APPENDIX C

PERFORMANCE SENSITIVITY ANALYSIS OPTION 1 – TECHNICAL MEMO

Memorandum

To/Attention	TTC	**Date**	October 02, 2009
From	TCG	**Project No**	TO-24649
cc	RS/MC File	**Steno**	sd
Subject	Eglinton Crosstown LRT-Black Creek M&S Facility Performance Sensitivity Analysis Alternative 1 (At-Grade)		

A maintenance and storage facility (M&S facility) is proposed at the northwest quadrant of Eglinton Avenue West and Black Creek Drive to provide service to the Eglinton Crosstown, Jane, and St. Clair LRT lines. This facility will be used for loading and offloading LRV throughout the day, using Eglinton Avenue to access the various LRT lines. The purpose of this technical memo is to assess the feasibility of an at-grade (surface) interface between the M&S facility, and the Eglinton Crosstown LRT, and the anticipated impacts in the surrounding area.

There are three signalized intersections analyzed for the report:

- Eglinton Avenue West at Weston Road;
- Eglinton Avenue West at the North Access Driveway; and
- Eglinton Avenue West at Black Creek Drive.

This technical memorandum describes the background to this work, the methodology used to complete the analysis, the analysis assumptions, presents the analysis results, and identifies the preferred approach to an at-grade operation at the M&S facility. It also addresses the projected impact that the at-grade connection alternative may have on the development potential for lands on the south side of Eglinton Avenue, west of Black Creek Drive.

Background

Previous analysis has shown that an at-grade solution is theoretically feasible, but had little or no spare capacity during peak LRV loading cycles. A revised LRV loading plan was provided by the TTC on July 8, 2009. Further analysis was completed using the revised loading plan, and a technical memorandum dated July 22, 2009 was submitted to the TTC by the TCG. As part of this analysis, several techniques were tested that were designed to increase LRV capacity in the study area. The objective was to determine whether the at-grade alternative can operate with sufficient residual capacity. The specific techniques tested were:

- Adjusting the LRT operation to reduce LRV demands on Eglinton Avenue West;
- Reducing signal cycle lengths through the addition of actuated movements, and the elimination of vehicle and pedestrian phases;
- Increasing the LRT intersection capacity to allow more LRV to travel through the signalized intersection in a given cycle.

Past analysis described how increasing the LRV loading in the AM peak period from 1 hour 40 minutes to an even loading scenario extending to 2 hours and 30 minutes, would provide some residual capacity. The above techniques developed for the purpose of increasing the residual capacity, were applied to the

extended LRV loading. The results show that the techniques that resulted in a lower traffic signal cycle length increased the number of spare cycles, and residual system capacity.

The TCG presented the last analysis iteration to the TTC on July 22, 2009. This memo is in response to the TTC request for additional data, revisions and further analysis to be conducted with the following modifications:

- Present the residual capacity in “slots” rather than available cycle lengths. This will provide TTC staff with a more accurate representation of the number of slots available during the loading period in case of delays to the loading process;
- Provide analysis and slots available for recovery for time periods beyond just AM peak loading period. This includes analysis for the following operational scenarios:
  - AM loading;
  - AM unloading;
  - PM loading; and
  - PM unloading;
- Adjust LRT clearance times.

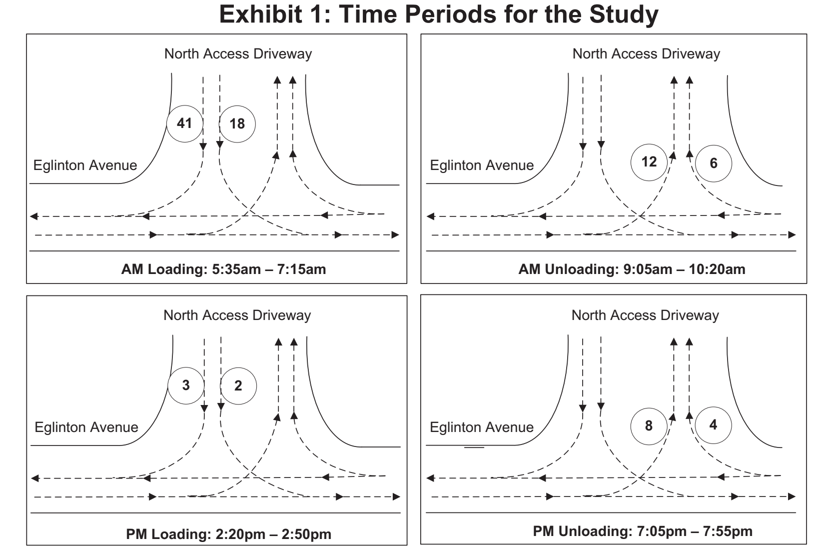
The analysis demonstrates that an at-grade system will work, provided the TTC extends the AM peak loading period, and uses a two-track system for vehicles entering and departing from the Black Creek M&S facility.

Methodology

This section describes the steps followed to conduct the analysis presented in this memo. This methodology was used to identify the number of slots available for recovery in the time periods selected, and they include the following steps:

1. Identify the analysis time periods where the loading and offloading from the North Access Driveway to/from Eglinton Avenue are anticipated to have the largest impact on the network. **Exhibit 1** illustrates the four loading and offloading periods that were chosen for this study, along with the number of LRVs, and the direction in which they are projected to load and unload.

Exhibit 1: Time Periods for the Study



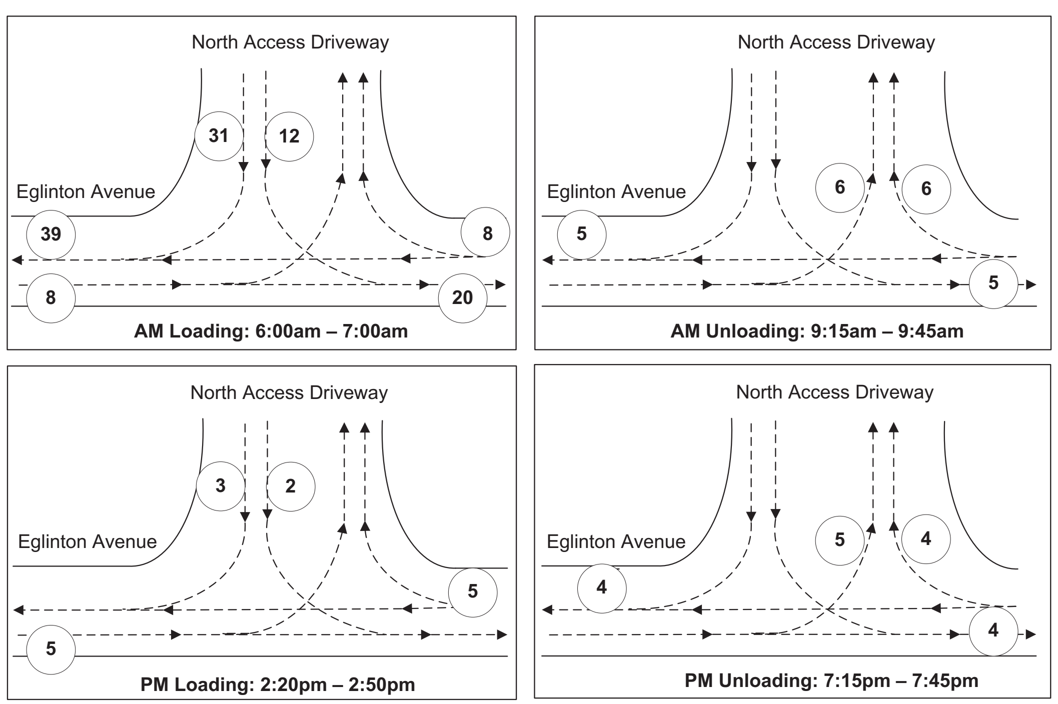
2. The time periods presented in step 1 are the projected time periods, as provided by TTC staff and outlined in the revised loading profile provided to the TCG in July, 2009. For analysis purposes, it is necessary to represent the above time periods as loading and offloading peak periods. The peak periods chosen for analysis were:
    - AM loading - 6:00am – 7:00am;
    - AM unloading – 9:15am – 9:45am;
    - PM loading – 2:20pm – 2:50pm; and
    - PM unloading – 7:15pm – 7:45pm.

    Typically, peak periods are represented by 1 hour peak periods when possible. The AM peak loading period is presented from 6:00am – 7:00am and the impact on the LRV loading and offloading during this 1 hour is analyzed.

    The remaining peak periods have been presented as 30 minute peak periods. This is due to the fact that the majority of the LRV loading and offloading occurs in 30 minute windows for these loading periods. Representing these peak periods over a 1 hour span would result in an overly optimistic representation of operating conditions. Similarly, calculating the LRV slots available in 30 minutes and multiplying them by 2 to represent a one hour loading period would present an overly conservative estimate. For this reason, the time periods are presented as 30 minute peak periods throughout the report (except for the AM loading).

    Exhibit 2 presents the AM and PM loading and offloading peak periods that are used for the analysis, and the LRV volumes during this time period.

Exhibit 2: Peak Periods for the Study



3. Review and identify the minimum LRT green requirements to cross each of the three intersections. The time for an LRV to make a turning movement from a stopped position was initially calculated to be 35 seconds. Through discussions with TTC Service Planning, this time was reduced to 28 seconds. Similarly, the time required for an LRV to progress through an intersection was calculated to be 25 seconds, and has been revised to 18 seconds. The calculations that resulted in these revised times are presented in **Appendix A**.
4. Identify the minimum pedestrian and vehicle crossing time requirements for each of the study signalized intersections.
5. Identify the minimum traffic signal timings for each turning movement at each of the study intersections.
6. Determine the cycle length, and number cycles per hour for each signalized intersection and scenario assuming that the three locations must remain coordinated at all times.
7. Determine the number of slots available for each of the LRT movements:
    - **Number of cycles** per time period determined by:

      Analysis Period (seconds)/ Cycle length (seconds)
    - **Available slots** = slots per cycle * number of cycles * cycle distribution
    - **Slots per cycle** are the number of slots available to progress the LRV through the intersection per cycle. This is determined by the green time available for each phase. Since it takes an LRV 18 seconds to cross an intersection, a green time of 18 seconds would allow for the progression of 1 LRV, and the availability of 1 slot. If 36 or more seconds are available, then 2 slots are assumed (36 seconds /18 seconds = 2).
    - **Cycle distribution** is the percentage of cycles in the analysis period, which are allocated to a LRT movement. E.g. if 18 LRVs are progressing through Weston Road in the eastbound direction, and 8 of them are turning into the carhouse while 10 of them are continuing eastbound, then the distribution is 44% turning into the carhouse (8/18) and 54% continuing eastbound (10/18).

      The reason the cycle distribution is used is that the slots are calculated based on the LRV destination and origin.
8. Determine the spare number of slots for the specified time periods:
    - **Spare slots** = Available Slots – Number of trains
9. Calculate the spare capacity for each of the LRT movements:
    - **Spare Capacity (%)** = Spare slots/Available slots

Assumptions

The following assumptions have been made for the purpose of this study:

1. **Exhibit 3** presents the minimum traffic signal cycle length for the existing study signalized intersections, based on the minimum phase times for the pedestrian and vehicles. The minimum pedestrian timing requirements are based on the guidelines provided by the City of Toronto for the Transit City work.

