Job title	Queens Quay Revitalization EA	Job number	96116
to	Pina Mallozzi (WT)	File reference	
cc	Colin Wong (Arup) David Pratt (Arup) Brent Raymond (DTAH)		
Prepared by	Marc-Paul Gauthier x 24581 (Toronto))	Date	September 1, 2009
Subject	Redpath Partial Signal Operations Analysis		

1. INTRODUCTION

1.1 Queens Quay Revitalization Environmental Assessment (EA)

As a part of the Queens Quay Revitalization EA and East Bayfront Transit EA, modifications are required to access conditions along Queens Quay. The Preferred Design for Queens Quay is south side transit operation with two-way traffic north of the tracks. This unique configuration requires special consideration for all access points to property south of Queens Quay.

1.2 Transit

Key to the sustainable development of the waterfront is an efficient transit system, capable of providing an attractive service able to compete with other modes. As lands within the port lands are built-out, transit service will need to be increased to accommodate additional demand. The full build-out of the port land, Lower Don Lands is expected to occur over the next 25 years. Therefore, high-frequency transit headways along Queens Quay east of Yonge Street may not be realized for some time.

1.3 Redpath Sugar

Redpath Sugar is a key stakeholder on Queens Quay with unique access requirements. This note outlines a proposed access strategy for the property at full build-out with transit operating at capacity (with 60 metres and servicing the East Bayfront, West Don Lands, Lower Don Lands and Port Lands demand including some demand for east Toronto beaches.

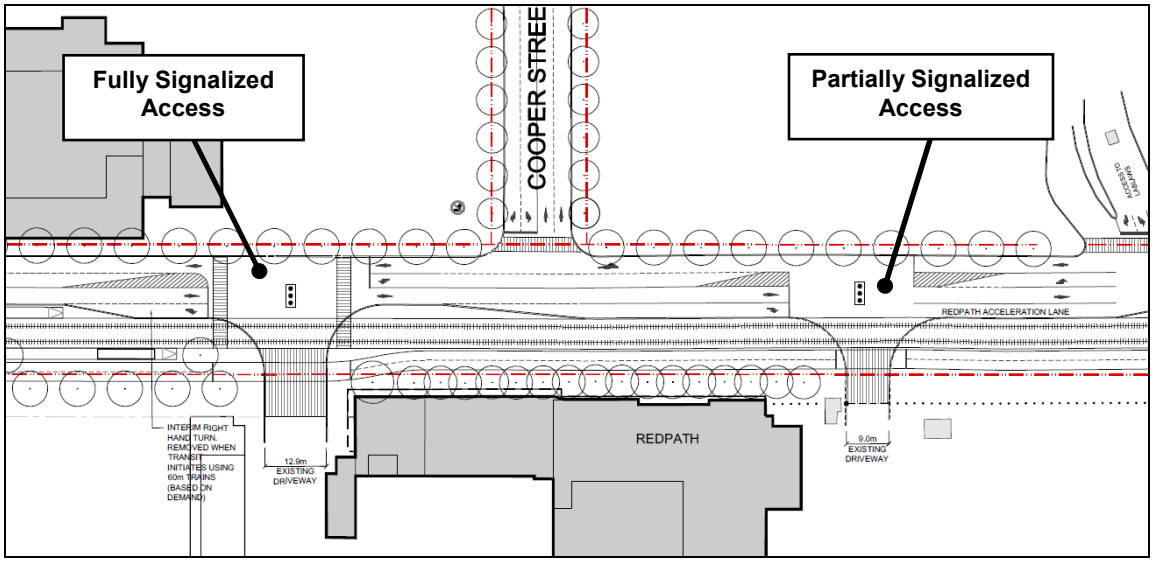
A transit adaptive gate was considered but not carried forward due to access limitations at Redpath. The gate would control egress movements from the Redpath site only. Redpath has indicated that it requires both access and egress be provided at their centre driveway and the nature of a gate is that it can only provide egress. A Technical Note "Redpath Actuated Gate Operations Analysis" dated May 29 2009 contains the findings of that investigation.

2. POINTS OF ACCESS

Figure 1 illustrates the proposed access strategy for Redpath Sugar for the Preferred Design. A larger plan and suggested approach routes are attached.

- The existing westerly access would be fully signalized and provide full inbound and outbound movements to/from the east and west. The eastbound right turn lane would be in place until transit demand on the waterfront requires 60 metre trains at which time the right turn lane would be removed and replaced with a 60 metre platform to service the longer trains.
- The existing access points in the middle of the Redpath site are proposed to be consolidated at a single driveway located as shown in Figure 1. The consolidated driveway would be in the same location as the existing driveway. The use of this driveway would be restricted to trucks only.

Figure 1 - Redpath Access Locations



2.1 West Access Full Signal

The west access would operate under full signal control similar to all intersections along Queens Quay under the south side transit scheme.

- East-west transit runs with east-west main green (auto; bicycle; pedestrian).
- Turns over the transit right-of-way are fully protected requiring a dedicated phase; this phase can be called by a vehicle waiting within a dedicated turn bay (storage lane).
- Pedestrian crossings are provided at the intersection in all directions.
- When transit demand requires the use of 60m trains, the eastbound right turn lane will be removed and all access at this location would be from westbound left turn in.

2.2 Centre Driveway Partial Signal

2.2.1 Context

In order to provide access and egress at the centre driveway, the team developed a special signalized intersection which was able to adapt to transit and ensure little to no delay to transit vehicles. In order to be fully adaptive to transit, the signal needed to run independent of adjacent signals.

