From: Joe McElwain
Sent: Monday, May 02, 2016 2:28 PM
To: Noecker, Rebecca (CI-StPaul); Foss, Katie (CI-StPaul); Maki, Taina (CI-StPaul); Dermody, Bill (CI-StPaul)
Cc: Thompson, Lucy (CI-StPaul)
Subject: RE: Victoria Park Apartments (Phase 3) traffic study

Bill, Rebecca:

Please find attached for your record as needed for Wednesday's City Council hearing: Traffic Impact Study for Victoria Park Phase 3. By Spack Consulting. Received this morning. This was requested as part of our City Plan Review process by City Traffic - David Kuebler. Traffic has been an argument from the Nova Classical Academy as part of their appeal on Phase 3 moving forward.

Thanks -

6. Conclusions and Recommendations
The traffic impacts of the proposed Victoria Park Apartments, Phase 3, on the study intersections were analyzed for the build conditions. All study intersections are forecasts to operate acceptably, with traffic operations very similar to that of existing conditions. The daily volumes on the study corridors were also forecasts to remain similar to today with no significant change in operations. No roadway modifications are needed as a result of this proposed development.
Due to the relatively low amount of traffic expected with this development and an afternoon peak that occurs at a different time, this development is not expected to significantly impact operations at the adjacent school.
Exploring incentives for walking, biking, and transit use, the proposed development could further reduce the expected low impact of its auto travel. The currently available trail and transit facilities suggest alternative forms of travel are a viable option.
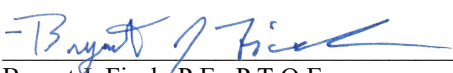
Joe McElwain
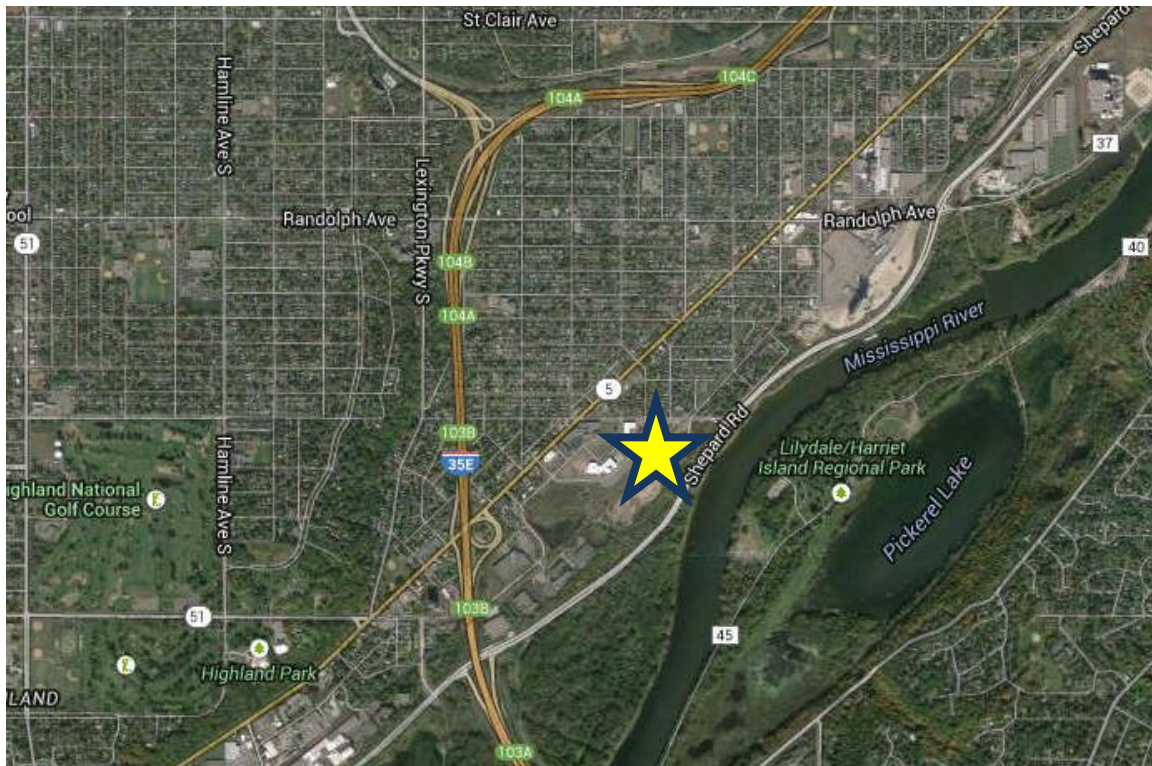
Traffic Impact Study

Victoria Park Phase 3
Saint Paul, Minnesota

I hereby certify that this report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

By: _____

Bryant J. Ficek, P.E., P.T.O.E.
License No. 42802

Date: May 2, 2016

Executive Summary

Background:
The Victoria Park Apartments Phase 3, planned for 51 residential dwelling units, is proposed on the southern corner of the Mercer Way/Kay Avenue intersection in Saint Paul, Minnesota. This study analyzed traffic impacts associated with the build out of this proposed development.

Results:
The traffic impacts on the study intersections were analyzed for the build conditions. The proposed development is expected to generate 339 vehicle trips per day and 32 vehicle trips during the p.m. peak hour (21 entering and 11 exiting).

All study intersections are forecasts to operate acceptably, with traffic operations very similar to that of existing conditions. The daily volumes on the study corridors were also forecast to remain similar to today with no significant change in operations.

Due to the relatively low amount of traffic expected with this development and an afternoon peak that occurs at a different time, this development is not expected to significantly impact operations at the adjacent school.

Recommendations:
No roadway modifications are needed as a result of this proposed development.

Exploring incentives for walking, biking, and transit use, the proposed development could further reduce the impact of its auto travel.

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1.   Introduction

The Victoria Park Apartments opened in February 2014. Located off Otto Avenue between the major intersections with West 7th Street and Shepard Road, these three buildings provide over 300 dwelling units. Phase 3 for the apartment complex is now proposed, which would add a fourth building to the site with 51 dwelling units. The purpose of this study is to determine if the proposed Victoria Park Phase 3 development will significantly impact the adjacent transportation system and to recommend mitigation measures if necessary.

The objectives of this study are to:
  i.   Document how the existing transportation system around the proposed site currently functions. This existing analysis is based on the build out results of the Victoria Park Phase 2 Traffic Impact Study completed in 2015 by Spack Consulting.
  ii. Determine how the current transportation system will operate with the addition of traffic from the proposed development.
  iii. Recommend appropriate transportation improvements if poor operations are identified as being caused by the addition of the proposed development.

The following corridors and intersections were identified for study in this report:
  • Otto Avenue
  • West 7th Street/Otto Avenue
  • Shepard Road/Otto Avenue

2.   Proposed Development

The site is located on the southern corner of the Mercer Way/Kay Avenue intersection in Saint Paul, Minnesota. The proposed 51 unit apartment building site location is adjacent to the existing Nova Classical Academy. Figure 1 in the Appendix shows the location of the proposed development.

Vehicular access to the proposed site will be through a garage entrance on Mercer Way. 52 vehicle parking stalls are proposed to be provided for the building with 46 of them in an underground parking facility and six on street along the frontage of the property. A preliminary site plan is shown in Figure 2 in the Appendix.

For the purposes of this report, the proposed development is assumed constructed later this year with full occupancy in 2018.

3.   Analysis of Existing Conditions

a. *Transportation Network Characteristics*

Otto Avenue, also known as Saint Paul Municipal State Aid Street (MSAS) 249, is designated as a Collector roadway. This two-lane road has a posted 30 mph speed and 35 mph speed limit to the west of and east of the intersection with Mercer Way, respectively.

West 7th Street, also known as Ramsey County State Aid Highway (CSAH) 5, is designated as an A-Minor Arterial. The corridor provides a three-lane section near the site, one through lane in each direction with a center two-way left turn lane. The posted speed limit is 35 mph in this area.

Shepard Road is also known as Saint Paul MSAS 194 to the south of and MSAS 249 to the north of the Otto Avenue intersection. It is designated as a Principal Arterial. The divided roadway provides two through lanes in each direction with exclusive turn lanes at intersections. The posted speed limit is 45 mph around the site.