Exhibit 3: Study Signalized Intersection Minimum Phase Times

Intersection	East-West Left Turn			East-West Through				North-South Left Turn			North-South Through				Cycle Length
	Green	Amber	Red	Green & Walk	Green & FDWK	Amber	Red	Green	Amber	Red	Green & Walk	Green & FDWK	Amber	Red	
Weston Road	7	4	2	7	15	4	2	-	-	-	7	21	4	3	76
Black Creek Drive	6	4	3	7	21	4	3	5	5	3	7	21	5	3	97

2. Two tracks exit the North Access Driveway. The first track is available for westbound vehicles exiting the driveway, and the second track is dedicated to eastbound LRVs.
3. Two tracks enter the North Access Driveway. The first track is available for westbound vehicles entering the driveway, and the second track is dedicated to eastbound LRVs.
4. The LRV clearance time for an intersection is 18 seconds while the time required to clear a corner turn is 28 seconds

AM Loading

Based on the minimum timing requirements shown in Exhibit 3, and the need for coordination, the minimum cycle length for the three intersections is 100 seconds (rounded up from 97 seconds). The 100 second cycle length provides 36 cycles per hour (3600 seconds /hour/100 seconds/ cycle). The 36 cycles do not provide sufficient capacity to serve the 43 trains at the North Access Driveway (31 southbound right + 12 southbound left) exiting the North Access Driveway as presented in Exhibit 4.

Exhibit 4: Slots Available in the AM Loading Peak Period

	At Weston				North Driveway						At Black Creek			
	EB On Service	EB to CH	WB On Service	WB from CH	EB On Service	EBL to CH	SBR from CH	SBL from CH	WBR to CH	WB On Service	EB On Service	EB from CH	WB On Service	WB to CH
Total slots available per time period	36	0	7	29	36	0	36	36	0	36	14	22	36	0
Slots used	8	0	8	31	8	0	31	12	0	8	8	12	8	0
Spare slots per movement	28	0	-1	-2	28	0	5	24	0	28	6	10	28	0
Spare slots per intersection	28		-3		28		5		28		16		28	
Percentage of slots available per time period	78%		-8%		78%		14%		78%		44%		78%	

The westbound LRV movement at Eglinton Avenue and Weston Road will operate above capacity and with no slots available for recovery purposes (-3 slots).

In order to increase the intersection capacity to progress LRVs at Weston Road, the east-west phase timing at Weston Road should be increased to be able to progress 2 LRVs in one cycle (36 seconds). The LRV trains exiting the North Access Driveway in the southbound right direction (westbound) should be loaded in a back-to-back mode i.e. two trains in one cycle. For a back-to-back operation to be feasible at North Access Driveway, a minimum cycle length of 84 seconds is required (28 seconds east-

west phase + 56 seconds southbound phase) based on the minimum LRV phase time of 28 seconds. Since the three intersections will be operating in a coordinated mode, the intersection with the highest cycle length will dictate the signal timings for the other two intersections. The minimum cycle length for the intersection of Eglinton Avenue at Black Creek Drive is 97 seconds. The assumption is that a cycle length of 100 seconds is required for all three intersections.

As outlined in the methodology, the total number of slots available per time period is calculated, followed by the number of spare slots available over that same time period, in this case 1 hour. This type of analysis is conducted for each of the movements at the three intersections for the back-to-back loading scenario. The movement with the least number of slots will dictate the overall number of slots available for the three intersections. **Exhibit 5** presents the slots available for recovery for the LRV based on the loading profile provided by the TTC assuming back-to-back LRV loading is possible, with no adjustments made to the loading period.

Exhibit 5: Slots Available in the AM Loading Peak Period (Back-to-back Loading)

	At Weston				North Driveway						At Black Creek			
	EB On Service	EB to CH	WB On Service	WB from CH	EB On Service	EBL to CH	SBR from CH	SBL from CH	WBR to CH	WB On Service	EB On Service	EB from CH	WB On Service	WB to CH
Total slots available per time period	36	0	12	47	36	0	72	36	0	36	14	22	36	0
Slots used	8	0	8	31	8	0	31	12	0	8	8	12	8	0
Spare slots per movement	28	0	4	16	28	0	41	24	0	28	6	10	28	0
Spare slots per intersection	28		20		28		24		28		16		28	
Percentage of slots available per time period	78%		34%		78%		67%		78%		44%		78%	

The number of spare slots available for LRV recovery at Eglinton Avenue at Weston Road is 20 per hour, while the number of slots available for the intersection of Eglinton Avenue at North Access Driveway is 24 per hour, and the number of slots available at Eglinton Avenue West at North Access Driveway is 16 slots per hour. As a result, 16 slots would be available for recovery purposes due to possible delays occurring during loading in the AM Peak.

Methods to Increase Capacity

As discussed in the beginning of this memo, three strategies were tested to provide more residual capacity for the LRV, they are:

- Adjust the LRT operation to reduce LRV demands on Eglinton Avenue West;
- Reduce signal cycle lengths through the addition of actuated movements, and the elimination of vehicle and pedestrian phases; and
- Increase the LRT intersection capacity to allow more LRV to travel through the signalized intersection in a given cycle.

The following applies these three strategies to the AM peak loading profile.

Adjust LRV Operation

Two strategies applied to adjust the LRV operation, and reduce the peak hour LRV volumes in the study area:

- Expand the LRV loading window to reduce the peak hour loading (i.e. begin loading earlier); and
- Reduce the number of cars per train (2 car trains on Eglinton Crosstown only).

Expanding the LRV Loading Window

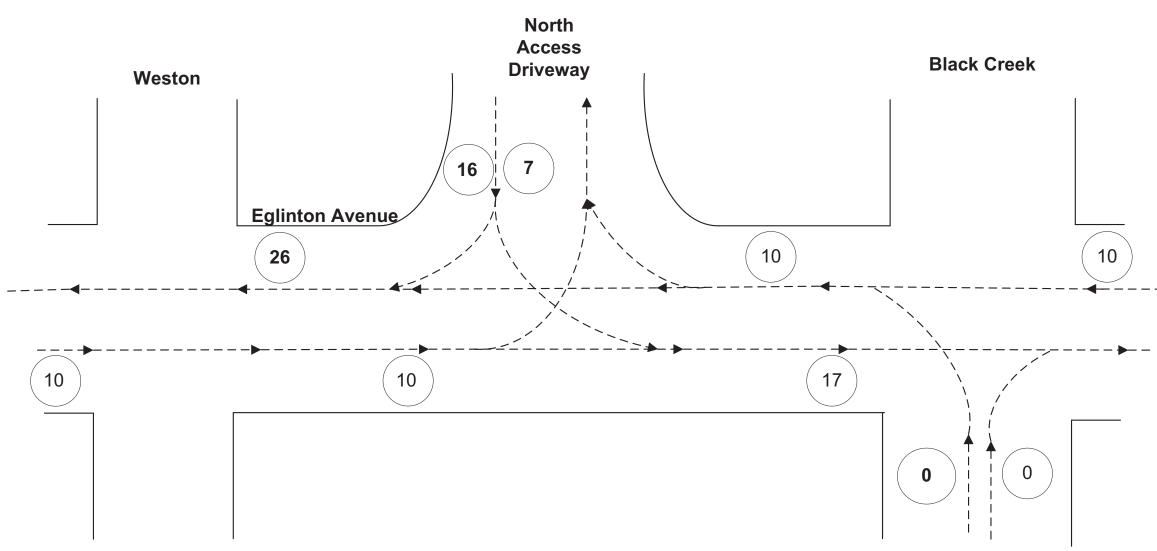
Based on the loading assumptions provided by the TTC, the trains in the AM peak are loaded onto the network between the hours of 5:35 am and 7:15 am. To test the impact of a longer loading window on LRV operations, loading times of 2.5 hours, and 3 hours, were analyzed. The strategy included the use of existing LRV loading volumes provided by the TTC, and distributing this loading evenly over the longer timeframe. A 100 second cycle length was used for analysis of the two even loading scenarios.

Exhibit 6 presents the peak hour LRV loading volumes when loading is extended over a 2.5 hour window. **Exhibit 7** presents the peak hour loading LRV volumes when even loading is extended over a 3 hour window. The following are the precise loading times for the three different LRV loading scenarios:

- Base Case: 1 hour 40 minutes (5:35 am – 7:15 am);
- Even Loading: 2 hours and 30 minutes (5:00 am – 7:30 am); and
- Even Loading: 3 hours (4:30 am – 7:30am).

When comparing the volumes from **Exhibit 6** with the volumes shown in **Exhibit 2** for the AM loading period, a reduction in peak hour LRV loading volumes is observed from the North Access Driveway (23 LRV compared to 43 LRV). A fewer number of LRV's crossing the intersection of Eglinton Avenue and Weston Road is observed in the westbound direction (24 LRV compared to 38 LRV), which is the critical movement. As a result, it is feasible to progress one eastbound LRV each cycle i.e. not in a back-to-back mode.

Exhibit 6: 2.5 Hour LRV AM Even Loading Volumes



When comparing the loading volumes between **Exhibit 6** (2.5 hour even loading) and **Exhibit 7** (3 hour even loading), a slight reduction is observed in the number of LRV's loading onto the network.

