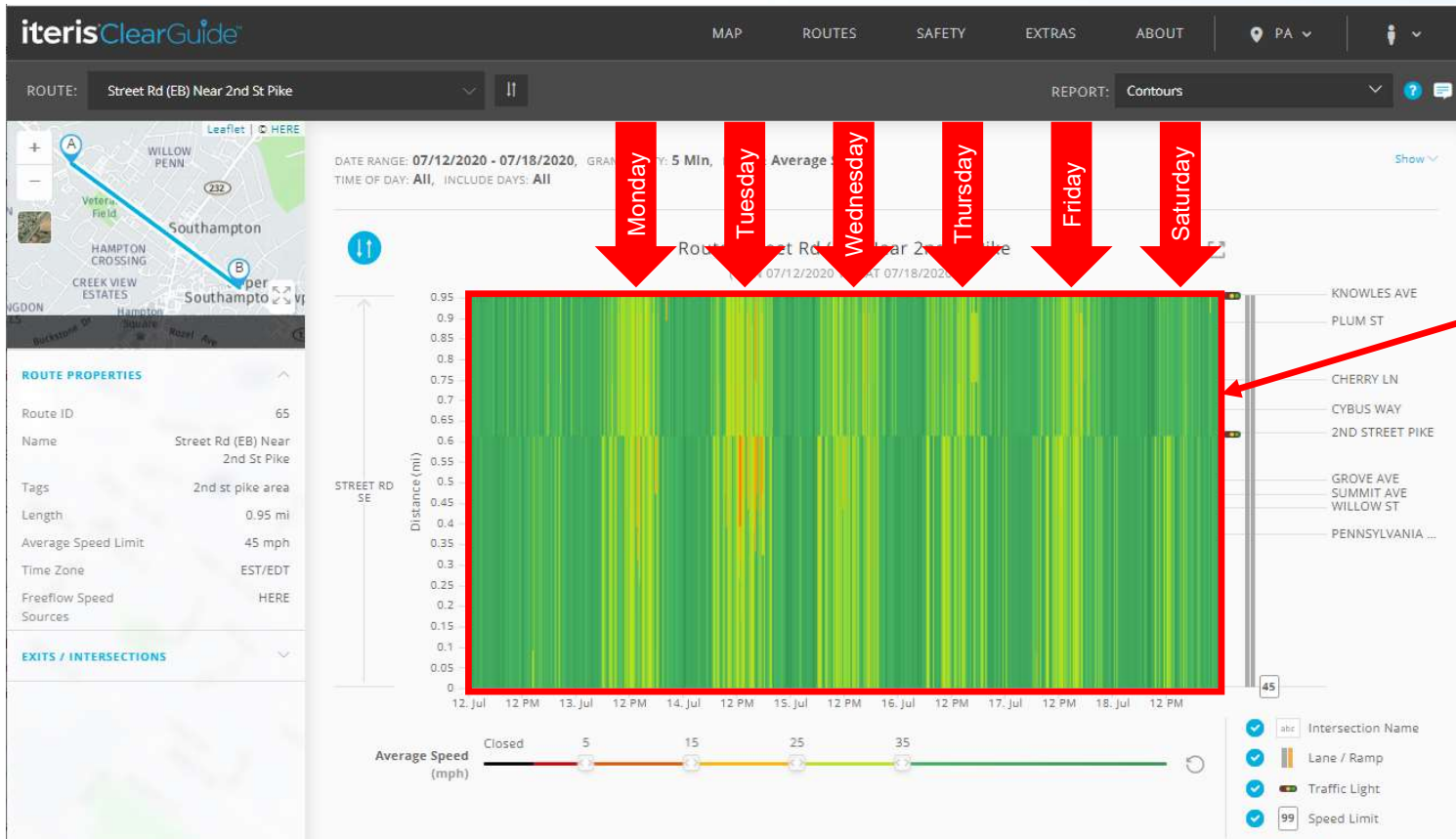
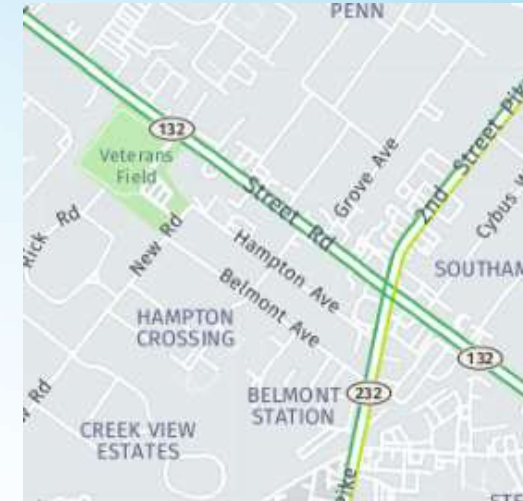
Street Rd – Monthly Contours Troubleshooting



New Timing Implemented

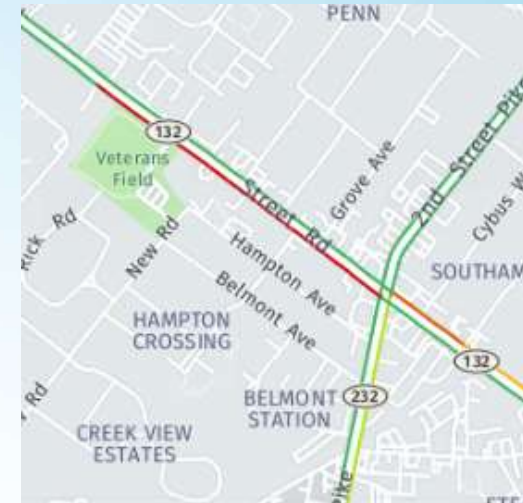
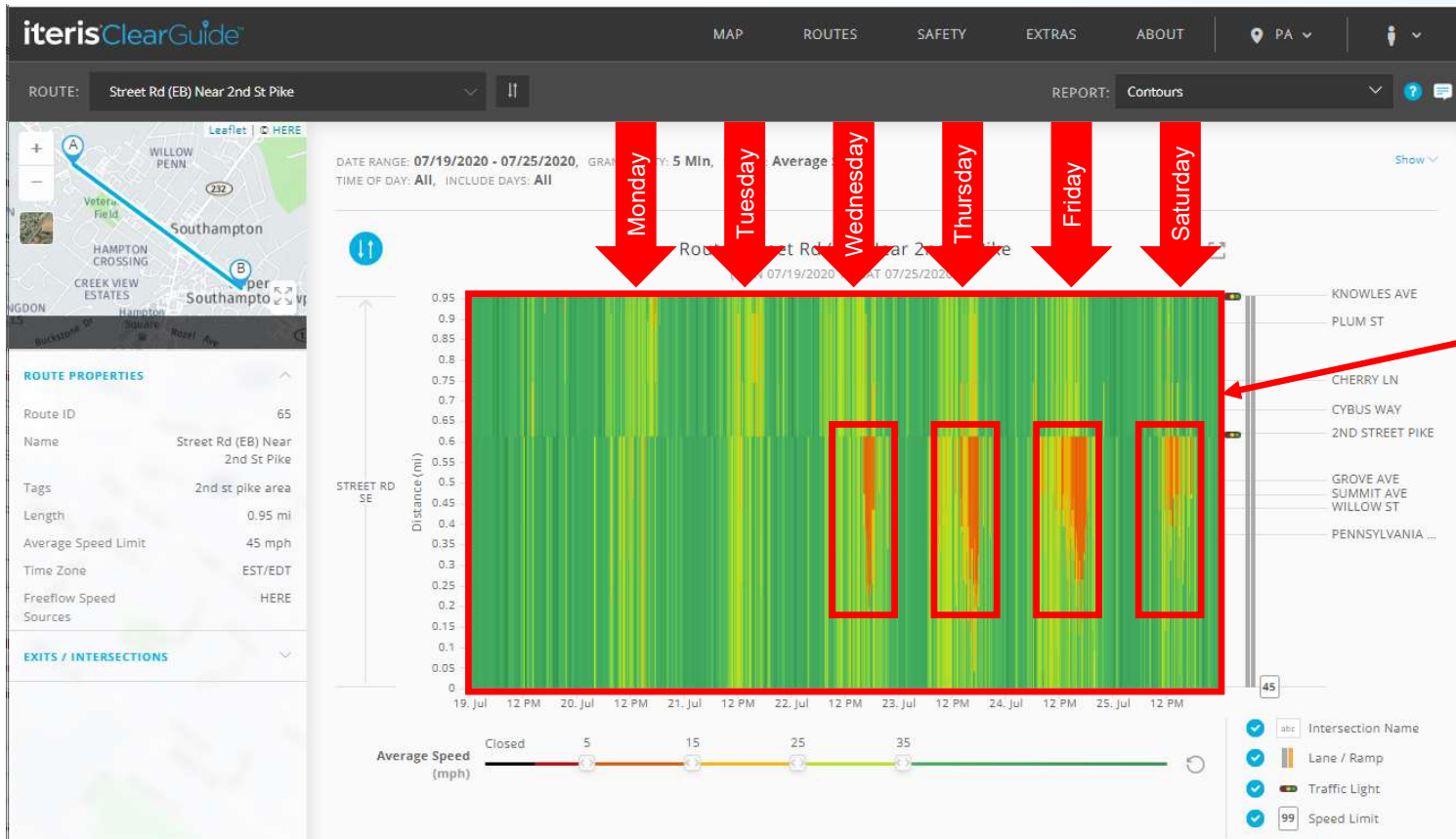
What Happened?