Historically in the City of Toronto, when two signalized intersections were "closely" spaced (i.e. within 150 metres of each other); the signals were linked such that the amber aspects at both signals appeared at the same time. This reduced the likelihood of driver confusion whereby a motorist would mistake a downstream signal aspect for the nearer signal and proceed or stop mistakenly. From Yonge Street to Lower Richardson Street, there are five signalized intersections all within 150 metres of each other:

- Yonge Street to Freeland Street, 140 metres
- Freeland Street to Redpath West Driveway, 100 metres
- Redpath West Driveway to Redpath Centre Driveway, 115 metres
- Redpath Centre Driveway to Lower Jarvis Street; 145 metres
- Lower Jarvis Street to Richardson Street; 100 metres

If these five signals had to be linked such that their amber aspects would all appear at the same time, it would not be possible to deploy effective transit signal priority or a signal coordination scheme. As a part of the Preferred Design, the EA recommendations include reducing the posted speed on Queens Quay to 40 km/h from the existing 50 km/h. At this speed, closely spaced signals are no longer a safety concern for City of Toronto Transportation Services and the requirement of linking the signals no longer applies. This reduction has also been reflected in the micro-simulation model used to analyse the proposed transit service on Queens Quay (i.e. the "VISSIM analysis"). Having established that the centre driveway partial signal could operate independently of adjacent signals, the EA Team developed a signal control strategy.

2.2.2 Control Strategy

In technical terms, the signal would operate as fully actuated with a transit preemption. Key physical features of the signal would be as follows:

- The signal has been termed "partial" because no north-south pedestrian crossings would be provided in order to reduce clearance times and allow the signal to cycle between north-south and east-west movements more quickly.
- Two transit detectors are included, one eastbound and one westbound. The eastbound transit detector is 150 metres long and extends to just west of the Redpath west driveway. The westbound transit detector is 200 metres long and extends to just east of the Lower Jarvis Street near side transit stop. The detector lengths are set based on maximum distance travelled in 17 seconds using the fastest transit vehicle approach speed extracted from the model. This ensures that all clearances can be served for no delay to transit.
- A dedicated eastbound right turn lane (approach) and eastbound acceleration lane (exit) are provided. Standard signal heads are provided for eastbound, westbound and northbound

movements. The fully protected eastbound right turn phase would be provided with dedicated (arrow) signal heads.

The signal has a two phase operation described as follows:

- Phase 1 serves the main east-west movements for all modes (pedestrians, cyclists, transit and auto). This signal dwells on this phase until a call is placed for Phase 2.
- Phase 2 serves the northbound exits and eastbound right turn in on an "overlap" where trucks would enter and/or exit on the same phase. The driveway and turn radii are sized to accommodate the simultaneous movement. The phase has a minimum 10 second green with 4 seconds amber and 3 seconds all red clearance.
- When a call is placed for Phase 2, the signal checks for transit vehicles within the detection zone. If there is a transit vehicle within the detection zone, the signal rests in Phase 1. Once the detection zone is clear of transit vehicles, the signal serves Phase 2.
- After Phase 2 is served, the signal reverts to Phase 1 until another call is placed for Phase 2.

2.2.3 Additional Information

Detection systems of this type can be equipped with built in intelligence which tracks the progress of the tram and adjusts the clearance start times as needed to maximize east-west green. The systems can also be equipped with a detector to detect vehicle (truck) presence on the tracks at the centre driveway which could provide audible warning to the streetcar operator in addition to seeing the truck on the tracks ahead. The model of the signal does not check for vehicle presence on the track at the driveway. However, conflict areas have been coded for transit and truck driveway links; therefore, if a vehicle does not clear tracks the train yields to the truck and comes to safe stop.

There is enough space within the cross section at Redpath to construct an eastbound acceleration lane which would provide a refuge area for exiting trucks. This refuge area would reduce the probability for conflict between trucks and light rail vehicles if there is queuing or other obstruction eastbound on Queens Quay. Reducing the potential for conflict will reduce the probability for delay to transit vehicles and provides an optimum operation for both Redpath and the TTC.

3. MICRO SIMULATION MODELLING

A micro-simulation model of Queens Quay using VISSIM software was created to assess transit operations along Queens Quay under potential future arrangements. The models used for that study were adapted for this sensitivity analysis. The full corridor model was truncated to include intersection east of Bay Street to Sherbourne Street. This focused study area centres on the Redpath centre driveway and includes three intersections upstream in both directions (east-west).

3.1 Assumptions & Inputs

3.1.1 Time Period

Transit patronage forecasts from the City of Toronto regional EMME/2 model are only available for the morning peak hour. The TTC has also indicated that for Queens Quay, the morning peak hour rush is their key evaluation time period. As such, all analysis done as part of this exercise is also for the morning peak hour in keeping with all transit analysis done to date.

3.1.2 Pedestrian Demand

Pedestrian volumes have been coded into crosswalks at every signalized intersection including the partial signal at Redpath. For purposes of this analysis, no detailed pedestrian forecasts were undertaken; however, the model includes a nominal 75 pedestrians crossing per direction (total of 150 per crosswalk) during the analysis period. At the Redpath partial signal, all of the pedestrian and vehicle interaction is controlled by the signals so the pedestrians in the model do not affect vehicle operations but are included for consistency.

3.1.3 Transit Demand

Transit demand for all central waterfront modelling (summarized in Table 1 and Table 2) was provided by the TTC and is related to the demand forecasting work done as part of the Central Waterfront Secondary Plan and waterfront transit environmental assessments.

Table 1 – Build-out Transit, Morning Peak Hour Demand, Eastbound

Stop	Ons	Offs	Offs as % of load	Onboard
				3128
Bay	105	808	25.8%	2425
Freeland	45	679	28.0%	1791
Jarvis	3	170	9.5%	1624
Sherbourne	34	376	23.2%	1282
Small	46	90	7.0%	1238
Trinity	9	12	1.0%	1235
Cherry	11	23	1.9%	

Notes:
1. Initial load per train based on 206 second headway with 60 metre trains.

Table 2 - Build-out Transit Demand Westbound

Stop	Ons	Offs	Offs as % of load	Onboard
				3010
Cherry	405	18	0.6%	3397
Trinity	43	10	0.3%	3430
Small	354	35	1.0%	3749
Sherbourne	311	26	0.7%	4034
Jarvis	309	36	0.9%	4307
Freeland	217	41	1.0%	4483
Bay	406	417	9.3%	

Notes:
1. Initial load per train based on 206 second headway with 60 metre trains.