Exhibit 7: 3 Hour LRV AM Even Loading Volumes

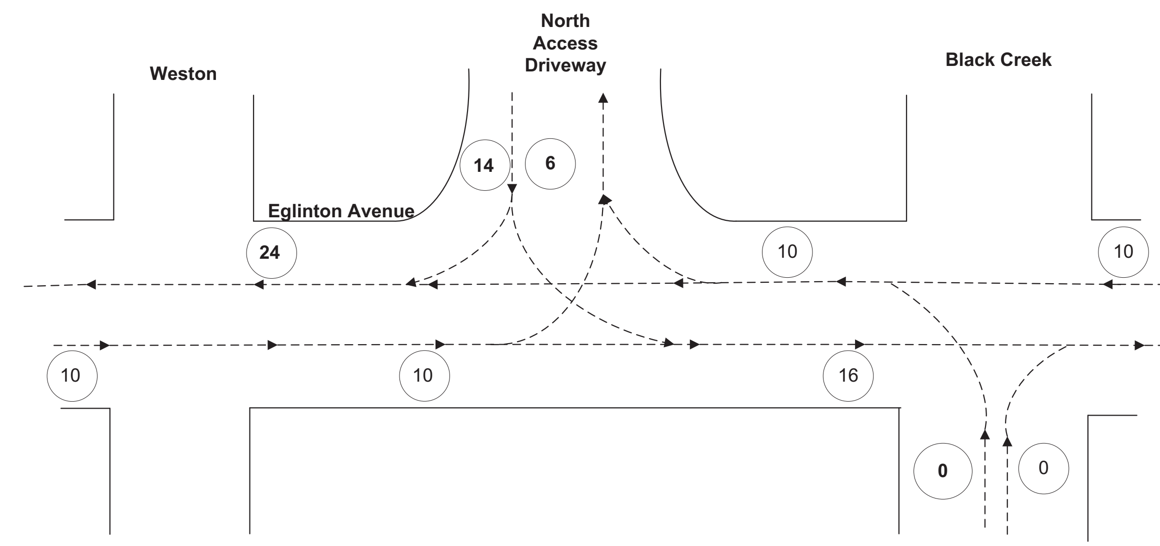
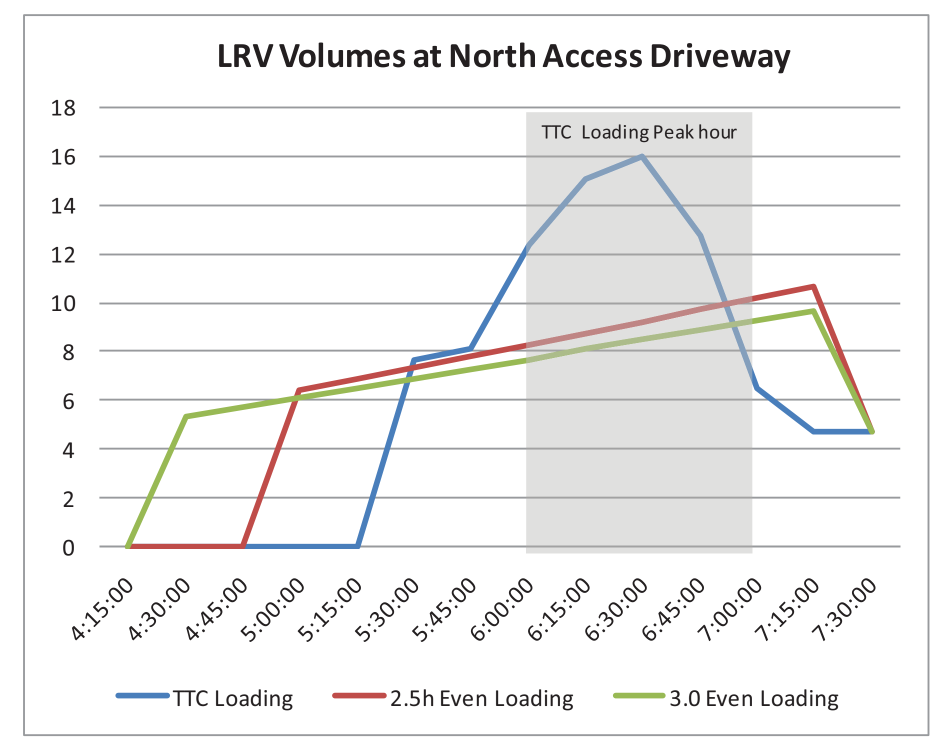


Exhibit 8 illustrates the difference in the total number of trains loading and crossing the intersection of Eglinton Avenue and North Access Driveway using the various loading timeframes.

Exhibit 8: LRT Loading Plus In-service Volumes



It is important to note that although the loading is distributed evenly in the 2.5 and 3 hour loading, there is still an increase in the total number of LRV vehicles crossing the North Access Driveway intersection. This is due to the eastbound and westbound LRV vehicles that are already loaded on the network, and that would cross the intersection during the loading time period.

Based on the loading volumes presented in **Exhibit 6** and **Exhibit 7**, the number of spare slots was calculated at each of the signalized intersections. The results are presented in **Exhibit 9**.

Exhibit 9: Even Loading Over an Extended Time Period

Scenario	Peak Hour Slots							Overall	Percentage
	At Weston		North Driveway			At Black Creek			
	EB	WB	EB	SB	WB	EB	WB		
1 hour 40 minute loading	28	-3	28	5	28	16	28	-3	N/A
2.5 hour even loading	26	10	26	20	26	19	26	10	28%
3 hour even loading	26	12	26	22	26	21	26	12	33%

For the loading scenarios presented above, the number of slots available for the network is determined by the eastbound movement at the intersection of Eglinton Avenue at Black Creek Drive. Ten (10) slots, or 28% of the total slots would be available for recovery purposes in the AM peak period (6:00am – 7:00am), when applying the 2.5 hour even loading, while 12 slots, or 33% of the total slots would be available when applying the 3 hour even loading scenario. As presented in **Exhibit 5,** the one hour back to back loading has significantly more slots available (16) for recovery purposes when compared with the 2.5 hour loading and the 3 hour loading. However, the 2.5 and 3 hour loading scenarios have assumed only one LRV can progress through the intersection of Eglinton Avenue at the North Access Driveway i.e. no back-to-back operations.

The results in **Exhibit 9** demonstrate how increasing the loading time window impacts the intersections' ability to progress the LRV by providing additional slots for recovery in the event that the trains are delayed, and not loaded according to the schedule. In theory, the longer loading window should provide more slots. However, the three hour loading scenario shows a diminishing benefit in comparison to the 2.5 hr even loading, and may not be practical due to scheduling requirements and constraints. For this reason, the 2.5 hour loading scenario has been assumed as the most likely scenario, and is used as the "base" for the rest of the AM loading analysis.

Reducing Number of Cars per Train

The above analyses has assumed that each LRV is composed of three (3) cars. For this scenario, the analysis assumes that a two-train car consist is used. In theory, the reduction in number of cars per LRV would lead to an increase in capacity since less green time would be required to progress the shorter vehicle. However, this is not always true since, in this case, the minimum east-west green time at the intersections of Eglinton Avenue West at Weston Road and Eglinton Avenue West and Black Creek Drive is governed by the pedestrian requirements, rather than the LRV requirements. Based on these pedestrian requirements, the cycle length cannot be reduced from a 100 second cycle. Since the three intersections should operate in coordination, there is no benefit of reducing the train length.

Reduced Signal Cycle Length

There are several techniques for reducing the minimum cycle lengths at the Weston Road, and Black Creek Drive signalized intersections, namely:

- Re-routing left turn movements, and removing the left turn phase;
- Two-stage north-south pedestrian crossing;
- Introduction of pedestrian buttons; and
- Pedestrian overpass to eliminate pedestrian phase;

The following presents the analysis completed for the above techniques for reducing the signal cycle length.

Rerouting Left Turn Movements

The analysis focuses on re-routing left turn movements at the intersection of Eglinton Avenue West at Black Creek Drive. Currently, vehicles completing left turns at the intersection of Eglinton Avenue West at Black Creek Drive are provided with a 13 second protected-permissive phase (minimum) in both the north-south direction and the east-west direction. Rerouting left turn movements at the intersection of Eglinton Avenue at Black Creek Drive decreases the minimum cycle to 71 seconds. However the intersection of Eglinton Avenue West and Weston Road has a minimum timing requirement of 76 seconds, resulting in a rounded cycle length between the three intersections of 80 seconds. The decrease in cycle length translates into an increase in the number of slots available for recovery from 10 to 19 per hour.

Exhibit 10 presents the number of slots available for recovery with the 2.5 hour even loading scenario, and a 2.5 hour loading scenario combined with the rerouted left turns.

Exhibit 10: Slots Available for Rerouted Left Turns at Eglinton Avenue/Black Creek Drive

Scenario	Peak Hour Slots							Overall	Percentage
	At Weston		North Driveway			At Black Creek			
	EB	WB	EB	SB	WB	EB	WB		
2.5 hour Loading	26	10	26	20	26	19	26	10	28%
Rerouting left Turns & 2.5 Hour Loading	35	19	35	29	35	28	35	19	42%

Based on the above analysis, 19 slots, or 42% of the total slots are available as a spare capacity for LRV recovery purposes.

Two-Stage North-South Pedestrian Crossing

Providing a two-stage north-south crossing for pedestrians will allow for the reduction in the intersection cycle length. For this scenario, a two-stage crossing has been assumed for pedestrians crossing the intersection at Eglinton Avenue West at Black Creek Drive, and Eglinton Avenue West at Weston Road in both the north-south and east-west direction. It is important to note that a two-stage crossing reduces the flashing don't walk duration by approximately half (depending on the roadway geometry), while the minimum walk duration, amber and all red remain the same. As a result, the cycle length is reduced by approximately 18 seconds at Weston Road and by 22 seconds at Black Creek Drive. This reduces the minimum cycle length at Weston Road to 58 seconds and at Black Creek Drive to 75 seconds, with a rounded cycle length of 75 seconds.

Exhibit 11 presents the number of cycle available for recovery with the 2.5 hour loading scenario, and a 2.5 hour loading scenario combined with the rerouted left turns.

Exhibit 11: Providing Two Stage Crossing at Eglinton Avenue/ Black Creek Drive

Scenario	Peak Hour Slots							Overall	Percentage
	At Weston		North Driveway			At Black Creek			
	EB	WB	EB	SB	WB	EB	WB		
2.5 hour Loading	26	10	26	20	26	19	26	10	28%
Two-stage Pedestrian Crossing & 2.5 Hour Loading	38	22	38	32	38	31	38	22	46%

Based on the above analysis, 22 slots, or 46% of the total slots will be available as a spare capacity for LRV recovery purposes.

Introduction of Pedestrian Buttons

Providing pedestrian buttons at the intersections of Eglinton Avenue West at Black Creek Drive, and Eglinton Avenue West at Weston Road will eliminate the continual operation of the north-south, and east-west pedestrian phase. As a result, these signalized intersections can operate on a shorter cycle length, based on vehicle demand.

When the pedestrian push buttons are activated, the signal length will be increased to accommodate the pedestrian time. Following the pedestrian phase, resynchronization is required to coordinate the traffic signals, which may take 2 or 3 signal cycles. This is similar to a transit signal priority treatment. The average cycle length is uncertain as some cycles are shorter than others. If it is assumed that the push buttons are activated every other cycle, then a cycle length of 80 seconds is an acceptable approximation.

Exhibit 12 presents the number of slots available for recovery with the 2.5 hour loading scenario, and a 2.5 hour loading scenario combined with the introduction of pedestrian push buttons.

Exhibit 12: Introduction of Pedestrian Buttons

Scenario	Peak Hour Slots							Overall	Percentage
	At Weston		North Driveway			At Black Creek			
	EB	WB	EB	SB	WB	EB	WB		
2.5 hour Loading	26	10	26	20	26	19	26	10	28%
Pedestrian Buttons and 2.5 Hour Loading	35	19	35	29	35	28	35	19	42%

Based on the above analysis, 25 slots, or 49% of the total slots will be available as a spare capacity for LRV recovery purposes.

Pedestrian Overpass

The introduction of a pedestrian overpass at the signalized intersections of Eglinton Avenue West at Black Creek Drive, and Eglinton Avenue West at Weston Road will eliminate the north-south pedestrian phase. As a result, these signalized intersections can operate on a shorter cycle length, based on vehicle demand. However, unlike the pedestrian push button option, with the pedestrian overpass the pedestrian timings (flashing don't walk) are eliminated from the traffic signal composition, and the only constraints is a result of vehicle requirements. Based on vehicle demand, a cycle of 80 seconds is feasible.