Street Rd – Daily Contour Troubleshooting



Implementation Week

Street Rd – Daily Contour Troubleshooting



The Week After Implementation Week

Street Rd (SR 0132)

Multi-Route Time Comparison

Wednesday to Friday, 24 hours per day												
Range 1		Range 2		Route Name	Range 1		Range 2		Diff	Percent Diff	Route Length	Units
Start	End	Start	End		Delay	Units	Units	Delay				
7/8/20	7/10/20	7/15/20	7/17/20	Street Rd from Valley Sq Blvd to PA Blvd	2.69	mins	2.24	mins	-0.45	-16.7%	8.319	mi
7/8/20	7/10/20	7/15/20	7/17/20	Street Rd from PA Blvd to Valley Sq Blvd	2.91	mins	2.07	mins	-0.84	-28.9%	8.349	mi
Total					5.6	mins	4.31	mins	-1.29	-23.0%	16.667	mi

Wednesday to Friday, AM Peak (6:00 am to 10:00 am)												
Range 1		Range 2		Route Name	Range 1		Range 2		Diff	Percent Diff	Route Length	Units
Start	End	Start	End		Delay	Units	Units	Delay				
7/8/20	7/10/20	7/15/20	7/17/20	Street Rd from Valley Sq Blvd to PA Blvd	2.95	mins	2.37	mins	-0.58	-19.7%	8.319	mi
7/8/20	7/10/20	7/15/20	7/17/20	Street Rd from PA Blvd to Valley Sq Blvd	3.78	mins	2.81	mins	-0.97	-25.7%	8.349	mi
Total					6.73	mins	5.18	mins	-1.55	-23.0%	16.667	mi

Wednesday to Friday, MD Peak (10:00 am to 3:00 pm)												
Range 1		Range 2		Route Name	Range 1		Range 2		Diff	Percent Diff	Route Length	Units
Start	End	Start	End		Delay	Units	Units	Delay				
7/8/20	7/10/20	7/15/20	7/17/20	Street Rd from Valley Sq Blvd to PA Blvd	5.1	mins	4.26	mins	-0.84	-16.5%	8.319	mi
7/8/20	7/10/20	7/15/20	7/17/20	Street Rd from PA Blvd to Valley Sq Blvd	5.43	mins	4.25	mins	-1.18	-21.7%	8.349	mi
Total					10.53	mins	8.51	mins	-2.02	-19.2%	16.667	mi

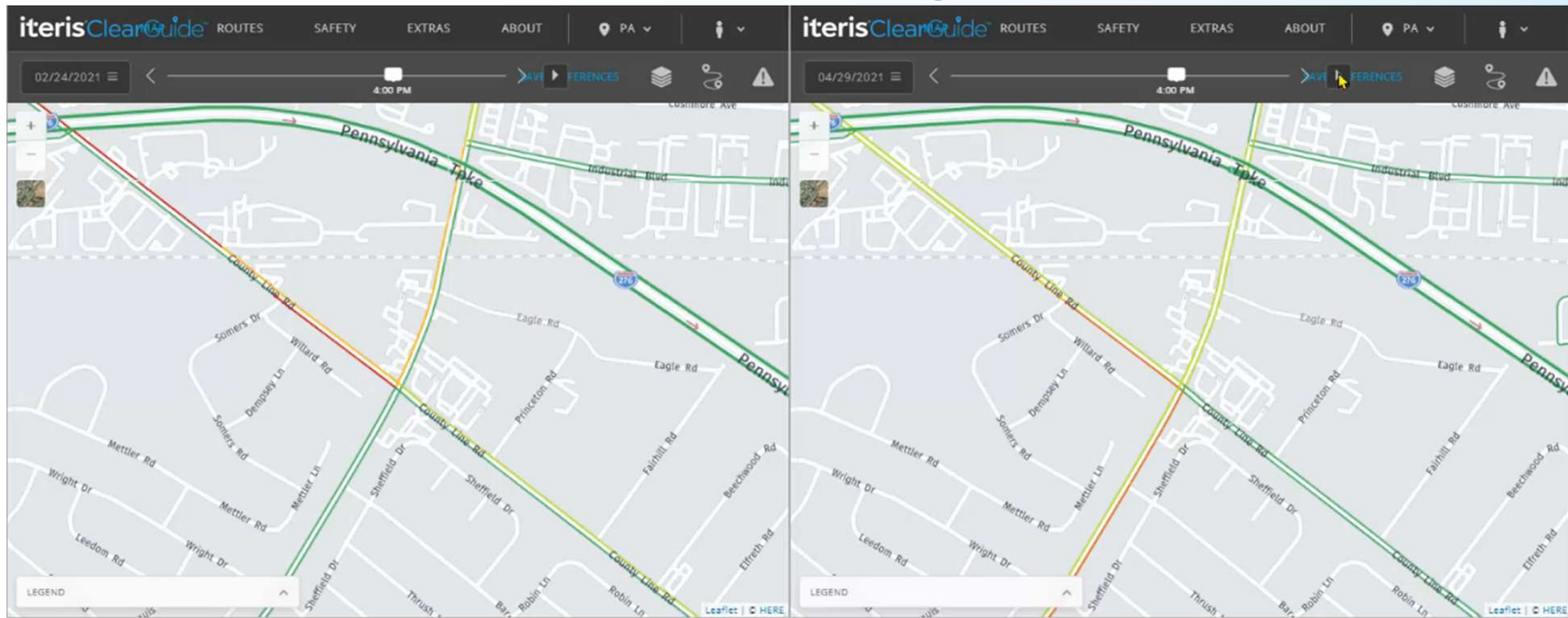
Wednesday to Friday, PM Peak (3:00 pm to 7:00 pm)												
Range 1		Range 2		Route Name	Range 1		Range 2		Diff	Percent Diff	Route Length	Units
Start	End	Start	End		Delay	Units	Units	Delay				
7/8/20	7/10/20	7/15/20	7/17/20	Street Rd from Valley Sq Blvd to PA Blvd	4.8	mins	4.05	mins	-0.75	-15.6%	8.319	mi
7/8/20	7/10/20	7/15/20	7/17/20	Street Rd from PA Blvd to Valley Sq Blvd	4.73	mins	2.78	mins	-1.95	-41.2%	8.349	mi
Total					9.53	mins	6.83	mins	-2.7	-28.3%	16.667	mi