3.1.3 Bicycle Demand

Bicycle traffic was not incorporated into the model. Interaction between the Martin Goodman Trail and the Redpath egress would be controlled in a manner similar to typical intersections where cyclists and pedestrians on the MGT would be stopped with a standard pedestrian signal head indication. If cyclist compliance becomes or is expected to become an issue, specific measures to control bicycle movements would be considered in the future.

3.1.4 Vehicle Demand

Truck schedules and forecasts were provided by Redpath to assist in understanding what is currently happening at the centre access and what is expected in years to come. During the morning peak hour (8:00 to 9:00 AM), existing truck traffic is 6 in and 8 out. The future forecasts show 9 trucks in and 12 trucks out during the same time period.

For purposes of this analysis, we have assumed a total of 10 trucks exiting and 5 trucks entering the site at the centre driveway during the morning peak hour assuming that at least a small proportion of truck traffic would use the west driveway.

Redpath truck forecasts and a network traffic figure are provided in the appendix. The model assumes an overall truck percentage of 5 percent for the entire network. The Redpath centre driveway volumes assume 100 percent trucks.

3.2 Findings

Four key measures – green time, delay; queuing and travel time – were extracted from the VISSIM model to assess the signal operations and impacts to Redpath. See tables in the appendix for detailed information. Findings are reported for the build-out scenario (60 metre trains; 206 second headways).

The travel time segments extracted from the model provide the speed of transit along Queens Quay. The speed of transit from this analysis was compared to the speed of transit from the gate analysis to understand the effects of reducing the transit desired speed from 50 km/h (gate analysis) to 40 km/h (partial signal analysis).

3.2.1 Green Time

Table 3 summarizes green times modelled at the centre driveway for vehicles exiting the Redpath site. Green time is the measure of time in the peak hour that the traffic signals indicate green for a particular phase. Key summary findings:

- Average east-west main phase green time is expected to be in the order of 106 seconds between side street (Redpath) calls; and a total of 52 minutes over the peak hour.
- Average northbound green time is expected to be 10 seconds per phase, and a total of 2 minutes over the hour. This phase serves the minimums green only when called. The green time appears short because it is only served when called, but is sufficient to allow one truck to exit the site and can serve forecasted demand.

Table 3 – Green Time

Movement	Average Green Time[1]	Total Green Time[2]
East-West	106 seconds	52 minutes
Northbound	10 seconds	2 minutes

Notes:
1. Average amount of time the signal dwells in the main east-west phase per cycle
2. Total amount of time the signal is green over 60 minutes

3.2.2 Truck Delay

Table 4 summarizes vehicle delay modelled at the centre driveway for trucks entering and exiting the Redpath site. Delay is summarized as average delay (including stopped delay, acceleration/deceleration and queue delay) and stopped delay alone. Values reported are average over five simulations. Key summary findings:

- Average delay for a truck exiting Redpath is expected to be in the order of 25 to 50 seconds with stopped delay of approximately 15 to 40 seconds.
- All vehicles have an opportunity to exit during the peak hour. If there is a queue of more than one truck, the short phase may only allow one truck to exit per cycle.

Table 4 – Redpath Centre Driveway Truck Delay (seconds)

Movement	Average Delay[1]	Stopped Delay[2]
Eastbound Right	35 seconds	28 seconds
Northbound Left Northbound Right	26 seconds 51 seconds	16 seconds 42 seconds

Notes:
1. Average delay includes queue delay, acceleration/deceleration and stopped delay
2. Stopped delay is only delay incurred while stationary.

3.2.3 Truck Queuing

Given the low volumes at the centre driveway and adaptive nature of the signal, queuing is not expected to be a concern. Under special circumstances if two trucks are discharged from the loading bays at the same time, this is the only scenario where we would expect a queue of more than one truck. In this case, trucks may be required to leave the site one at a time (i.e. the second truck would need to wait for the next cycle).

While not included in the modelling done for this analysis, it is possible to include within the signal logic a green time extension for Redpath that can only be served if no transit vehicles are present within the detection zone. Queuing results are contained in the appendix.

3.2.4 Transit Delay

Table 5 summarizes transit vehicle delay modelled at the centre driveway for trams passing in front of the Redpath Centre driveway. Delay is summarized as average delay (including stopped delay, acceleration/deceleration and queue delay) and stopped delay. Key summary findings:

- Average delay for transit passing in front of the driveway is expected to be negligible in the order of 0.6 to 2.8 seconds with no stopped delay.
- Average delays indicate that trams may slow slightly on approach to the intersections either due to tram queues or trucks completing a manoeuvre.

Table 5 – Redpath Centre Driveway Tram Delay (seconds)

Movement	Average Delay[1]	Stopped Delay[2]
Eastbound Through	3 seconds	0 seconds
Westbound Through	1 seconds	0 seconds

Notes:
1. Average delay includes queue delay, acceleration/deceleration and stopped delay
2. Stopped delay is only delay incurred while stationary.

3.2.5 Transit Travel Times

Transit travel speeds are a key consideration assessing any planned transit service such as the proposed light rail for Queens Quay. This transit travel time comparison is specifically intended to assess impacts of reducing the transit vehicle desired speeds from 50 km/h as analyzed previously in the actuated gate analysis, to 40 km/h used in this partial signal analysis.

The total travel time used in this analysis is the sum of six different travel time segments which capture travel times for each block. The complete section is from Yonge Street to Lower Sherbourne Street and is approximately one kilometre long. Table 6 outlines the overall transit travel speeds. Key findings are as follows:

- With a tram desired speed of 50 km/h, the total travel time eastbound is 216.3 seconds or 16.7 km/h; and the total travel time westbound is 168.0 seconds or 21.7 km/h.
- With a tram desired speed 40 km/h, the total travel time eastbound is 220.6 seconds or 16.4 km/h; and the total travel time westbound is 164.3 seconds or 22.2 km/h.