Exhibit 13 presents the number of slots available for recovery with the 2.5 hour loading scenario, and a 2.5 hour loading scenario combined with the introduction of a pedestrian overpass.

Exhibit 13: Pedestrian Overpass

Scenario	Peak Hour Slots							Overall	Percentage
	At Weston		North Driveway			At Black Creek			
	EB	WB	EB	SB	WB	EB	WB		
2.5 hour Loading	26	10	26	20	26	19	26	10	28%
Pedestrian Overpass and 2.5 Hour Loading	35	19	35	29	35	28	35	19	42%

Based on the above analysis, 19 slots, or 42% of the total slots will be available as a spare capacity for LRV recovery purposes in one hour.

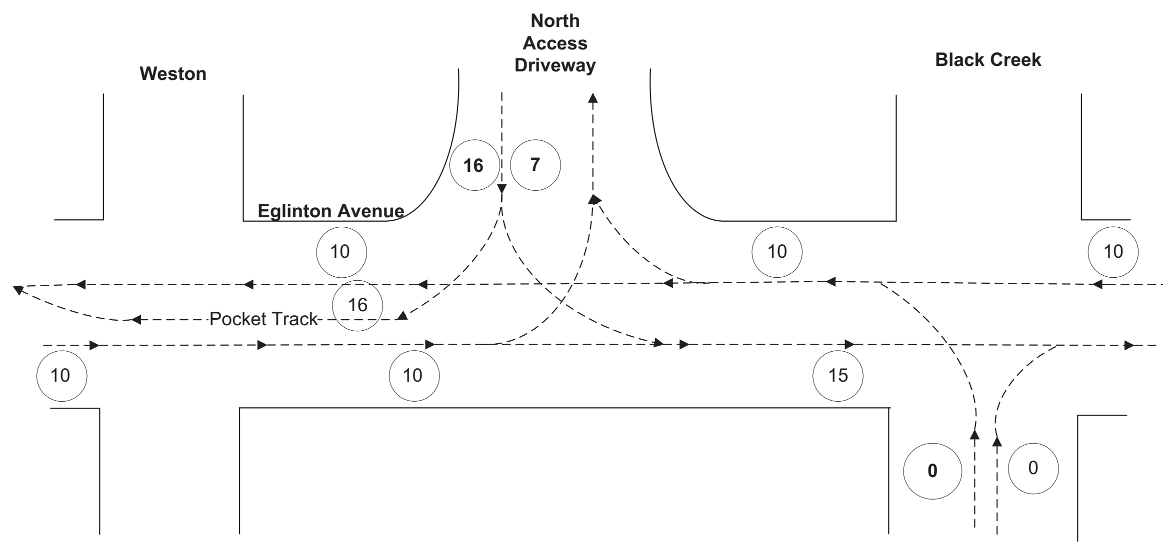
Increasing LRT Capacity at Intersections

Increasing the LRT capacity at the intersections may be achieved by increasing the number of tracks crossing the intersection in such a way that two trains can cross the intersection in the same direction at the same time, and without any conflict. The scenario analyzed in this section provides a westbound parallel track at Weston Avenue.

A parallel track assumes an extra track is available and operates parallel to the main track. Of the three intersections, the critical intersection for LRV operations is Eglinton Avenue West at Weston Road. A track parallel to the main track would assist in loading the westbound LRV vehicles without interfering with the primary track.

In this scenario, all 16 trains being loaded in the westbound direction would be loaded into a second track west of the driveway, and parallel to the main track. The remaining trains already operating on the track will use the main track. The trains being loaded onto the network proceed in a westbound route parallel to the main track until they have crossed the intersection of Eglinton Avenue at Weston Road. After crossing this intersection they will merge with the main track in the westbound direction. This operation is illustrated in **Exhibit 14**.

Exhibit 14: Westbound Parallel tracks



Using a 100 second cycle length, **Exhibit 15** presents the number of cycle available for recovery with the 2.5 hour loading scenario, and a 2.5 hour loading scenario combined with the introduction of a parallel track.

Exhibit 15: Parallel Track Analysis

Scenario	Peak Hour Slots							Overall	Percentage
	At Weston		North Driveway			At Black Creek			
	EB	WB	EB	SB	WB	EB	WB		
2.5 hour Loading	26	10	26	20	26	19	26	10	28%
Parallel Track and 2.5 Hour loading	26	46	26	20	26	19	26	19	53%

Based on the above analysis, 19 slots, or 53% of the total slots will be available as a spare capacity for LRV recovery purposes.

This option provides the intersection of Eglinton Avenue West at Weston Road with the opportunity to increase the intersection's LRV capacity and progress the LRV's comfortably, it is important to note that the design and construction of a second track parallel to the main track would have a significant impact on the properties in the area, and the railway bridge reconstruction.

AM Loading Summary of Findings

Exhibit 16 summarizes the above analysis for the AM loading period.

Exhibit 16: AM Peak LRV Loading Summary of Findings

Scenario	Cycle length (seconds)	Peak Hour Slots							Overall	Percentage
		At Weston		North Driveway			At Black Creek			
		EB	WB	EB	SB	WB	EB	WB		
1 Hour 40 minute loading	100	28	-3	28	5	28	16	28	-3	N/A
1 hour 40 minute loading (back-to-back)	100	28	20	28	24	28	16	28	16	44%
2.5 hour loading	100	26	10	26	20	26	19	26	10	28%
3 hour even loading	100	26	12	26	22	26	21	26	12	33%
Reducing Cars per Train & 2.5 Hour Loading	100	26	10	26	20	26	19	26	10	28%
Rerouting left Turns & 2.5 Hour Loading	80	35	19	35	29	35	28	35	19	42%
Two-stage Pedestrian Crossing & 2.5 Hour Loading	75	38	22	38	32	38	31	38	22	46%
Pedestrian Buttons and 2.5 Hour Loading	80	35	19	35	29	35	28	35	19	42%
Pedestrian Overpass and 2.5 Hour Loading	80	35	19	35	29	35	28	35	19	42%
Parallel Track and 2.5 Hour loading	100	26	46	26	20	26	19	26	19	53%

The following summarizes the results of the analysis for the 1 hour loading peak period in the AM:

- Without implementing any strategies to increase LRV capacity, the base scenario does not provide any slots for recovery over a 1 hour period;
- Implementing a back-to-back operation at Eglinton Avenue at the North Access Driveway provides for 16 slots during the 1 hour period for recovery purposes;
- Expanding the loading window to 2.5 hours provides 10 slots for recovery purposes;
- Expanding the loading window to 3 hours provides 12 slots for recovery purposes;
- Reducing the cars per train has no impact on the network, when compared to the base scenario;
- Rerouting vehicle left turns results in a decrease in the cycle length from 100 seconds to 80 seconds, and increases the slots available for recovery to 10, or 28% of the total slots available in 1 hour, when coupled with the 2.5 hour even loading;
- Implementing a two-stage pedestrian crossing results in a decrease in the cycle length from 100 seconds to 75 seconds, and increases the slots available for recovery to 22, or 46% of the total slots available in 1 hour, when coupled with the 2.5 hour even loading;
- Introducing pedestrian push buttons results in a decrease in the cycle length from 100 seconds to 80 seconds, and increases the slots available for recovery to 19, or 42% of the total slots available in 1 hour, when coupled with the 2.5 hour even loading;
- Constructing a pedestrian overpass results in a decrease in the cycle length from 100 seconds to 80 seconds, and increases the slots available for recovery to 19, or 53% of the total slots available in 1 hour, when coupled with the 2.5 hour even loading; and

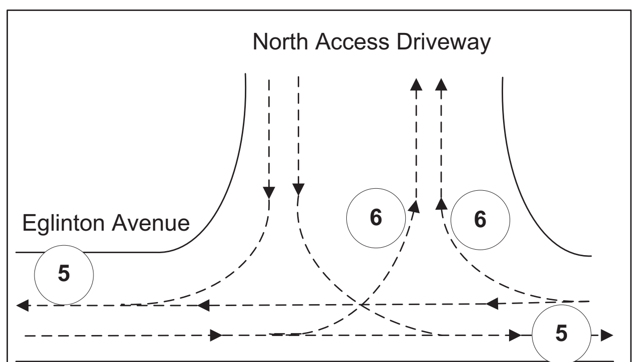
- Constructing a parallel track from the North Access Driveway to Eglinton Avenue at Weston Road provides for 19 slots, or 53% of the total slots available in 1 hour, when coupled with the 2.5 hour even loading.

AM Offloading

As presented in the methodology, 18 LRV are expected to be taken out of service between 9:05am and 10:20pm, with 12 LRVs being taken off out of service from the west, and 6 LRVs offloaded from the east. Although the unloading process extends over a period of 1 hour and 15 minutes, the majority of the offloading occurs in a 30 minute interval, between 9:15am and 9:45am.

The 30 minute interval where the majority of the offloading occurs was selected as the time period for this analysis. **Exhibit 17** illustrates the LRV volumes on Eglinton Avenue, and the LRV offloading into the carhouse during the selected AM period.

Exhibit 17: AM Peak LRV Offloading Volumes



AM Unloading: 9:15am – 9:45am

For the AM offloading period, the following scenarios were analyzed for the three intersections:

- No modifications to the LRV volumes and time period;
- Reducing cars per train from 3 to 2;
- Rerouting left turning vehicles;
- Introducing a two-stage pedestrian crossing;
- Implementing pedestrian push buttons; and
- Constructing a pedestrian overpass.

Exhibit 18 presents the results of the analysis for the above scenarios. The worksheets used for the analysis are presented in **Appendix B**.