County Line Road Monitoring

4:30 PM to 6:00 PM (Apr 21 2021 vs Apr 29 2021) - Thur

Range 1		Range 2		Range 1		Range 2		Diff	Percent Diff	Route Length	Units	
Start	End	Start	End	Delay	Units	Delay	Units					
2/24/21	2/25/21	4/29/21	4/29/21	County Line Rd from Delmont to Pine	6.76 mins	5.24 mins	-1.52	-22.5%	7.047	mi		
2/24/21	2/25/21	4/29/21	4/29/21	County Line Rd from Pine to Delmont	4.93 mins	4.07 mins	-0.86	-17.4%	7.060	mi		
2/24/21	2/25/21	4/29/21	4/29/21	Meeting House Rd NB near County Line Rd	0.26 mins	0.27 mins	0.01	3.8%	0.827	mi		
2/24/21	2/25/21	4/29/21	4/29/21	Blair Mill Rd NB Near County Line Rd	0.38 mins	0.65 mins	0.27	71.1%	0.710	mi		
2/24/21	2/25/21	4/29/21	4/29/21	York Rd NB Near County Line Rd	0.73 mins	0.62 mins	-0.11	-15.1%	1.078	mi		
2/24/21	2/25/21	4/29/21	4/29/21	York Rd SB Near County Line Rd	0.59 mins	0.53 mins	-0.06	-10.2%	1.078	mi		
2/24/21	2/25/21	4/29/21	4/29/21	Jacksonville Rd NB Near County Line Rd	0.65 mins	0.68 mins	0.03	4.6%	0.787	mi		
2/24/21	2/25/21	4/29/21	4/29/21	Jacksonville Rd SB Near County Line Rd	0.82 mins	1.04 mins	0.22	26.8%	0.787	mi		
2/24/21	2/25/21	4/29/21	4/29/21	Warminster Rd NB Near County Line Rd	0.15 mins	0.12 mins	-0.03	-20.0%	0.451	mi		
2/24/21	2/25/21	4/29/21	4/29/21	Newtown Rd SB Near County Line Rd	0.02 mins	0.01 mins	-0.01	-50.0%	0.634	mi		
2/24/21	2/25/21	4/29/21	4/29/21	S Davisville Rd NB Near County Line Rd	0.37 mins	0.34 mins	-0.03	-8.1%	0.702	mi		
2/24/21	2/25/21	4/29/21	4/29/21	N Davisville Rd SB Near County Line Rd	0.06 mins	0.06 mins	0	0.0%	0.340	mi		
2/24/21	2/25/21	4/29/21	4/29/21	2nd St Pike NB Near County Line Rd	0.68 mins	1.06 mins	0.38	55.9%	0.664	mi		
2/24/21	2/25/21	4/29/21	4/29/21	2nd St Pike SB Near County Line Rd	0.74 mins	0.68 mins	-0.06	-8.1%	0.664	mi		
2/24/21	2/25/21	4/29/21	4/29/21	Buck Rd SB Near County Line Rd	0.13 mins	0.06 mins	-0.07	-53.8%	0.505	mi		
2/24/21	2/25/21	4/29/21	4/29/21	Pine Rd NB Near County Line Rd	0.18 mins	0.23 mins	0.05	27.8%	0.535	mi		
Total					17.45	mins	15.66	mins	-1.79	-10.3%	23.871	mi