Mercer Way and Kay Avenue are both local, two lane undivided roads.

The intersections of West 7th Street/Otto Avenue and Shepard Road/Otto Avenue are under traffic signal control. The existing traffic control and travel lanes are shown in Figure 3 in the Appendix.

West 7th Street near the site is served by Metro Transit Route 54 with stops at the intersection with Otto Avenue. The area also has sidewalks around the site with a separated off-street path on the east side of Shepard Road.

A CP railroad crosses Otto Avenue just west of the intersection with Stewart Avenue. Based on information from the Minnesota Department of Transportation (MnDOT), approximately 6 trains per day use this quiet zone crossing.

b. *Traffic Volumes*

The traffic volumes used in this study are based on the volumes from the Victoria Park Phase 2 Traffic Impact Study completed by Spack Consulting in 2015. In that study, 13-hour turning movement counts were conducted at the study intersections in late March and early April 2015. From those counts, it was determined that the p.m. peak hour, from 4:30 to 5:30 p.m., has the greatest concentration of vehicle traffic compared to other hours of the day.

The Victoria Park Phase 2 Traffic Impact Study had a build out year of 2016. Since this analysis is building off of that previously completed study, the build out volumes from the Victoria Park Phase 2 Traffic Impact Study are used as the existing volumes in this study.

c. Intersection Level of Service

LOS A

LOS C

LOS D = Acceptable

LOS F = Unacceptable

Source: City of
San Jose, CA

An intersection capacity analysis was then conducted for the existing intersections per the *Highway Capacity Manual, 2010*. Intersections are assigned a "Level of Service" letter grade for the peak hour of traffic based on the number of lanes, traffic volumes, and traffic control. Level of Service A (LOS A) represents light traffic flow (free flow conditions) while LOS F represents heavy traffic flow (over capacity conditions). LOS D at intersections is typically considered acceptable by most government agencies. Individual movements are also assigned LOS grades. At busy intersections, one or more individual movements typically operate at LOS F when the overall intersection is operating acceptably at LOS D or better. This is particularly true for side-street stop control intersections during the peak hours. The mainline may operate acceptably while the side-street does not have sufficient gaps in mainline traffic for an acceptable grade. The pictures on the left represent some of the LOS grades (from a signal controlled intersection in San Jose, CA). These LOS grades represent the overall intersection operation, not individual movements.

The existing p.m. peak hour turning movement volumes from the Build scenario of the Victoria Park Phase 2 Traffic Impact Study were used in these LOS calculations. The LOS calculations were completed with the VISTRO™ software package, which uses the methodology detailed in the *Highway Capacity Manual 2010*. Signal timing was provided by the City for the Victoria Park Phase 2 Traffic Impact Study and replicated here. The LOS results for the existing study peak hours, based on the existing traffic control and lane configurations, are shown in Table 1. Full results, including grades for all individual movements are included in the Appendix.

Table 1 – Existing PM Peak Hour Level of Service (LOS)[1]

Intersection	Existing[2] LOS
West 7th Street/Otto Avenue	B (d)
Shepard Road/Otto Avenue	B (d)

[1]The first letter is the Level of Service for the intersection. The second letter (in parentheses) is the Level of Service for the worst operating movement

[2]The existing volumes are based off of the Build volumes from the Victoria Park Phase 2 Traffic Impact Study

As shown in Table 2, the study intersections operate at an overall acceptable LOS B or better. Individual movements are also operating at an acceptable LOS D or better.

d. Corridor Daily Volume Analysis

An analysis of the study corridor was completed using the daily traffic information from the MnDOT's Traffic Mapping Application. Table 2 shows the existing volume as well as the estimated capacity for the type of facility, using information from the *Highway Capacity Manual*.

Table 2 – Daily Volume and Capacity

Roadway	Type	Daily Volume[1]	Capacity[2]
Otto Ave – West of Mercer	2-Lane Undivided	1,900	11,500 – 19,900
Otto Ave – East of Mercer	2-Lane Undivided	2,000	11,500- 19,900

[1] Annual Average Daily Traffic (ADT) from MnDOT (2011 Volumes) plus Build volumes from Victoria Park Phase 2 Traffic Impact Study
[2] Based on the Highway Capacity Manual

As shown, Otto Avenue is well below the low end of the capacity range for this type of facility.

4. Projected Traffic

a. Site Traffic Forecasting

To establish the trip generation expected for the proposed site, counts were taken at Phase 1 of the Victoria Park apartments. Completed in late March 2015, the counts covered entering and exiting traffic for the parking lot access on Otto Avenue in addition to on-street parking adjacent to the building. The trip generation rates based on these counts are:

- Daily Traffic: 4.82 trips per dwelling unit
- PM Peak Hour: 0.58 trips per dwelling unit

For comparison purposes, the methods and rates from the *Institute of Transportation Engineers (ITE) Trip Generation Manual, 9th Edition*, were also consulted. Based on ITE Land Use Code 220, the trip generation rates are:

- Daily Traffic: 6.65 trips per dwelling unit
- PM Peak Hour: 0.62 trips per dwelling unit

Spack Consulting has also collected trip generation data at apartment buildings around the Twin Cities between 2014 and 2015. The trip generation rates based on those counts, which include the Victoria Park apartments, are:

- Daily Traffic: 4.19 trips per dwelling unit
- PM Peak Hour: 0.44 trips per dwelling unit

To provide a conservatively high estimate for the purposes of this report, the ITE rates were used to determine the following projected traffic for the 51 proposed apartments at this site:

- 339 vehicle trips per day
- 32 vehicle trips during the p.m. peak hour (21 entering and 11 exiting)

A trip distribution pattern was previously developed for the previous Victoria Park Traffic Impact Study based on existing traffic, site access, and access to the regional transportation system. Used for this study, the pattern is:

- 20 percent to/from the north on West 7th Street
- 25 percent to/from the south on West 7th Street
- 30 percent to/from the north on Shepard Road
- 25 percent to/from the south on Shepard Road

Traffic generated by the site development was assigned to the area roadways per this distribution pattern. To present a conservative analysis, all of the traffic going to/from the northeast and southwest on West 7th Street was routed through the West 7th Street/Otto Avenue intersection rather than using other routes.

b. Non-Site Traffic Forecasting

The City of Saint Paul's Comprehensive Plan includes traffic forecasts for the year 2030. Comparing these 2030 volumes to the baseline 2008 volumes used for several locations surrounding the site, the annual growth rate was approximately 0.8 or 0.9 percent per year. For the purposes of this study, an annual growth rate of one percent per year was applied for two years.

c. Total Traffic

Traffic forecasts were developed for the Build Scenario by first increasing the existing traffic (aka the Build volumes from the Victoria Park Phase 2 Traffic Impact Study) by the two percent to account for the non-site traffic. The traffic generated by the proposed development was then added to provide the total traffic projected following construction of the site. The resultant Build peak hour forecasts are shown in the Appendix under the capacity analysis section for each scenario.

5. Analysis of Future Conditions

a. Level of Service Analysis

The forecasted turning movement volumes for the Build Scenario were used to re-analyze the study intersections. As before, the LOS calculations were done in accordance with the 2010 Highway Capacity Manual using VISTRO™ software. Table 3 shows the summary of the results with the complete LOS calculations in the Appendix.

Table 3 – 2018 PM Peak Hour Level of Service (LOS)[1]

Intersection	No-Build	Build
West 7th Street/Otto Avenue	B (d)	B (d)
Shepard Road/Otto Avenue	B (d)	B (d)

[1]The first letter is the Level of Service for the intersection. The second letter (in parentheses) is the Level of Service for the worst operating movement

As shown, the increase of traffic projected by the proposed development will not significantly impact the current operations. Delays and vehicle queuing remain about the same with the new traffic added. No modifications are needed to the study intersections as a part of the Victoria Park Phase 3 development.