Exhibit 18: AM Peak LRV Offloading Summary of Findings

Scenario	Cycle length (seconds)	Peak Half Hour Slots							Overall	Percentage
		At Weston		North Driveway			At Black Creek			
		EB	WB	EB	SB	WB	EB	WB		
30 Minute offloading	100	7	13	13	12	13	13	7	7	39%
Reducing Cars per Train	100	7	13	13	12	13	13	7	7	39%
Rerouting left Turns	80	11	17	17	16	17	17	11	11	50%
Two-stage Pedestrian Crossing	75	13	19	19	18	19	19	13	13	54%
Pedestrian Buttons	80	11	17	17	16	17	17	11	11	50%
Pedestrian Overpass	80	11	17	17	16	17	17	11	11	50%

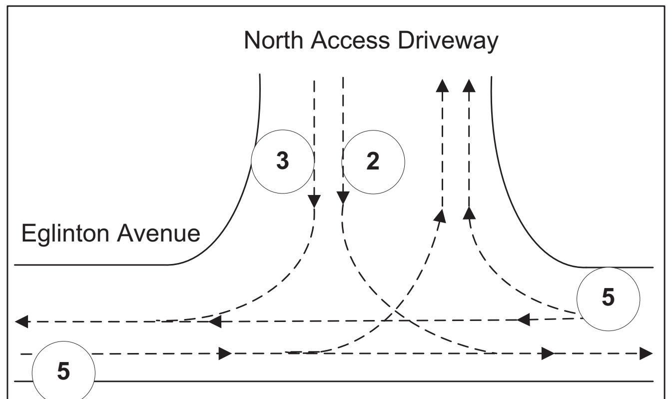
The following summarizes the results of the analysis for the 30 minute offloading peak period in the AM:

- Without implementing any strategies to increase LRV capacity, the base scenario provides 7 slots over a 30 minute period, or 39% spare capacity of total slots;
- Reducing the cars per train has no impact on the network, when compared to the base scenario;
- Rerouting vehicle left turns results in a decrease in the cycle length from 100 seconds to 75 seconds, and increases the slots available for recovery to 13, or 54% of the total slots available in 30 minutes;
- Implementing a two-stage pedestrian crossing results in a decrease in the cycle length from 100 seconds to 75 seconds, and increases the slots available for recovery to 11, or 50% of the total slots available in 30 minutes;
- Introducing pedestrian push buttons results in a decrease in the cycle length from 100 seconds to 80 seconds, and increases the slots available for recovery to 11, or 56% of the total slots available in 30 minutes. The analysis has been conducted on the assumption that the push button is activated 50% of the time, as in the AM loading scenario. However, this is an unrealistic assumption, since the push buttons would likely be activated continuously during the AM peak period. If it is assumed that the push button is activated 100% of the time, then the result is still acceptable since the results would mirror the base scenario i.e. 7 slots, or 39% of slots in 30 minutes; and
- Constructing a pedestrian overpass results in a decrease in the cycle length from 100 seconds to 80 seconds, and increases the slots available for recovery to 11, or 50% of the total slots available in 30 minutes.

PM Loading

As presented in the methodology, 5 LRVs are expected to be loaded on the network prior to the PM traffic peak period, with 3 LRVs loaded in the westbound direction, and 2 LRVs loaded in the eastbound direction in 30 minutes, between 2:20pm and 2:50pm. **Exhibit 19** illustrates the LRV volumes on Eglinton Avenue as well as the LRVs being loaded onto the network during the selected PM period.

Exhibit 19: PM Peak LRV Loading Volumes



PM Loading: 2:20pm – 2:50pm

For the PM loading period, the following scenarios were analyzed for the three intersections:

- No modifications to the volumes and time period;
- Back-to-back loading from the carhouse to Eglinton Avenue;
- Reducing cars per train from 3 to 2;
- Rerouting left turning vehicles;
- Introducing a two-stage pedestrian crossing;
- Implementing pedestrian push buttons; and
- Constructing a pedestrian overpass.

Exhibit 20 presents the results of the analysis for the above scenarios. The worksheets used for the analysis are presented in **Appendix B**.

Exhibit 20: PM Peak LRV Loading Summary of Findings

Scenario	Cycle length (seconds)	Peak Half Hour Slots: At Weston EB	At Weston WB	North Driveway EB	North Driveway SB	North Driveway WB	At Black Creek EB	At Black Creek WB	Overall	Percentage
30 minute offloading	100	13	10	13	15	13	11	13	10	56%
30 minute back-to-back loading	100	13	14	13	16	13	11	13	11	61%
Reducing Cars per Train	100	13	10	13	15	13	11	13	10	56%
Rerouting left Turns	80	17	14	17	19	17	15	17	14	64%
Two-stage Pedestrian Crossing	75	19	16	19	21	19	17	19	16	67%
Pedestrian Buttons	80	17	14	17	19	17	15	17	14	64%
Pedestrian Overpass	80	17	14	17	19	17	15	17	14	64%

The following summarizes the results of the analysis for the 30 minute loading peak period in the PM:

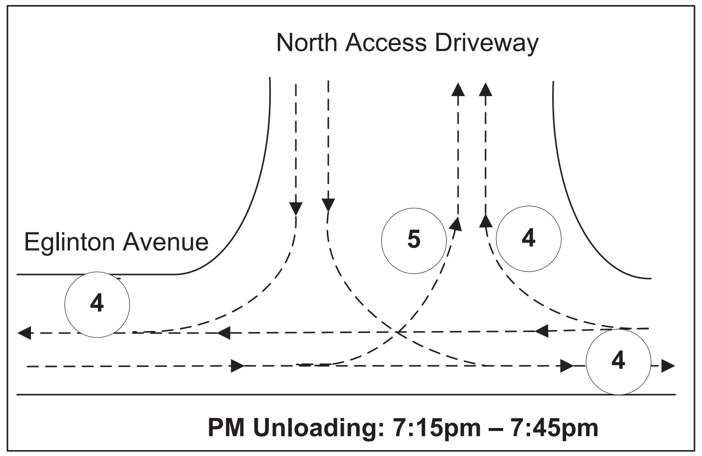
- Without implementing any strategies to increase LRV capacity, the base scenario provides 10 slots over a 30 minute period, or 56% spare capacity of total slots;
- Assuming back-to-back operation is possible at the North Access Driveway, 11 slots will be available for recovery over a 30 minute period, or 61% of total slots;
- Reducing the cars per train has no impact on the network, when compared to the base scenario;
- Rerouting vehicle left turns results in a decrease in the cycle length from 100 seconds to 80 seconds, and increases the slots available for recovery to 14, or 64% of the total slots available in 30 minutes;
- Implementing a two-stage pedestrian crossing results in a decrease in the cycle length from 100 seconds to 75 seconds, and increases the slots available for recovery to 16, or 67% of the total slots available in 30 minutes;
- Introducing pedestrian push buttons results in a decrease in the cycle length from 100 seconds to 80 seconds, and increases the slots available for recovery to 14, or 64% of the total slots available in 30 minutes. The analysis has been conducted on the assumption that the push button is activated 50% of the time, as in the AM loading scenario. However, this is an unrealistic assumption, since the push buttons would likely be activated continuously during the AM peak period. If it is assumed that the push button is activated 100% of the time, then the result is still acceptable since the results would mirror the base scenario i.e. 10 slots, or 56% of slots in 30 minutes; and
- Constructing a pedestrian overpass results in a decrease in the cycle length from 100 seconds to 80 seconds, and increases the slots available for recovery to 14, or 64% of the total slots available in 30 minutes.

PM Offloading

As presented in the methodology, 12 LRV are expected to be taken out of service between 7:05pm and 7:55pm, with 8 LRVs being taken off the tracks and into the carhouse from the west and 4 LRVs offloaded from the east. Although this offloading extends over a period of 50 minutes, the majority of the offloading occurs in a 30 minute interval, between 7:15pm and 7:45pm where 12 LRVs are offloaded into the car house, with 5 LRVs offloading from the west and 4 LRVs offloading from the east.

The 30 minute interval where the majority of the offloading occurs is used as the time period for this analysis. **Exhibit 21** illustrates the LRV volumes on Eglinton Avenue and the LRV offloading into the carhouse during the selected PM period.

Exhibit 21: PM Peak LRV Offloading Volumes



For the PM offloading period, the following scenarios were analyzed for the three intersections:

- No modifications to the volumes and time period;
- Reducing cars per train from 3 to 2;
- Rerouting left turning vehicles;
- Introducing a two-stage pedestrian crossing;
- Implementing pedestrian push buttons; and
- Constructing a pedestrian overpass.

Exhibit 22 presents the results of the analysis for the above scenarios. The worksheets used for the analysis are presented in **Appendix B**.

Exhibit 22: PM Peak LRV Offloading Summary of Findings

Scenario	Cycle length (seconds)	Peak Half Hour Slots							Overall	Percentage
		At Weston		North Driveway			At Black Creek			
		EB	WB	EB	SB	WB	EB	WB		
30 minute offloading	100	9	14	14	13	14	14	10	9	50%
Reducing Cars per Train	100	9	14	14	13	14	14	10	9	50%
Rerouting left Turns	80	13	18	18	17	18	18	14	13	59%
Two-stage Pedestrian Crossing	75	15	20	20	19	20	20	16	15	62%
Pedestrian Buttons	80	13	18	18	17	18	18	14	13	59%
Pedestrian Overpass	80	13	18	18	17	18	18	14	13	59%

The following summarizes the results of the analysis for the 30 minute offloading peak period in the AM:

- Without implementing any strategies to increase LRV capacity, the base scenario provides 10 slots over a 30 minute period, or 50% of total slots;
- Reducing the cars per train has no impact on the network, when compared to the base scenario;

- Rerouting vehicle left turns results in a decrease in the cycle length from 100 seconds to 80 seconds, and increases the slots available for recovery to 13, or 59% of the total slots available in 30 minutes;
- Implementing a two-stage pedestrian crossing results in a decrease in the cycle length from 100 seconds to 75 seconds, and increases the slots available for recovery to 13, or 59% of the total slots available in 30 minutes;
- Introducing pedestrian push buttons results in a decrease in the cycle length from 100 seconds to 70 seconds, and increases the slots available for recovery to 16, or 64% of the total slots available in 30 minutes. The analysis has been conducted on the assumption that the push button is activated 50% of the time, as in the AM loading scenario. However, this is an unrealistic assumption, since the push buttons would likely be activated continuously during the AM peak period. If it is assumed that the push button is activated 100% of the time, then the result is still acceptable since the results would mirror the base scenario i.e. 9 slots, or 50% of slots in 30 minutes; and
- Constructing a pedestrian overpass results in a decrease in the cycle length from 100 seconds to 80 seconds, and increases the slots available for recovery to 13, or 59% of the total slots available in 30 minutes.

Projected Impact on Development Potential

Another consideration for the performance sensitivity analysis is the projected impact that the at-grade connection alternative may have on the development potential for lands on the south side of Eglinton Avenue west of Black Creek Drive.

In 1990, Dumez Real Estate North America Inc. (DRENA) proposed a development in the south west quadrant of the Eglinton Avenue and Black Creek Drive intersection. The south west quadrant of Eglinton Avenue and Black Creek Drive is currently occupied by a big-box supermarket (No Frills) and the development proposed in a Traffic Impact Study completed for the DRENA development (hereto referred to as the DRENA TIS) has not been initiated. The development plans assumed that there would be direct, full movements access to Eglinton Avenue through a signalized intersection. However, with the at-grade connection alternative, this access would be restricted to a right-in-right-out movements only.

The purpose of this sensitivity analysis is to assess the projected impact on the development potential for the lands on the south side of Eglinton Avenue, west of Black Creek Drive, with the required restrictions on the Eglinton Avenue access. Based on the proposed type of development, the PM Peak period is the critical time period, and therefore, only the PM Peak was analyzed.