Table 6 - Tram Travel Speeds

Desired Speed	Eastbound			Westbound		
	Time (s)	Speed		Time (s)	Speed	
		(m/s)	(km/h)		(m/s)	(km/h)
50 km/h	216.3	4.6	16.7	168.0	6.0	21.7
40 km/h	220.6	4.6	16.4	164.3	6.2	22.2
Change	**+4.3**	**-0.1**	**-0.3**	**-3.7**	**+0.1**	**+0.5**

Notes:
1. Total travel distance measured eastbound is 1002.5 metres.
2. Total travel distance measured westbound is 1011.8 metres.

From Table 6 we can see that reducing the tram desired speed or "running speed" from 50 km/h to 40 km/h does not have a significant impact on overall transit travel times and speeds. This is because transit vehicles travel at desired speed for only a portion of a travel time segment. The rest (most) of the time is spent accelerating, decelerating, boarding/alighting passengers, and stopped at signals.

4. SPECIAL CIRCUMSTANCES

4.1 Conflicts

If, under special or extreme circumstances, a truck does not clear the tracks by the time a TTC vehicle arrives, the truck would be required to clear the right-of-way immediately. In this case, the train must stop and wait for the truck to enter traffic along Queens Quay. Once the tracks are clear, the train may proceed. It should be possible to avoid this situation given the eastbound acceleration lane (include for this reason specifically) and westbound left turn lane which begins immediately west of the centre driveway.

4.2 Changes

After installation, any proposed changes to the access condition at Redpath (including alignment; signal operation etc.) will include consultation with Redpath, the City of Toronto, the TTC, and Waterfront Toronto.

5. CONCLUSIONS

Based on the analysis conducted using VISSIM, the following conclusions can be made:

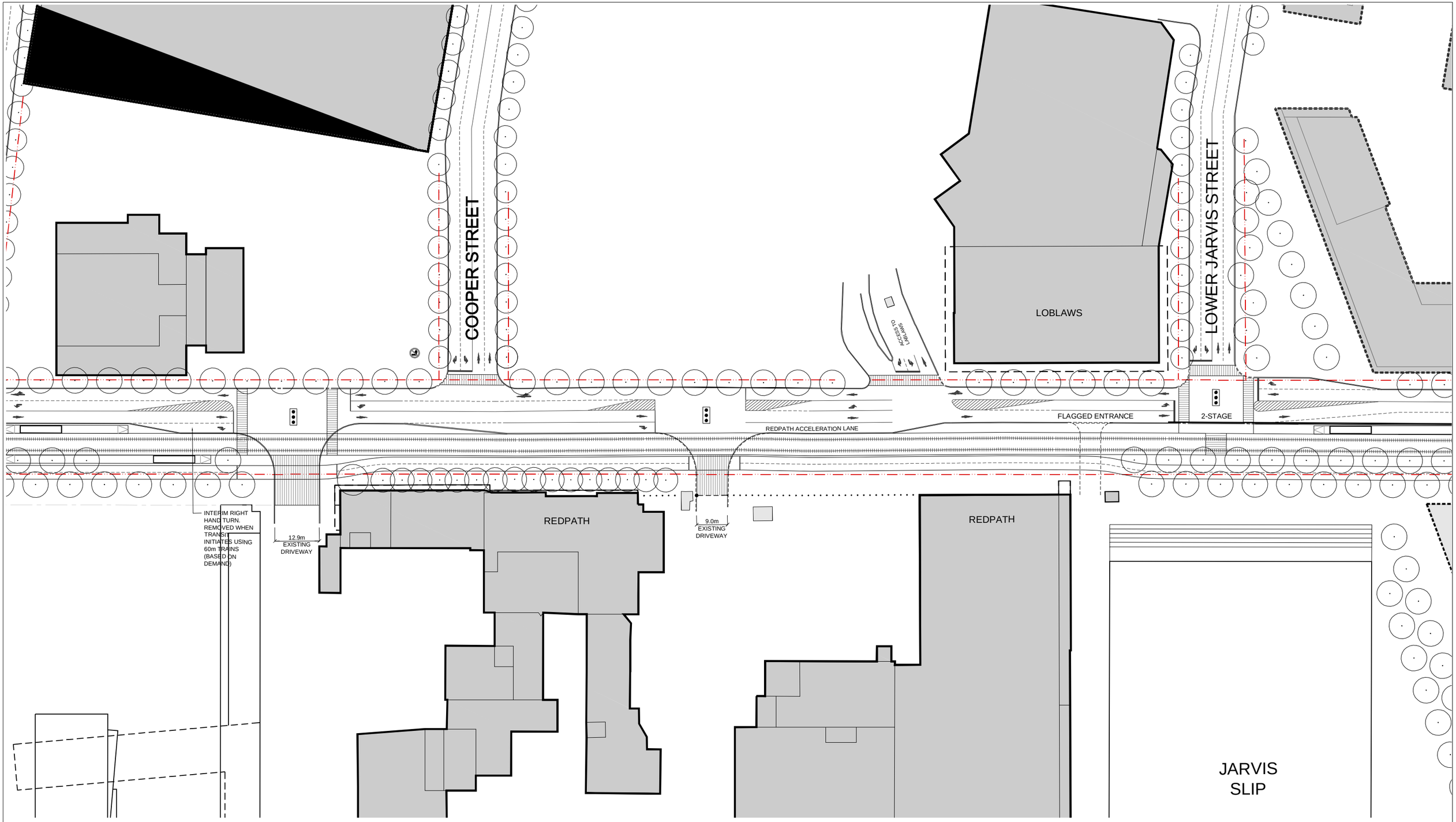
- There is sufficient green time to allow all forecasted truck demand to enter and exit the Redpath site at the centre driveway. The signal will dwell in east-west main phase green for most of the peak hour.
- Average delay for a truck exiting Redpath is expected to be in the order of 25 to 50 seconds with stopped delay of approximately 15 to 40 seconds.
- Queuing is not expected to be a problem for trucks exiting the Redpath centre driveway.
- No delay to transit is expected under normal operating conditions.
- Overall transit travel speeds are similar if posted at either 40 km/h or 50 km/h.