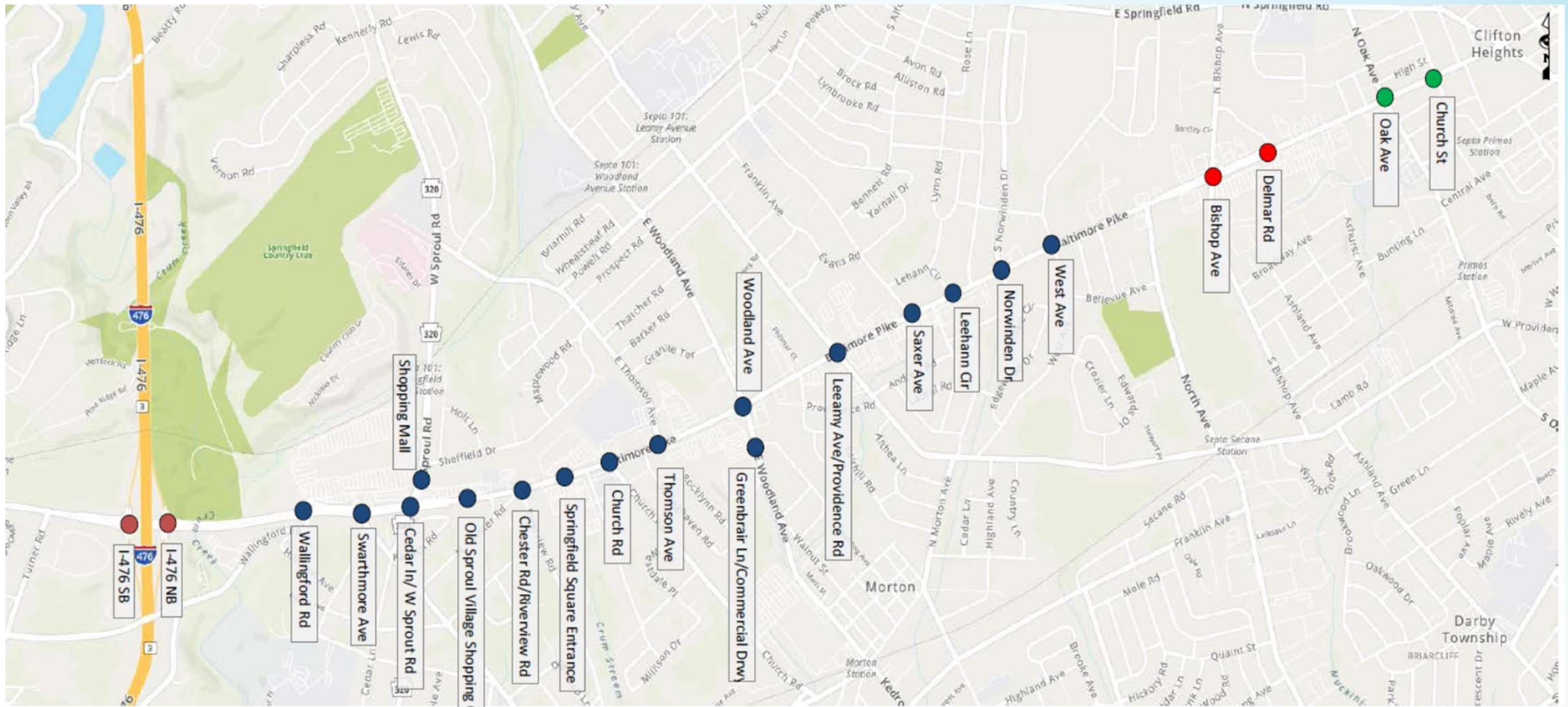
County Line Road Monitoring



Before
February 24, 2021

During Imp
April 29, 2021

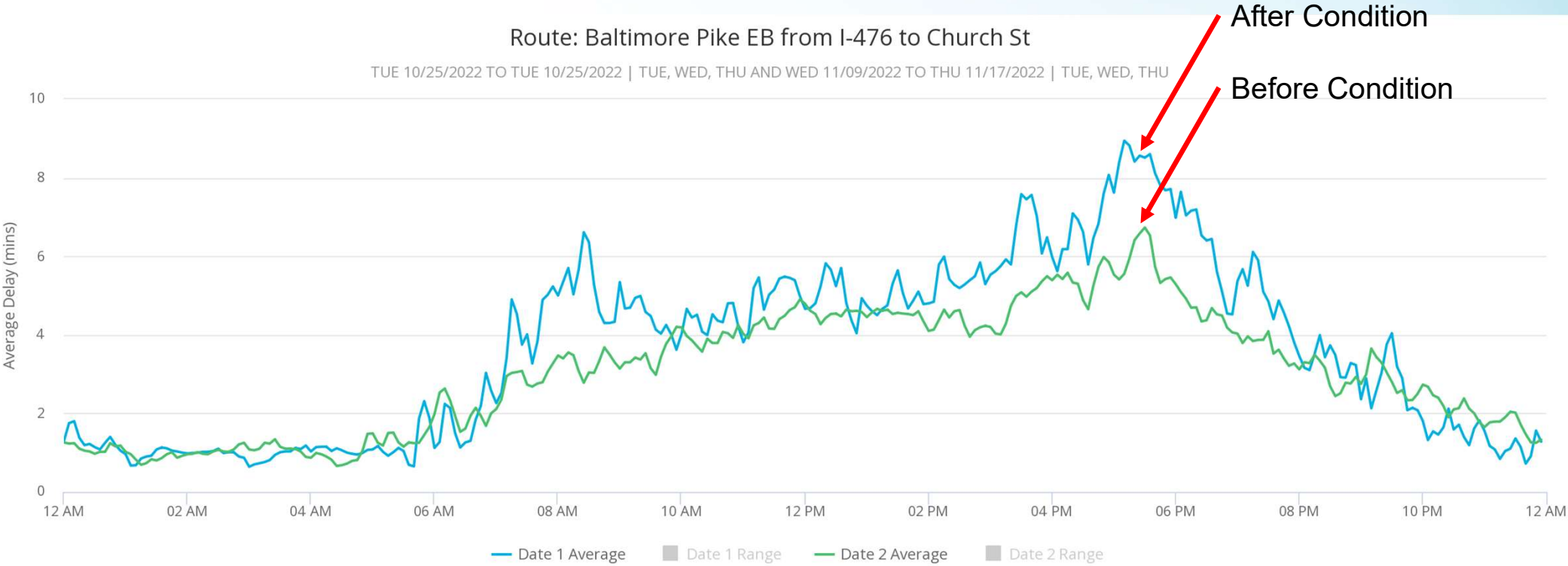
Baltimore Pike (SR 0132)



Baltimore Pike – Time of Day Before vs. After

Route: Baltimore Pike EB from I-476 to Church St

TUE 10/25/2022 TO TUE 10/25/2022 | TUE, WED, THU AND WED 11/09/2022 TO THU 11/17/2022 | TUE, WED, THU



Baltimore Pike – Route Comparison Before vs. After

Route: Baltimore Pike EB from I-476 to Church St

TUE 10/25/2022 TO TUE 10/25/2022 | TUE, WED, THU AND WED 11/09/2022 TO THU 11/17/2022 | TUE, WED, THU

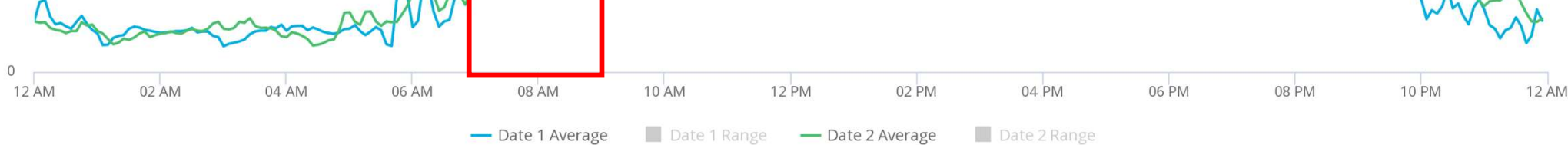
10



DATE RANGE: 10/25/2022 - 11/03/2022, DATE RANGE 2: 11/09/2022 - 11/17/2022, METRIC 1: Delay In Minutes (SL)
 TIME OF DAY: 7:00 AM-9:00 AM, INCLUDE DAYS: Tue, Wed, Thu

Route Name	ID	10/25/22-11/3/22	11/9/22-11/17/22	Diff	% Diff	Length (mi)
Baltimore Pike EB from I-476 to Church St	158	4	3.06	-0.94	-23.5%	3.71
Baltimore Pike WB from Church St to I-476	159	5.77	3.97	-1.8	-31.2%	3.61

2



Baltimore Pike – Route Comparison Before vs. After

Route: Baltimore Pike EB from I-476 to Church St

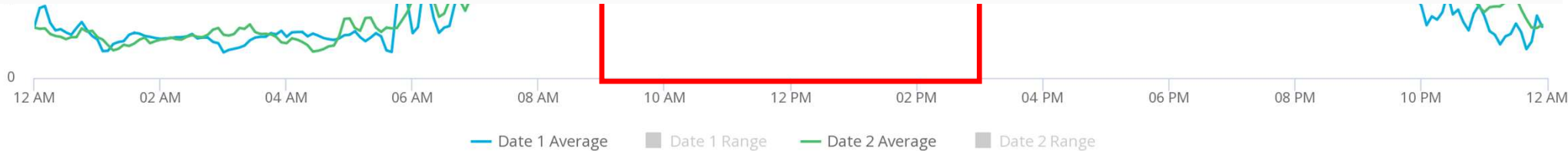
TUE 10/25/2022 TO TUE 10/25/2022 | TUE, WED, THU AND WED 11/09/2022 TO THU 11/17/2022 | TUE, WED, THU



DATE RANGE: 10/25/2022 - 11/03/2022, DATE RANGE 2: 11/09/2022 - 11/17/2022, METRIC 1: Delay In Minutes (SL)

TIME OF DAY: 9:00 AM-3:00 PM, INCLUDE DAYS: Tue, Wed, Thu

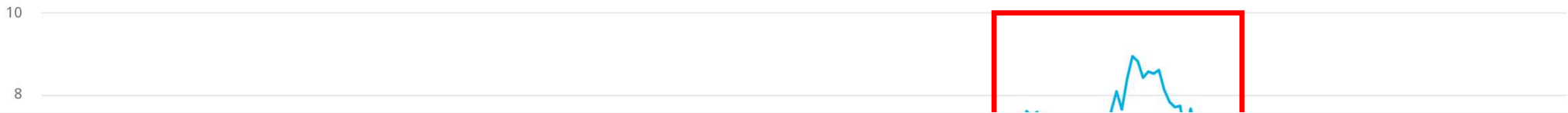
Route Name	ID	10/25/22-11/3/22	11/9/22-11/17/22	Diff	% Diff	Length (mi)
Baltimore Pike EB from I-476 to Church St	158	5	4.19	-0.81	-16.2%	3.71
Baltimore Pike WB from Church St to I-476	159	5.07	4.59	-0.48	-9.47%	3.61



