

Traffic impact of the Greenfield Bridge closures (AM peak)

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Disclaimer

- This research is funded in part by Traffic21 at Carnegie Mellon University, in the efforts of facilitating infrastructure design, operation and planning for smart cities. The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. The Pittsburgh governmental agencies assumes no liability for the contents or use thereof.

Statements

- These are preliminary findings of our dynamic model analysis of the Greenfield Bridge closure and its impact on AM rush hours only at this time.
- We are currently working on PM rush hours and evaluating several scenarios of traffic management strategies.
- This is the first of its kind study in the Pittsburgh Region using big data to assess traffic impact and facilitate decision making on traffic management. The high-resolution traffic models will be calibrated and adjusted as we learn from the actual observation, which can be further enhanced for incident management and road closure management in other places of the region.

Statement con'd

- This is the beginning of a long term relationship with the city and we will plan to continue working with the city throughout the closure provide predictive information on traffic impacts.
- This will allow the city to most effectively manage the traffic impacts with any mitigation efforts they see fit.

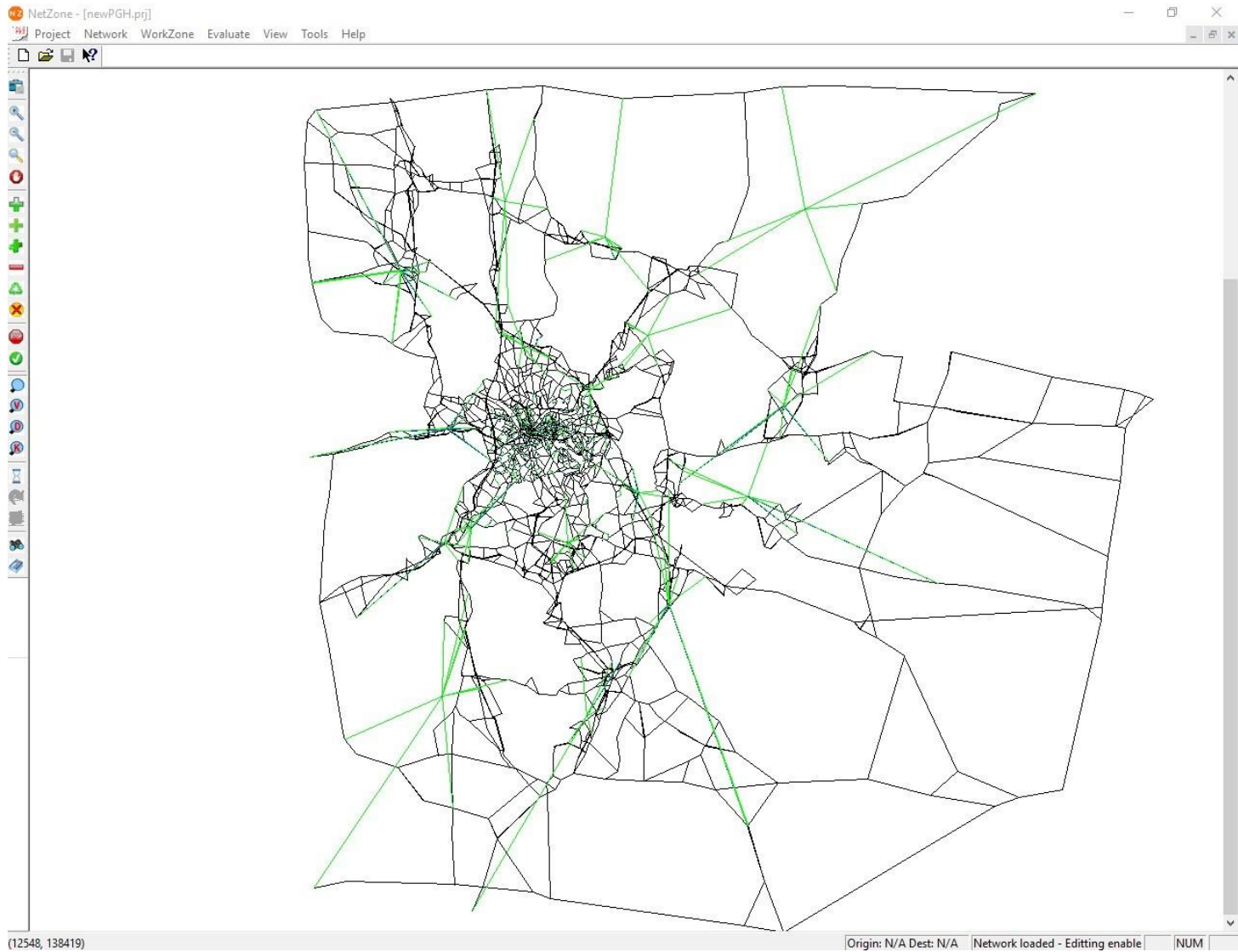
Assumptions

- This research study is based upon the assumptions
 - No effective detouring strategies have been implemented
 - After several days of closures, traffic settles to a stabilized pattern

