Eakins Oval Alternatives Analysis

City of Philadelphia Background Materials

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MEMORANDUM

Date: June 16, 2020

To: Gustave Scheerbaum
From: Adrienne Eiss
Subject: Task 3 and 4
CC: Jeff Riegner

Work Order Number: 32201-001
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Project: Eakins Oval Alternatives Analysis

This memo updates the work products of Task 4 of the Eakins Oval Alternatives Analysis that were transmitted June 15, 2020. It was confirmed yesterday that the Synchro files provided for our use had swapped the volumes between the Spring Garden Street Bridge and MLK Jr. Drive approaches to the Oval. Our process allowed us to quickly update the O-D information and map, which are attached. There are no other changes to the memo from June 15.

Task 3 Deliverable: Data sheets from speed and queuing observations.

Results are shown on Attachments 1 and 2.

Per the April 27, 2020 phone call with you, changes were made to this task due to the pandemic. Due to the sharp reduction in traffic, field traffic data on speeds and queues could not be collected for model calibration. In its place, Drive Engineering obtained INRIX data for travel time which is historic and pre-pandemic. Data was obtained for the period September 10, 2019 through September 12, 2019 (Tuesday through Thursday).

Drive pulled and summarized 46 INRIX segments. We then went through the list and refined it to 11 travel time segments in and around the Oval. These results will be used to calibrate the VISSIM model of existing conditions before proceeding to test alternatives.

Task 4 Deliverable: AM and PM peak hour matrices tracking volumes at each entry point to their exit points.

The following materials are attached:

- Attachment 3: Zone map
- Attachments 4 – 5: AM and PM summary of O-D tracking of volumes at each entry point to their exit points
- Attachments 6 – 9: AM and PM peak hour matrices
- Attachments 10 – 11: AM and PM peak hour O-D volume diagrams

Streetlight data reflects typical 2019 peak hour driving conditions determined through their data algorithms and pooling across various months to determine typical conditions and removes abnormal traffic such as winter weather, holiday traffic, etc. WRA specified seventeen “gates” or zones as illustrated on Attachment 3. Streetlight provided hourly numbers for destinations of traffic originating at each zone. For each zone, vehicles that were sampled passing that zone and that subsequently passed through another zone were identified as an origin-destination pair. The numbers are not full counts, but rather samples of the origin-destination pairs.

Results for the AM peak hour and for the PM peak hour were compiled into 17x17 matrices. Middle filters in Streetlight were used to determine interactions in zones 9 through 12 and zones 13 through 16 (Pennsylvania Avenue), so that volumes in the matrix reflect movements through the Oval.

Post-processing was performed to adjust these matrices to match the intersection volumes around the Oval in the AM and PM Synchro models provided by Department of Streets (Concept_3_ AM_MOD.syn and Concept_3_PM_MOD.syn). Those models were developed by others in 2019 using the most recent available counts, balanced between intersections. The following is a more detailed description of the process.

The provided O-D matrix used two data sources to determine O-D pairs through Eakins Oval, a 17-zone seed Streetlight Matrix and the provided balanced counts from Synchro that accounted for the turns in and out of the Eakins Oval. Before the two sources could be melded together, a volume map was created where it associated zone pairs with each applicable Eakins Oval turning movement. This allowed us to identify locations where the seed matrix was off from the balanced counts.

The movements consist of two types of turns, external and internal. External zones consist of volume entering/exiting the Eakins Oval from/to zone(s) typically from one central location, whereas internal zones are the circulating volume that comes from a combination of zones and areas. The first part of the process relied heavily on refining the external volumes, entering and exiting. The origin and destination links were factored up or down based on the difference from the count, keeping the zone proportions intact. For example, if the predicted Streetlight turning movement was 200 and the balanced count was 100, the associated zone was factored in half to match the count volume, the overall volume would drop, but would keep the relative proportion to the zones intact. The zones or turning movement counts that were the furthest off from the balanced count were typically adjusted first. External factoring full sail adjusted the origins or destinations of a zone. This was an iterative process.

As the external zones around the Eakins Oval began to resemble the balanced turning movement count, limited internal counts were adjusted also by a factor to further improve the matrix estimation. Like the external adjustment, a factor adjustment was used to bring the internal movements closer to the count. As stated earlier, the turning movement sheet determined what zone pairs were associated with each turn. All the zone pairs that were determined to derive the internal count were factored by the same proportion. There was very minimal manual override used during the process. Manual override was only used at a few select locations where the Streetlight data and balanced counts would never match by only reducing proportions. The estimation of the O-D matrix was considered complete when the projected adjusted Streetlight matrix resembled the turning movement counts from the Synchro models.

We look forward to reviewing this material with you and your traffic engineering staff.

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Adrienne Eiss

Attachment 1

Eakins Oval AM Peak Hour Vehicle Travel Time

Travel Segments	INRIX TMC Code	Distance (miles)	AM Peak Hour 8-9 AM				
			Travel Times (sec)			Difference	
			INRIX (sec)	Avg Segment Speed (MPH)	Simulated (sec)	Difference (sec)	Difference (%)
NB BENJAMIN FRANKLIN PARKWAY (OUTER) FROM N 22ND ST TO EAKINS OVAL	103+50472	0.14	27.7	18.2			
NB BENJAMIN FRANKLIN PARKWAY (CENTER) FROM N 22ND ST TO SPRING GARDEN ST	103+07625	0.28	52.9	19.1			
NB KELLY DR NB FROM SPRING GARDEN ST TO N 25TH ST	103P04834	0.15	31.1	17.4			
WB SPRING GARDEN ST FROM PENNSYLVANIA AVE TO MLK JR DR AT EAKINS OVAL	103P07500	0.24	91.1	9.5			
SB KELLY DR FROM N 25TH ST TO EAKINS OVAL	103N04834	0.11	26.7	14.8			
NB MLK JR AT EAKINS OVAL TO SCHUYLKILL TRAIL CONNECTOR	103P04838	0.12	16.7	25.9			
EB/SB EAKINS OVAL AT ART MUSEUM STAIRS TO SPRING GARDEN ST AND MLK JR DR	103N07625	0.12	34.1	12.7			
EB SPRING GARDEN ST EB FROM MLK JR DR OVERPASS TO PENNSYLVANIA AVE	103N07500	0.32	116.7	9.9			
SB MLK JR AT SCHUYLKILL TRAIL CONNECTOR TO EAKINS OVAL	103N04838	0.15	39.5	13.7			
SB BENJAMIN FRANKLIN PARKWAY SB (CENTER) FROM SPRING GARDEN ST TO N 22ND ST	103-07624	0.26	42.3	22.1			
SB BENJAMIN FRANKLING PARKWAY (OUTER) FROM EAKINS OVAL TO N 22ND ST	103-50471	0.16	36.8	15.7			

*Average INRIX speeds for 8-9 from 9/10/19, 9/11/19, and 9/12/19

Attachment 2

Eakins Oval PM Peak Hour Vehicle Travel Time

Travel Segments	INRIX TMC Code	Distance (miles)	PM Peak Hour 5-6 PM				
			Travel Times (sec)			Difference	
			INRIX (sec)	Avg Segment Speed (MPH)	Simulated (sec)	Difference (sec)	Difference (%)
NB BENJAMIN FRANKLIN PARKWAY (OUTER) FROM N 22ND ST TO EAKINS OVAL	103+50472	0.14	39.8	12.7			
NB BENJAMIN FRANKLIN PARKWAY (CENTER) FROM N 22ND ST TO SPRING GARDEN ST	103+07625	0.28	78.4	12.9			
NB KELLY DR NB FROM SPRING GARDEN ST TO N 25TH ST	103P04834	0.15	51.9	10.4			
WB SPRING GARDEN ST FROM PENNSYLVANIA AVE TO MLK JR DR AT EAKINS OVAL	103P07500	0.24	81.9	10.5			
SB KELLY DR FROM N 25TH ST TO EAKINS OVAL	103N04834	0.11	52.7	7.5			
NB MLK JR AT EAKINS OVAL TO SCHUYLKILL TRAIL CONNECTOR	103P04838	0.12	18.9	22.9			
EB/SB EAKINS OVAL AT ART MUSEUM STAIRS TO SPRING GARDEN ST AND MLK JR DR	103N07625	0.12	34.4	12.6			
EB SPRING GARDEN ST EB FROM MLK JR DR OVERPASS TO PENNSYLVANIA AVE	103N07500	0.32	101.1	11.4			
SB MLK JR AT SCHUYLKILL TRAIL CONNECTOR TO EAKINS OVAL	103N04838	0.15	45.4	11.9			
SB BENJAMIN FRANKLIN PARKWAY SB (CENTER) FROM SPRING GARDEN ST TO N 22ND ST	103-07624	0.26	44.2	21.2			
SB BENJAMIN FRANKLING PARKWAY (OUTER) FROM EAKINS OVAL TO N 22ND ST	103-50471	0.16	48.8	11.8			

*Average INRIX speeds for 8-9 from 9/10/19, 9/11/19, and 9/12/19

Attachment 3

Eakins Oval Origin and Destination Zones

Attachment 4

Tracking from Oval Entry to Oval Exit - AM Peak

ENTRY TO OVAL	EXIT FROM OVAL	AM Peak Hour % exiting	AM Peak Hour % circulating
Spring Garden Street Bridge			100%
	MLK Jr. Drive	0%	100%
	N. 24th Street/ I-676 Ramp	15%	84%
	Ben Franklin Parkway outer lanes SB	9%	75%
	Ben Franklin Parkway inner lanes SB S. of 22nd Street	47%	29%
	Spring Garden Street east	24%	5%
	Kelly Drive	5%	0%
MLK Jr. Drive			100%
	N. 24th Street/ I-676 Ramp	31%	69%
	Ben Franklin Parkway outer lanes SB	15%	54%
	Ben Franklin Parkway inner lanes SB S. of 22nd Street	32%	22%
	Spring Garden Street east	21%	2%
	Kelly Drive	1%	0%
Ben Franklin Parkway NB inner lanes			100%
to Kelly includes half of N. 22nd Street left turns	Kelly Drive	41%	59%
others include all of 22nd St left turns	Spring Garden Street Bridge	20%	39%
	MLK Jr. Drive	35%	4%
	N. 24th Street/ I-676 Ramp	3%	1%
	Ben Franklin Parkway SB outer lanes	1%	0%
Ben Franklin Parkway NB outer lanes			100%
includes all of N. 22nd Street left turns	Spring Garden Street east	0%	100%
includes half of N. 22nd Street left turns	Kelly Drive	67%	33%
	Spring Garden Street Bridge	8%	25%
	MLK Jr. Drive	21%	4%
	N. 24th Street/ I-676 Ramp	1%	4%
	Ben Franklin Parkway SB outer lanes	0%	3%
	Ben Franklin Parkway SB inner lanes	3%	0%
Spring Garden Street			100%
to Kelly Drive from zone 10 only	Kelly Drive	23%	77%
others include 23rd Street	Spring Garden Street Bridge	36%	41%
zones 9 and 12 use Tunnel	MLK Jr. Drive	26%	15%
	N. 24th Street/ I-676 Ramp	10%	5%
	Ben Franklin Parkway SB outer lanes	2%	3%
	Ben Franklin Parkway SB inner lanes	3%	0%
Kelly Drive			100%
includes PA Ave zones 13 and 15	Spring Garden Street Bridge	8%	92%
except to Spring Garden St. east	MLK Jr. Drive	2%	91%
	N. 24th Street/ I-676 Ramp	32%	59%
	Ben Franklin Parkway SB outer lanes	20%	39%
	Ben Franklin Parkway SB inner lanes	34%	5%
	Spring Garden Street east (incl PA Ave zone 9)	5%	0%