It should also be noted that the projected traffic from the proposed development is not expected to significantly impact operations at the adjacent school. Besides adding a relatively low amount of traffic to the area, the afternoon peak hour operations for the proposed apartment building are anticipated to occur later in the day than the peak hour for the adjacent school building.

b. *Daily Traffic Volumes*

Similar to the intersection analysis, the study corridors were re-examined using the projected daily volumes. Table 4 shows the projected volumes and capacity of the study corridors. The existing volumes are provided for comparison purposes.

Table 4 – Projected 2018 Daily Volume and Capacity

Roadway	Type	Daily Volume[1]		due to Project	Projected Build	Capacity[4]
		Existing[2]	2018[3]			
Otto Ave – West of Mercer	2-Lane Undivided	1,900	1,950	150	2,100	11,500 – 19,900
Otto Ave – East of Mercer	2-Lane Undivided	2,000	2,050	200	2,250	11,500 – 19,900

[1] Volumes rounded to the nearest 50
[2] Annual Average Daily Traffic (ADT) from MnDOT (2011 Volumes) plus Build volumes from Victoria Park Phase 2 Traffic Impact Study
[3] With 2% growth rate
[4] Based on the Highway Capacity Manual

As shown, Otto Avenue is forecast to remain well below the capacity range through the 2018 Build scenario.

c. *Alternate Forms of Transportation*

In order to reduce the amount of vehicle traffic, alternative forms of transportation for accessing the site should be encouraged. Having access to other modes of travel is often seen as an amenity for residents and a general benefit to the site. When provided as part of an overall network of trails and public transit, the net effect is a reduction in traffic volumes and better overall traffic operations. It should be noted that no reduction in vehicular traffic was applied for the analysis of this report.

For this site, sidewalks and the close regional trail adjacent to Shepard Road as well as nearby transit options already exist. If any sidewalks/trails are impacted by construction, they should be rebuilt following the latest ADA-compliant guidelines.

Incentives for non-motorized vehicle travel could also be explored by the proposed development. Examples include secure spots for bicycle parking, employer subsidized transit passes, and housing unit discounts for not using parking spaces. Many other types of incentives are available to encourage future residents and workers at the proposed site to walk, bike, or use transit.

6.   Conclusions and Recommendations

The traffic impacts of the proposed Victoria Park Apartments, Phase 3, on the study intersections were analyzed for the build conditions. All study intersections are forecasts to operate acceptably, with traffic operations very similar to that of existing conditions. The daily volumes on the study corridors were also forecasts to remain similar to today with no significant change in operations. No roadway modifications are needed as a result of this proposed development.

Due to the relatively low amount of traffic expected with this development and an afternoon peak that occurs at a different time, this development is not expected to significantly impact operations at the adjacent school.

Exploring incentives for walking, biking, and transit use, the proposed development could further reduce the expected low impact of its auto travel. The currently available trail and transit facilities suggest alternative forms of travel are a viable option.

7.   Appendix

a. Figures 1-3

b. Capacity Analysis Backup

- PM Peak Hour – Existing
- PM Peak Hour – 2018 No-Build
- PM Peak Hour – 2018 Build

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**Figure 1
Location Maps**
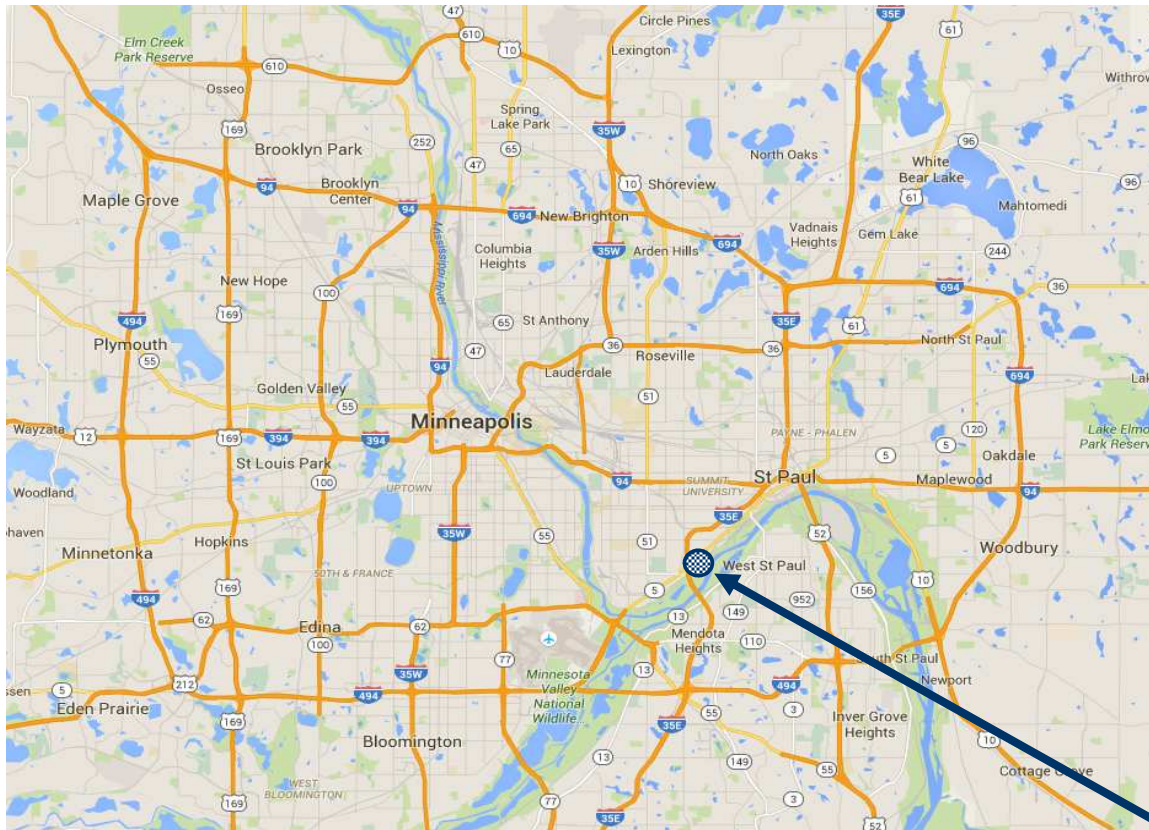
↑
**North
No Scale**