6. RECOMMENDATIONS

- A partially signalized intersection as described in this note is considered for implementation at the Redpath centre driveway in the south side transit alternative for the Queens Quay Revitalization EA.
- An eastbound acceleration lane is constructed to allow additional flexibility for trucks leaving the Redpath site to find a gap in eastbound traffic. This will reduce the occurrence of truck/light rail vehicle conflicts and potential transit delays.

7. ATTACHMENTS

7.1 Access Functional Plan



sheet number

9

QUEEN'S QUAY REVITALIZATION EA - SOUTH SIDE TRANSIT 2-WAY OPERATIONS

Central Waterfront EA - East Bayfront EA

WATERFRONToronto - City of Toronto - Toronto Transit Commission

PARTIALLY SIGNALIZED INTERSECTION AT REDPATH CENTRE DRIVEWAY

Redpath Sugar

2009-05-21

scale 1:1000

WEST 8 + DTAH

West 8 urban design & landscape architecture b.v .
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tel: 010 4855801 fax: 010 4856323 email: west8@west8.nl

du Toit Allsopp Hillier
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tel: 416.968.9479 fax: 416.968.0687 email: admin@dtah.com

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McCormick Rankin Corporation
2655 North Sheridan Way, Mississauga, ON L5K 2P8
tel: 905.823.8500 fax: 905.823.8503.

7.2 Network Traffic Volumes

DRAFT

Future Conditions: South Side 2-Way Turning Movements

York Street to Lower Jarvis Street

Queens Quay Revitalization EA

Transportation graphics

May 2009

ARUP

Legend

AM(PM)