Attachment 5

Tracking from Oval Entry to Oval Exit - PM Peak

ENTRY TO OVAL	EXIT FROM OVAL	PM Peak Hour % exiting	PM Peak Hour % circulating
Spring Garden Street Bridge			100%
	MLK Jr. Drive	1%	99%
	N. 24th Street/ I-676 Ramp	20%	78%
	Ben Franklin Parkway outer lanes SB	9%	69%
	Ben Franklin Parkway inner lanes SB S. of 22nd Street	22%	47%
	Spring Garden Street east	38%	9%
	Kelly Drive	9%	0%
MLK Jr. Drive			100%
	N. 24th Street/ I-676 Ramp	35%	65%
	Ben Franklin Parkway outer lanes SB	16%	49%
	Ben Franklin Parkway inner lanes SB S. of 22nd Street	28%	22%
	Spring Garden Street east	21%	1%
	Kelly Drive	1%	0%
Ben Franklin Parkway NB inner lanes			100%
to Kelly includes half of N. 22nd Street left turns	Kelly Drive	39%	61%
others include all of 22nd St left turns	Spring Garden Street Bridge	21%	40%
	MLK Jr. Drive	37%	3%
	N. 24th Street/ I-676 Ramp	2%	1%
	Ben Franklin Parkway SB outer lanes	1%	0%
Ben Franklin Parkway NB outer lanes			100%
includes all of N. 22nd Street left turns	Spring Garden Street east	9%	91%
includes half of N. 22nd Street left turns	Kelly Drive	69%	23%
	Spring Garden Street Bridge	6%	17%
	MLK Jr. Drive	13%	4%
	N. 24th Street/ I-676 Ramp	1%	2%
	Ben Franklin Parkway SB outer lanes	1%	2%
	Ben Franklin Parkway SB inner lanes	2%	0%
Spring Garden Street			100%
to Kelly Drive from zone 10 only	Kelly Drive	17%	83%
others include 23rd Street	Spring Garden Street Bridge	31%	52%
zones 9 and 12 use Tunnel	MLK Jr. Drive	45%	8%
	N. 24th Street/ I-676 Ramp	5%	3%
	Ben Franklin Parkway SB outer lanes	1%	2%
	Ben Franklin Parkway SB inner lanes	2%	0%
Kelly Drive			100%
includes PA Ave zones 13 and 15	Spring Garden Street Bridge	7%	93%
except to Spring Garden St. east	MLK Jr. Drive	4%	89%
	N. 24th Street/ I-676 Ramp	28%	61%
	Ben Franklin Parkway SB outer lanes	25%	36%
	Ben Franklin Parkway SB inner lanes	36%	0%
	Spring Garden Street east (incl PA Ave zone 9)	0%	0%

Attachment 6 AM Origin to Destination Trips

AM Origin and Destination Matrix		Zone and Destination	1 Spring Garden St	2 MLK Jr Dr	3 N 24th St/ I-676 ramp	4 N 22nd St (S)	5 Ben Franklin Pkwy SB	6 Ben Franklin Pkwy inner	7 Ben Franklin Pkwy NB	8 N 22nd St (N)	9 Penn Ave (near Hamilton)	10 Spring Garden St	11 N 23rd St	12 Penn Ave (near Judson St)	13 Penn Ave (near Green St)	14 N 25th St	15 Penn Ave (near Fairmont Ave)	16 Kelly Dr	17 Museum Parking	Origin Volume through Oval	% of total origin travelling thru Oval
Zone and Origin		Total	645	610	1252	0	1022	1433	0	526	983	676	0	255	569	216	286	602	8		
1	Spring Garden St	594		2	90		54	278		0	13	128		2	1	16	2	8	0	594	100%
2	MLK Jr Dr	1229	4		376		187	390		0	48	205		3	1	4	1	8	0	1229	100%
3	N 24th St/ I-676 ramp	0																			
4	N 22nd St (S)	1240	81	110	13		324	33		426	0	0		1	2	48	30	169	2	487	39%
5	Ben Franklin Pwky SB	0																			
6	Ben Franklin Pwky inner	706	126	255	15		10			0	0	0		0	8	43	41	206	1	706	100%
7	Ben Franklin Pwky NB	307	25	68	3		1	10		100	0	0		0	1	10	14	73	1	207	67%
8	N 22nd St (N)	0																			
9	Penn Ave (near Hamilton)	193	25	11	11		1	1		0		0		123	0	0	0	21	0	50	26%
10	Spring Garden St	515	151	112	22		5	11		0	0			102	0	0	0	111	0	413	80%
11	N 23rd St	427	27	16	26		6	2		0	289	36		23	0	0	0	2	0	79	18%
12	Penn Ave (near Judson St)	925	43	3	31		10	9		0	604	223			0	0	0	2	0	98	11%
13	Penn Ave (near Green St)	299	4	4	5		7	3		0	0	0		0		87	188	0	1	24	8%
14	N 25th St	0																			
15	Penn Ave (near Fairmont Ave)	966	51	16	156		85	93		0	0	0		0	555	6		1	3	401	41%
16	Kelly Dr	1677	108	12	501		329	604		0	29	84		1	0	0	9		0	1667	99%
17	Museum Parking	6	0	0	1		2	0		0	0	0		0	0	1	0	1		4	65%

AM Origin of traffic to/through Oval ranked by volume

#	Matrix Zone	Volume
16	Kelly Drive SB	1667
2	MLK Jr. Drive SB	1229
6	Ben Franklin Parkway inner lanes, NB	706
1	Spring Garden Street Bridge	594
4	22nd Street NB approaching Parkway	487
10	Spring Garden Street east of Oval, WB	413
15	Pennsylvania Avenue near Fairmount Avenue, SB	401
7	Ben Franklin Parkway outer lanes NB	207
12	Pennsylvania Avenue near Judson Street	98
11	N. 23rd Street, SB	79
9	Pennsylvania Avenue near Hamilton Street	50
13	Pennsylvania Avenue near Green Street	24

% of Origin Traffic detected in Oval

> 80%	50% < x < 80%	33% < x < 50%	20% < x < 33%	10% < x < 20%	< 10%

Volume not traveling through Oval

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Attachment 7 AM Origin to Destination Percentages

AM Origin and Destination Matrix		Zone and Destination	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
			Spring Garden St	MLK Jr Dr	N 24th St/ I-676 ramp	N 22nd St (S)	Ben Franklin Pkwy SB	Ben Franklin Pkwy inner	Ben Franklin Pkwy NB	N 22nd St (N)	Penn Ave (near Hamilton)	Spring Garden St	N 23rd St	Penn Ave (near Judson St)	Penn Ave (near Green St)	N 25th St	Penn Ave (near Fairmont Ave)	Kelly Dr	Museum Parking
Zone and Origin																			
1	Spring Garden St		0%	0%	15%	0%	9%	47%	0%	0%	2%	22%	0%	0%	0%	3%	0%	1%	0%
2	MLK Jr Dr		0%	0%	31%	0%	15%	32%	0%	0%	4%	17%	0%	0%	0%	0%	0%	1%	0%
3	N 24th St/ I-676 ramp		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4	N 22nd St (S)		6%	9%	1%	0%	26%	3%	0%	34%	0%	0%	0%	0%	0%	4%	2%	14%	0%
5	Ben Franklin Pwky SB		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6	Ben Franklin Pwky		18%	36%	2%	0%	1%	0%	0%	0%	0%	0%	0%	0%	1%	6%	6%	29%	0%
7	Ben Franklin Pwky NB		8%	22%	1%	0%	0%	3%	0%	33%	0%	0%	0%	0%	0%	3%	5%	24%	0%
8	N 22nd St (N)		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
9	Penn Ave (near Hamilton)		13%	6%	6%	0%	1%	0%	0%	0%	0%	0%	0%	64%	0%	0%	0%	11%	0%
10	Spring Garden St		29%	22%	4%	0%	1%	2%	0%	0%	0%	0%	0%	20%	0%	0%	0%	22%	0%
11	N 23rd St		6%	4%	6%	0%	1%	0%	0%	0%	68%	8%	0%	5%	0%	0%	0%	1%	0%
12	Penn Ave (near Judson St)		5%	0%	3%	0%	1%	1%	0%	0%	65%	24%	0%	0%	0%	0%	0%	0%	0%
13	Penn Ave (near Green St)		1%	1%	2%	0%	2%	1%	0%	0%	0%	0%	0%	0%	0%	29%	63%	0%	0%
14	N 25th St		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
15	Penn Ave (near Fairmont Ave)		5%	2%	16%	0%	9%	10%	0%	0%	0%	0%	0%	0%	57%	1%	0%	0%	0%
16	Kelly Dr		6%	1%	30%	0%	20%	36%	0%	0%	2%	5%	0%	0%	0%	0%	1%	0%	0%
17	Museum Parking		0%	0%	26%	0%	39%	0%	0%	0%	0%	0%	0%	0%	0%	18%	0%	18%	0%