Study Area

Proposed Site

Figure 2
Concept Plan
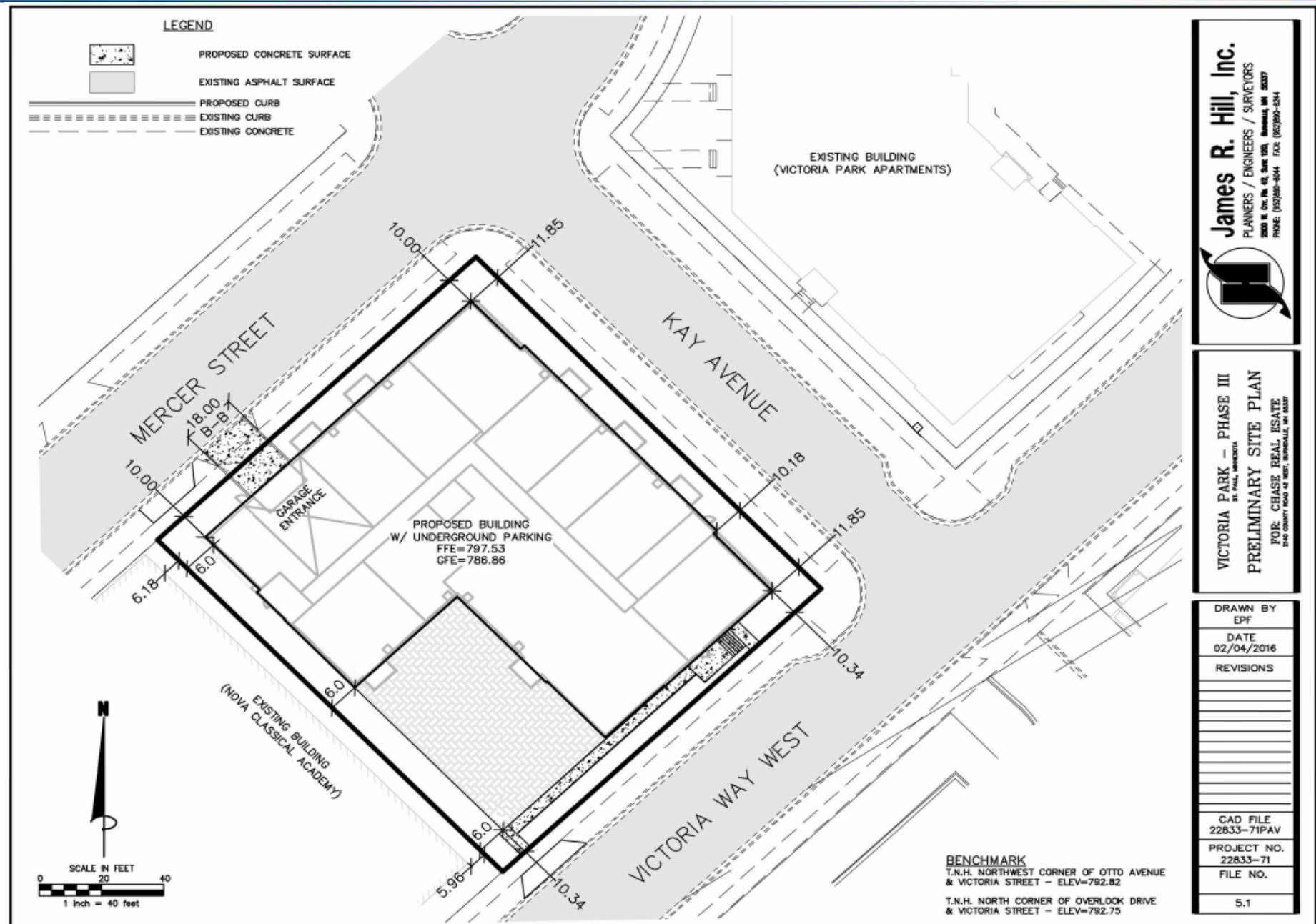
Figure 3
Existing Roadway Configuration
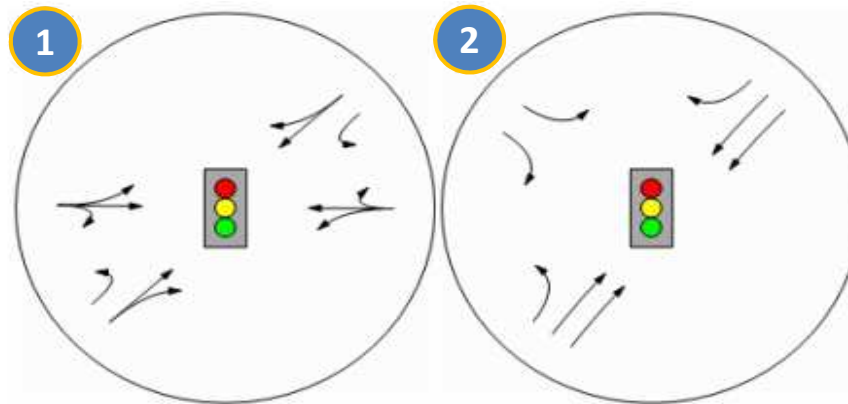
Appendix B - Capacity Analysis Backup

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Victoria Park Phase 3

Vistro File: C:\...\Phase 3 Vistro.vistro

Report File: C:\...\PM Existing.pdf

Scenario 1: PM Existing

4/29/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	W 7th St & Otto Ave	Signalized	HCM 2010	WB Left	0.561	12.1	B
2	Shepard Rd & Otto Ave	Signalized	HCM 2010	NEB Left	0.591	14.5	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

Appendix B - Capacity Analysis Backup

Intersection Level Of Service Report
Intersection 1: W 7th St & Otto Ave

Control Type:	Signalized	Delay (sec / veh):	12.1
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.561

Intersection Setup

Name	Otto Ave			Otto Ave			7th St			7th St		
Approach	Eastbound			Westbound			Northeastbound			Southwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			No			Yes		

volumes

Name	Otto Ave			Otto Ave			7th St			7th St		
Base Volume Input [veh/h]	12	9	5	60	13	42	4	579	71	47	429	13
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	3.00	2.00	2.00	3.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	1	0	0	4	0	0	7	0	0	2
Total Hourly Volume [veh/h]	12	9	4	60	13	38	4	579	64	47	429	11
Peak Hour Factor	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	3	2	1	16	3	10	1	150	17	12	111	3
Total Analysis Volume [veh/h]	12	9	4	62	13	39	4	601	66	49	445	11
Presence of On-Street Parking	No		Yes	No		Yes	No		Yes	No		Yes
On-Street Parking Maneuver Rate [/h]	0	0	6	0	0	6	0	0	6	0	0	6
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	16			13			0			13		
Bicycle Volume [bicycles/h]	0			0			0			0		

Appendix B - Capacity Analysis Backup

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	110
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	76.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	0	4	0	0	4	0	0	2	0	0	2	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	15	0	0	15	0
Maximum Green [s]	0	28	0	0	28	0	0	40	0	0	40	0
Amber [s]	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0
All red [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	40	0	0	40	0	0	70	0	0	70	0
Vehicle Extension [s]	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0
Walk [s]	0	8	0	0	8	0	0	8	0	0	8	0
Pedestrian Clearance [s]	0	21	0	0	21	0	0	17	0	0	17	0
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0
Minimum Recall		No			No			Yes			Yes	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			Yes			Yes	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

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Lane Group Calculations

Lane Group	C	C	L	C	L	C
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	2.00	2.00	0.00	2.00	0.00
l2, Clearance Lost Time [s]	4.00	4.00	4.00	4.00	4.00	4.00
g_i, Effective Green Time [s]	15	15	83	83	83	83
g / C, Green / Cycle	0.14	0.14	0.75	0.75	0.75	0.75
(v / s)_i Volume / Saturation Flow Rate	0.02	0.09	0.00	0.47	0.07	0.31
s, saturation flow rate [veh/h]	1119	1203	837	1432	690	1452
c, Capacity [veh/h]	203	216	581	1078	419	1093
d1, Uniform Delay [s]	41.58	44.78	8.15	6.28	14.05	4.89
k, delay calibration	0.15	0.15	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.38	2.81	0.02	2.67	0.57	1.17
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

	C	C	L	C	L	C
X, volume / capacity	0.12	0.53	0.01	0.62	0.12	0.42
d, Delay for Lane Group [s/veh]	41.96	47.59	8.17	8.94	14.62	6.06
Lane Group LOS	D	D	A	A	B	A
Critical Lane Group	No	Yes	No	Yes	No	No
50th-Percentile Queue Length [veh]	0.62	3.11	0.04	6.32	0.69	3.30
50th-Percentile Queue Length [ft]	15.46	77.78	0.95	158.08	17.16	82.45
95th-Percentile Queue Length [veh]	1.11	5.60	0.07	10.45	1.24	5.94
95th-Percentile Queue Length [ft]	27.84	140.00	1.71	261.18	30.89	148.41

Victoria Park Phase 3

Scenario 1: 1: PM Existing

Appendix B - Capacity Analysis Backup

Generated with PTV VISTRO
Version 4.00-02

Spack CONSULTING

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	41.96	41.96	41.96	47.59	47.59	47.59	8.17	8.94	8.94	14.62	6.06	6.06
Movement LOS	D	D	D	D	D	D	A	A	A	B	A	A
d_A, Approach Delay [s/veh]	41.96			47.59			8.94			6.89		
Approach LOS	D			D			A			A		
d_I, Intersection Delay [s/veh]	12.13											
Intersection LOS	B											
Intersection V/C	0.561											

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SG: 2 70s
SG: 102 25s
SG: 4 40s
SG: 104 29s

Victoria Park Phase 3

Scenario 1: 1: PM Existing

Traffic Impact Study — B5 — Victoria Park Phase 3

Appendix B - Capacity Analysis Backup

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Intersection Level Of Service Report
Intersection 2: Shepard Rd & Otto Ave

Control Type:	Signalized	Delay (sec / veh):	14.5
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.591