Modeling details

- Scope: SPC region, ten counties, all main roads
- Simulated 0.7 million trips
- Time-of-day period: 5-10AM
- Temporal resolution: 5 seconds
- Validated by PennDOT hourly counts data and INRIX 5-min travel time data

Scope



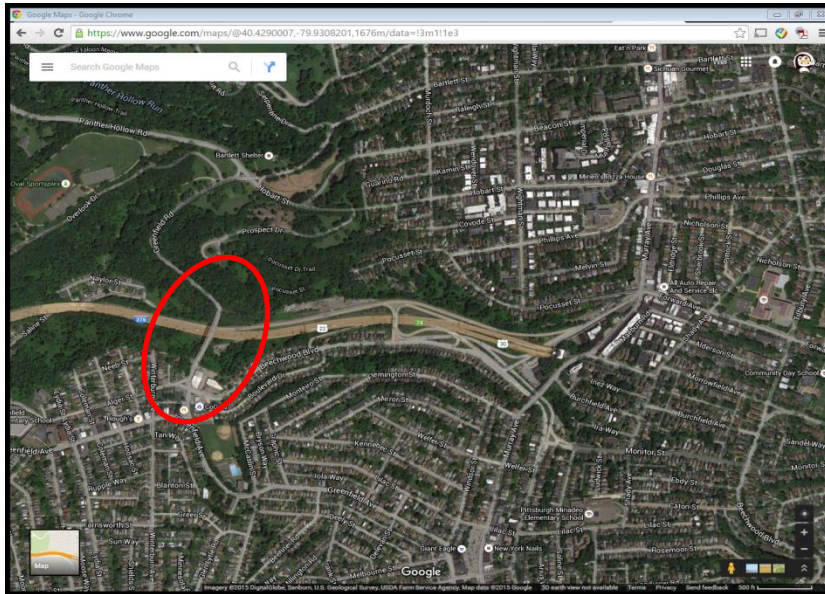
Data coverage



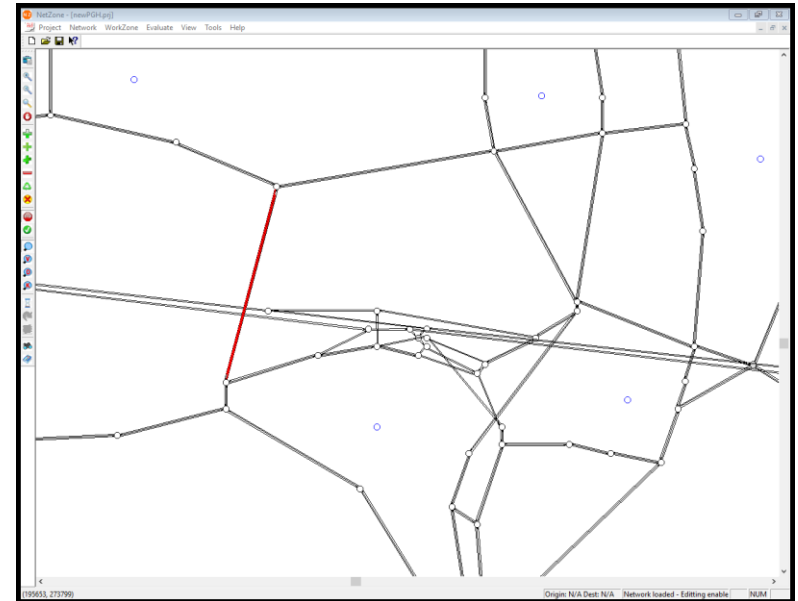
Red: travel speed
(from INRIX)
Blue: hourly
counts (from SPC
and PennDOT)

The Greenfield Bridge

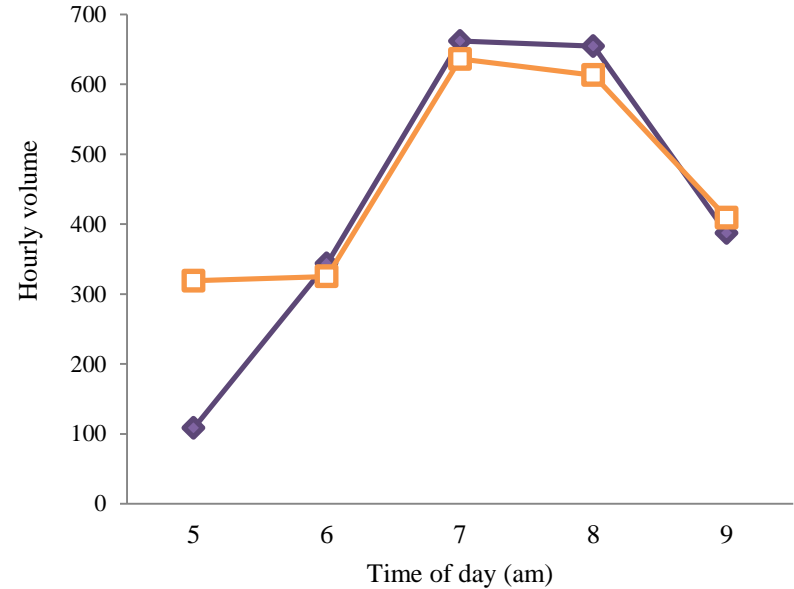
Birdview (from Google Map)