Attachment 8 PM Origin to Destination Trips

PM Origin and Destination Matrix		Zone and Destination	1 Spring Garden St	2 MLK Jr Dr	3 N 24th St/ I-676 ramp	4 N 22nd St (S)	5 Ben Franklin Pkwy SB	6 Ben Franklin Pkwy	7 Ben Franklin Pkwy NB	8 N 22nd St (N)	9 Penn Ave (near Hamilton)	10 Spring Garden St	11 N 23rd St	12 Penn Ave (near Judson St)	13 Penn Ave (near Green St)	14 N 25th St	15 Penn Ave (near Fairmont Ave)	16 Kelly Dr	17 Museum Parking	Origin Volume through Oval	% of total origin travelling thru Oval
Zone and Origin		Total	742	1152	1007	0	726	957	0	901	570	770	0	821	562	479	921	1128	16		
1	Spring Garden St	808		12	164		72	178		0	21	280		9	5	26	7	32	3	805	100%
2	MLK Jr Dr	1385	6		478		221	379		0	30	251		3	1	2	1	10	1	1385	100%
3	N 24th St/ I-676 ramp	0																			
4	N 22nd St (S)	1479	89	128	22		149	24		604	2	7		38	8	71	66	267	3	681	46%
5	Ben Franklin Pwky SB	0																			
6	Ben Franklin Pwky	1505	312	596	18		11			10	0	0		0	8	45	81	423	2	1505	100%
7	Ben Franklin Pwky NB	720	38	90	9		5	12		287	0	3		10	2	22	33	206	2	433	60%
8	N 22nd St (N)	0																			
9	Penn Ave (near Hamilton)	559	20	29	8		3	2		0		0		458	0	0	0	39	0	42	8%
10	Spring Garden St	768	157	234	14		5	6		0	0			254	0	0	0	97	0	514	67%
11	N 23rd St	235	18	21	12		2	4		0	99	24		49	0	0	0	6	0	63	27%
12	Penn Ave (near Judson St)	679	30	5	9		7	6		0	418	204			0	0	0	1	0	27	4%
13	Penn Ave (near Green St)	1058	3	4	4		6	5		0	0	0		0		287	712	36	1	59	6%
14	N 25th St	0																			
15	Penn Ave (near Fairmont Ave)	731	29	14	45		37	36		0	0	0		0	536	26		8	0	161	22%
16	Kelly Dr	811	37	20	220		208	301		0	0	0		0	0	0	22		4	785	97%
17	Museum Parking	14	2	0	3		0	4		0	0	1		0	1	1	0	2		11	79%

PM Origin of traffic to/through Oval ranked by volume

#	Matrix Zone	Volume
6	Ben Franklin Parkway inner lanes, NB	1505
2	MLK Jr. Drive SB	1385
1	Spring Garden Steet Bridge EB	805
16	Kelly Drive SB	785
4	22nd Street NB approaching Parkway	681
10	Spring Garden Street east of Oval, WB	514
7	Ben Franklin Parkway outer lanes NB	433
15	Pennsylvania Avenue near Fairmount Avenue	161
11	N. 23rd Street, SB	63
13	Pennsylvania Avenue near Green Street	59
9	Pennsylvania Avenue near Hamilton Street	42
12	Pennsylvania Avenue near Judson Street	27

% of Origin Traffic detected in Oval

> 80%	50% < x < 80%	33% < x < 50%	20% < x < 33%	10% < x < 20%	< 10%

Volume not traveling through Oval

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Attachment 9 PM Origin to Destination Percentages

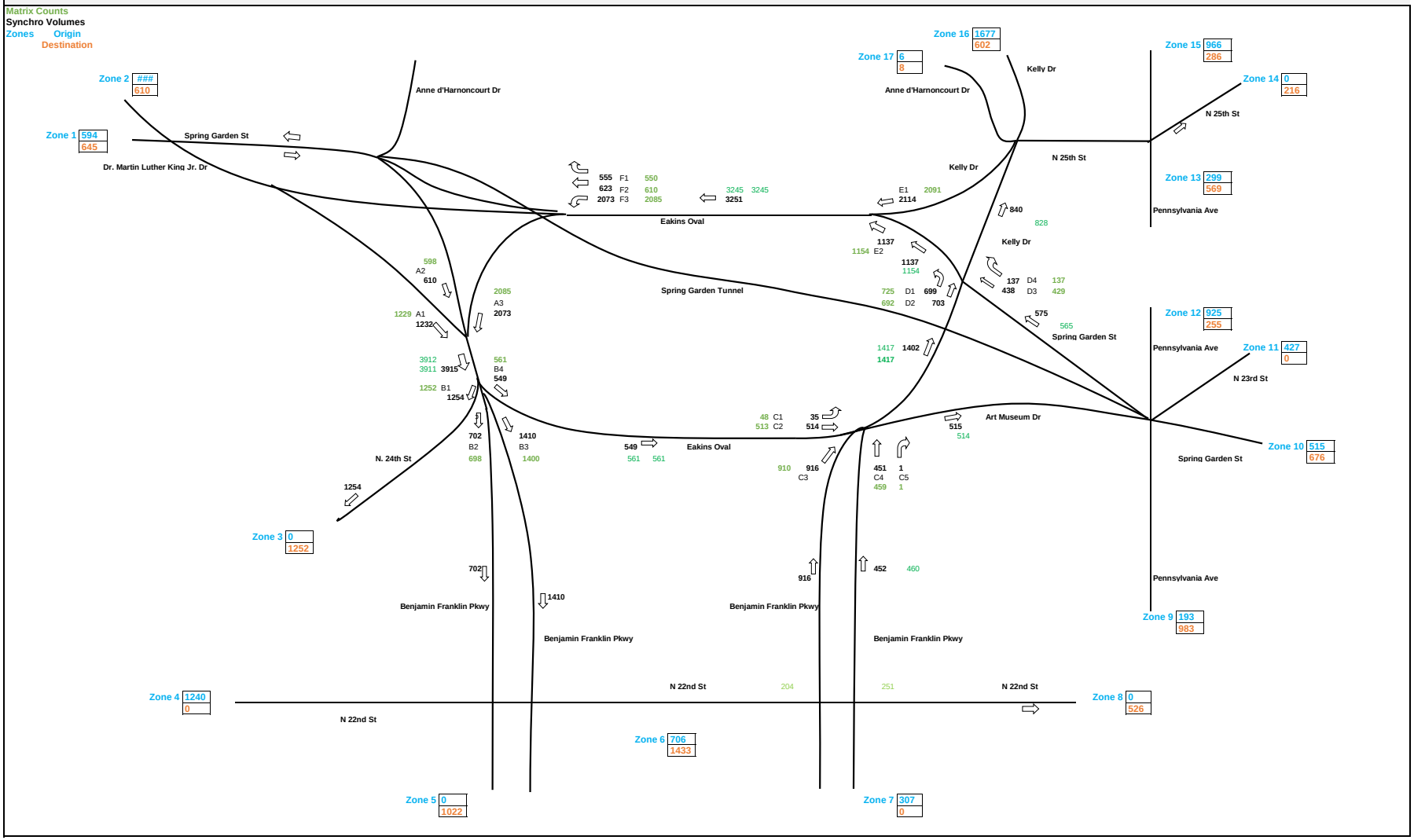
PM Origin and Destination Matrix		Zone and Destination	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
			Spring Garden St	MLK Jr Dr	N 24th St/ I-676 ramp	N 22nd St (S)	Ben Franklin Pkwy SB	Ben Franklin Pkwy inner	Ben Franklin Pkwy NB	N 22nd St (N)	Penn Ave (near Hamilton)	Spring Garden St	N 23rd St	Penn Ave (near Judson St)	Penn Ave (near Green St)	N 25th St	Penn Ave (near Fairmont Ave)	Kelly Dr	Museum Parking
Zone and Origin																			
1	Spring Garden St	1	0%	1%	20%	0%	9%	22%	0%	0%	3%	35%	0%	1%	1%	3%	1%	4%	0%
2	MLK Jr Dr	2	0%	0%	34%	0%	16%	27%	0%	0%	2%	18%	0%	0%	0%	0%	0%	1%	0%
3	N 24th St/ I-676 ramp	3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
4	N 22nd St (S)	4	6%	9%	2%	0%	10%	2%	0%	41%	0%	0%	0%	3%	1%	5%	4%	18%	0%
5	Ben Franklin Pwky SB	5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
6	Ben Franklin Pwky	6	21%	40%	1%	0%	1%	0%	0%	1%	0%	0%	0%	0%	1%	3%	5%	28%	0%
7	Ben Franklin Pwky NB	7	5%	13%	1%	0%	1%	2%	0%	40%	0%	0%	0%	1%	0%	3%	5%	29%	0%
8	N 22nd St (N)	8	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
9	Penn Ave (near Hamilton)	9	4%	5%	1%	0%	0%	0%	0%	0%	0%	0%	0%	82%	0%	0%	0%	7%	0%
10	Spring Garden St	10	20%	30%	2%	0%	1%	1%	0%	0%	0%	0%	0%	33%	0%	0%	0%	13%	0%
11	N 23rd St	11	7%	9%	5%	0%	1%	2%	0%	0%	42%	10%	0%	21%	0%	0%	0%	3%	0%
12	Penn Ave (near Judson St)	12	4%	1%	1%	0%	1%	1%	0%	0%	62%	30%	0%	0%	0%	0%	0%	0%	0%
13	Penn Ave (near Green St)	13	0%	0%	0%	0%	1%	1%	0%	0%	0%	0%	0%	0%	0%	27%	67%	3%	0%
14	N 25th St	14	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
15	Penn Ave (near Fairmont Ave)	15	4%	2%	6%	0%	5%	5%	0%	0%	0%	0%	0%	0%	73%	4%	0%	1%	0%
16	Kelly Dr	16	5%	2%	27%	0%	26%	37%	0%	0%	0%	0%	0%	0%	0%	0%	3%	0%	0%
17	Museum Parking	17	17%	0%	22%	0%	0%	25%	0%	0%	0%	7%	0%	0%	7%	7%	0%	14%	0%