Intersection Setup

Name	Shepard Rd		Shepard Rd		Otto Ave	
Approach	Northeastbound		Southwestbound		Southeastbound	
Lane Configuration	⬈‖‖		‖‖⬂		⬀⬂	
Turning Movement	Left	Thru	Thru	Right	Left	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	1	0	0	1
Pocket Length [ft]	300.00	100.00	400.00	100.00	100.00	75.00
Speed [mph]	45.00		45.00		35.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		Yes		No	

volumes

Name	Shepard Rd		Shepard Rd		Otto Ave	
Base Volume Input [veh/h]	109	786	1413	111	58	75
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	3.00	3.00	2.00	2.00	2.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	22	0	15
Total Hourly Volume [veh/h]	109	786	1413	89	58	60
Peak Hour Factor	0.9430	0.9430	0.9430	0.9430	0.9430	0.9430
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	29	208	375	24	15	16
Total Analysis Volume [veh/h]	116	834	1498	94	62	64
Presence of On-Street Parking	No	No	No	No	No	No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0
Pedestrian Volume [ped/h]	8		3		0	
Bicycle Volume [bicycles/h]	0		0		0	

Appendix B - Capacity Analysis Backup

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Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protected	Permissive	Permissive	Permissive	Permissive	Permissive
Signal group	1	6	2	0	4	0
Auxiliary Signal Groups						
Lead / Lag	Lead	-	-	-	Lead	-
Minimum Green [s]	9	12	12	0	10	0
Maximum Green [s]	15	50	50	0	35	0
Amber [s]	3.5	5.5	5.5	0.0	3.5	0.0
All red [s]	0.5	2.0	2.0	0.0	1.5	0.0
Split [s]	19	58	58	0	40	0
Vehicle Extension [s]	2.5	6.0	6.0	0.0	4.0	0.0
Walk [s]	0	7	7	0	5	0
Pedestrian Clearance [s]	0	8	8	0	10	0
I1, Start-Up Lost Time [s]	2.0	2.0	2.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	2.0	5.5	5.5	0.0	3.0	0.0
Minimum Recall	No	Yes	Yes		No	
Maximum Recall	No	No	No		No	
Pedestrian Recall	No	No	No		No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Appendix B - Capacity Analysis Backup

Lane Group Calculations

Lane Group	L	C	C	R	L	R
L, Total Lost Time per Cycle [s]	4.00	7.50	7.50	7.50	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	5.50	5.50	5.50	3.00	3.00
g_i, Effective Green Time [s]	8	61	49	49	10	10
g / C, Green / Cycle	0.10	0.74	0.59	0.59	0.11	0.11
(v / s)_i Volume / Saturation Flow Rate	0.07	0.26	0.47	0.07	0.04	0.04
s, saturation flow rate [veh/h]	1597	3161	3161	1425	1597	1425
c, Capacity [veh/h]	161	2325	1854	836	183	164
d1, Uniform Delay [s]	36.38	3.97	13.56	7.64	34.04	34.26
k, delay calibration	0.08	0.39	0.39	0.39	0.15	0.15
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	4.41	0.34	3.10	0.21	1.54	2.16
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

	L	C	C	R	L	R
X, volume / capacity	0.72	0.36	0.81	0.11	0.34	0.39
d, Delay for Lane Group [s/veh]	40.79	4.31	16.67	7.85	35.58	36.42
Lane Group LOS	D	A	B	A	D	D
Critical Lane Group	Yes	No	Yes	No	No	Yes
50th-Percentile Queue Length [veh]	2.36	1.56	9.34	0.65	1.20	1.26
50th-Percentile Queue Length [ft]	58.91	38.89	233.54	16.34	30.02	31.61
95th-Percentile Queue Length [veh]	4.24	2.80	14.35	1.18	2.16	2.28
95th-Percentile Queue Length [ft]	106.04	70.00	358.85	29.42	54.04	56.90

Victoria Park Phase 3

Scenario 1: 1: PM Existing

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	40.79	4.31	16.67	7.85	35.58	36.42
Movement LOS	D	A	B	A	D	D
d_A, Approach Delay [s/veh]	8.76		16.15		36.01	
Approach LOS	A		B		D	
d_I, Intersection Delay [s/veh]	14.45					
Intersection LOS	B					
Intersection V/C	0.591					

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
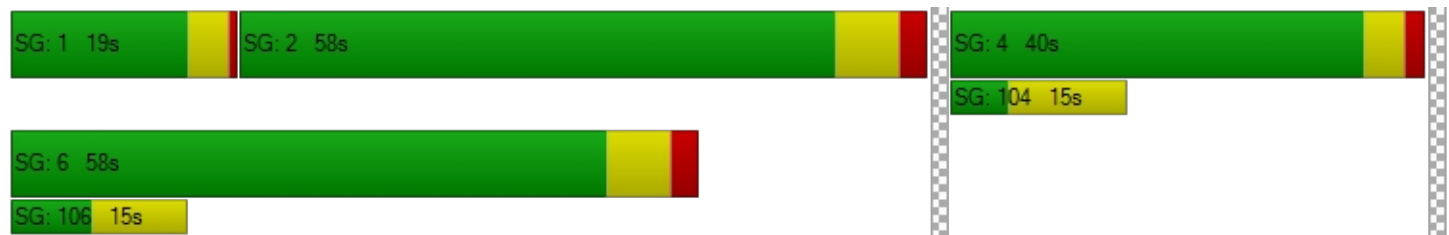
SG: 1 19s SG: 2 58s SG: 4 40s

SG: 104 15s

SG: 6 58s

SG: 106 15s

Appendix B - Capacity Analysis Backup

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Lane Configuration and Traffic Control
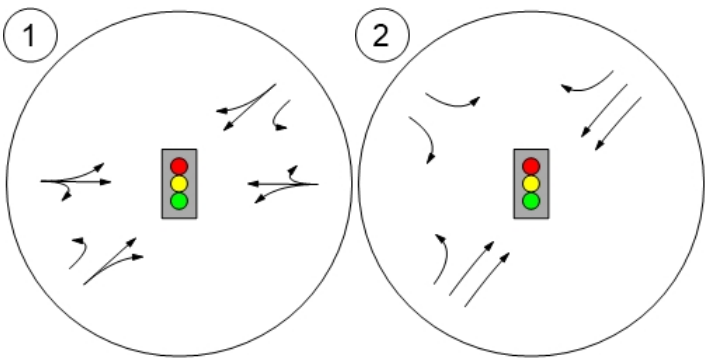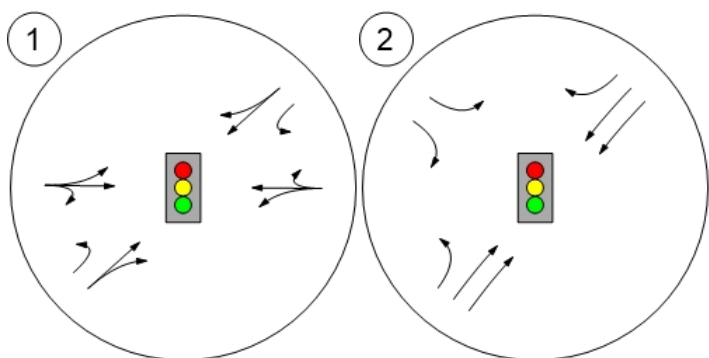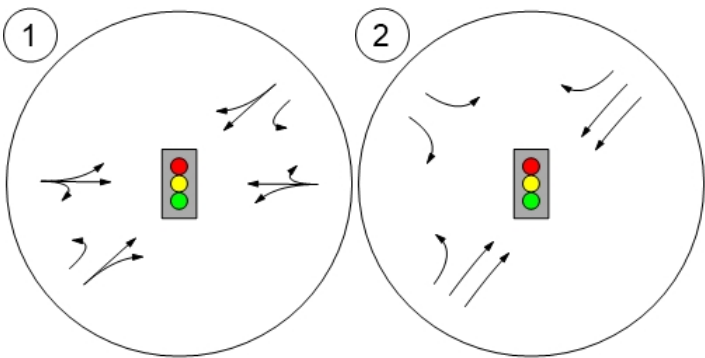
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Traffic Volume - Base Volume