Public Highway

F.G Gardiner Expressway

Private Driveways / Access

N

7.3 Redpath Truck Forecasts

REDPATH TRUCK TRIPS DURING SEPTEMBER, 2008

Start Time	Day/Date Tues	Wed	Thu	Fri	Mon	Tues	Wed	Thu	Fri	Mon	Tues	Wed	Thu	Fri	Mon	Tues	Wed	Thu	Fri	Mon	Tues	Totals	Avg	In	Out
Hour	**2**	**3**	**4**	**5**	**8**	**9**	**10**	**11**	**12**	**15**	**16**	**17**	**18**	**19**	**22**	**23**	**24**	**25**	**26**	**29**	**30**				
0	10	6	7	3	6	12	10	8	4	10	9	6	9	5	8	7	9	10	3	4	8	154	7	3	4
1	9	7	4	4	2	5	6	6	5	7	5	8	9	4	7	6	6	3	7	2	6	118	6	2	4
2	5	5	6	7	6	4	9	5	8	5	4	5	3	5	13	7	6	6	3	8	6	126	6	3	3
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4	7	12	10	6	10	9	11	9	8	7	8	10	9	8	7	6	5	9	6	12	8	177	8	5	3
5	8	7	9	8	11	9	11	10	10	9	7	9	11	8	9	9	5	10	6	9	6	181	9	5	4
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16	11	8	14	13	12	12	13	16	14	13	14	21	7	7	5	8	7	5	3	6	8	217	10	2	8
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19	8	10	7	6	10	13	9	8	9	13	12	10	5	6	7	10	5	12	6	4	5	175	8	6	2
20	6	7	7	6	7	5	7	7	2	4	8	6	14	7	7	7	8	6	7	6	8	142	7	3	4
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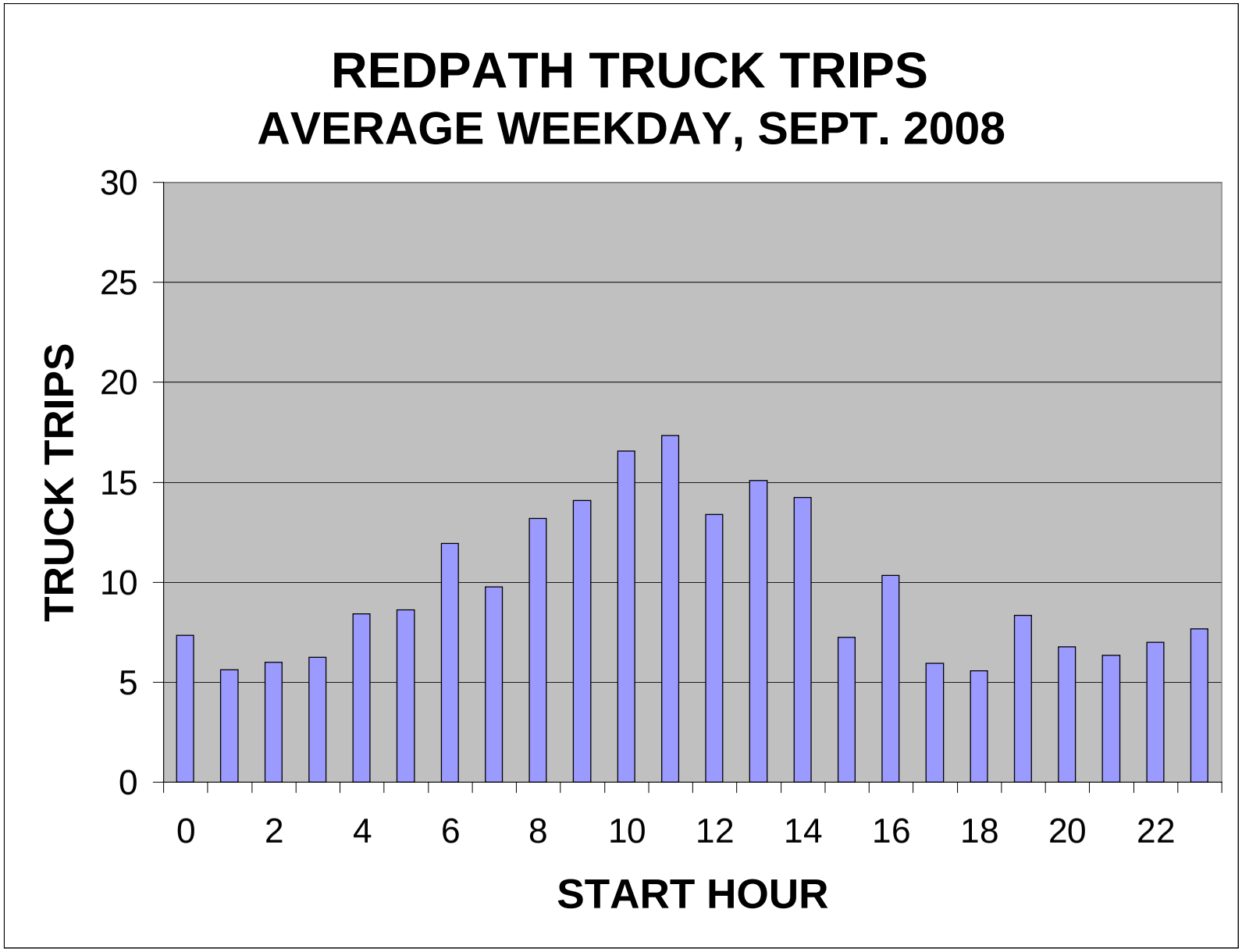
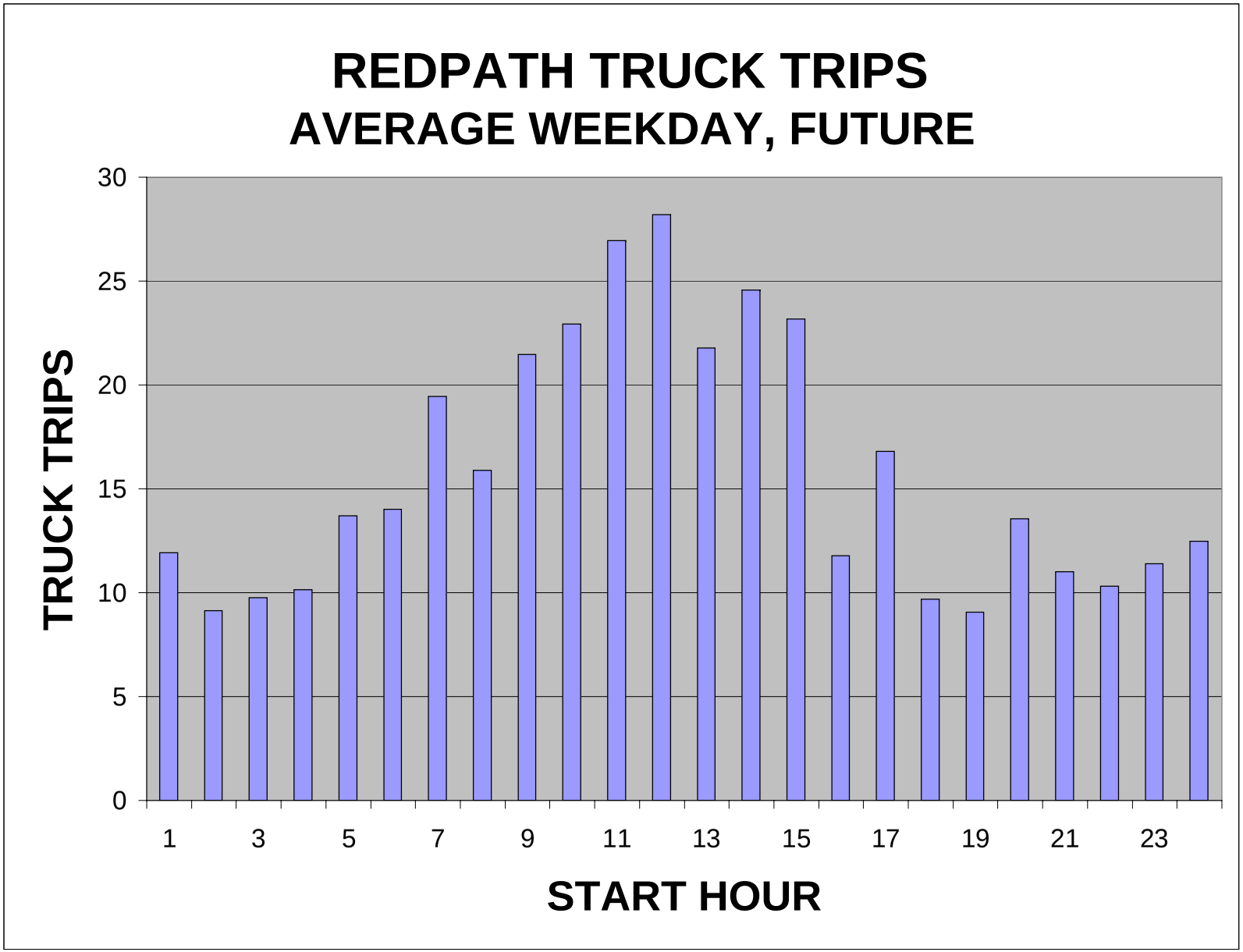
23	11	10	5	5	5	7	7	9	6	8	8	4	6	6	11	10	10	10	6	5	12	161	8	5	2
Totals	258	276	222	214	236	234	260	246	214	246	230	248	232	188	236	254	224	234	176	222	244	4894	**233**	117	117

Day	**Mon**	**Tues**	**Wed**	**Thu**	**Fri**	**Avg**
Avg	235	244	252	234	198	233
% of Avg	101%	105%	108%	100%	85%	


REDPATH TRUCK TRIPS
AVERAGE WEEKDAY, SEPT. 2008
TRUCK TRIPS
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
16
18
20
22
START HOUR