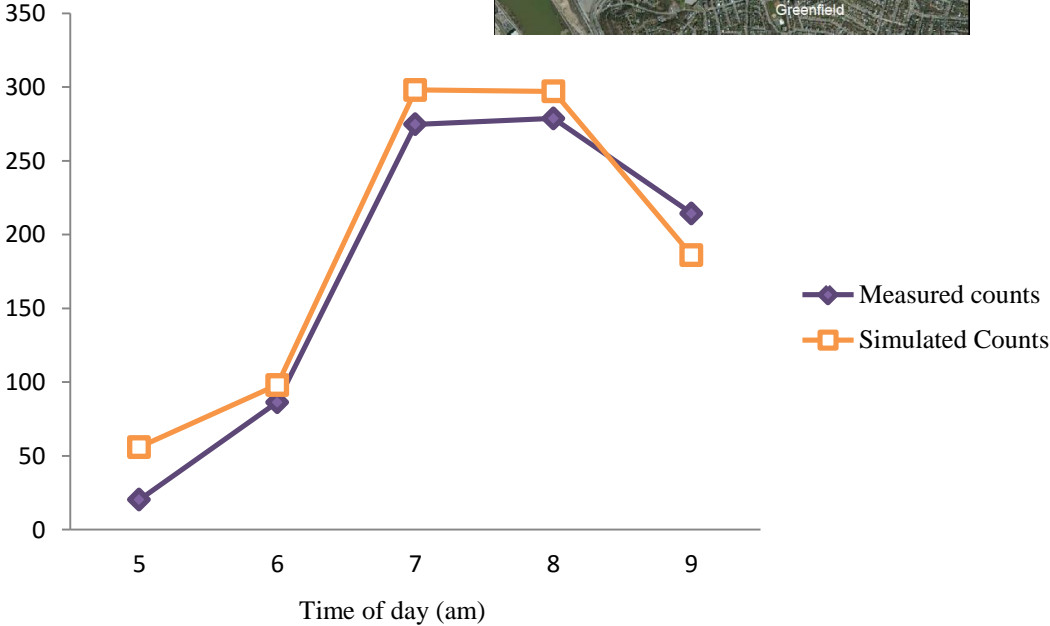
Model settings (from the simulator)



Greenfield Bridge: simulated counts match observations



S to N



N to S

Changes in network performance, fuel use and emissions (from 5am to 10am, entire ten-county region)

Item	Tot. Number of Travels	Tot. Travel Time	Avg. Travel Time	Tot. Delay	Avg. Delay	Avg. Travel Distance	VMT
Unit	Vehicles	Hour	Minute	Hour	Minute	Mile	Mile
Before closure	677,306	124,624	11.04	21,174	1.88	6.72	4,550,256
After closure	677,306	125,171	11.09	21,754	1.93	6.72	4,551,555
Change by percentage	0.00%	0.44%	0.45%	2.74%	2.66%	0.00%	0.03%

Item	Fuel	CO2	HC	CO	NOX
Unit	Gallon	Ton	Ton	Ton	Ton
Before closure	154,109	1,367.72	3.49	5.35	4.96
After closure	154,133	1,367.93	3.49	5.35	4.97
Change by percentage	0.02%	0.02%	0.00%	0.00%	0.20%