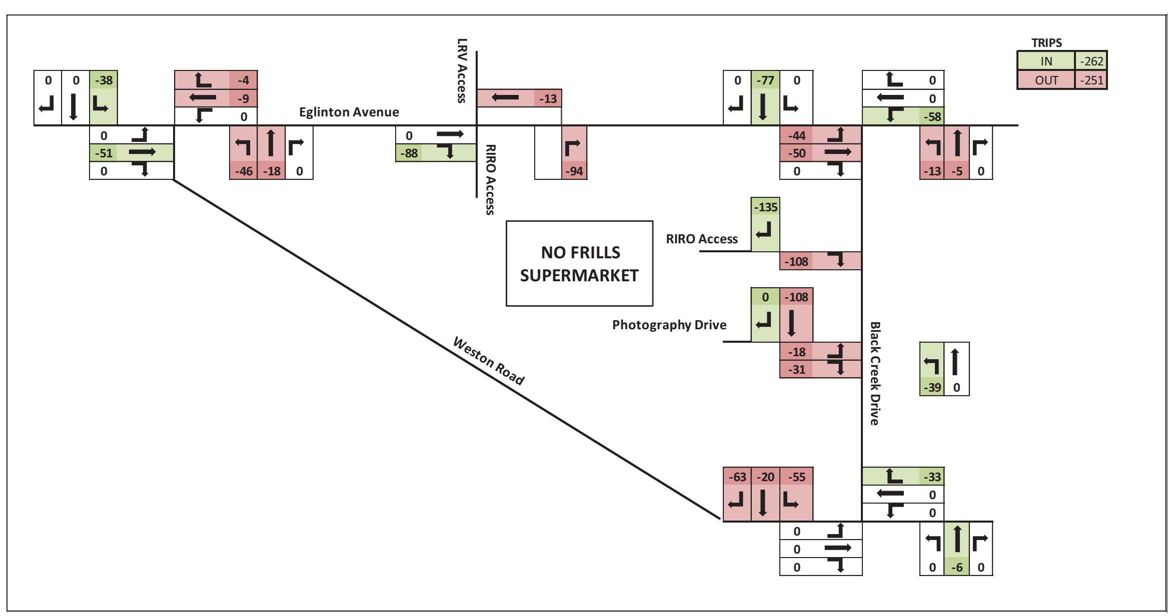
Exhibit 23 shows the study area with the five signalized intersections included in this analysis and the location of the development proposed in the DRENA TIS.

TTC – October 02, 2009

Exhibit 23: Study Area

The base conditions of this analysis were considered to be future traffic operations under full implementation of the ECLRT including the existing development (No Frills). If the lands south of Eglinton Avenue, west of Black Creek Drive are to be redeveloped, the traffic associated with the No Frills must be discounted to determine the true development potential of the lands. The traffic associated with the No Frills was assumed using the trip generation rate for supermarkets in the ITE Trip Generation Manual, 8th Edition and distributed based on current traffic patterns in the area. Exhibit 24 illustrates the site traffic associated with the current No Frills development.

Exhibit 24: PM Peak Discounted No Frills Site Traffic



TTC – October 02, 2009

The traffic generated by the existing development (No Frills) was removed from the background traffic volumes to determine the traffic volumes with no development in the lands south of Eglinton Avenue, west of Black Creek Drive. Based on these reduced volumes, the analysis below was conducted to assess of the projected impact on the development potential.

Iteration 1

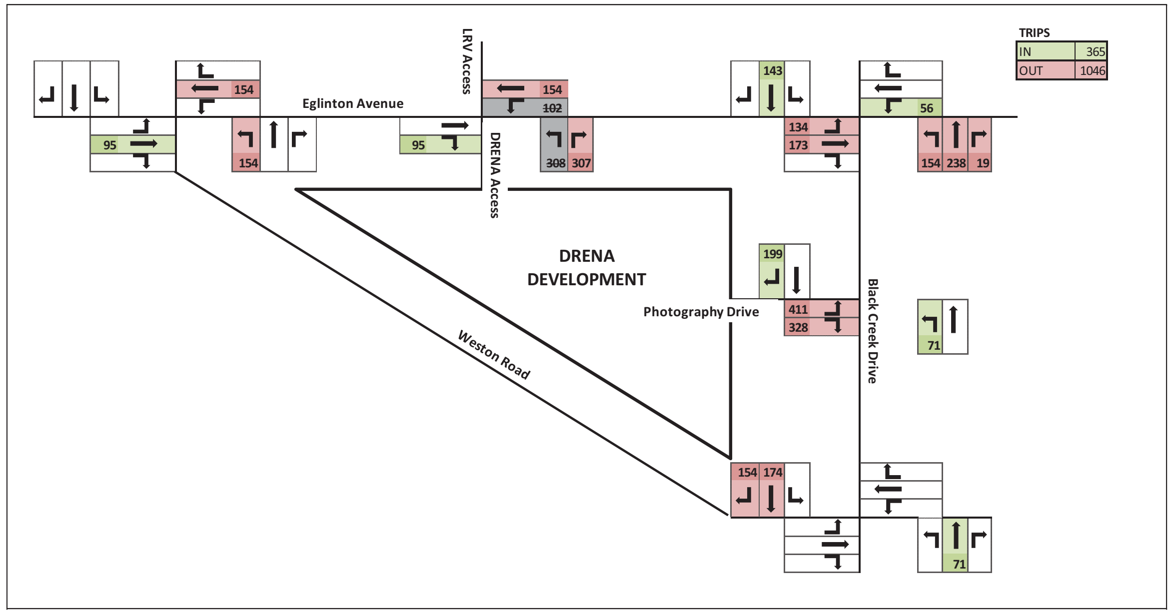
Under Iteration 1, analysis was first conducted assuming reduced development quantities (based on input provided by City of Toronto staff) from those proposed in the original DRENA TIS. These quantities are shown in Exhibit 25.

Exhibit 25: Iteration 1 – Development Quantities

Development Type	Units	Base Case	Iteration 1	DRENA TIS
Drena Residential	condominium units	0	850	850
Drena Office/Retail	sq. ft.	0	635,000	635,000
Humber College	sq. ft.	0	120,000	120,000
Gateway Office	sq. ft.	0	250,000	360,000

The trip generation rates for general traffic were based on the DRENA TIS rates, but were adjusted to reflect a transit modal split of 35% with the implementation of the ECLRT. The trips generated by the development were distributed based on the distribution used in the DRENA TIS, but adjusted to reflect that the proposed access on Eglinton Avenue was modified to function as a right-in-right-out access only, instead of a full movements access. Left turning traffic at this intersection was assigned to the Black Creek Drive access. Exhibit 26 illustrates the trip assignment of Iteration 1.

Exhibit 26: PM Peak Site Traffic (Iteration 1)



The traffic generated by the existing big-box supermarket (No Frills) was removed from the background traffic volumes, upon which the anticipated site traffic associated with the projected development was added. This scenario was analyzed using the Synchro 7 software package. The v/c ratio results of the Iteration 1 analysis are shown in Exhibit 27.

Exhibit 27: PM Peak V/C Ratio Results (Iteration 1)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Overall
Eglinton Avenue and Black Creek Drive													
Base Conditions	0.73	0.84	0.05	0.88	0.84	0.12	0.24	0.74	0.16	0.57	0.85	0.19	0.79
Iteration 1	1.04	0.89	0.05	0.97	0.86	0.12	0.96	0.88	0.19	0.72	1.04	0.22	0.92
Eglinton Avenue and Weston Road													
Base Conditions	0.46	0.41	0.08	0.25	0.62		0.67	0.44		0.21	0.69		0.63
Iteration 1	0.54	0.55	0.09	0.26	0.91		0.54	0.29		0.02	0.70		0.75
Black Creek Drive and Weston Road													
Base Conditions	0.34	0.48		0.33	0.69	0.56		0.85	0.21	0.83	0.81		0.75
Iteration 1	0.34	0.48		0.33	0.69	0.53		0.96	0.17	0.95	1.00		0.92
Eglinton Avenue and LRV / DRENA Access													
Base Conditions		0.28			0.37								0.36
Iteration 1		0.28	0.06		0.42				0.18				0.40
Black Creek Drive and Photography Drive													
Base Conditions	0.13		0.21				0.10	0.43			0.44		0.46
Iteration 1	0.82		0.56				0.28	0.60			0.72		0.76

Under base conditions, the v/c results indicate that no movement experiences a v/c ratio greater than 1.0. Under Iteration 1, the volumes of the eastbound left (EBL) and southbound through (SBT) movements at the Eglinton Avenue and Black Creek Drive intersection exceed their capacity. The volumes of the southbound through (SBT) movement at the Black Creek Drive and Weston Road intersection just meet the capacity (v/c is 1.00).

The 50th percentile queuing results of the 1st iteration of analysis are shown in Exhibit 28.

Exhibit 28: PM Peak 50th Percentile Queuing Results (m) (Iteration 1)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Eglinton Avenue and Black Creek Drive												
Storage Length or Distance to Driveway	75.0	150.0	60.0	80.0		60.0	70.0	250.0	60.0	70.0		60.0
Base Conditions	20.8	88.9	1.2	29.7	88.4	0.4	7.4	66.6	0.0	22.9	124.7	3.7
Iteration 1	~38.6	101.0	0.0	29.7	89.8	0.6	35.5	79.4	0.4	23.7	~150.6	5.0
Eglinton Avenue and Weston Road												
Storage Length or Distance to Driveway	50.0		70.0	40.0			70.0			60.0		
Base Conditions	17.6	50.0	0.0	8.2	16.6		12.2	30.8		6.6	56.6	
Iteration 1	17.9	70.4	0.0	7.3	119.5		21.2	22.7		0.6	56.7	
Black Creek Drive and Weston Road												
Storage Length or Distance to Driveway		65.0		65.0					30.0		270.0	
Base Conditions	6.5	32.7		10.0	51.7	0.0		48.9	1.7	138.0	134.8	
Iteration 1	6.5	32.7		10.0	51.7	0.0		65.1	2.8	~179.0	~201.5	
Eglinton Avenue and LRV / DRENA Access												
Storage Length or Distance to Driveway												
Base Conditions		0.0			6.7							
Iteration 1		0.0	0.0		5.7				0.0			
Black Creek Drive and Photography Drive												
Storage Length or Distance to Driveway							60.0					
Base Conditions	3.3		0.0				0.6	20.5			0.3	
Iteration 1	72.5		18.4				4.5	73.6			13.1	

~ Denotes the Volume of this movement exceed it's capacity

The results of the 50th percentile queuing analysis reveals that the queues do not exceed the storage lengths for turning movements and do not exceed the distance to the proposed DRENA development accesses.

The results of the Iteration 1 analysis indicate that the trips generated by the assumed development quantities combined with existing traffic yields v/c ratios exceeding 1.0 for multiple movements. Therefore, the development quantities were reduced in the next iteration, to a point where the v/c ratios would be acceptable. Since queuing was determined to not be problematic in Iteration 1, it will not be problematic in subsequent iterations, where development quantities are reduced.

Iteration 2 – Reduced Development

Under Iteration 2, the analysis was conducted assuming the reduced development quantities shown in Exhibit 29.