Attachment 10

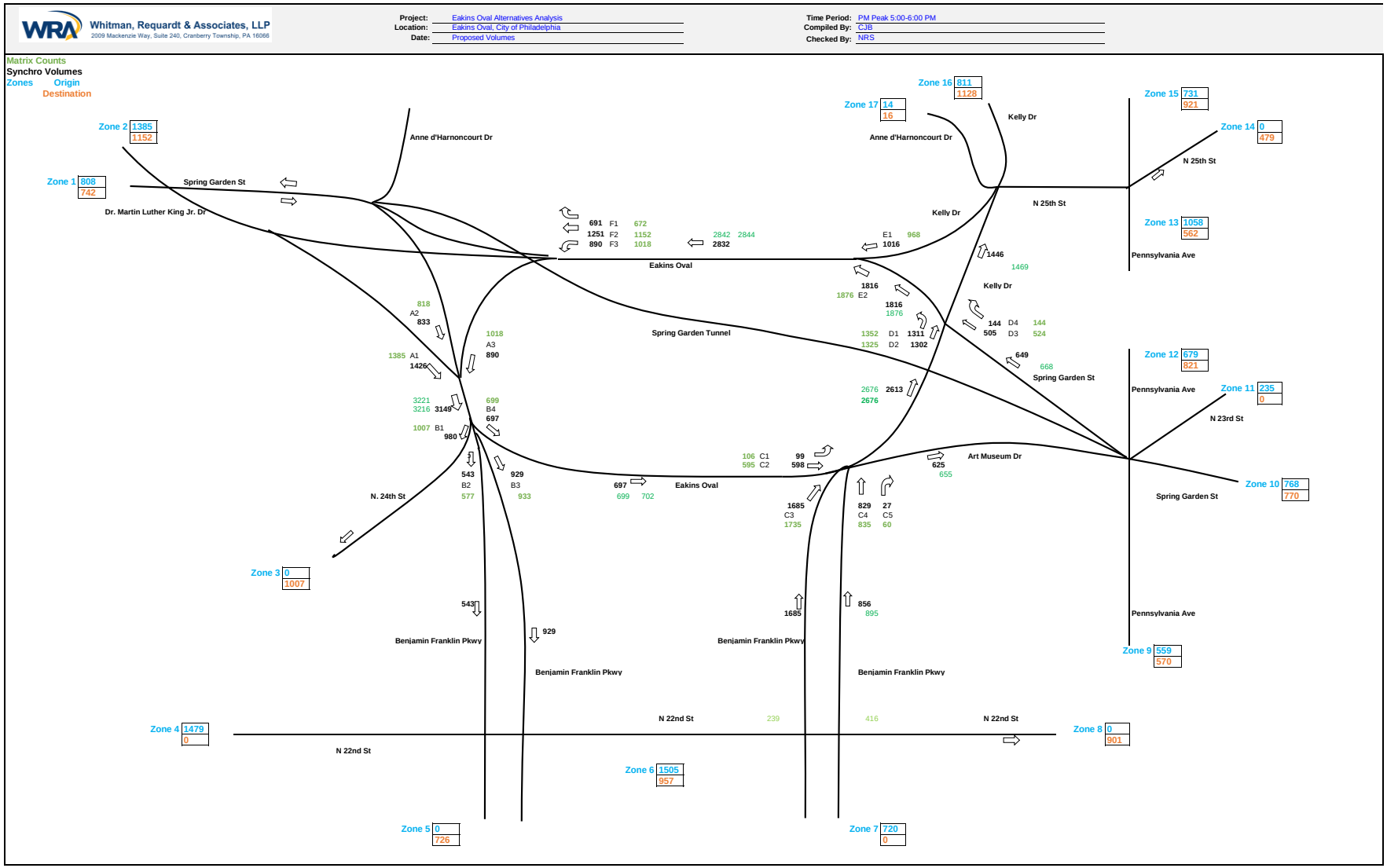
Whitman, Requardt & Associates, LLP
2009 Mackenzie Way, Suite 240, Cranberry Township, PA 16066

Project: Eakins Oval Alternatives Analysis
Location: Eakins Oval, City of Philadelphia
Date: Proposed Volumes

Time Period: AM Peak 8:00-9:00 AM
Compiled By: CJB
Checked By: NRS



Attachment 11



MEMORANDUM

Date: October 7, 2020

To: Gustave Scheerbaum
From: Adrienne Eiss
Subject: Task 5
CC: Jeff Riegner

Work Order Number: 32201-001
Contract Number: 19625120
Project: Eakins Oval Alternatives Analysis

The purpose of this memorandum is to deliver Task 5 of the Eakins Oval Alternatives Analysis project, which consists of base calibrated and analysis results of the roundabouts concept provided by the Department of Streets. In this memo the roundabouts concept is referred to as Alternative 1. Task 5 utilizes VISSIM 2020 to complete the existing calibration and Alternative 1 analysis.

The Eakins Oval Alternatives Analysis study is aimed at determining a preferred alternative to the existing Eakins Oval that meets the following goals:

- Remove the roadway in front of the Art Museum to enable creation of a larger park space
- Improve pedestrian and bicycle access, comfort, and safety travelling to and through the Oval
- Provide acceptable vehicular operations; this is defined as being safe and without excessive queues that lock up adjacent intersections, rather than using traditional Level of Service (LOS) criteria

In summary, Alternative 1 meets the first goal, but falls short on the second and third. Regarding pedestrians, street crossings must be signalized to meet safety standards with the Alternative 1 roundabout configuration. The locations of pedestrian crossings are similar to existing, and the crossing delays are generally longer than the existing base condition. Vehicular operations have areas of significant queuing and capacity constraints in both the AM and PM peak periods. At the large “peanut” roundabout at the end of the Ben Franklin Parkway, the number of lanes needed for capacity is likely to create driver confusion over the proper lane to be in and potential for unsafe maneuvers. Pedestrian and vehicular operations will be described more fully in the body of this memo. A final concern for Alternative 1 is constructability of the northern roundabout because of physical constraints.

In addition to the exhibits in this memo, the following materials are attached:

- Attachment 1 – 2: AM and PM peak hour origin-destination volume diagrams (counts vs Streetlight vs VISSIM)
- Attachments 3 – 4: AM and PM base calibrated intersection node analysis (delay, LOS, and queuing)
- Attachments 5 – 6: AM and PM Alternative 1 intersection node analysis (delay, LOS, and queuing)

VISSIM Model Development

VISSIM 2020 is a microscopic simulation software tool that assigns individual vehicles to a travel network that represents all the roads, traffic signals, and unsignalized control within the study area. This model provides a visual and realistic simulation of the vehicle interactions with each other and the traffic control devices in the network.

The VISSIM model is a multimodal simulation model that includes motor vehicles, pedestrians, and bicyclists. Transit routes and stops were added to the model to account for both SEPTA and the various Philadelphia tour buses that traverse the study area. Since there was no new volume data collection associated with this project, the consultant team relied on a combination of historic bicyclist and pedestrian counts and vehicular volumes provided within the existing VISSIM model to populate the pedestrian and bicyclist crossings. Pedestrian, bicyclist, and transit volumes were entered as static routes in the model. The vehicle movements (passenger car and truck) relied on the origin-destination (O-D) data provided under the Task 4 deliverable. As illustrated in the Task 4 materials, the study area was

broken into 17 zones, which represent the different origins and destinations of the study area. Truck percentages from the previously provided Synchro models were utilized to make assumptions for the trucks' origins. The VISSIM model used dynamic assignment from the matrices developed under Task 4 to account for the volumes and routes of passenger cars and trucks.

For this study, the models include an initialization (seed) time of 900 seconds (15 minutes), followed by 3,600 seconds (one hour) of actual simulation time during which data was collected by the VISSIM model; the actual simulation time is the equivalent to the established AM and PM peak hours. The approximated seeding period, or initialization time, was necessary to populate the network prior to VISSIM recording data for analysis.

The VISSIM model was extended to account for Anne D'Harnoncourt Drive around the Art Museum and 22nd St and Pennsylvania Avenue signalized intersections. Through the model development, the model was verified based on base geometry lane alignment, speeds, and existing signal timings. Base conditions reflect September 2019 since all the data collection (RITIS and Streetlight) was from September 2019. Base conditions do not reflect the recently completed lane restriping.

Base Calibrated

The VISSIM models were run five times (different seeds) per peak to account for microsimulation variance when summarizing output results. Calibration was performed to ensure that VISSIM simulated volumes reflect the O-D matrix development and existing Synchro models from Task 4. Matching travel speeds from RITIS to the model is also a function of calibration. The lane change distance, link driving behavior, and geometric alignment of the weaves in the Oval were adjusted to obtain a calibrated model. Refer to Attachments 1 and 2 to see the volume comparison among Synchro, Streetlight O-D, and final VISSIM. Exhibit 1 below provides a comparison between September 2019 RITIS speeds and VISSIM model speeds. The goal was to match majority of the segments by +/- 3 mph. Once the model was developed, the segments submitted under Task 3 were revised to the segments listed under Exhibit 1. These segments generally capture the speeds of the links entering Eakins Oval.

Exhibit 1: Speed Calibration

Segment	Distance (miles)	AM		PM	
		INRIX (MPH)	VISSIM (MPH)	INRIX (MPH)	VISSIM (MPH)
NB Ben Franklin Outer from 22nd St Eakins Oval	0.14	18.2	19.1	12.7	18.2
NB Ben Franklin Inner from 22nd St to Spring Garden St	0.28	19.1	18.9	12.9	14.2
NB Kelly Dr from Spring Garden St to 25th St	0.15	17.4	24.0	10.4	12.8
WB Spring Garden St from Penn Ave to MLK Jr Dr Exit	0.24	9.5	8.4	10.5	7.7
SB Kelly Dr from 25th St to Eakins Oval	0.11	14.8	16.7	7.5	17.0
Eakins Oval from Kelly Dr to MLK Entrance	0.12	12.7	9.8	12.6	14.4
EB Spring Garden St from MLK Jr Dr to Penn Ave	0.32	9.9	11.1	11.4	11.3
SB MLK Jr Dr from Schuylkill Trail to Eakins Oval	0.15	13.7	14.2	11.9	14.4

In addition to the travel time segments, the model provided Eakins Oval intersection delay, LOS, and queues (Attachments 3 and 4) to establish base conditions. Generally, base LOS operations are acceptable with LOS D or better. Since Alternative 1 and future alternatives are expected to significantly change the geometric profile of the Oval, key O-D passenger car travel time segments (Exhibit 2) were defined to provide a direct comparison between base conditions and Alternative 1. Base condition travel times are summarized in Exhibit 3. The travel time segments either start after the adjacent intersection or at the beginning of the network.