Prediction on the following seven road segments



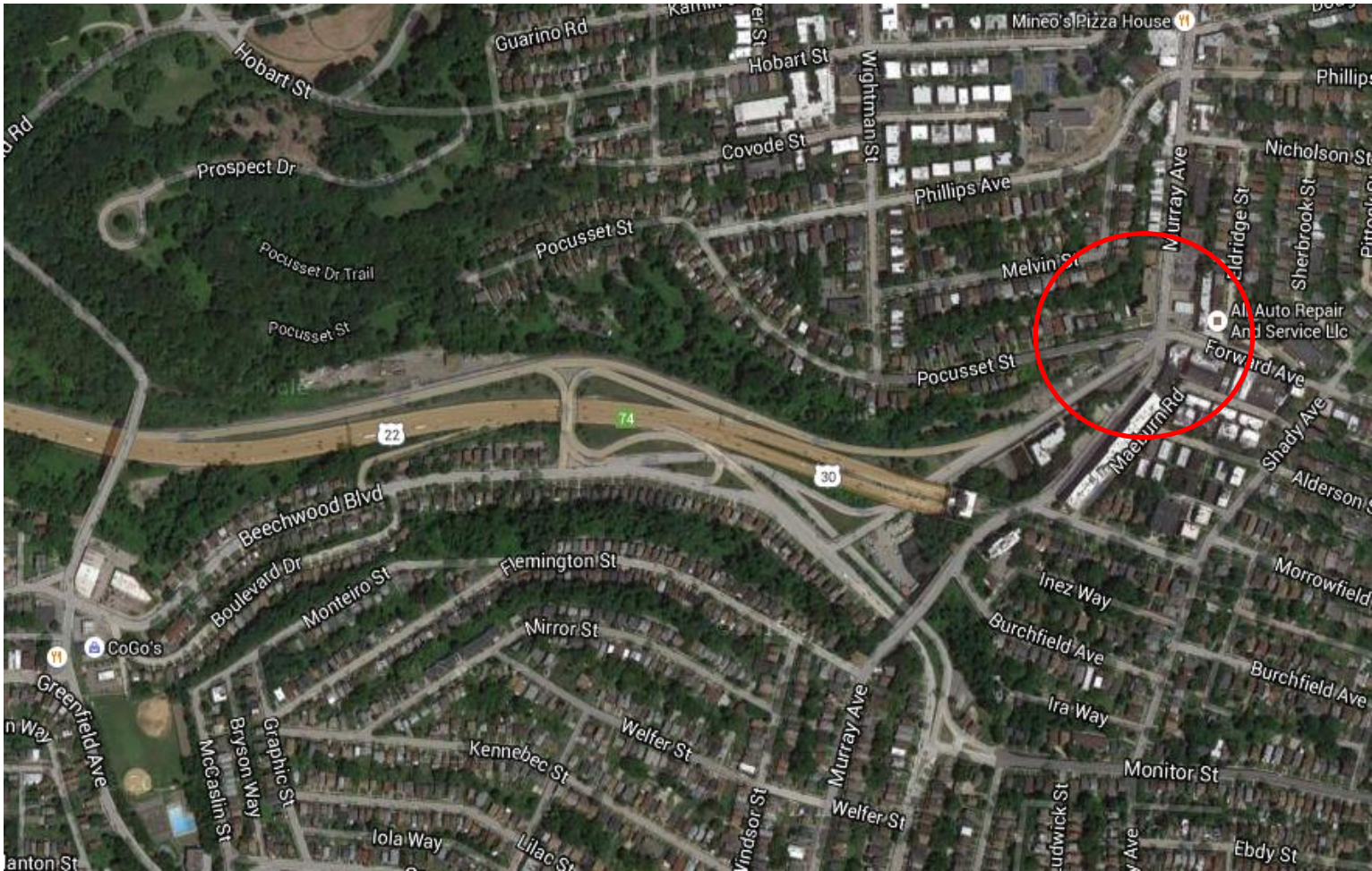
Change in traffic flow after closure (total vehicles from 5am to 10am)

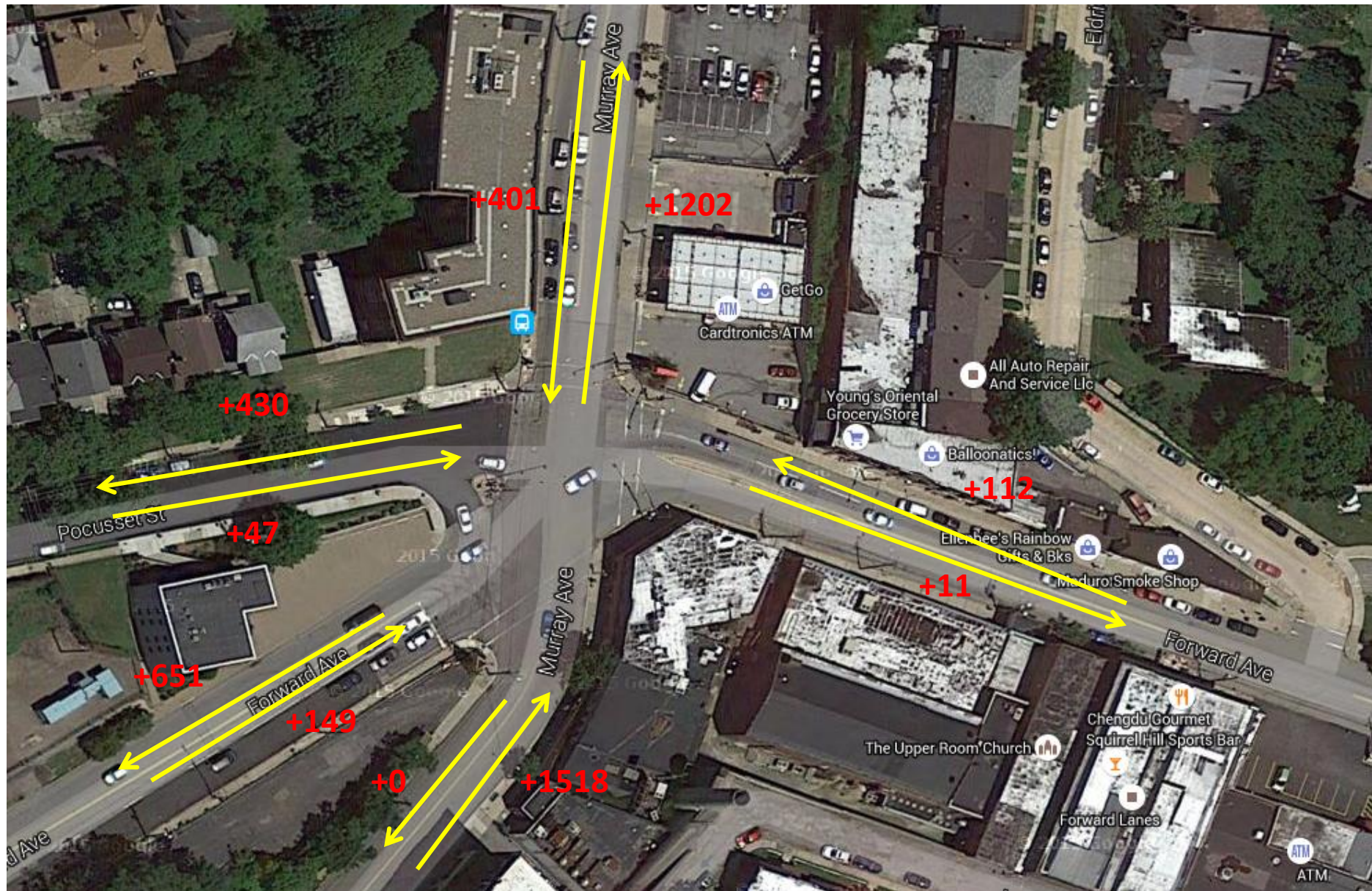
ID	1		2		3		4		5	
Name	Second Avenue @ Bates St		Frazier St		Ramp to 376W		Beechwood @ Forward Ave		Murray Ave	
Direction	N to S	S to N	N to S	S to N	N to S	S to N	N to S	S to N	N to S	S to N
Before	5315	2013	1736	2105	5543	1962	2779	1508	4746	1719
After	5329	2062	1794	2433	5488	2142	3430	1657	4679	3237
Change	14	49	58	328	-55	180	651	149	-67	1518
Change by %	0.26%	2.43%	3.34%	15.58%	-0.99%	9.17%	23.43%	9.88%	-1.41%	88.31%