Appendix B - Capacity Analysis Backup

Victoria Park Phase 3

Vistro File: C:\...\Phase 3 Vistro.vistro   Scenario 2: PM 2018 No-Build

Report File: C:\...\PM 2018 No-Build.pdf   4/29/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	W 7th St & Otto Ave	Signalized	HCM 2010	WB Left	0.571	12.4	B
2	Shepard Rd & Otto Ave	Signalized	HCM 2010	NEB Left	0.604	14.8	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: W 7th St & Otto Ave

Control Type:	Signalized	Delay (sec / veh):	12.4
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.571

Intersection Setup

Name	Otto Ave			Otto Ave			7th St			7th St		
Approach	Eastbound			Westbound			Northeastbound			Southwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			No			Yes		

volumes

Name	Otto Ave			Otto Ave			7th St			7th St		
Base Volume Input [veh/h]	12	9	5	60	13	42	4	579	71	47	429	13
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	3.00	2.00	2.00	3.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]			1			4			7			2
Total Hourly Volume [veh/h]	12	9	4	61	13	39	4	591	65	48	438	11
Peak Hour Factor	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	3	2	1	16	3	10	1	153	17	12	114	3
Total Analysis Volume [veh/h]	12	9	4	63	13	40	4	613	67	50	454	11
Presence of On-Street Parking	No		Yes	No		Yes	No		Yes	No		Yes
On-Street Parking Maneuver Rate [/h]	0	0	6	0	0	6	0	0	6	0	0	6
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	16			13			0			13		
Bicycle Volume [bicycles/h]	0			0			0			0		

Victoria Park Phase 3

Scenario 2: 2: PM 2018 No-Build

Appendix B - Capacity Analysis Backup

Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	110
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	76.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	0	4	0	0	4	0	0	2	0	0	2	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	15	0	0	15	0
Maximum Green [s]	0	28	0	0	28	0	0	40	0	0	40	0
Amber [s]	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0
All red [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	40	0	0	40	0	0	70	0	0	70	0
Vehicle Extension [s]	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0
Walk [s]	0	8	0	0	8	0	0	8	0	0	8	0
Pedestrian Clearance [s]	0	21	0	0	21	0	0	17	0	0	17	0
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0
Minimum Recall		No			No			Yes			Yes	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			Yes			Yes	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Appendix B - Capacity Analysis Backup

Lane Group Calculations

Lane Group	C	C	L	C	L	C
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	2.00	2.00	0.00	2.00	0.00
l2, Clearance Lost Time [s]	4.00	4.00	4.00	4.00	4.00	4.00
g_i, Effective Green Time [s]	15	15	83	83	83	83
g / C, Green / Cycle	0.14	0.14	0.75	0.75	0.75	0.75
(v / s)_i Volume / Saturation Flow Rate	0.02	0.10	0.00	0.47	0.07	0.32
s, saturation flow rate [veh/h]	1116	1202	830	1432	681	1452
c, Capacity [veh/h]	204	218	572	1076	407	1091
d1, Uniform Delay [s]	41.43	44.71	8.38	6.46	14.71	4.99
k, delay calibration	0.15	0.15	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.38	2.85	0.02	2.82	0.62	1.22
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

	C	C	L	C	L	C
X, volume / capacity	0.12	0.53	0.01	0.63	0.12	0.43
d, Delay for Lane Group [s/veh]	41.81	47.56	8.40	9.29	15.33	6.21
Lane Group LOS	D	D	A	A	B	A
Critical Lane Group	No	Yes	No	Yes	No	No
50th-Percentile Queue Length [veh]	0.62	3.17	0.04	6.63	0.72	3.43
50th-Percentile Queue Length [ft]	15.43	79.16	0.97	165.81	18.05	85.70
95th-Percentile Queue Length [veh]	1.11	5.70	0.07	10.86	1.30	6.17
95th-Percentile Queue Length [ft]	27.78	142.48	1.75	271.40	32.50	154.26

Victoria Park Phase 3

Scenario 2: 2: PM 2018 No-Build

Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	41.81	41.81	41.81	47.56	47.56	47.56	8.40	9.29	9.29	15.33	6.21	6.21
Movement LOS	D	D	D	D	D	D	A	A	A	B	A	A
d_A, Approach Delay [s/veh]	41.81			47.56			9.28			7.10		
Approach LOS	D			D			A			A		
d_I, Intersection Delay [s/veh]	12.36											
Intersection LOS	B											
Intersection V/C	0.571											

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SG: 2 70s
SG: 102 25s
SG: 4 40s
SG: 104 29s

Appendix B - Capacity Analysis Backup

Intersection Level Of Service Report
Intersection 2: Shepard Rd & Otto Ave

Control Type:	Signalized	Delay (sec / veh):	14.8
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.604

Intersection Setup

Name	Shepard Rd		Shepard Rd		Otto Ave	
Approach	Northeastbound		Southwestbound		Southeastbound	
Lane Configuration	⌐‖‖		‖‖⌐		⌐⌐	
Turning Movement	Left	Thru	Thru	Right	Left	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	1	0	0	1
Pocket Length [ft]	300.00	100.00	400.00	100.00	100.00	75.00
Speed [mph]	45.00		45.00		35.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		Yes		No	

volumes

Name	Shepard Rd		Shepard Rd		Otto Ave	
Base Volume Input [veh/h]	109	786	1413	111	58	75
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	3.00	3.00	2.00	2.00	2.00
Growth Rate	1.02	1.02	1.02	1.02	1.02	1.02
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	22	0	15
Total Hourly Volume [veh/h]	111	802	1441	91	59	62
Peak Hour Factor	0.9430	0.9430	0.9430	0.9430	0.9430	0.9430
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	29	213	382	24	16	16
Total Analysis Volume [veh/h]	118	850	1528	97	63	66
Presence of On-Street Parking	No	No	No	No	No	No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0
Pedestrian Volume [ped/h]	8		3		0	
Bicycle Volume [bicycles/h]	0		0		0	

Appendix B - Capacity Analysis Backup

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Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protected	Permissive	Permissive	Permissive	Permissive	Permissive
Signal group	1	6	2	0	4	0
Auxiliary Signal Groups						
Lead / Lag	Lead	-	-	-	Lead	-
Minimum Green [s]	9	12	12	0	10	0
Maximum Green [s]	15	50	50	0	35	0
Amber [s]	3.5	5.5	5.5	0.0	3.5	0.0
All red [s]	0.5	2.0	2.0	0.0	1.5	0.0
Split [s]	19	58	58	0	40	0
Vehicle Extension [s]	2.5	6.0	6.0	0.0	4.0	0.0
Walk [s]	0	7	7	0	5	0
Pedestrian Clearance [s]	0	8	8	0	10	0
I1, Start-Up Lost Time [s]	2.0	2.0	2.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	2.0	5.5	5.5	0.0	3.0	0.0
Minimum Recall	No	Yes	Yes		No	
Maximum Recall	No	No	No		No	
Pedestrian Recall	No	No	No		No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Victoria Park Phase 3

Scenario 2: 2: PM 2018 No-Build

Appendix B - Capacity Analysis Backup

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Lane Group Calculations

Lane Group	L	C	C	R	L	R
L, Total Lost Time per Cycle [s]	4.00	7.50	7.50	7.50	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	5.50	5.50	5.50	3.00	3.00
g_i, Effective Green Time [s]	8	62	49	49	10	10
g / C, Green / Cycle	0.10	0.74	0.59	0.59	0.11	0.11
(v / s)_i Volume / Saturation Flow Rate	0.07	0.27	0.48	0.07	0.04	0.05
s, saturation flow rate [veh/h]	1597	3161	3161	1425	1597	1425
c, Capacity [veh/h]	161	2327	1857	837	183	164
d1, Uniform Delay [s]	36.58	3.99	13.82	7.66	34.21	34.45
k, delay calibration	0.08	0.39	0.39	0.39	0.15	0.15
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	4.68	0.35	3.40	0.22	1.58	2.27
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.73	0.37	0.82	0.12	0.34	0.40
d, Delay for Lane Group [s/veh]	41.27	4.34	17.21	7.88	35.78	36.73
Lane Group LOS	D	A	B	A	D	D
Critical Lane Group	Yes	No	Yes	No	No	Yes
50th-Percentile Queue Length [veh]	2.42	1.60	9.78	0.68	1.23	1.31
50th-Percentile Queue Length [ft]	60.51	40.08	244.54	16.96	30.69	32.85
95th-Percentile Queue Length [veh]	4.36	2.89	14.91	1.22	2.21	2.37
95th-Percentile Queue Length [ft]	108.92	72.15	372.77	30.52	55.24	59.13