Exhibit 2: Key O-D Travel Time Segments

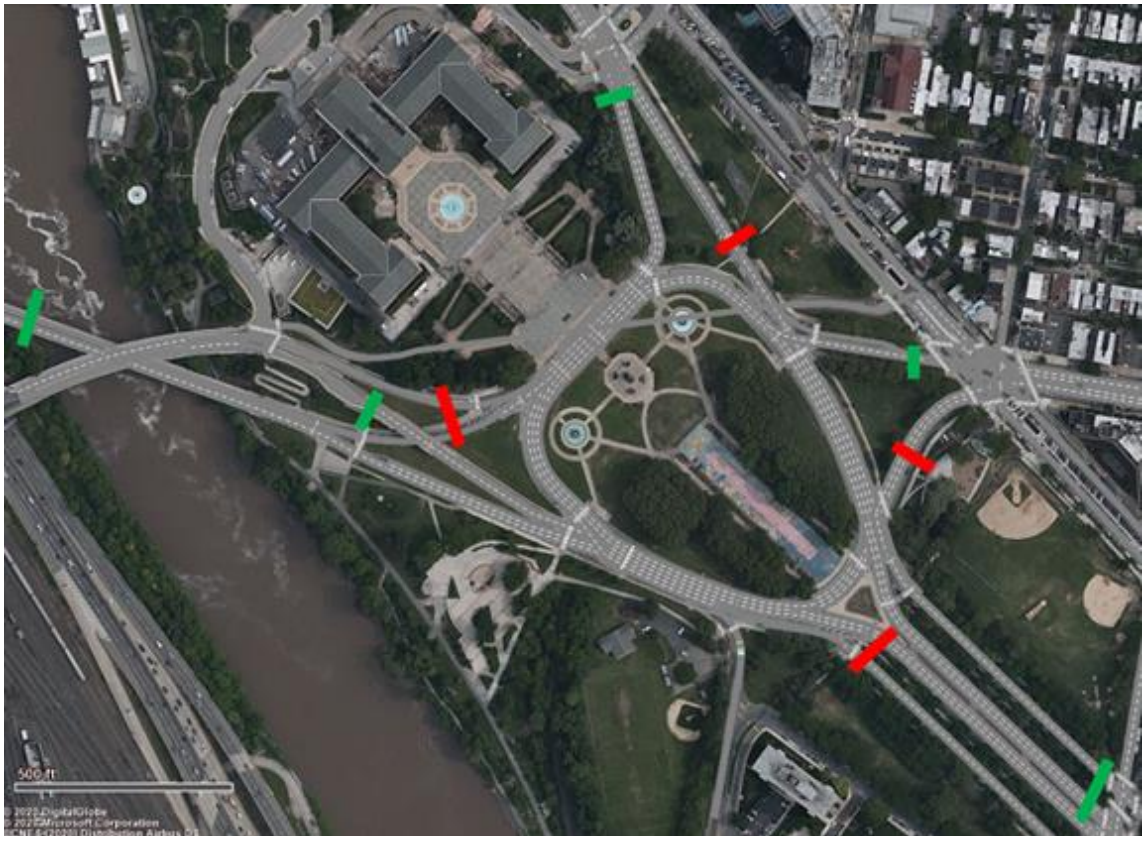


Exhibit 3: Key O-D Base Passenger Car Travel Times

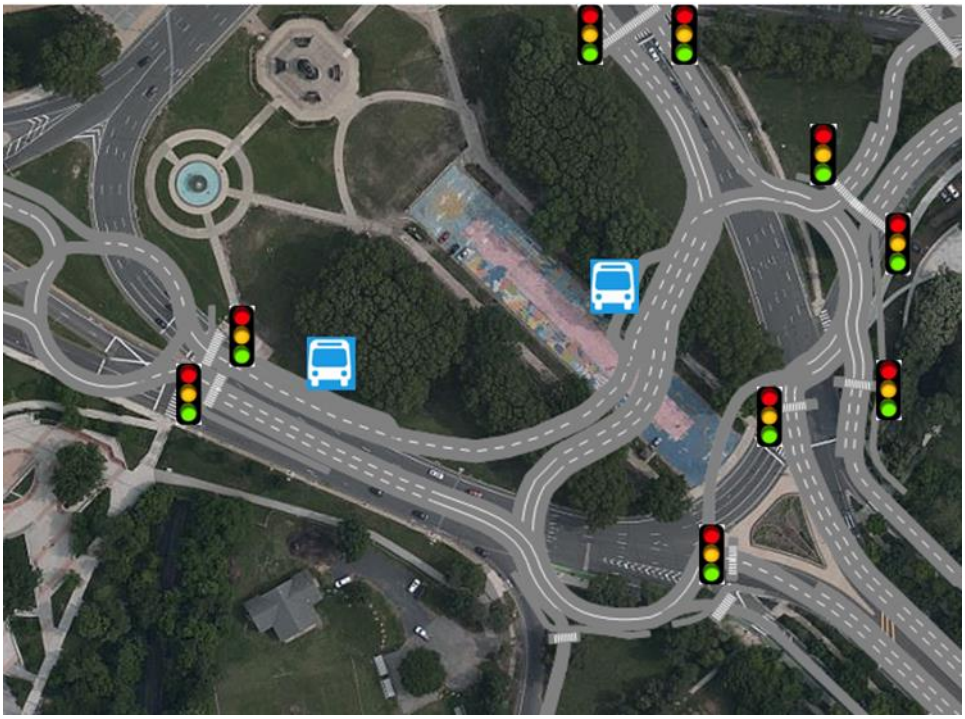
Segment	Travel Time (secs)	
	AM	PM
Kelly Dr		
- Spring Garden St West	35.2	38.0
- MLK Jr Dr	40.0	56.8
- 24th St	93.3	71.7
- Ben Franklin Parkway Outer	98.7	80.3
- Ben Franklin Parkway Inner	84.8	65.2
Spring Garden St West		
- 24th St	58.2	50.4
- Ben Franklin Parkway Outer	64.3	51.3
- Ben Franklin Parkway Inner	53.4	38.5
- Spring Garden St East	72.4	70.4
- Kelly Dr	99.9	112.0
- MLK Jr Dr	168.0	162.4
MLK Jr Dr		
- 24th St	71.1	77.1
- Ben Franklin Parkway Outer	79.0	88.8
- Ben Franklin Parkway Inner	77.1	85.1
- Spring Garden St East	93.5	124.9
- Kelly Dr	118.5	170.3
- Spring Garden St West	212.1	216.7
Ben Franklin Parkway Inner		
- Kelly Dr	63.6	69.1
- Spring Garden St West	135.3	121.8
- MLK Jr Dr	132.1	124.3
- 24th St	157.7	156.5
Ben Franklin Parkway Outer		
- Spring Garden St East	50.8	34.2
- Kelly Dr	66.4	50.8
- Spring Garden St West	142.7	111.4
- MLK Jr Dr	141.5	122.5
- 24th St	175.6	144.0
Spring Garden St East		
- Kelly Dr	60.0	56.1
- Spring Garden St West	106.6	106.9
- MLK Jr Dr	101.2	114.7
- 24th St	146.5	156.4
- Ben Franklin Parkway Outer	145.1	174.7
- Ben Franklin Parkway Inner	123.3	157.6

Alternative 1 description

The Philadelphia Department of Streets provided the sketch concept for Alternative 1 (Exhibit 4). The alternative consists of three roundabouts, combining the Ben Franklin Parkway roundabouts into a peanut shape or "Figure Eight." WRA then reviewed the schematic and developed more specific street geometry based on the volume and O-D data. Through an iterative process, WRA refined the final configuration for analysis, as shown in Exhibit 5.

Exhibit 4: Dept. of Streets Concept

Exhibit 5: Alternative 1 VISSIM Concept



The vehicle speeds traversing the roundabouts in Alternative 1 fall within a range of 20-26 mph. A two-lane roundabout typical diameter, curb to curb, is approximately 175 feet, whereas a three-lane roundabout is approximately 220 feet. Since there is significant pedestrian and bicyclist traffic in the study area, it is recommended to provide pretimed signalization for the pedestrians for any multilane (2+) crossings, exiting or entering. All signal timings assumed a cycle length of 100 seconds or less to limit the wait time for pedestrians. In addition, most of the pedestrian crossings involve crossing two roadways, either a two-way road or two closely spaced roadways in the same direction. The pedestrian crossing phases were generally separated with a phase to allow for pedestrians and bicyclists to traverse the sidewalk/median between the crosswalks in an attempt to allow them to make the entire crossing under one signal cycle. Both crosswalk phases do not occur at the same time; they are staggered to improve pedestrian travel time. Since this is the signalization of a roundabout, vehicles still will have to yield during the green phase. The pedestrian crossing time was calculated based on 15-foot lane widths (appropriate for a large and complex roundabout even in this urban setting) with 3 seconds of buffer time between "flashing don't walk" and approach "green." The roundabout approaches also were assumed to have a 3-second yellow change and 3-second red clearance interval.

The northern roundabout serves the intersection of MLK Jr. Drive, Spring Garden Street West, and a two-way roadway extending from the Figure Eight roundabout at the end of the Ben Franklin Parkway. The northern roundabout is a 2x1 hybrid roundabout, with all pedestrian and bicyclist crossings to occur on the southern side of the roundabout. All three approaches to the roundabout are two-lane entrances. The circulating roadway is two lanes except for two areas: between the SB exit to the Figure Eight and the NB entry from the Figure Eight, and between the NB exit to Spring Garden Street and the SB entry from Spring Garden Street. The exits to both NB MLK Jr. Drive and Spring Garden Street are single lane exits. The exit to the south toward Ben Franklin Parkway is two lanes. A third lane is then added dedicated for the right turn into 24th Street/I-676 ramp. The southern crosswalk across the roundabout entry and exit operates as one signal. This is a two-stage crossing with time in between pedestrian phases to allow pedestrians to travel the median. Signalization of the crosswalks on the exiting lanes of the roundabout does have a drawback. The exit lane of the roundabout must stop on red, which causes intermittent queuing within the roundabout.