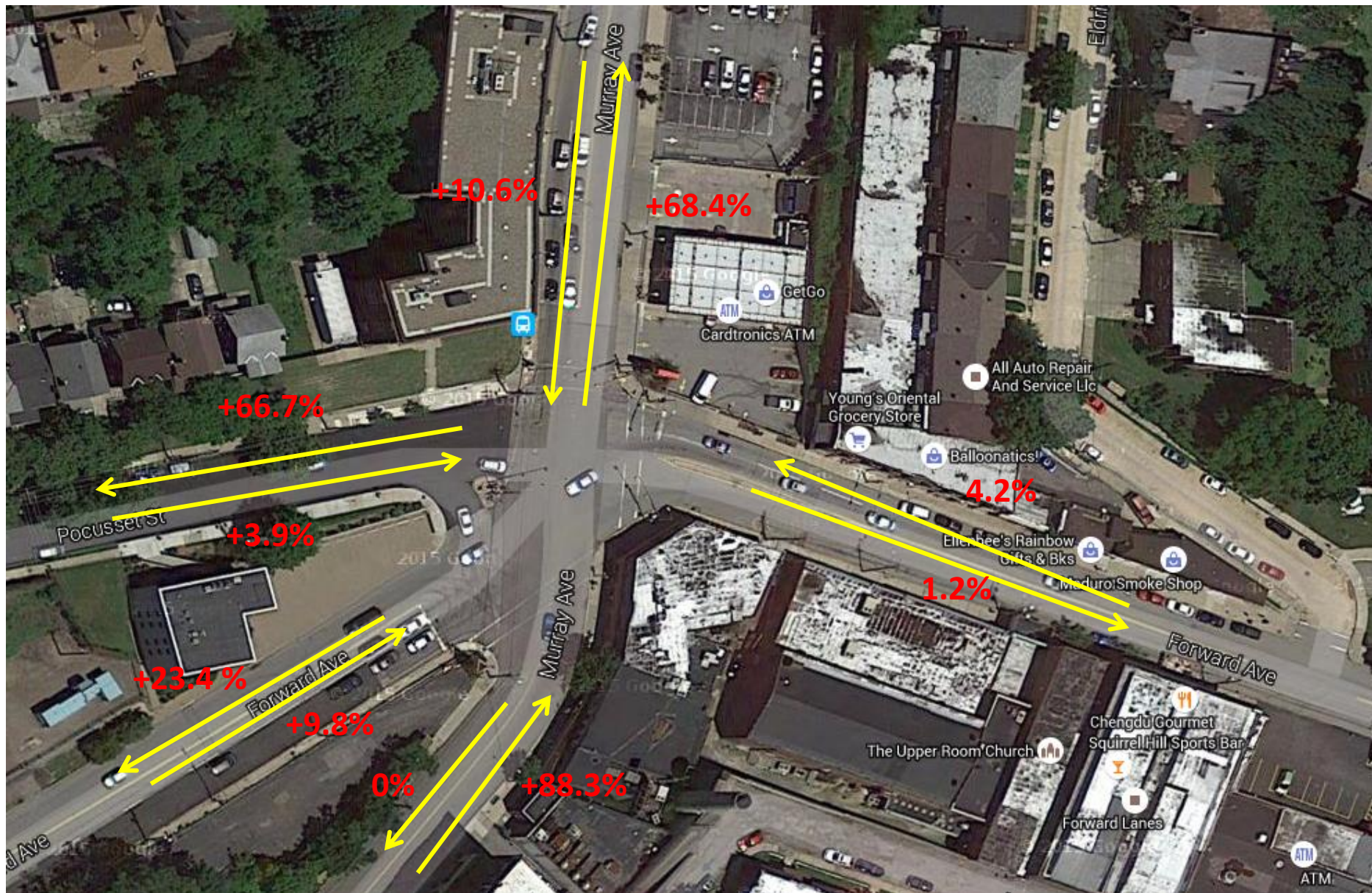
ID	6		7	
Name	Greenfield Ave. West		Greenfield Ave. East	
Direction	W to E	E to W	W to E	E to W
Before	1617	5106	299	482
After	1033	5045	284	383
Change	-584	-61	-15	-99
Change by %	-36.12%	-1.19%	-5.02%	-20.54%