Victoria Park Phase 3

Scenario 2: 2: PM 2018 No-Build

Appendix B - Capacity Analysis Backup

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	41.27	4.34	17.21	7.88	35.78	36.73
Movement LOS	D	A	B	A	D	D
d_A, Approach Delay [s/veh]	8.84		16.66		36.27	
Approach LOS	A		B		D	
d_I, Intersection Delay [s/veh]	14.81					
Intersection LOS	B					
Intersection V/C	0.604					

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SG: 1 19s SG: 2 58s SG: 4 40s SG: 104 15s

SG: 6 58s SG: 106 15s

Lane Configuration and Traffic Control

Traffic Volume - Future Total Volume

Victoria Park Phase 3

Scenario 2: 2: PM 2018 No-Build

Appendix B - Capacity Analysis Backup

Victoria Park Phase 3

Vistro File: C:\...\Phase 3 Vistro.vistro

Report File: C:\...\PM 2018 Build.pdf

Scenario 3: Copy of PM 2018 No-Build

4/29/2016

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	W 7th St & Otto Ave	Signalized	HCM 2010	WB Left	0.581	12.8	B
2	Shepard Rd & Otto Ave	Signalized	HCM 2010	NEB Left	0.609	15.0	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

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Intersection Level Of Service Report
Intersection 1: W 7th St & Otto Ave

Control Type:	Signalized	Delay (sec / veh):	12.8
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.581

Intersection Setup

Name	Otto Ave			Otto Ave			7th St			7th St		
Approach	Eastbound			Westbound			Northeastbound			Southwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [ft]	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Speed [mph]	30.00			30.00			35.00			35.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	Yes			Yes			No			Yes		

volumes

Name	Otto Ave			Otto Ave			7th St			7th St		
Base Volume Input [veh/h]	12	9	5	60	13	42	4	579	71	47	429	13
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	3.00	2.00	2.00	3.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Growth Rate	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	3	0	2	0	0	5	4	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]			1			4			7			2
Total Hourly Volume [veh/h]	12	9	4	64	13	41	4	591	70	52	438	11
Peak Hour Factor	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	3	2	1	17	3	11	1	153	18	13	114	3
Total Analysis Volume [veh/h]	12	9	4	66	13	43	4	613	73	54	454	11
Presence of On-Street Parking	No		Yes	No		Yes	No		Yes	No		Yes
On-Street Parking Maneuver Rate [/h]	0	0	6	0	0	6	0	0	6	0	0	6
Local Bus Stopping Rate [/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Volume [ped/h]	16			13			0			13		
Bicycle Volume [bicycles/h]	0			0			0			0		

Victoria Park Phase 3

Scenario 3: 3: Copy of PM 2018 No-Build

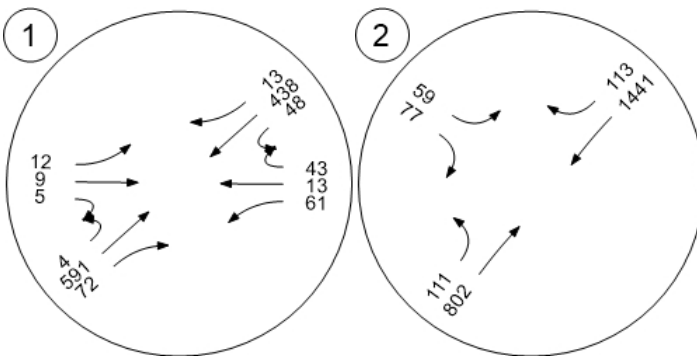# Appendix B - Capacity Analysis Backup

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Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	110
Coordination Type	Time of Day Pattern Coordinated
Actuation Type	Fully actuated
Offset [s]	76.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss	Permiss
Signal group	0	4	0	0	4	0	0	2	0	0	2	0
Auxiliary Signal Groups												
Lead / Lag	-	-	-	-	-	-	-	-	-	-	-	-
Minimum Green [s]	0	10	0	0	10	0	0	15	0	0	15	0
Maximum Green [s]	0	28	0	0	28	0	0	40	0	0	40	0
Amber [s]	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0
All red [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
Split [s]	0	40	0	0	40	0	0	70	0	0	70	0
Vehicle Extension [s]	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0
Walk [s]	0	8	0	0	8	0	0	8	0	0	8	0
Pedestrian Clearance [s]	0	21	0	0	21	0	0	17	0	0	17	0
I1, Start-Up Lost Time [s]	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0
I2, Clearance Lost Time [s]	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0	0.0	4.0	0.0
Minimum Recall		No			No			Yes			Yes	
Maximum Recall		No			No			No			No	
Pedestrian Recall		No			No			Yes			Yes	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Victoria Park Phase 3

Scenario 3: 3: Copy of PM 2018 No-Build

Traffic Impact StudyB25Victoria Park Phase 3

Appendix B - Capacity Analysis Backup

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Lane Group Calculations

Lane Group	C	C	L	C	L	C
L, Total Lost Time per Cycle [s]	6.00	6.00	6.00	6.00	6.00	6.00
l1_p, Permitted Start-Up Lost Time [s]	2.00	2.00	2.00	0.00	2.00	0.00
l2, Clearance Lost Time [s]	4.00	4.00	4.00	4.00	4.00	4.00
g_i, Effective Green Time [s]	16	16	82	82	82	82
g / C, Green / Cycle	0.14	0.14	0.75	0.75	0.75	0.75
(v / s)_i Volume / Saturation Flow Rate	0.02	0.10	0.00	0.48	0.08	0.32
s, saturation flow rate [veh/h]	1110	1200	830	1430	678	1452
c, Capacity [veh/h]	208	223	567	1068	397	1085
d1, Uniform Delay [s]	41.01	44.50	8.65	6.76	15.58	5.17
k, delay calibration	0.15	0.15	0.50	0.50	0.50	0.50
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	0.36	2.96	0.02	2.97	0.71	1.24
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

X, volume / capacity	0.12	0.55	0.01	0.64	0.14	0.43
d, Delay for Lane Group [s/veh]	41.37	47.46	8.68	9.73	16.30	6.41
Lane Group LOS	D	D	A	A	B	A
Critical Lane Group	No	Yes	No	Yes	No	No
50th-Percentile Queue Length [veh]	0.61	3.33	0.04	6.96	0.81	3.53
50th-Percentile Queue Length [ft]	15.33	83.29	0.99	173.90	20.27	88.14
95th-Percentile Queue Length [veh]	1.10	6.00	0.07	11.28	1.46	6.35
95th-Percentile Queue Length [ft]	27.60	149.92	1.78	282.04	36.49	158.64

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	41.37	41.37	41.37	47.46	47.46	47.46	8.68	9.73	9.73	16.30	6.41	6.41
Movement LOS	D	D	D	D	D	D	A	A	A	B	A	A
d_A, Approach Delay [s/veh]	41.37			47.46			9.72			7.44		
Approach LOS	D			D			A			A		
d_I, Intersection Delay [s/veh]	12.83											
Intersection LOS	B											
Intersection V/C	0.581											

Sequence

Ring 1	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SG: 2 70s

SG: 102 25s

SG: 4 40s

SG: 104 29s

Victoria Park Phase 3

Scenario 3: 3: Copy of PM 2018 No-Build

Appendix B - Capacity Analysis Backup

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Intersection Level Of Service Report
Intersection 2: Shepard Rd & Otto Ave

Control Type:	Signalized	Delay (sec / veh):	15.0
Analysis Method:	HCM 2010	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.609