FUTURE REDPATH TRUCK TRIPS

Start Time Hour	Sept 2008 Avg	Near-term Growth	Full-cap Growth	Future Total Avg	In	Out
0	7	2	3	12	5	7
1	6	1	2	9	3	6
2	6	1	2	10	4	6
3	6	1	3	10	6	5
4	8	2	3	14	8	5
5	9	2	3	14	8	6
6	12	3	5	19	13	6
7	10	2	4	16	10	5
8	13	3	5	21	9	12
9	14	3	6	23	13	9
10	17	4	7	27	15	12
11	17	4	7	28	14	14
12	13	3	5	22	9	12
13	15	3	6	25	11	13
14	14	3	6	23	8	15
15	7	2	3	12	4	7
16	10	2	4	17	4	13
17	6	1	2	10	2	8
18	6	1	2	9	4	5
19	8	2	3	14	10	3
20	7	2	3	11	5	6
21	6	1	3	10	5	5
22	7	2	3	11	7	4
23	8	2	3	12	8	4
Totals	233	52	94	379	190	190


REDPATH TRUCK TRIPS
AVERAGE WEEKDAY, FUTURE
TRUCK TRIPS
30
25
20
15
10
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1
3
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7
9
11
13
15
17
19
21
23
START HOUR

7.4 Simulation Results

Project: Queens Quay Revitalization EA
Project ID: 096116-00
Date: September 1 2009
Analyst: MPG

Redpath Centre - Node 15 - Evalution; Average of Multirun Simulation Seeds 61 to 65

Movement	FromLink	ToLink	Movement	Veh(All)	aveQueue	Delay(All)	maxQueue	PersDelay(All)	tStopd(All)
Westbound Tram	9	9	E-W	17	0.0	0.6	0.0	0.6	0.0
Eastbound Tram	11	11	W-E	18	0.0	2.8	0.0	2.8	0.0
Eastbound Right	12	17	W-S	5	0.5	34.8	14.9	34.8	28.3
Northbound Left	15	61	S-W	4	0.6	26.3	12.6	26.3	15.7
Northbound Right	15	131	S-E	3	0.6	50.7	12.6	50.7	42.3
Eastbound Left (Loblaws)	60	10101	W-NE	34	8.7	7.0	135.8	7.0	6.5
Eastbound Through	60	132	W-E	570	8.7	9.9	135.8	9.9	8.8
Westbound Through	61	61	E-W	607	3.1	3.2	105.6	3.2	1.8

Notes:
FromLink: Number of the link entering node
ToLink: Number of the link leaving node
Movement: Movement (Bearing from-to)
Veh(All): Number of Vehicles, All Vehicle Types
aveQueue: Average Queue Length [m]
Delay(All): Average delay per vehicle [s], All Vehicle Types
maxQueue: Maximum Queue Length [m]
PersDelay(All): Average delay per person [s], All Vehicle Types
tStopd(All): Average stopped delay per vehicle [s], All Vehicle Types

Node evaluation Seed 61

File: j:\projects\96\96116\5 external project data\5-02 ptv\090805 vissim redpath signal\buildout 60m\206s buildout headways 60m trains_40kmh.inp
Comment:
Date: Thursday, August 20, 2009 12:42:40 PM
VISSIM: 5.10-07 [18115M]

Node 15: Redpath

Node: Node Number
FromLink: Number of the link entering node
ToLink: Number of the link leaving node
Movement: Movement (Bearing from-to)
Veh(All): Number of Vehicles, All Vehicle Types
aveQueue: Average Queue Length [m]
Delay(All): Average delay per vehicle [s], All Vehicle Types
maxQueue: Maximum Queue Length [m]
PersDelay(All): Average delay per person [s], All Vehicle Types
tStopd(All): Average stopped delay per vehicle [s], All Vehicle Types

Node	FromLink	ToLink	Movement	Veh(All)	aveQueue	Delay(All)	maxQueue	PersDelay(All)	tStopd(All)
15	9	9	E-W	17	0	0.6	0	0.6	0
15	11	11	W-E	18	0	2.9	0	2.9	0
15	12	17	W-S	5	0.5	33.7	12.6	33.7	27
15	15	61	S-W	5	0.9	30.9	12.5	30.9	20.2
15	15	131	S-E	2	0.9	87.7	12.5	87.7	78.1
15	60	10101	W-NE	27	4.1	5.9	150.3	5.9	6
15	60	132	W-E	557	4.1	4.7	150.3	4.7	3.9
15	61	61	E-W	585	3.7	3.5	106.2	3.5	2
15	0	0	All	1216	1.8	4.4	150.3	1.8	3.2
0	0	0	All	1216	1.8	4.4	150.3	1.8	3.2

Node evaluation Seed 62

File: j:\projects\96\96116\5 external project data\5-02 ptv\090805 vissim redpath signal\buildout 60m\206s buildout headways 60m trains_40kmh.inp
Comment:
Date: Thursday, August 20, 2009 12:47:17 PM
VISSIM: 5.10-07 [18115M]

Node 15: Redpath

Node: Node Number
FromLink: Number of the link entering node
ToLink: Number of the link leaving node
Movement: Movement (Bearing from-to)
Veh(All): Number of Vehicles, All Vehicle Types
aveQueue: Average Queue Length [m]
Delay(All): Average delay per vehicle [s], All Vehicle Types
maxQueue: Maximum Queue Length [m]
PersDelay(All): Average delay per person [s], All Vehicle Types
tStopd(All): Average stopped delay per vehicle [s], All Vehicle Types