Critical intersection: Murray @ Forward





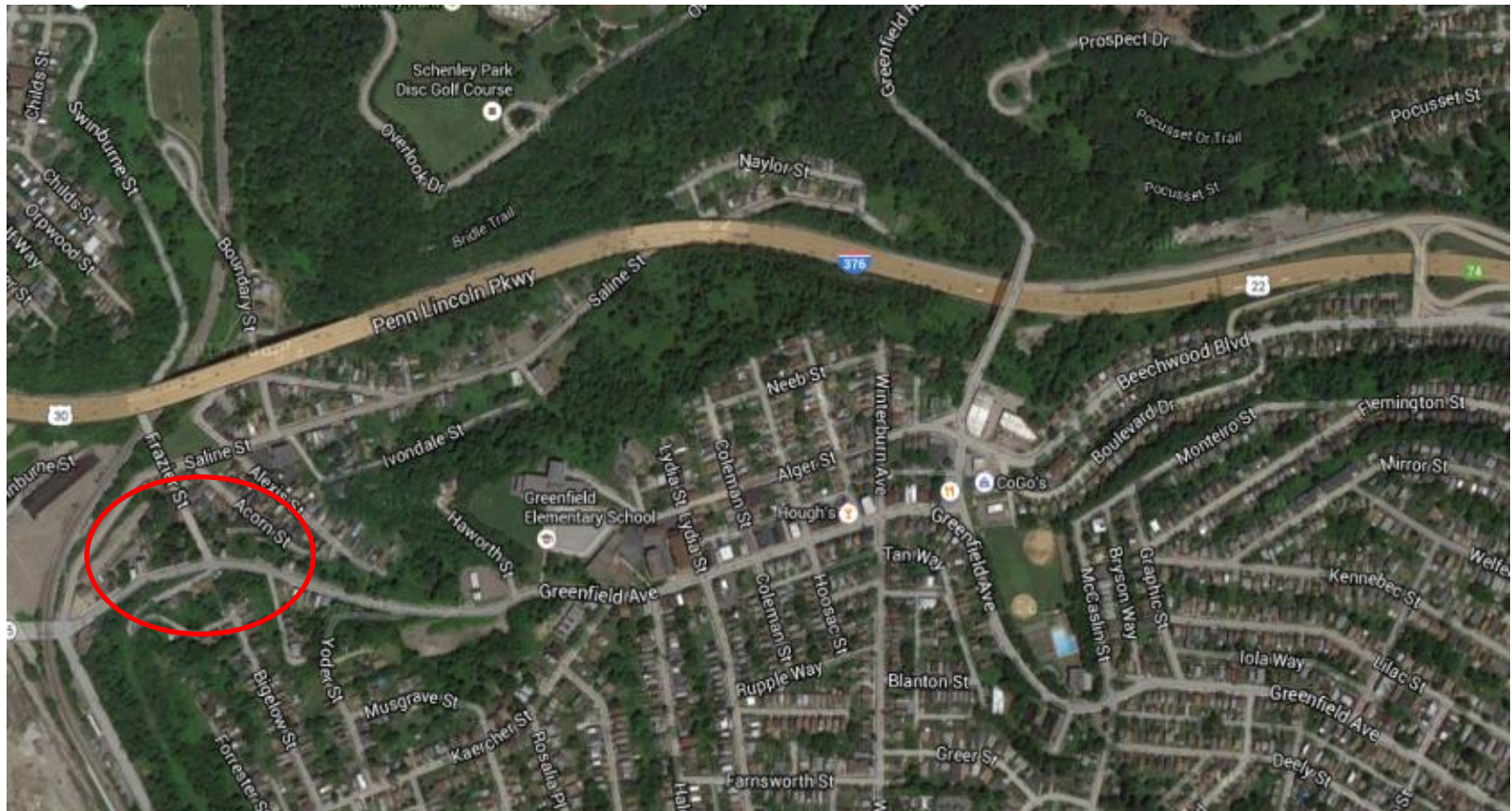


Road	Pocusset St.		Forward Ave. West		Murray Ave. South		Forward Ave. East		Murray Ave. North	
Direction	W to E	E to W	N to S	S to N	N to S	S to N	W to E	E to W	N to S	S to N
Before	1203	655	2779	1508	4746	1719	915	2621	3801	1757
After	1250	1085	3430	1657	4746	3237	926	2733	4202	2959
Change	47	430	651	149	0	1518	11	112	401	1202
Change by %	3.91%	65.65%	23.43%	9.88%	0.00%	88.31%	1.20%	4.27%	10.55%	68.41%