Intersection Setup

Name	Shepard Rd		Shepard Rd		Otto Ave	
Approach	Northeastbound		Southwestbound		Southeastbound	
Lane Configuration	⬑⬆⬆		⬆⬆⬏		⬑⬏	
Turning Movement	Left	Thru	Thru	Right	Left	Right
Lane Width [ft]	12.00	12.00	12.00	12.00	12.00	12.00
No. of Lanes in Pocket	1	0	1	0	0	1
Pocket Length [ft]	300.00	100.00	400.00	100.00	100.00	75.00
Speed [mph]	45.00		45.00		35.00	
Grade [%]	0.00		0.00		0.00	
Crosswalk	Yes		Yes		No	

volumes

Name	Shepard Rd		Shepard Rd		Otto Ave	
Base Volume Input [veh/h]	109	786	1413	111	58	75
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	2.00	3.00	3.00	2.00	2.00	2.00
Growth Rate	1.02	1.02	1.02	1.02	1.02	1.02
In-Process Volume [veh/h]	0	0	0	0	0	0
Site-Generated Trips [veh/h]	5	0	0	6	3	3
Diverted Trips [veh/h]	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0
Other Volume [veh/h]	0	0	0	0	0	0
Right-Turn on Red Volume [veh/h]	0	0	0	22	0	15
Total Hourly Volume [veh/h]	116	802	1441	97	62	65
Peak Hour Factor	0.9430	0.9430	0.9430	0.9430	0.9430	0.9430
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	31	213	382	26	16	17
Total Analysis Volume [veh/h]	123	850	1528	103	66	69
Presence of On-Street Parking	No	No	No	No	No	No
On-Street Parking Maneuver Rate [/h]	0	0	0	0	0	0
Local Bus Stopping Rate [/h]	0	0	0	0	0	0
Pedestrian Volume [ped/h]	8		3		0	
Bicycle Volume [bicycles/h]	0		0		0	

Appendix B - Capacity Analysis Backup

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Intersection Settings

Located in CBD	Yes
Signal Coordination Group	-
Cycle Length [s]	90
Coordination Type	Time of Day Pattern Isolated
Actuation Type	Fully actuated
Offset [s]	0.0
Offset Reference	LeadGreen
Permissive Mode	SingleBand
Lost time [s]	0.00

Phasing & Timing

Control Type	Protected	Permissive	Permissive	Permissive	Permissive	Permissive
Signal group	1	6	2	0	4	0
Auxiliary Signal Groups						
Lead / Lag	Lead	-	-	-	Lead	-
Minimum Green [s]	9	12	12	0	10	0
Maximum Green [s]	15	50	50	0	35	0
Amber [s]	3.5	5.5	5.5	0.0	3.5	0.0
All red [s]	0.5	2.0	2.0	0.0	1.5	0.0
Split [s]	19	58	58	0	40	0
Vehicle Extension [s]	2.5	6.0	6.0	0.0	4.0	0.0
Walk [s]	0	7	7	0	5	0
Pedestrian Clearance [s]	0	8	8	0	10	0
l1, Start-Up Lost Time [s]	2.0	2.0	2.0	0.0	2.0	0.0
l2, Clearance Lost Time [s]	2.0	5.5	5.5	0.0	3.0	0.0
Minimum Recall	No	Yes	Yes		No	
Maximum Recall	No	No	No		No	
Pedestrian Recall	No	No	No		No	
Detector Location [ft]	0.0	0.0	0.0	0.0	0.0	0.0
Detector Length [ft]	0.0	0.0	0.0	0.0	0.0	0.0
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00

Exclusive Pedestrian Phase

Pedestrian Signal Group	0
Pedestrian Walk [s]	0
Pedestrian Clearance [s]	0

Victoria Park Phase 3

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Lane Group Calculations

Lane Group	L	C	C	R	L	R
L, Total Lost Time per Cycle [s]	4.00	7.50	7.50	7.50	5.00	5.00
l1_p, Permitted Start-Up Lost Time [s]	0.00	0.00	0.00	0.00	0.00	0.00
l2, Clearance Lost Time [s]	2.00	5.50	5.50	5.50	3.00	3.00
g_i, Effective Green Time [s]	9	62	49	49	10	10
g / C, Green / Cycle	0.10	0.74	0.59	0.59	0.11	0.11
(v / s)_i Volume / Saturation Flow Rate	0.08	0.27	0.48	0.07	0.04	0.05
s, saturation flow rate [veh/h]	1597	3161	3161	1425	1597	1425
c, Capacity [veh/h]	162	2326	1854	836	184	164
d1, Uniform Delay [s]	36.72	4.01	13.90	7.74	34.29	34.55
k, delay calibration	0.08	0.39	0.39	0.39	0.15	0.15
I, Upstream Filtering Factor	1.00	1.00	1.00	1.00	1.00	1.00
d2, Incremental Delay [s]	5.29	0.35	3.43	0.24	1.67	2.42
d3, Initial Queue Delay [s]	0.00	0.00	0.00	0.00	0.00	0.00
Rp, platoon ratio	1.00	1.00	1.00	1.00	1.00	1.00
PF, progression factor	1.00	1.00	1.00	1.00	1.00	1.00

Lane Group Results

	L	C	C	R	L	R
X, volume / capacity	0.76	0.37	0.82	0.12	0.36	0.42
d, Delay for Lane Group [s/veh]	42.02	4.36	17.33	7.98	35.96	36.97
Lane Group LOS	D	A	B	A	D	D
Critical Lane Group	Yes	No	Yes	No	No	Yes
50th-Percentile Queue Length [veh]	2.55	1.61	9.84	0.73	1.29	1.38
50th-Percentile Queue Length [ft]	63.84	40.35	246.08	18.20	32.29	34.51
95th-Percentile Queue Length [veh]	4.60	2.91	14.99	1.31	2.32	2.48
95th-Percentile Queue Length [ft]	114.92	72.63	374.71	32.76	58.11	62.12

Victoria Park Phase 3

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Movement, Approach, & Intersection Results

d_M, Delay for Movement [s/veh]	42.02	4.36	17.33	7.98	35.96	36.97
Movement LOS	D	A	B	A	D	D
d_A, Approach Delay [s/veh]	9.12		16.74		36.48	
Approach LOS	A		B		D	
d_I, Intersection Delay [s/veh]	15.00					
Intersection LOS	B					
Intersection V/C	0.609					

Sequence

Ring 1	1	2	-	4	-	-	-	-	-	-	-	-	-	-	-	-
Ring 2	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SG: 1 19s SG: 2 58s SG: 4 40s
SG: 104 15s
SG: 6 58s
SG: 106 15s

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Lane Configuration and Traffic Control

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Traffic Volume - Base Volume

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Traffic Volume - Net New Site Trips
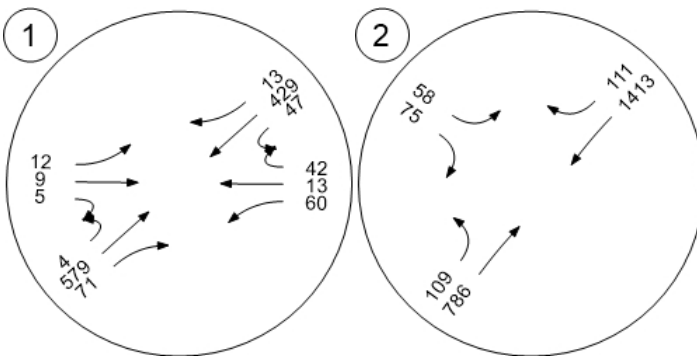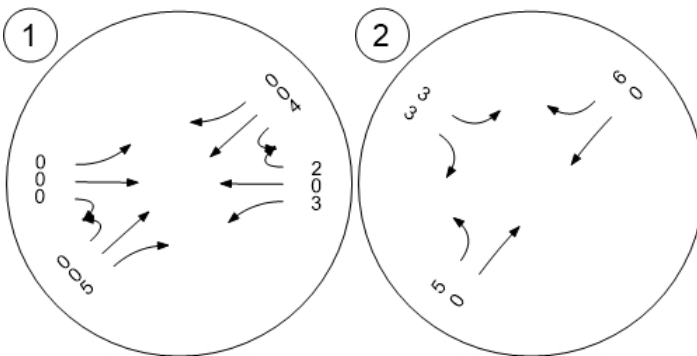
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Traffic Volume - Future Total Volume