Baltimore Pike – Route Comparison Before vs. After

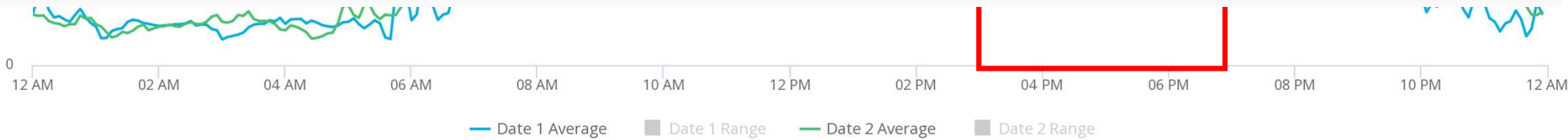
Route: Baltimore Pike EB from I-476 to Church St

TUE 10/25/2022 TO TUE 10/25/2022 | TUE, WED, THU AND WED 11/09/2022 TO THU 11/17/2022 | TUE, WED, THU

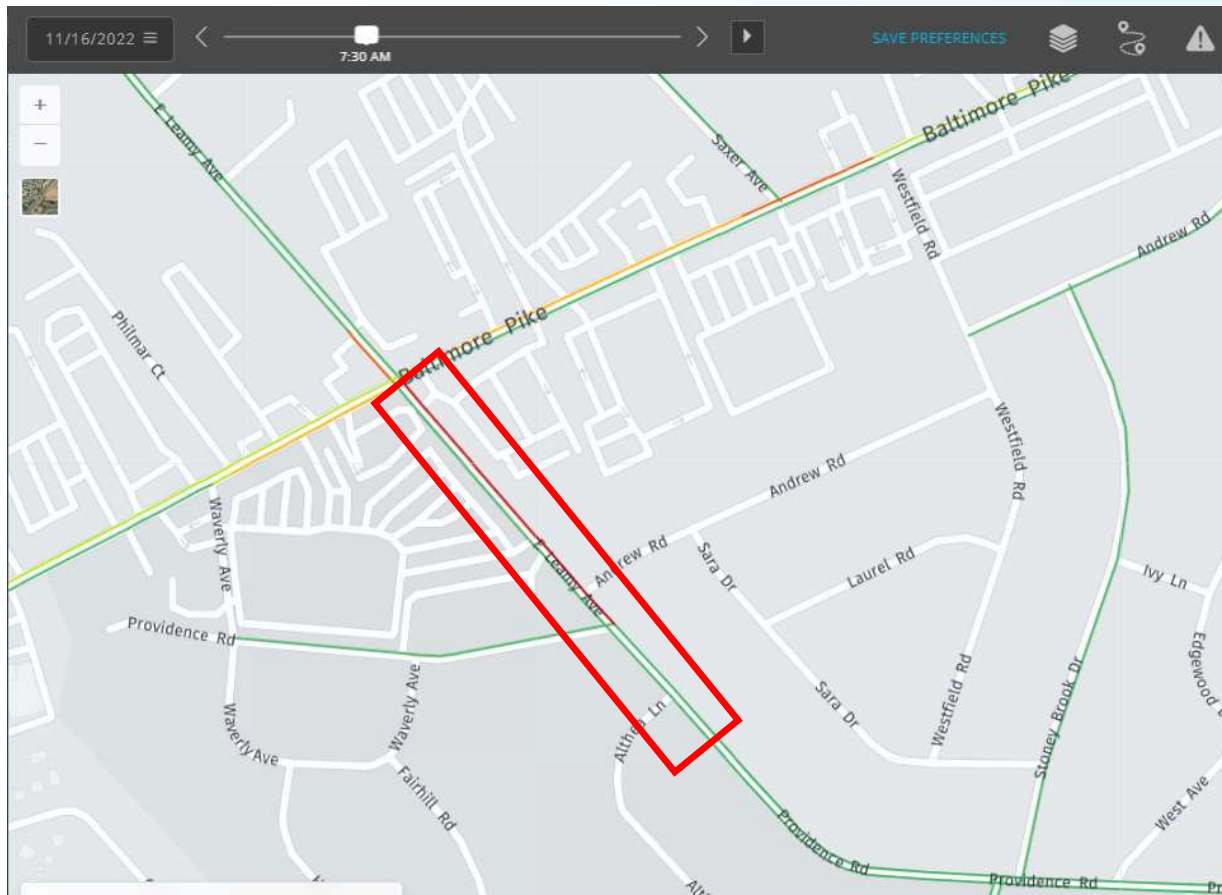


DATE RANGE: 10/25/2022 - 11/03/2022, DATE RANGE 2: 11/09/2022 - 11/17/2022, METRIC 1: Delay In Minutes (SL)
 TIME OF DAY: 3:00 PM-7:00 PM, INCLUDE DAYS: Tue, Wed, Thu

Route Name	ID	10/25/22-11/3/22	11/9/22-11/17/22	Diff	% Diff	Length (mi)
Baltimore Pike EB from I-476 to Church St	158	7.27	5.15	-2.12	-29.16%	3.71
Baltimore Pike WB from Church St to I-476	159	6.51	5.23	-1.28	-19.66%	3.61