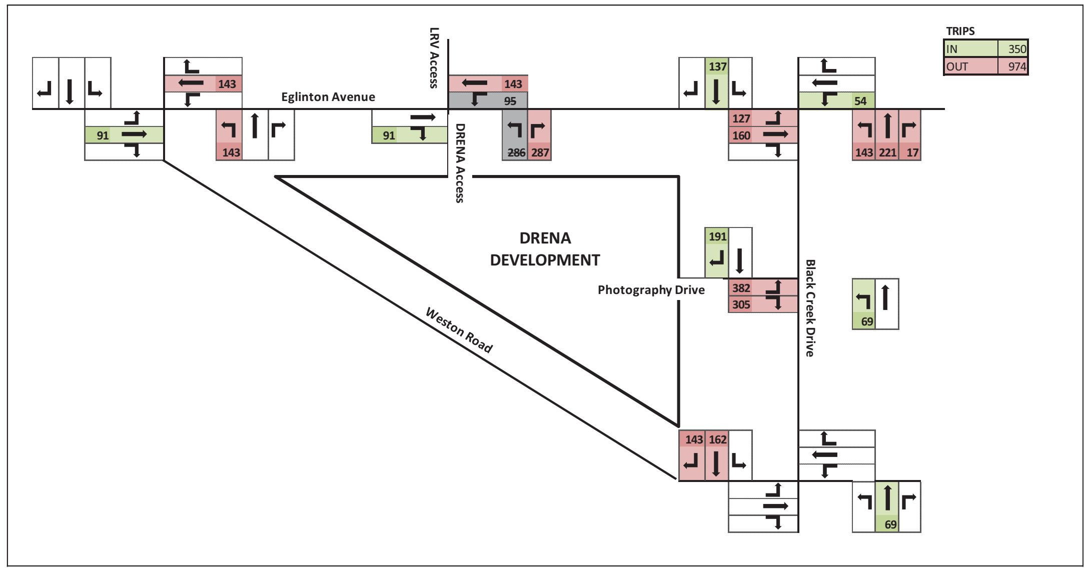
Exhibit 29: Iteration 2 – Development Quantities

Development Type	Units	Base Case	Iteration 2	DRENA TIS
Drena Residential	condominium units	0	850	850
Drena Office/Retail	sq. ft.	0	635,000	635,000
Humber College	sq. ft.	0	120,000	120,000
Gateway Office	sq. ft.	0	175,000	360,000

The same adjustments were made to the trip generation rates and trip distribution as in Iteration 1.

Exhibit 26 illustrates the trip assignment of Iteration 2.

Exhibit 30: PM Peak Site Traffic (Iteration 2)



The v/c ratio results of Iteration 2 are shown in Exhibit 31.

Exhibit 31: PM Peak V/C Ratio Results (Iteration 2)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Overall
Eglinton Avenue and Black Creek Drive													
Base Conditions	0.73	0.84	0.05	0.88	0.84	0.12	0.24	0.74	0.16	0.57	0.85	0.19	0.79
Iteration 2	1.00	0.88	0.05	0.96	0.86	0.12	0.99	0.87	0.18	0.72	1.01	0.22	0.91
Eglinton Avenue and Weston Road													
Base Conditions	0.46	0.41	0.08	0.25	0.62		0.67	0.44		0.21	0.69		0.63
Iteration 2	0.54	0.54	0.09	0.26	0.90		0.51	0.29		0.02	0.70		0.74
Black Creek Drive and Weston Road													
Base Conditions	0.34	0.48		0.33	0.69	0.56		0.85	0.21	0.83	0.81		0.75
Iteration 2	0.34	0.48		0.33	0.69	0.53		0.96	0.17	0.95	0.97		0.90
Eglinton Avenue and LRV / DRENA Access													
Base Conditions		0.28			0.37								0.36
Iteration 2		0.28	0.06		0.41				0.17				0.40
Black Creek Drive and Photography Drive													
Base Conditions	0.13		0.21				0.10	0.43			0.44		0.46
Iteration 2	0.80		0.54				0.27	0.59			0.70		0.74

Under base conditions, the v/c results indicate that no movement experiences a v/c ratio greater than 1.0. Under Iteration 2, the volumes of the eastbound left (EBL) and southbound through (SBT) movements at the Eglinton Avenue and Black Creek Drive intersection reach or marginally exceed their capacity (v/c's are 1.00 or 1.01). All other movement v/c ratios are below 1.0.

The results of this analysis conducted in the PM Peak indicates that traffic operations under base conditions are such that volume does not exceed capacity of any movement at any of the intersections analyzed.

Development of the southwest quadrant under the quantities assumed in Iteration 1 would result in capacity constraints in two movements at the Eglinton Avenue and Black Creek Drive intersection and result in one movement at the Black Creek Drive and Weston Road intersection just reaching capacity.

Development of the southwest quadrant under the quantities assumed in Iteration 2 would result in all movements operating with v/c ratios less than one, with exception to a two movements that would be at or marginally over (1.00 or 1.01) at the Eglinton Avenue and Black Creek Drive intersection.

Therefore, in order to maintain traffic operation such that volumes do not exceed capacity within the study area (Iteration 2 results), there must be a 5% reduction in the overall number of trips generated by the development (compared to the number of trips in Iteration 1).

Overall Summary

Based on the above analysis an at-grade solution will work, during all four time periods analyzed. The following provides a summary of the results of the LRV AM Loading analysis:

- There are no slots available for recovery purposes in the peak period from 6:00am – 7:00am, when mitigating measures are not provided, using the revised loading profile.
- Expanding the loading window from 1 hour and 40 minutes to a 2.5 hour even loading results in 10 slots available for recovery in the one hour AM peak loading period. This is used as the base assumption for the LRV AM loading period.
- The scenario which provides TTC staff with the largest number of slots in the AM peak, with the 2.5 hour even loading, is the two-stage pedestrian crossing, which provides 19 slots for recovery. It is important to note that all scenarios, except for reducing the number of cars per train, when coupled with the 2.5 hour even loading assumption, result in over 19 slots available in 1 hour (greater than 40% of the slots available).

The following provides a summary of the results of the LRV AM offloading analysis:

- When no mitigating measures are provided, 7 slots (39%) are available in 30 minutes.
- The scenario which provides TTC staff with the largest number of slots in the AM peak offloading period is the consideration of a two-stage crossing, which provides 13 slots (54%) for recovery in 30 minutes. It is important to note that all scenarios, except for reducing the number of cars per train, result in over 11 slots available in 30 minutes (greater than 50% of the slots available).

The following provides a summary of the results of the LRV PM loading analysis:

- When no mitigating measures are provided, 10 slots (56%) are available in 30 minutes
- The scenario which provides TTC staff with the largest number of slots in the PM peak offloading period is the consideration of a two-stage crossing, which provides 16 slots (67%) for recovery in 30 minutes. It is important to note that all scenarios result in over 10 slots available in 30 minutes (greater than 55% of the slots available).

The following provides a summary of the results of the LRV PM offloading analysis:

- When no mitigating measures are provided, 9 slots (50%) are available in 30 minutes
- The scenario which provides TTC staff with the largest number of slots in the PM peak offloading period is the consideration of a two-stage crossing, which provides 15 slots (62%) for recovery in 30 minutes. It is important to note that all scenarios result in over 9 slots available in 30 minutes (greater than 50% of the slots available).

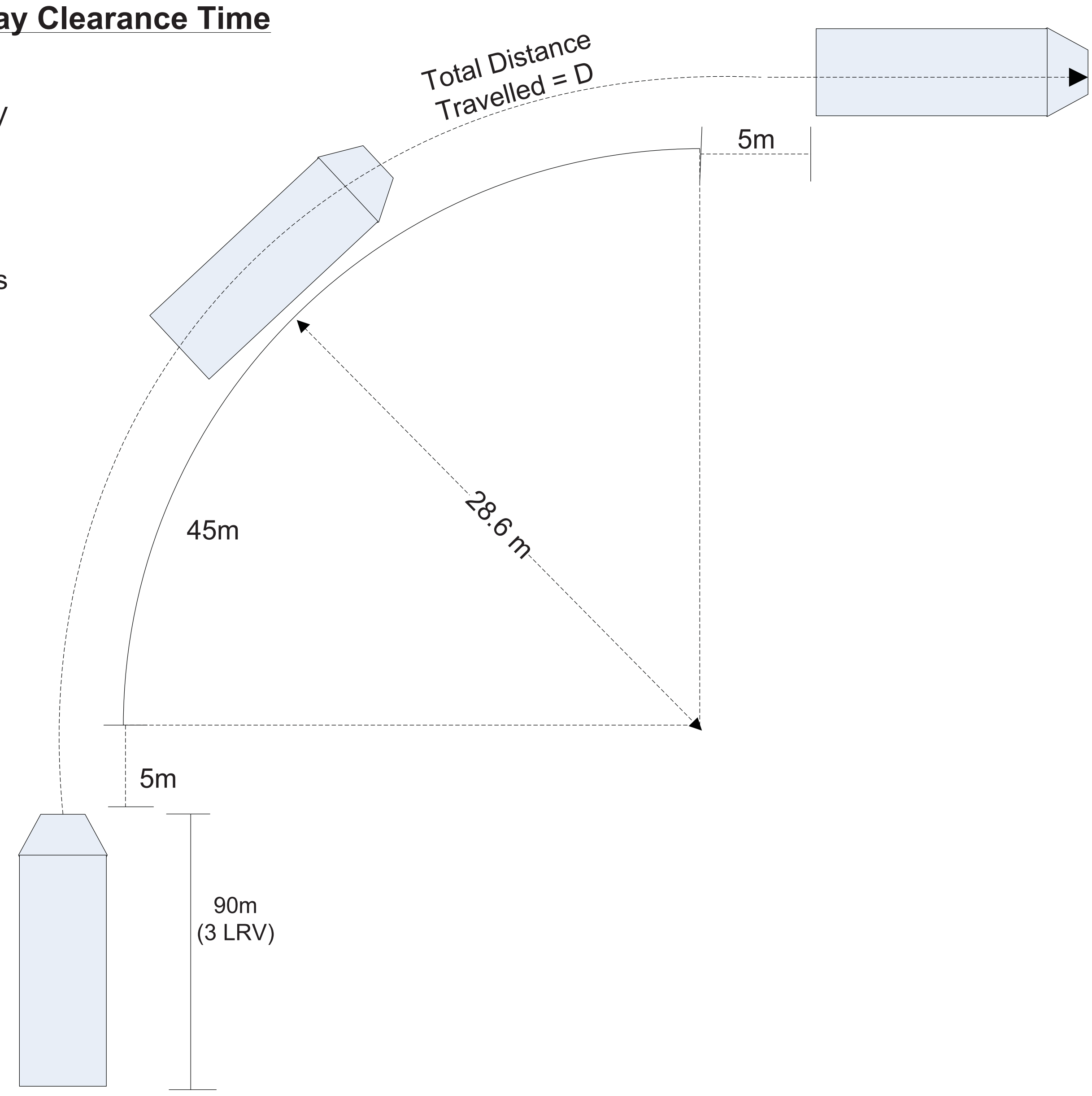
The following provides a summary of the projected impact on development potential:

- In order to maintain traffic operation such that volumes do not exceed capacity within the study area, there must be a 5% reduction in the overall number of trips generated by the development in comparison with the level of development proposed alternative forwarded by the City of Toronto staff (Iteration 1).