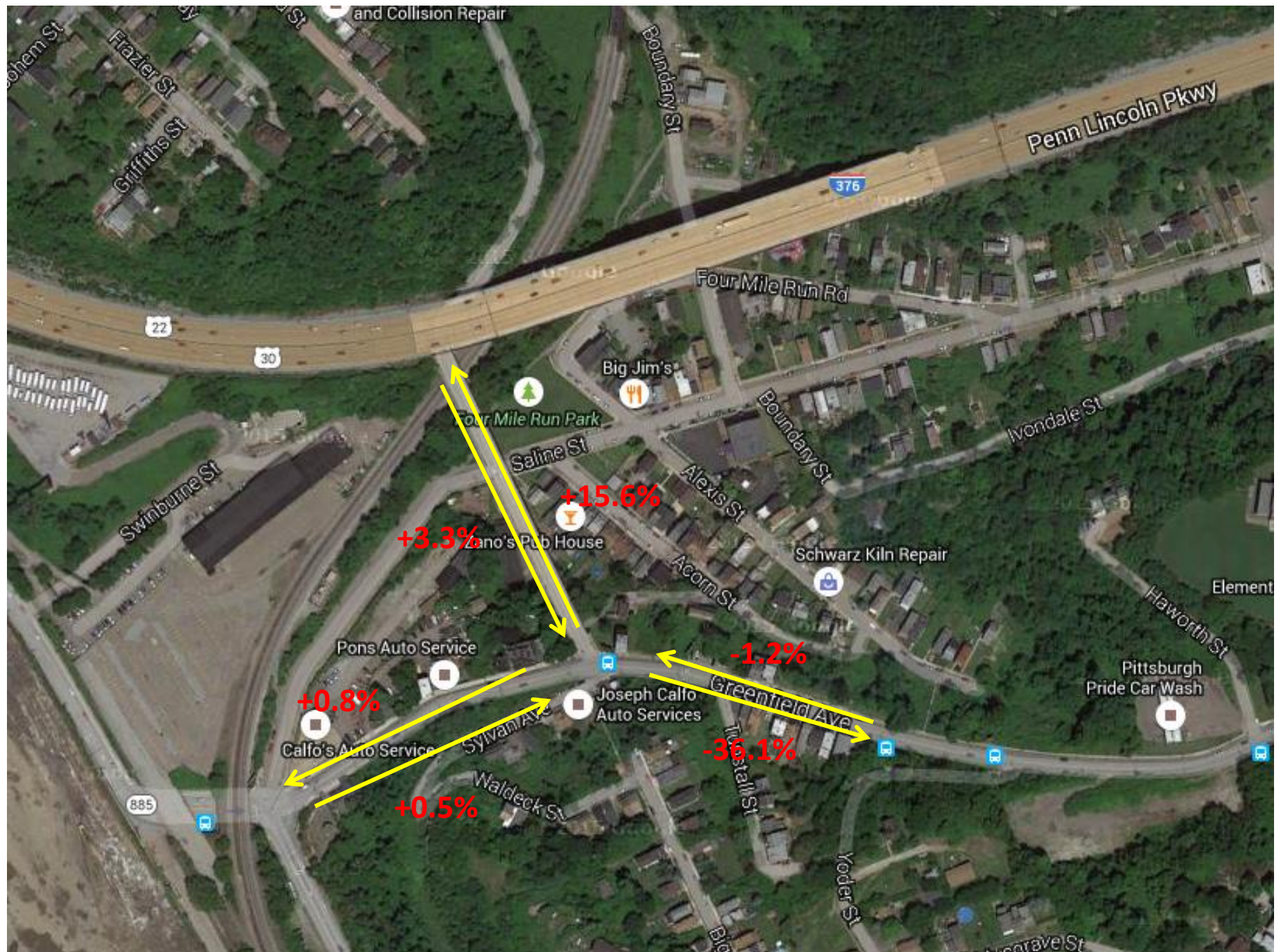
Reasons for traffic boost at Murray @ Forward: traffic detours from the following routes



Critical intersection: Frazier @ Greenfield







Change in traffic flow on the Greenfield Ave. (from 5am to 10am)

Road	Frazier St		Greenfield Ave. (west of Frazier St)		Greenfield Ave. (east of Frazier St)	
	N to S	S to N	W to E	E to W	W to E	E to W
Before	1736	2105	1235	4099	1617	5106
After	1794	2433	1245	4121	1033	5045
Change	58	328	10	22	-584	-61
Change by %	3.34%	15.58%	0.81%	0.54%	-36.12%	-1.19%