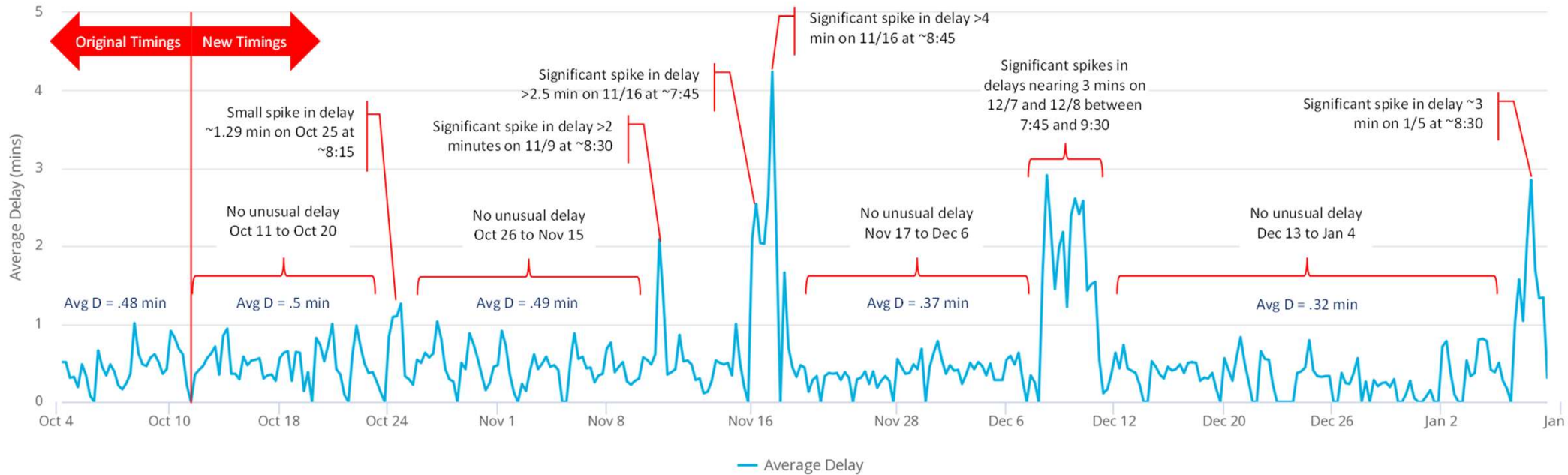
Baltimore Pike Troubleshooting



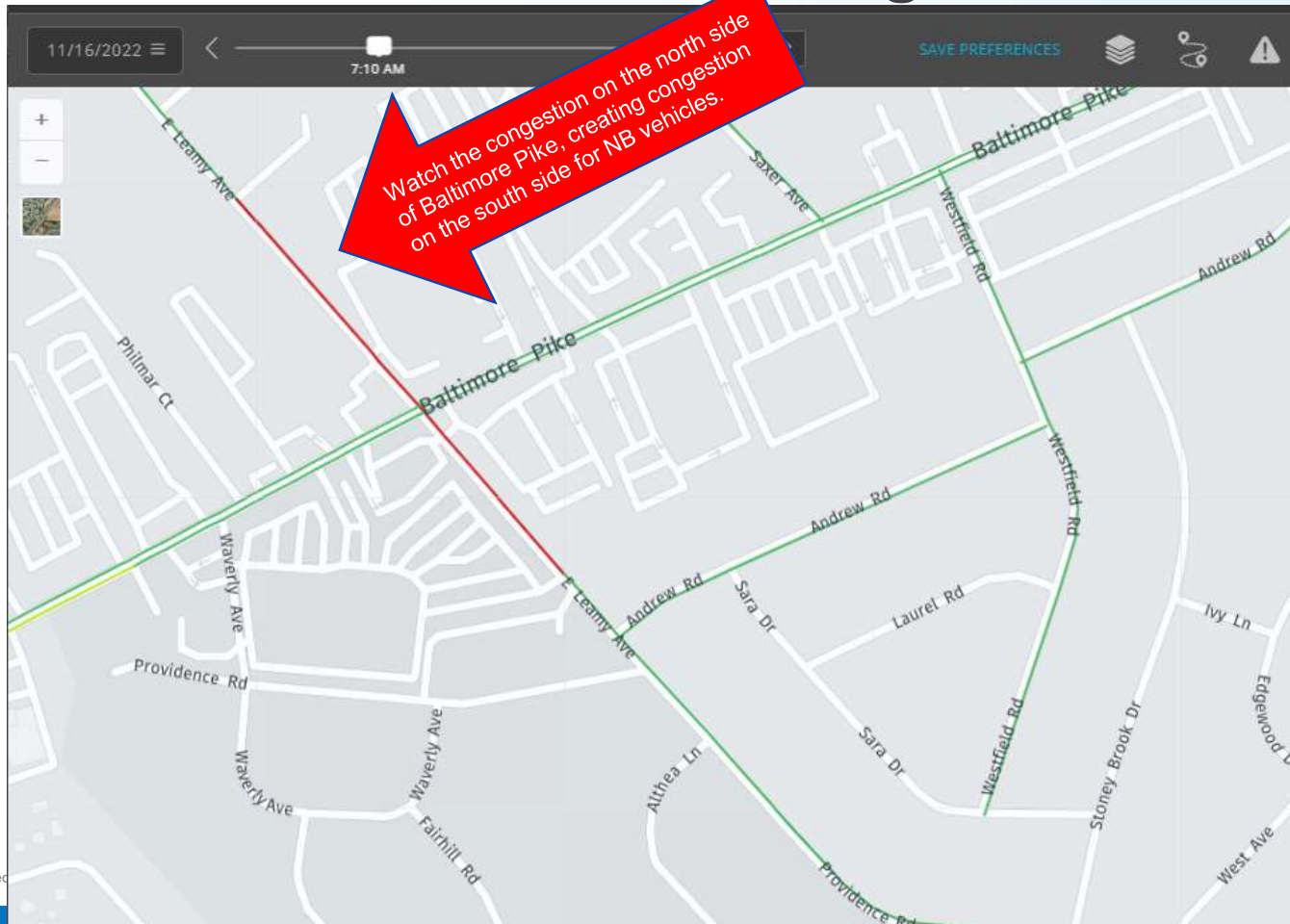
Baltimore Pike - Timeseries Troubleshooting

Route: Providence/leamy NB

TUE 10/04/2022 TO THU 01/05/2023 | 7:30 AM-9:30 AM | TUE, WED, THU



Baltimore Pike - Timeseries Troubleshooting



Watch the congestion on the north side of Baltimore Pike, creating congestion on the south side for NB vehicles.

Columbus OH Downtown Timing Troubleshooting

The screenshot displays the Iteris ClearGuide web application interface. The browser address bar shows the URL: `ohio.iteris-clearguide.com/map?type=route-my#39.9626,-82.9921,15,0,eyJmaWx0ZXJ0cmFmZmljip71mluY2lkZW50cyt6e...`. The application header includes the logo, navigation tabs (MAP, ROUTES, EXTRAS, ABOUT), and a location dropdown set to 'OH'. A search bar is located in the top right of the interface.

The main map area shows a street grid in downtown Columbus, OH, with several routes highlighted in grey. The routes are defined by brackets on the map. The search results panel on the right lists the following entries:

ID	NAME	CREATED ON
ID: 144	Broad St from Marconi Blvd to Parsons Ave	CREATED: Apr 5, 2023
ID: 143	Broad St from Parsons Ave to Marconi Blvd	CREATED: Apr 5, 2023
ID: 142	Spring St (WB) Elijah Pierce to Neil	CREATED: Apr 1, 2023
	Long St (EB) Neil to Hamilton	

Columbus OH Downtown Timing Troubleshooting

Closure
(Severity: Critical) [Less Detail](#)

Location Ramp closed to OH-315 Northbound - Closed due to roadwork.