Node	FromLink	ToLink	Movement	Veh(All)	aveQueue	Delay(All)	maxQueue	PersDelay(All)	tStopd(All)
15	9	9	E-W	18	0	0.7	0	0.7	0
15	11	11	W-E	18	0	2.5	0	2.6	0
15	12	17	W-S	5	0.7	45.7	12.5	45.7	38.7
15	15	61	S-W	3	0.4	18.4	12.7	18.4	8.1
15	15	131	S-E	5	0.4	26.5	12.7	26.5	17.7
15	60	10101	W-NE	34	18.2	13.6	179.6	13.6	13.2
15	60	132	W-E	588	18.2	14.7	179.6	14.7	13.3
15	61	61	E-W	617	3	4.1	133	4.1	2.1
15	0	0	All	1288	5.1	9.4	179.6	2.6	7.6
0	0	0	All	1288	5.1	9.4	179.6	2.6	7.6

Node evaluation Seed 63

File: j:\projects\96\96116\5 external project data\5-02 ptv\090805 vissim redpath signal\buildout 60m\206s buildout headways 60m trains_40kmh.inp
Comment:
Date: Thursday, August 20, 2009 12:51:46 PM
VISSIM: 5.10-07 [18115M]

Node 15: Redpath

Node: Node Number
FromLink: Number of the link entering node
ToLink: Number of the link leaving node
Movement: Movement (Bearing from-to)
Veh(All): Number of Vehicles, All Vehicle Types
aveQueue: Average Queue Length [m]
Delay(All): Average delay per vehicle [s], All Vehicle Types
maxQueue: Maximum Queue Length [m]
PersDelay(All): Average delay per person [s], All Vehicle Types
tStopd(All): Average stopped delay per vehicle [s], All Vehicle Types

Node	FromLink	ToLink	Movement	Veh(All)	aveQueue	Delay(All)	maxQueue	PersDelay(All)	tStopd(All)
15	9	9	E-W	17	0	0.6	0	0.6	0
15	11	11	W-E	18	0	2.6	0	2.6	0
15	12	17	W-S	3	0.2	30.5	12.4	30.5	24.6
15	15	61	S-W	6	0.7	35	12.6	35	25.7
15	15	131	S-E	1	0.7	60.1	12.6	60.1	51
15	60	10101	W-NE	39	0.4	11.4	82.6	11.4	10.7
15	60	132	W-E	558	0.4	14.4	82.6	14.4	13.6
15	61	61	E-W	606	1.9	1.8	88.9	1.8	1.1
15	0	0	All	1248	0.5	8	88.9	2.4	7.2
0	0	0	All	1248	0.5	8	88.9	2.4	7.2

Node evaluation Seed 64

File: j:\projects\96\96116\5 external project data\5-02 ptv\090805 vissim redpath signal\buildout 60m\206s buildout headways 60m trains_40kmh.inp
Comment:
Date: Thursday, August 20, 2009 12:56:09 PM
VISSIM: 5.10-07 [18115M]

Node 15: Redpath

Node: Node Number
FromLink: Number of the link entering node
ToLink: Number of the link leaving node
Movement: Movement (Bearing from-to)
Veh(All): Number of Vehicles, All Vehicle Types
aveQueue: Average Queue Length [m]
Delay(All): Average delay per vehicle [s], All Vehicle Types
maxQueue: Maximum Queue Length [m]
PersDelay(All): Average delay per person [s], All Vehicle Types
tStopd(All): Average stopped delay per vehicle [s], All Vehicle Types

Node	FromLink	ToLink	Movement	Veh(All)	aveQueue	Delay(All)	maxQueue	PersDelay(All)	tStopd(All)
15	9	9	E-W	17	0	0.5	0	0.5	0
15	11	11	W-E	18	0	3.1	0	3.1	0
15	12	17	W-S	5	0.4	26.6	24.5	26.6	20.2
15	15	61	S-W	5	0.6	13.2	12.5	13.2	2
15	15	131	S-E	3	0.6	55.1	12.5	55.1	47.4
15	60	10101	W-NE	32	8.8	2.6	145.9	2.6	1.3
15	60	132	W-E	551	8.8	5.4	145.9	5.4	4.7
15	61	61	E-W	600	1.9	1.9	97	1.9	1.1
15	0	0	All	1231	2.6	3.8	145.9	1.7	2.9
0	0	0	All	1231	2.6	3.8	145.9	1.7	2.9

Node evaluation Seed 65

File: j:\projects\96\96116\5 external project data\5-02 ptv\090805 vissim redpath signal\buildout 60m\206s buildout headways 60m trains_40kmh.inp
Comment:
Date: Thursday, August 20, 2009 1:00:33 PM
VISSIM: 5.10-07 [18115M]

Node 15: Redpath

Node: Node Number
FromLink: Number of the link entering node
ToLink: Number of the link leaving node
Movement: Movement (Bearing from-to)
Veh(All): Number of Vehicles, All Vehicle Types
aveQueue: Average Queue Length [m]
Delay(All): Average delay per vehicle [s], All Vehicle Types
maxQueue: Maximum Queue Length [m]
PersDelay(All): Average delay per person [s], All Vehicle Types
tStopd(All): Average stopped delay per vehicle [s], All Vehicle Types

Node	FromLink	ToLink	Movement	Veh(All)	aveQueue	Delay(All)	maxQueue	PersDelay(All)	tStopd(All)
15	9	9	E-W	17	0	0.5	0	0.5	0
15	11	11	W-E	18	0	2.7	0	2.7	0
15	12	17	W-S	5	0.5	37.3	12.6	37.3	30.9
15	15	61	S-W	3	0.6	33.9	12.8	33.9	22.7
15	15	131	S-E	6	0.6	24.1	12.8	24.1	17.3
15	60	10101	W-NE	39	12.1	1.6	120.5	1.6	1.1
15	60	132	W-E	596	12.1	10.1	120.5	10.1	8.6
15	61	61	E-W	628	5.2	4.9	102.7	4.9	2.5
15	0	0	All	1312	3.9	7.3	120.5	2.3	5.4
0	0	0	All	1312	3.9	7.3	120.5	2.3	5.4

DOCUMENT CHECKING (not mandatory for File Note)

	Prepared by	Checked by	Approved by
Name	Marc-Paul Gauthier	Colin Wong	David Pratt
Signature			