The western roundabout within the Figure Eight is a 3x1 hybrid roundabout with three lanes entering and circulating on the northern section with one lane (outer) dropping into 24th Street/I-676 ramp. The middle circulating lane exits to the single Ben Franklin Parkway Outer lane or to the Ben Franklin Parkway Inner roadway. The inner circulating lane either exits to Ben Franklin Parkway Inner or becomes a single circulating lane towards Spring Garden Street East or Kelly Drive. Pedestrians and bicyclists are to cross the single lanes of 24th Street and Ben Franklin Parkway Outer as a yield, whereas they will cross the two lanes exiting Ben Franklin Parkway Inner using a signalized crosswalk.

The eastern roundabout within the Figure Eight is a 3-lane roundabout with every approach entering the roundabout as three lanes except for the single lane circulating from the western portion of the Figure Eight. Spring Garden Street East is a single lane exit that opens to three lanes after the roundabout, and Kelly Drive is a two-lane exit.

- Both the inner and outer Ben Franklin Parkway approaches have the same lane designations. The left lane is for trips destined to Ben Franklin Parkway SB, 24th Street, MLK Jr. Drive, and Spring Garden Street West; the center lane is for trips destined to MLK Jr. Drive, Spring Garden Street West, and Kelly Drive; the right lane is for trips to Kelly Drive and Spring Garden Street East.
- The Spring Garden Street East approach has the lane designation of the left lane for trips to Ben Franklin Parkway/24th St/MLK Jr. Drive), center lane for trips to MLK Jr. Drive/Spring Garden Street West), and the right lane dedicated for trips to Kelly Drive.
- The Kelly Drive approach has the lane designation of left lane for trips to Spring Garden Street East and Ben Franklin Parkway Inner, center lane for trips to Ben Franklin Parkway Inner or Outer, and right lane for trips to MLK Jr. Drive, Spring Garden Street West, and 24th Street/I-676 ramp. Pedestrians and bicyclists are to cross the two NB Ben Franklin Parkway approaches and the Spring Garden Street East entry-exit under signal control (under one controller). Similar to the northern roundabout, each of those crosswalks will operate as a staged crossing with a buffer time for pedestrians to traverse the median. The Spring Garden Street East exit was modeled as signalized pedestrian and bicycle crossing due to the expected pedestrian/bicyclist volume despite the exit being a single lane (which opens to three lanes for storage at the signal at Pennsylvania Avenue).The pedestrian and bicyclist crossing across Kelly Drive was assumed to be a midblock staged crossing removed from the roundabout. Both crosswalk phases do not occur at the same time; they are

staggered to improve pedestrian travel time. The bus stops near the Art Museum were relocated. The SEPTA stop for the northbound/westbound Route 38 and 43 was relocated to the northbound approach to the northern roundabout. The pulloff for tour buses was located on the southern side of the Oval.

The Art Museum side of the Figure Eight has five lanes, with two lanes heading toward the northern roundabout and MLK Jr. Drive and Spring Garden Street West, and three lanes towards the western portion of the Figure Eight (24th St and Ben Franklin Parkway). This number of lanes is required due to the sheer traffic volume of Ben Franklin Parkway and Spring Garden Street plus the intermittent stopping of the approaches for pedestrian/bicyclist traffic. Kelly Drive has approximately 2,000 vehicles yielding against 1,100 vehicles in the AM and approximately 1,000 vehicles against 1,800 vehicles in the PM. Since Kelly Drive is the last to enter the roundabout, providing enough capacity to its larger destinations (24th St and Ben Franklin Parkway) is critical.

Alternative 1 traffic operations

Refer to Attachments 5 and 6 for delay, LOS, volume, and queuing for Alternative 1. The AM peak shows that the queue from SB MLK Jr. Drive/Spring Garden Street West at the Figure Eight extends back through the northern roundabout, and MLK Jr. Drive has failing LOS at both junctions. The PM peak shows that northbound Ben Franklin Parkway has failing LOS and excessive queuing that spills back into the adjacent intersection of 22nd Street. Spring Garden Street East queues exceed the distance between the Figure Eight and the signal at Pennsylvania Avenue

There are a few other items to consider with Alternative 1. The geometric footprint is significant, with multiple three-lane approaches and at one point a five-lane section to handle traffic volumes without unreasonable queuing. Due to the roundabout diameter requirements, there will be adjacent green space and park impacts. Although a smaller O-D pattern, Kelly Drive to MLK Jr. Drive and Spring Garden Street West distance increases with this alternative, potentially causing some commuters to seek alternative routes.

For the AM, the predominant item to note is the competing volumes from MLK Jr. Drive and Spring Garden Street West and traffic from Kelly Drive and the eastern portion of the Figure Eight roundabout. Volume from MLK Jr. Drive and Spring Garden Street West are forced to merge into the heavy volume (around 1800 vehicles yielding into 2100 vehicles) resulting in the queue and delay shown. The delay is significant enough to force queuing off the network and prevents volume from MLK Jr. Drive from entering the roundabouts. The queue frequently extends beyond the VISSIM model, i.e. the segment start points shown on Exhibit 2. MLK Jr. Drive queues extend across the bridge over the Schuylkill River. Because delay and queue are only measured for vehicles on the network, actual delay and queuing will be worse than what is shown in Attachment 5. Adding a third lane of capacity at the northern roundabout will improve queuing and operations. However, the origin of the problem is where the SB MLK Jr. Drive and Spring Garden Street traffic must yield to traffic circulating in the Figure Eight roundabout.

For the PM, the signal spacing of approximately 215 feet between the Figure Eight and the Spring Garden Street signal at Pennsylvania Avenue is not desirable. The model showed intermittent queue bi-directional spillback between the intersections. The actual delay is comparable to existing; however, the true delay happens beyond this intersection on Pennsylvania Avenue due to the reduced storage space and queue spillback. Inclusion of a signalized exit at Spring Garden Street East was needed due to the irregular yielding of vehicles to the pedestrian and bicyclist traffic. The sheer volume of vehicles entering from the western portion of the Figure Eight and Ben Franklin Parkway Inner leaves little gap time for Ben Franklin Parkway Outer to enter the roundabout. In addition, the queue spillback and pedestrian crossing at Spring Garden Street East also block vehicles from entering the roundabout from Ben Franklin Parkway Outer. The pedestrian signal along Ben Franklin Parkway Inner was adjusted to provide metering to allow more traffic from Ben Franklin Parkway Outer to enter the roundabout. The signal timings were adjusted to balance the delay between the two Ben Franklin Parkway approaches. Both queues and delays extend south into the adjacent signalized intersection at 22nd Street. The entering traffic from Spring Garden Street East also experiences delay and queuing that intermittently spills back towards Pennsylvania Avenue due to similar limited gap issues as well as the required signalization of the pedestrian/bicyclist crossing.

Exhibit 6 provides a direct comparison of O-D passenger car travel time between base calibrated and Alternative 1. As seen in the exhibit and attachments, there are unacceptable levels of queuing and delay in this alternative.

Exhibit 6: Key O-D Passenger Car Travel Times Comparison Base vs Alternative 1

Segment	Travel Time (secs)			
	AM Base	AM Alt 1	PM Base	PM Alt 1
Kelly Dr				
- Spring Garden St West	35.2	97.0	38.0	94.6
- MLK Jr Dr	40.0	91.8	56.8	101.4
- 24th St	93.3	71.9	71.7	77.5
- Ben Franklin Parkway Outer	98.7	82.3	80.3	93.1
- Ben Franklin Parkway Inner	84.8	86.5	65.2	88.9
Spring Garden St West				
- 24th St	58.2	103.2	50.4	66.5
- Ben Franklin Parkway Outer	64.3	168.3	51.3	69.5
- Ben Franklin Parkway Inner	53.4	179.6	38.5	88.7
- Spring Garden St East	72.4	208.6	70.4	117.7
- Kelly Dr	99.9	232.3	112.0	137.1
- MLK Jr Dr	168.0	33.9	162.4	33.1
MLK Jr Dr				
- 24th St	71.1	429.6	77.1	128.2
- Ben Franklin Parkway Outer	79.0	478.1	88.8	137.9
- Ben Franklin Parkway Inner	77.1	509.4	85.1	131.9
- Spring Garden St East	93.5	531.5	124.9	152.8
- Kelly Dr	118.5	534.6	170.3	176.8
- Spring Garden St West	212.1	390.9	216.7	75.3
Ben Franklin Parkway Inner				
- Kelly Dr	63.6	62.9	69.1	148.0
- Spring Garden St West	135.3	84.3	121.8	159.4
- MLK Jr Dr	132.1	91.2	124.3	156.2
- 24th St	157.7	66.0	156.5	121.0
Ben Franklin Parkway Outer				
- Spring Garden St East	50.8	28.1	34.2	148.9
- Kelly Dr	66.4	61.7	50.8	160.2
- Spring Garden St West	142.7	88.7	111.4	183.1
- MLK Jr Dr	141.5	97.6	122.5	177.7
- 24th St	175.6	63.6	144.0	161.4
Spring Garden St East				
- Kelly Dr	60.0	41.0	56.1	44.6
- Spring Garden St West	106.6	65.1	106.9	76.2
- MLK Jr Dr	101.2	79.4	114.7	120.9
- 24th St	146.5	46.8	156.4	80.3
- Ben Franklin Parkway Outer	145.1	54.2	174.7	86.3
- Ben Franklin Parkway Inner	123.3	67.6	157.6	108.7

Decrease in delay or < 1 minute increase in delay

Increase in delay between 1 and 2 minutes

Increase in delay between 2 and 3 minutes

Increase in delay > 3 minutes

The Alt. 1 queue frequently extends beyond the VISSIM model. Because travel time is only measured from the segment start point, it will not include increase in travel time outside the travel time segment and model.

Alternative 1 pedestrian and bicycle operations

Alternative 1 provides pedestrian and bicycle crossings at locations near the existing crossings. However, one existing crossing was removed. The crosswalk from Ben Franklin Parkway Inner to the Oval had to be removed since this would involve pedestrians crossing the circulating lanes of the Figure Eight roundabout. To enter the park/green space within the Oval from the south or west, pedestrians must either cross the approaches and exits of Ben Franklin Parkway, Spring Garden Street, and Kelly Drive or cross at the northern roundabout near the existing crossing at the skate park. Since there are no roadways on the north or northeast side of the Oval under Alternative 1, pedestrians and bicyclists have free access between the Oval and the Art Museum with no vehicular conflicts.