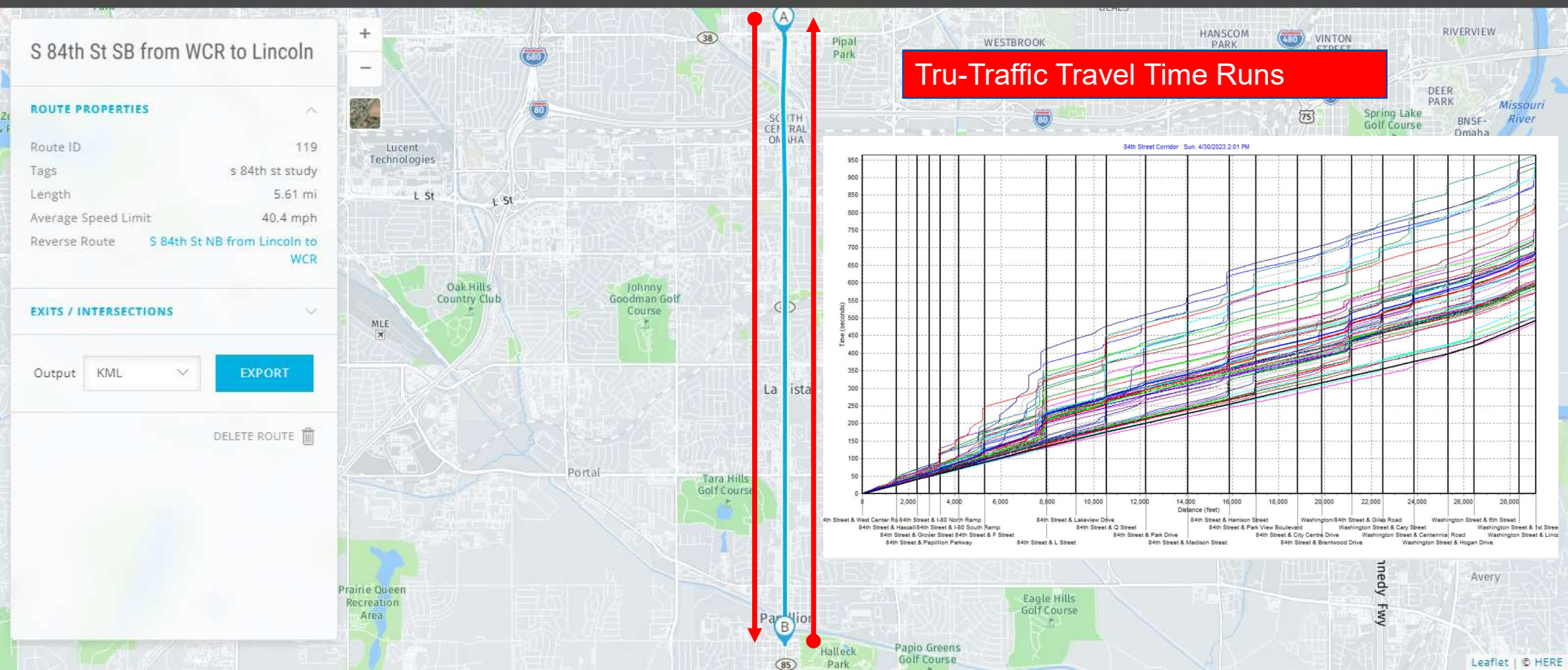
Start Time 03/25/2023 3:00 AM

ID 4361954537726623763

Provider: HERE

March 24, 2023 Fri	March 25, 2023 Sat	March 26, 2023 Sun	March 27, 2023 Mon	March 28, 2023 Tue	March 29, 2023 Wed	March 30, 2023 Thu	March 31, 2023 Fri
Database Coding	Implement Databased via Centracs at TMC - OH-315 Closure Begins	Continued Implementation of Off-line Intersections	Fine-Tuning and Observations	Fine-Tuning and Observations	Fine-Tuning and Observations	Fine-Tuning and Observations	Fine-Tuning and Observations

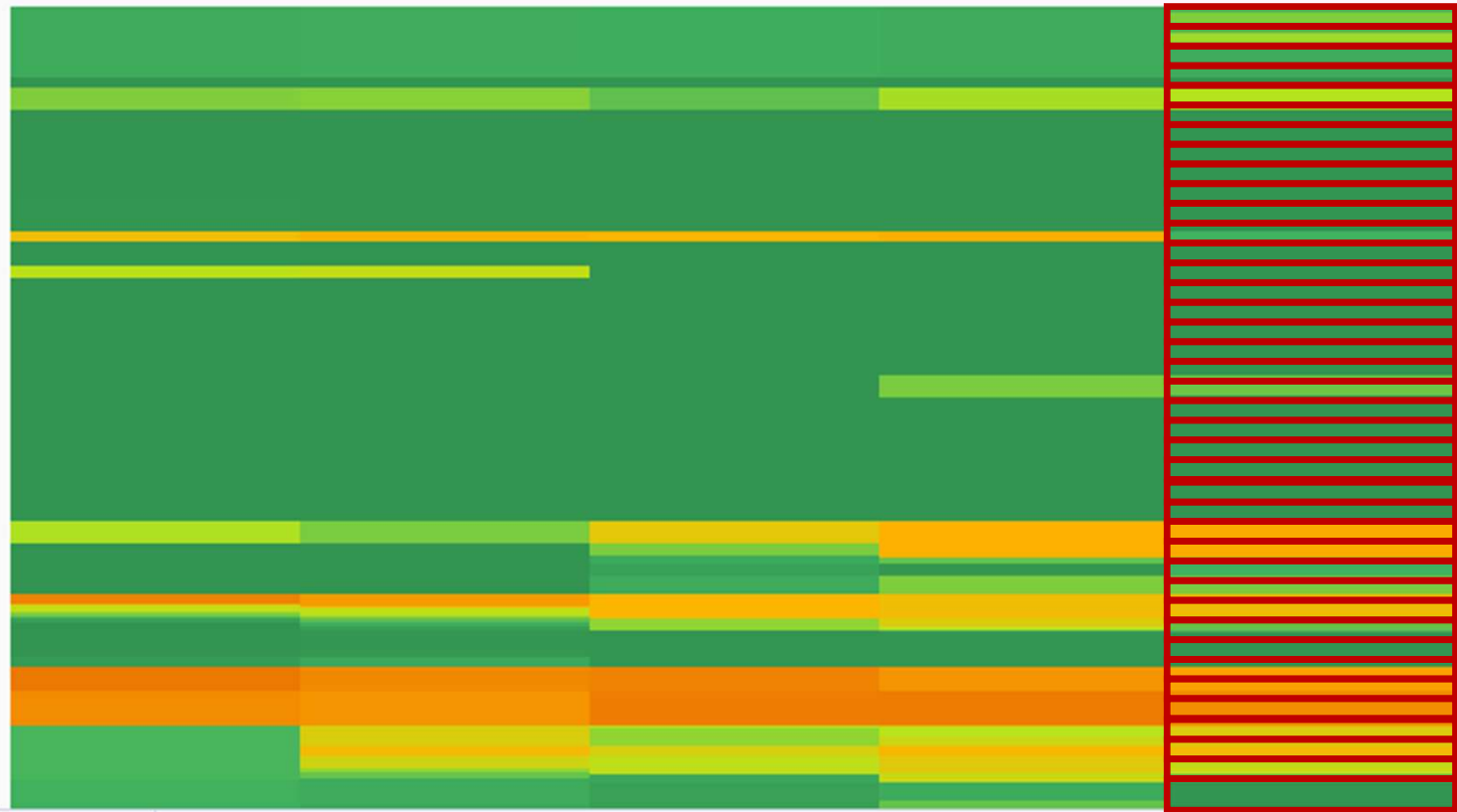
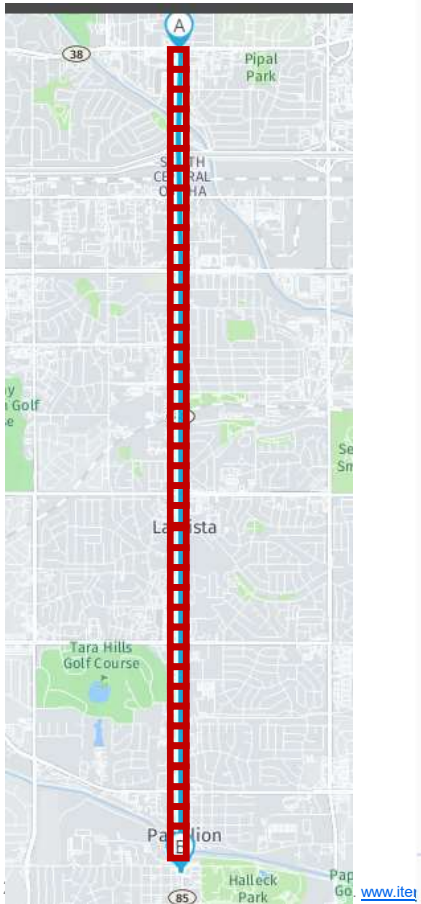
Big Data vs. Floating Car S 84th St



Big Data vs. Floating Car

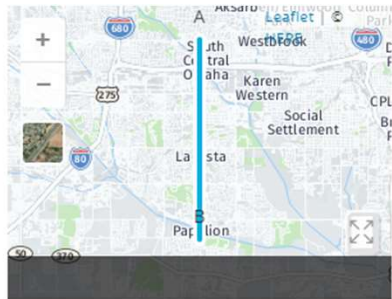
Route: S 84th St SB from WCR to Lincoln

(WED 04/26/2023 TO WED 04/26/2023)