Change in travel time from the Glenwood Bridge

From	To	Time	Before	After	Change
Glenwood Bridge	CMU North	07:00 - 07:30	10.8	10.8	0.00%
Glenwood Bridge	CMU North	07:30 - 08:00	10.8	10.8	0.00%
Glenwood Bridge	CMU North	08:00 - 08:30	11.0	11.1	0.87%
Glenwood Bridge	CMU North	08:30 - 09:00	10.9	11.1	1.63%
Glenwood Bridge	CMU South	07:00 - 07:30	8.1	8.1	0.00%
Glenwood Bridge	CMU South	07:30 - 08:00	8.1	8.1	0.00%
Glenwood Bridge	CMU South	08:00 - 08:30	8.3	8.4	1.15%
Glenwood Bridge	CMU South	08:30 - 09:00	8.2	8.4	2.16%
Glenwood Bridge	Carlow Univ.	07:00 - 07:30	8.8	8.8	0.00%
Glenwood Bridge	Carlow Univ.	07:30 - 08:00	8.8	8.8	0.00%
Glenwood Bridge	Carlow Univ.	08:00 - 08:30	9.0	9.1	1.05%
Glenwood Bridge	Carlow Univ.	08:30 - 09:00	9.0	9.2	1.99%
Glenwood Bridge	Univ. of Pittsburgh	07:00 - 07:30	9.5	9.5	0.00%
Glenwood Bridge	Univ. of Pittsburgh	07:30 - 08:00	9.6	9.6	0.00%
Glenwood Bridge	Univ. of Pittsburgh	08:00 - 08:30	9.8	9.8	0.93%
Glenwood Bridge	Univ. of Pittsburgh	08:30 - 09:00	9.7	9.9	1.85%

Change in travel time from the Homestead Bridge

From	To	Time	Before	After	Change
Homestead Bridge	CMU North	07:00 - 07:30	12.2	12.2	0.00%
Homestead Bridge	CMU North	07:30 - 08:00	12.2	12.2	0.00%
Homestead Bridge	CMU North	08:00 - 08:30	12.2	12.2	0.00%
Homestead Bridge	CMU North	08:30 - 09:00	12.2	12.2	0.00%
Homestead Bridge	CMU South	07:00 - 07:30	10.3	12.1	17.93%
Homestead Bridge	CMU South	07:30 - 08:00	10.3	12.1	17.34%
Homestead Bridge	CMU South	08:00 - 08:30	10.3	12.1	17.90%
Homestead Bridge	CMU South	08:30 - 09:00	10.3	12.1	17.93%
Homestead Bridge	Carlow Univ.	07:00 - 07:30	12.3	12.3	0.00%
Homestead Bridge	Carlow Univ.	07:30 - 08:00	12.3	12.3	0.00%
Homestead Bridge	Carlow Univ.	08:00 - 08:30	12.3	12.3	0.00%
Homestead Bridge	Carlow Univ.	08:30 - 09:00	12.3	12.3	0.00%
Homestead Bridge	Univ. of Pittsburgh	07:00 - 07:30	13.1	13.1	0.00%
Homestead Bridge	Univ. of Pittsburgh	07:30 - 08:00	13.1	13.1	0.00%
Homestead Bridge	Univ. of Pittsburgh	08:00 - 08:30	13.1	13.1	0.00%
Homestead Bridge	Univ. of Pittsburgh	08:30 - 09:00	13.1	13.1	0.00%

Change in travel time from the Squirrel Hill Tunnel

From	To	Time	Before	After	Change
Squirrel Hill Tunnel	CMU North	07:00 - 07:30	18.8	18.9	0.75%
Squirrel Hill Tunnel	CMU North	07:30 - 08:00	17.2	19.2	11.60%
Squirrel Hill Tunnel	CMU North	08:00 - 08:30	19.2	19.2	0.24%
Squirrel Hill Tunnel	CMU North	08:30 - 09:00	18.6	18.9	1.64%
Squirrel Hill Tunnel	CMU South	07:00 - 07:30	17.1	17.6	2.74%
Squirrel Hill Tunnel	CMU South	07:30 - 08:00	15.5	17.9	15.02%
Squirrel Hill Tunnel	CMU South	08:00 - 08:30	17.5	17.8	2.18%
Squirrel Hill Tunnel	CMU South	08:30 - 09:00	16.9	17.5	3.84%
Squirrel Hill Tunnel	Carlow Univ.	07:00 - 07:30	17.2	17.3	0.79%
Squirrel Hill Tunnel	Carlow Univ.	07:30 - 08:00	15.6	17.6	12.64%
Squirrel Hill Tunnel	Carlow Univ.	08:00 - 08:30	17.5	17.6	0.17%
Squirrel Hill Tunnel	Carlow Univ.	08:30 - 09:00	17.0	17.3	1.75%
Squirrel Hill Tunnel	Univ. of Pittsburgh	07:00 - 07:30	17.9	18.0	0.75%
Squirrel Hill Tunnel	Univ. of Pittsburgh	07:30 - 08:00	16.4	18.3	12.07%
Squirrel Hill Tunnel	Univ. of Pittsburgh	08:00 - 08:30	18.3	18.3	0.00%
Squirrel Hill Tunnel	Univ. of Pittsburgh	08:30 - 09:00	17.7	18.0	1.69%

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