The existing unsignalized pedestrian crossing of the exit from the Oval to Spring Garden Street West is eliminated because this roadway is eliminated. This crossing now serves pedestrians crossing between MLK Jr. Drive and the Art Museum. If the relocated exit to Spring Garden Street West is constructed as an overpass of MLK Jr. Drive (the existing Spring Garden Street approach lanes bridge over MLK Jr. Drive but the bridge is not wide enough to add an exit lane), pedestrians will have free access between MLK Jr. Drive and the Art Museum.

The signalized crosswalks were designed to limit the time pedestrians and bicyclists are waiting at the crossing, with a maximum of 100-second cycle and staging the phases of the crosswalk. If the pedestrian does not make it from one end to the other end of the median within the transition phase, then the pedestrian would need to wait two cycles to cross an entire approach. Today pedestrians and bicyclists traveling from Ben Franklin Parkway Inner would need to cross Ben Franklin Parkway Inner and the Oval to get to the park. With Alternative 1, the pedestrians and bicyclists would have to cross Ben Franklin Parkway Outer, Spring Garden Street East (two crossings), walk 200 to 250 feet towards the Kelly Drive midblock crossing, and then cross that signalized crossing to get to the park.

Future Alternatives

There are operational insights from Alternative 1 that should be considered for the development of other alternatives:

Ben Franklin Parkway Inner and Outer entering the Oval/Roundabout – Close proximity of these two heavy approaches creates operational constraints and requires pedestrians and bicyclists to cross two different signalized crosswalks. Alternatives should look to either simplify the junction of these two approaches, separate the two approaches, or close an approach. Eliminating the Outer lane entry into the Oval could be considered. The SEPTA stop for the Route 38 would need to relocate to the Inner right lane. The land adjacent to the Outer lanes is all park and play fields in the block between 22nd Street and the Oval. If parking is needed for the play fields, consider making the Outer lanes two-way with a cul de sac at the Oval end, or close the Outer lanes in this block and create a new parking lane alongside the Inner lanes.

Spring Garden Street East – The geometric footprint of the roundabouts reduces the available storage of Spring Garden Street between Ben Franklin Parkway and Pennsylvania Avenue. Future alternatives should look to optimize the storage space between these two roadways.

AM volume demand to 24th Street/I-676 ramp and to SB Ben Franklin Parkway - The AM volume demand of MLK Jr. Drive and Spring Garden Street versus the conflicting demand from Kelly Drive and Spring Garden Street East to 24th Street/I-676 and to Ben Franklin Parkway needs to be considered in alternative development.

Ben Franklin Parkway and Kelly Drive Volume – The volume demand of NB Ben Franklin Parkway versus the demand of SB Kelly Drive in the PM is significant and minimizing interaction between those movements needs to be considered in alternative development.

Multi-lane roundabout exits – The signalization of the pedestrian and bicyclist crossings across multiple lanes needs to be considered for roundabout exits. This causes vehicular traffic to queue into the roundabout during the crossing phase. Future alternatives should consider traditional signalized intersections in lieu of multilane roundabouts.

Art Museum frontage – Due to the difficulty in accommodating conflicting vehicle movements as described above, consider keeping a greatly reduced roadway in front of the Art Museum. Potentially, this road would serve only Kelly Drive SB, would be one way and only two lanes wide, and would be signalized near the existing signal location to provide a phase for pedestrian crossings between the Oval and the Art Museum with no vehicular conflicts. Having vehicular access may be necessary in any case for service/delivery to future food or retail uses in proximity to the Art Museum.

We look forward to reviewing this material with you and your traffic engineering staff. After you have had an opportunity to review this memorandum, we would like to have a virtual meeting to answer your questions and discuss next steps.

_____

Adrienne Eiss

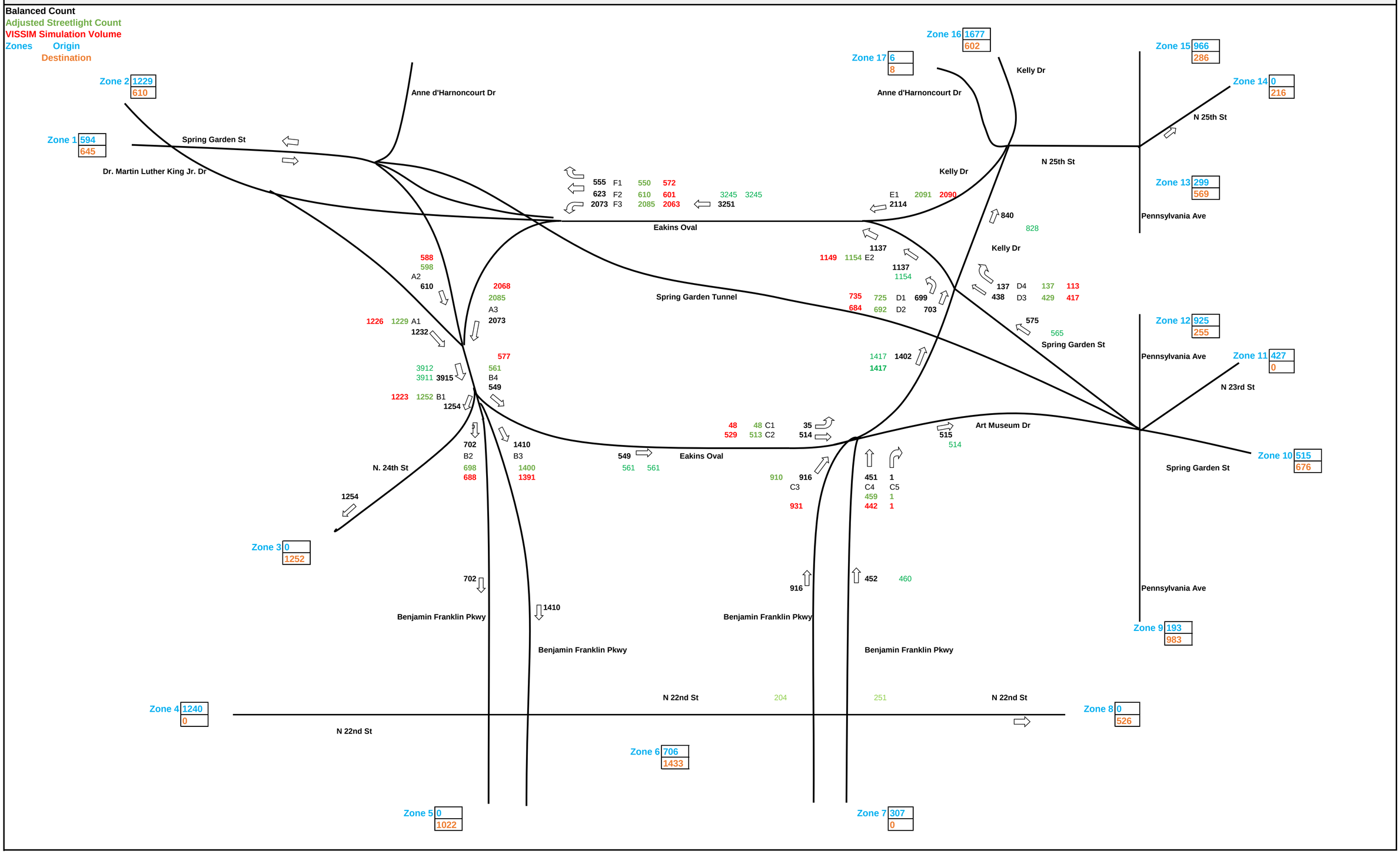
Attachment 1 - AM Peak Hour O-D volume diagrams

Whitman, Requardt & Associates, LLP
2009 Mackenzie Way, Suite 240, Cranberry Township, PA 16066

Project: Eakins Oval Alternatives Analysis
Location: Eakins Oval, City of Philadelphia
Date: Proposed Volumes

Time Period: AM Peak 8:00-9:00 AM
Compiled By: CJB
Checked By: NRS

Balanced Count
Adjusted Streetlight Count
VISSIM Simulation Volume
Zones Origin / Destination



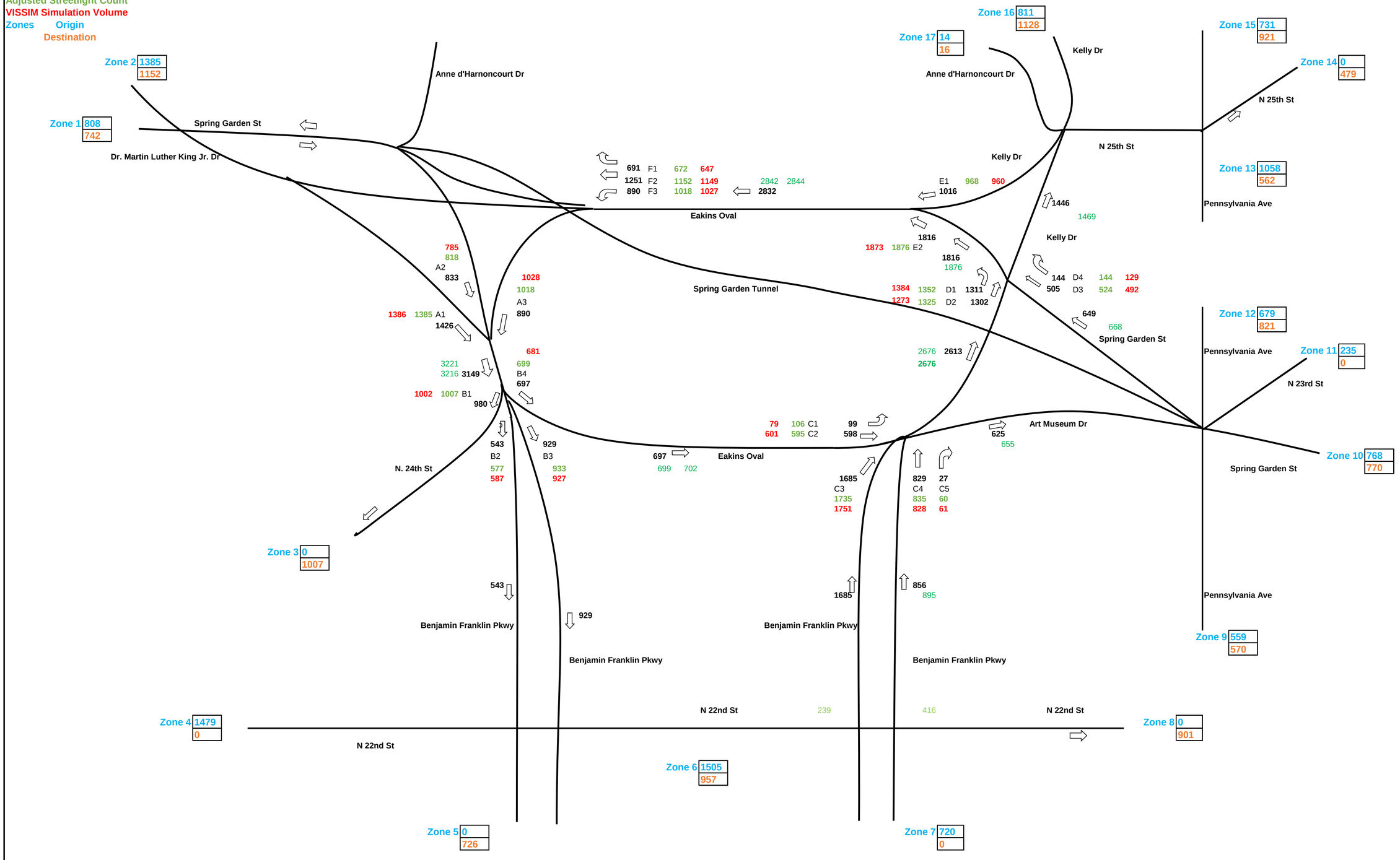
Attachment 2 - PM Peak Hour O-D volume diagrams