04 PM

Big Data vs. Floating Car S 84th St



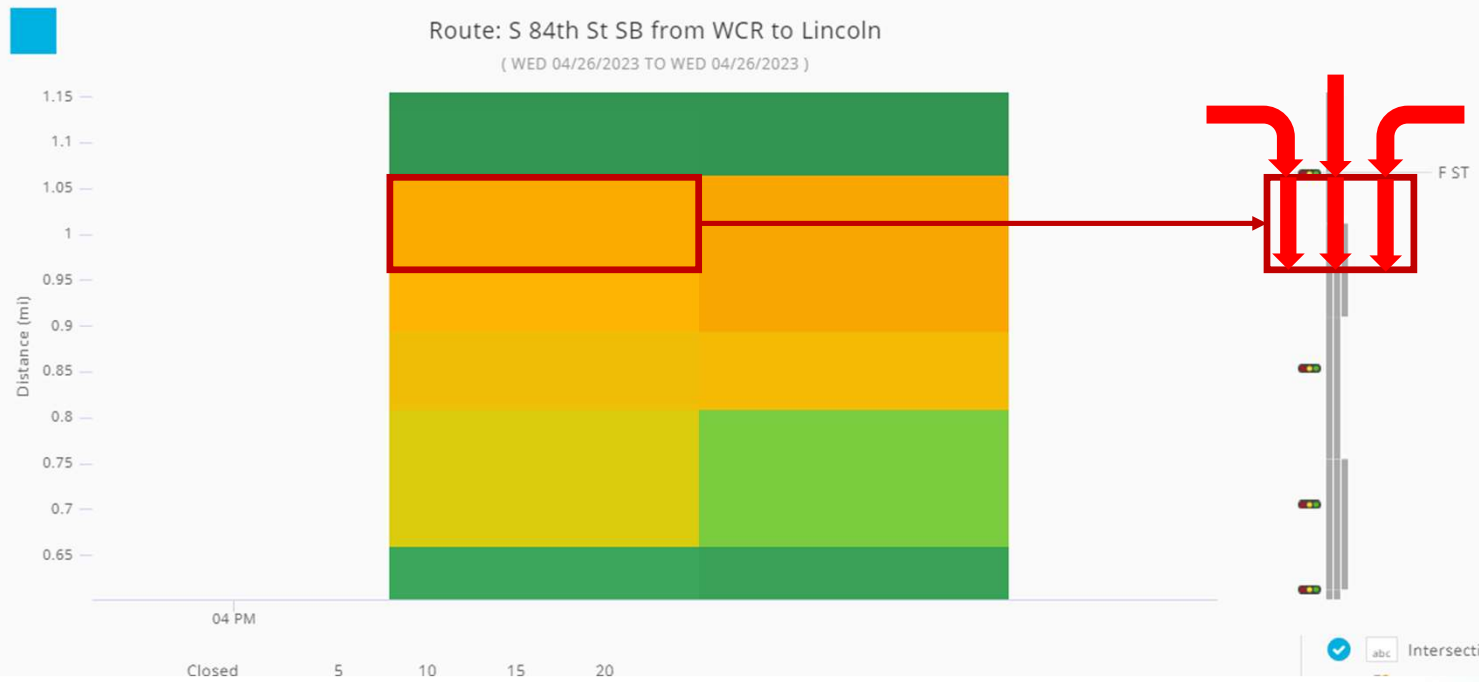
ROUTE PROPERTIES

Route ID	119
Name	S 84th St SB from WCR to Lincoln
Tags	s 84th st study
Length	5.61 mi
Average Speed Limit	40.4 mph
Time Zone	CST/CDT
Freeflow Speed	HERE
Sources	

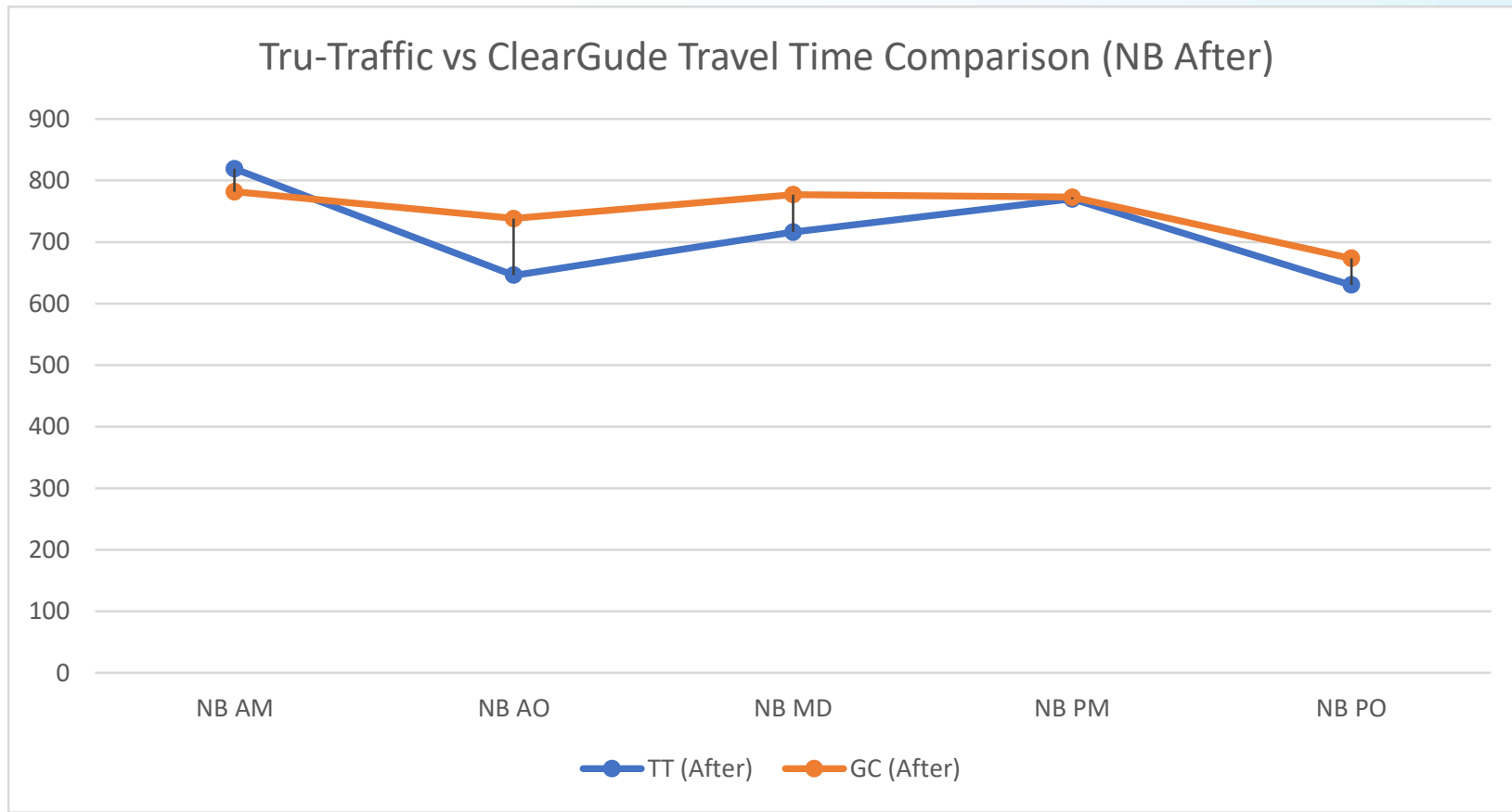
EXITS / INTERSECTIONS

DATE RANGE: 04/26/2023 - 04/26/2023, GRANULARITY: 5 Min, METRIC: Average Speed
TIME OF DAY: All, INCLUDE DAYS: All

Show



Big Data vs. Floating Car S 84th St





Thank You.

John Albeck, P.E., PTOE

jalbeck@iteris.com

531-200-9127