Whitman, Requardt & Associates, LLP
2009 Mackenzie Way, Suite 240, Cranberry Township, PA 16066

Project: Eakins Oval Alternatives Analysis
Location: Eakins Oval, City of Philadelphia
Date: Proposed Volumes

Time Period: PM Peak 5:00-6:00 PM
Compiled By: CJB
Checked By: NRS

Balanced Count
Adjusted Streetlight Count
VISSIM Simulation Volume
Zones Origin
Destination



Attachment 3 - AM Base Intersection Node Evaluation

Intersection	Delay (s/veh)	LOS	Direction	Delay (s/veh)	LOS	Movement	Volume (veh)	Delay (s/veh)	LOS	Max Queue (ft)
Eakins Oval and Benjamin Franklin Parkway/Spring Graden St	13.7	B	Eakins Oval	18.4	B	Left	48	14.0	B	270
						Through	529	18.8	B	270
			Benjamin Franklin Parkway Northbound (Inner)	8.6	A	Through	931	8.6	A	35
			Benjamin Franklin Parkway Northbound (Outer)	18.3	B	Through	442	18.3	B	185
						Right	1	24.3	C	185
Eakins Oval and Spring Graden St/Kelly Dr	17.3	B	Eakins Oval	10.3	B	Left	735	11.4	B	260
						Through	684	9.1	A	260
			Spring Garden Westbound	35.9	D	Through	417	37.4	D	195
						Right	113	30.2	C	150
Eakins Oval and Kelly Dr	18.1	B	Eakins Oval	31.2	C	Through	1149	31.2	C	370
			Kelly Dr	11.0	B	Through	2090	11.0	B	325
Eakins Oval and Spring Garden/Martin Luther King Jr Dr	12.2	B	Eakins Oval	12.1	B	Left	2063	12.1	B	410
				17.6	C	Through	601	17.6	C	450
				6.9	A	Right	572	6.9	A	420
Eakins Oval and Spring Garden/Martin Luther King Jr Dr Merge	19.7	B	Eakins Oval	19.2	B	Through	2068	19.2	B	380
			Spring Garden Eastbound	18.5	B	Through	588	18.5	B	165
			Martin Luther King Dr Eastbound	21.2	C	Through	1226	21.2	C	265
Eakins Oval and N 24th St/Benjamin Franklin Parkway	4.2	A	Eakins Oval	4.8	A	Right 1	1223	4.8	A	420
				5.4	A	Right 2	688	5.4	A	120
				2.7	A	Through	1391	2.7	A	400
				5.1	A	Left	577	5.1	A	400

Attachment 4 - PM Base Intersection Node Evaluation

Intersection	Delay (s/veh)	LOS	Direction	Delay (s/veh)	LOS	Movement	Volume (veh)	Delay (s/veh)	LOS	Max Queue (ft)
Eakins Oval and Benjamin Franklin Parkway/Spring Graden St	14.4	B	Eakins Oval	29.0	C	Left	79	31.6	C	255
						Through	601	28.7	C	255
			Benjamin Franklin Parkway Northbound (Inner)	13.2	B	Through	1751	13.2	B	330
			Benjamin Franklin Parkway Northbound (Outer)	5.5	A	Through	828	5.5	A	135
						Right	61	6.0	A	135
Eakins Oval and Spring Graden St/Kelly Dr	18.6	B	Eakins Oval	13.9	B	Left	1384	17.9	B	350
						Through	1273	9.5	A	350
			Spring Garden Westbound	38.7	D	Through	492	41.6	D	240
						Right	129	27.7	C	170
Eakins Oval and Kelly Dr	16.3	B	Eakins Oval	18.2	B	Through	1873	18.2	B	390
			Kelly Dr	12.6	B	Through	960	12.6	B	165
Eakins Oval and Spring Garden/Martin Luther King Jr Dr	10.3	B	Eakins Oval	5.5	A	Left	1027	5.5	A	350
				18.0	C	Through	1149	18.0	C	395
				4.3	A	Right	647	4.3	A	365
Eakins Oval and Spring Garden St/Martin Luther King Jr Dr Merge	13.6	B	Eakins Oval	9.4	A	Through	1028	9.4	A	170
			Spring Garden Eastbound	2.6	A	Through	785	2.6	A	100
			Martin Luther King Dr Eastbound	22.8	C	Through	1386	22.8	C	285
Eakins Oval and N 24th St/Benjamin Franklin Parkway	8.2	A	Eakins Oval	10.3	B	Right 1	1002	10.3	B	455
				10.8	B	Right 2	587	10.8	B	155
				5.2	A	Through	927	5.2	A	435
				6.7	A	Left	681	6.7	A	435

Attachment 5 - AM Alternative 1 Intersection Node Evaluation

Intersection	Delay (s/veh)	LOS	Direction	Delay (s/veh)	LOS	Movement	Volume (veh)	Delay (s/veh)	LOS	Avg Queue	Max Queue (ft)
Northwest Roundabout	140.2	F	* Martin Luther King Jr Dr Eastbound	336.7	F	Left	9	336.7	F	1141	1245
				356.1	F	Through	800	356.1	F	1141	1245
			Spring Garden St Eastbound	21.1	C	Right	28	21.1	C	38	230
				57.5	F	Through	582	57.5	F	38	230
			Spring Garden St Westbound	4.6	A	Through	361	4.6	A	28	345
				13.4	B	Through 2	570	13.4	B	28	345
Southwest Roundabout	30.0	D	* Martin Luther King Jr Dr/Spring Garden St	82.5	F	Left	336	82.5	F	617	925
				82.2	F	Through	538	82.2	F	617	925
				74.4	F	Through	171	74.4	F	617	925
				21.1	C	Right	337	21.1	C	617	925
			Westbound Roundabout Approach	7.0	A	Left	116	7.0	A	4	315
				9.0	A	Through	730	9.0	A	4	315
				3.7	A	Through	450	3.7	A	4	315
				3.0	A	Right	757	3.0	A	4	315
Southeast Roundabout	20.0	C	Benjamin Franklin Parkway Inner	10.5	B	Left	516	10.5	B	33	240
				11.9	B	Through	393	11.9	B	33	240
				11.5	B	Right	1	11.5	B	33	240
			Benjamin Franklin Parkway Outer	16.3	C	Left	205	16.3	C	11	150
				14.4	B	Through	261	14.4	B	11	150
				0.0	A	Right	0	0.8	A	11	150
			Spring Garden Westbound	18.3	C	Through	374	18.3	C	27	190
				11.7	B	Right	134	11.7	B	27	190
			Kelly Dr Southbound	26.4	D	Right	1879	26.4	D	95	520

* - Queue extends into adjacent intersection and/or off of the network

Attachment 6 - PM Alternative 1 Intersection Node Evaluation

Intersection	Delay (s/veh)	LOS	Direction	Delay (s/veh)	LOS	Movement	Volume (veh)	Delay (s/veh)	LOS	Avg Queue	Max Queue (ft)
Northwest Roundabout	30.7	D	Martin Luther King Jr Dr Eastbound	31.6	D	Left	13	31.6	D	316	975
				59.4	F	Through	1346	59.4	F	316	975
			Spring Garden St Eastbound	20.2	C	Right	32	20.2	C	64	325
				24.8	C	Through	769	24.8	C	64	325
			Spring Garden St Westbound	5.5	A	Through	542	5.5	A	104	590
				11.2	B	Through 2	1029	11.2	B	104	590
Southwest Roundabout	14.0	B	Martin Luther King Jr Dr/Spring Garden St	27.6	D	Left	638	27.6	D	215	860
				22.1	C	Through	547	22.1	C	215	860
				15.2	C	Through	297	15.2	C	215	860
				9.2	A	Right	635	9.2	A	215	860
			Westbound Roundabout Approach	0.0	A	Left	0	0.0	A	0	50
				7.1	A	Through	366	7.1	A	0	50
				1.3	A	Through	281	1.3	A	0	50
				1.4	A	Right	352	1.4	A	0	50
Southeast Roundabout	73.4	F	Benjamin Franklin Parkway Inner *	79.3	F	Left	1067	79.3	F	533	1045
				95.9	F	Through	703	95.9	F	533	1045
				111.8	F	Right	24	111.8	F	533	1045
			Benjamin Franklin Parkway Outer *	106.5	F	Left	209	106.5	F	482	1100
				111.0	F	Through	462	111.0	F	482	1100
				116.7	F	Right	32	116.7	F	482	1100
			Spring Garden Westbound *	54.2	F	Through	389	54.2	F	111	350
				17.1	C	Right	117	17.1	C	111	350
			Kelly Dr Southbound	35.4	E	Right	910	35.4	E	93	430

* - Queue extends into adjacent intersection and/or off of the network