APPENDIX A

CLEARANCE TIME CALCULATIONS

Calculation of LRV North Access Driveway Clearance Time



Total distance travelled = D
Arch radius(m) + setback1(m) + setback2(m) + LRV length (m)
D = 45 + 5 + 5+ 30(3) = 145m

Vf = Vo +at
Vf = LRV turning speed (m/s) = 25 km/hr = 6.94 m/s
Vo = initial velocity (m/s) = 0 m/s
A = acceleration (m/s2) = 1.4 m/s2
T1 = time (seconds)
Vf = Vo +at1 = 0 +at = at1
T1 = Vf/a = 6.94/1.4 = 4.96 seconds
=> It takes the LRV 4.96 s to reach 25 km/hr

The distance travelled by LRV in 4.96 seconds is:
D1 = Vot +(½)at2
D1 = (0)(4.96) + (½)(1.4)(4.96)(4.96) = 17.22 m

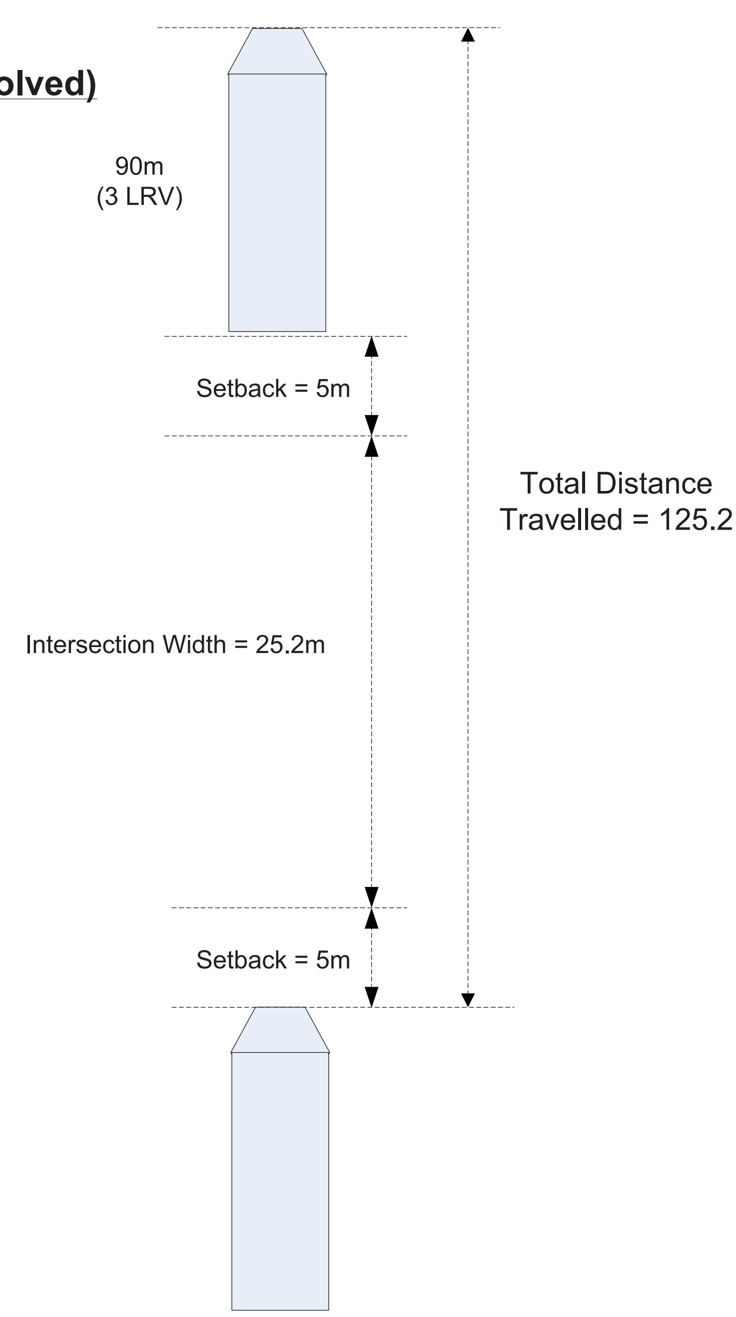
Remaining distance =
D2 = D – D1 = 145 – 17 = 127.78 m
Time to cover remaining distance = T2 = d_2/v
T2 = 127.78 m / 6.94 m/s = 18.41 seconds

Time needed for LRV to clear intersection:
T3 = T1 + T2 = 4.96 + 18.41 = 23.37 seconds

Assumptions:
- 5 second reaction time + Interlocking

Total time needed for LRV to cross intersection
T = T_3 + reaction time (s) + interlocking (s)
T = 23 + 5 = 28 seconds

Calculation of LRV East/West Clearance Time (No interlocking involved)



Total distance travelled = D
Intersection width(m) + setback1(m) + setback2(m) + LRV length (m)
D = 25.2 + 5 + 5+ 30(3) = 125.2m

Vf = Vo +at
Vf = LRV speed (m/s) = 50 km/hr = 13.89 m/s
Vo = initial velocity (m/s) = 0 m/s
A = acceleration (m/s2) = 1.4 m/s2
T1 = time (seconds)
Vf = Vo +at1 = 0 +at = at1
T1 = Vf/a = 13.89/1.4 = 9.92 seconds
=> It takes the LRV 9.92s to reach 50 km/hr

The distance travelled by LRV in 9.92 seconds is:
D1 = Vot +(½)at2
D1 = (0)(9.92) + (½)(1.4)(9.92)(9.92) = 68.89 m

Remaining distance =
D2 = D – D1 = 125.2 – 68.89 = 56.31 m
Time to cover remaining distance = T2 = d_2/v
T2 = 56.31 m / 13.89 m/s = 4.05 seconds

Time needed for LRV to clear intersection:
T3 = T1 + T2 = 9.92 + 4.05 = 13.97 seconds

Assumptions:
- 4 second reaction time

Total time needed for LRV to cross intersection
T = T_3 + reaction time (s)
T = 14 + 4 = 18 seconds

APPENDIX B

CALCULATIONS

Calculation Sheet

Train Volumes and Minimum LRT Green Requirements

Calculation Sheet	Train Volumes – At Weston				At North Dwy						At Black Creek				Minimum LRT Green Requirements – At Weston		At North Dwy		At Black Creek	
	EB On Service	EB to CH	WB On Service	WB from CH	EB On Service	EBL to CH	SBR from CH	SBL from CH	WBR to CH	WB On Service	EB On Service	EB from CH	WB On Service	WB to CH	EB	WB	E/W	N/S	EB	WB
AM Loading																				
1 hour 40 minute loading	8	0	8	31	8	0	31	12	0	8	8	12	8	0	18	18	28	28	18	18
1 hour 40 minute loading Back to Back	8	0	8	31	8	0	31	12	0	8	8	12	8	0	18	36	28	56	18	18
2.5 hour loading	10	0	10	16	10	0	16	7	0	10	10	7	10	0	18	18	28	28	18	18
3 hour loading	10	0	10	14	10	0	14	6	0	10	10	6	10	0	18	18	28	28	18	18
Reducing cars per train & 2.5 hour loading	10	0	10	16	10	0	16	7	0	10	10	7	10	0	16	16	23	23	16	16
Re-routing left turns & 2.5 hour loading	10	0	10	16	10	0	16	7	0	10	10	7	10	0	18	18	28	28	18	18
Two-Stage pedestrian crossing & 2.5 hour loading	10	0	10	16	10	0	16	7	0	10	10	7	10	0	18	18	28	28	18	18
Pedestrian buttons & 2.5 hour loading	10	0	10	16	10	0	16	7	0	10	10	7	10	0	18	18	28	28	18	18
Pedestrian overpass & 2.5 hour loading	10	0	10	16	10	0	16	7	0	10	10	7	10	0	18	18	28	28	18	18
Parallel track & 2.5 hour loading	10	0	10	16	10	0	16	7	0	10	10	7	10	0	18	36	28	28	18	18
AM Offloading																				
30 minute offloading	5	6	5	0	5	6	0	0	6	5	5	0	5	6	18	18	28	28	18	18
Reducing Cars per Train	5	6	5	0	5	6	0	0	6	5	5	0	5	6	16	16	23	23	16	16
Re-routing left turns	5	6	5	0	5	6	0	0	6	5	5	0	5	6	18	18	28	28	18	18
Two-Stage pedestrian crossing	5	6	5	0	5	6	0	0	6	5	5	0	5	6	18	18	28	28	18	18
Pedestrian buttons	5	6	5	0	5	6	0	0	6	5	5	0	5	6	18	18	28	28	18	18
Pedestrian overpass	5	6	5	0	5	6	0	0	6	5	5	0	5	6	18	18	28	28	18	18
PM Loading																				
30 minute offloading	5	0	5	3	5	0	3	2	0	5	5	2	5	0	18	18	28	28	18	18
30 minute back-to-back loading	5	0	5	3	5	0	3	2	0	5	5	2	5	0	18	36	28	56	18	18
Reducing Cars per Train	5	0	5	3	5	0	3	2	0	5	5	2	5	0	16	16	23	23	16	16
Re-routing left turns	5	0	5	3	5	0	3	2	0	5	5	2	5	0	18	18	28	28	18	18
Two-Stage pedestrian crossing	5	0	5	3	5	0	3	2	0	5	5	2	5	0	18	18	28	28	18	18
Pedestrian buttons	5	0	5	3	5	0	3	2	0	5	5	2	5	0	18	18	28	28	18	18
Pedestrian overpass	5	0	5	3	5	0	3	2	0	5	5	2	5	0	18	18	28	28	18	18
PM Offloading																				
30 minute offloading	4	5	4	0	4	5	0	0	4	4	4	0	4	4	18	18	28	28	18	18
Reducing Cars per Train	4	5	4	0	4	5	0	0	4	4	4	0	4	4	16	16	23	23	16	16
Re-routing left turns	4	5	4	0	4	5	0	0	4	4	4	0	4	4	18	18	28	28	18	18
Two-Stage pedestrian crossing	4	5	4	0	4	5	0	0	4	4	4	0	4	4	18	18	28	28	18	18
Pedestrian buttons	4	5	4	0	4	5	0	0	4	4	4	0	4	4	18	18	28	28	18	18
Pedestrian overpass	4	5	4	0	4	5	0	0	4	4	4	0	4	4	18	18	28	28	18	18

Minimum Pedestrains and/or Vehicles Requirement

	At Weston				At North Driveway			At Black Creek				
	EWL	EW	NS	Total	EW	NS	Total	EWL	EW	NSL	NS	Total
AM Loading												
1 hour 40 minute loading	13	28	35	76	18	18	36	13	35	13	36	97
1 hour 40 minute loading Back to Back	13	28	35	76	18	18	36	13	35	13	36	97
2.5 hour loading	13	28	35	76	18	18	36	13	35	13	36	97
3 hour loading	13	28	35	76	18	18	36	13	35	13	36	97
Reducing cars per train & 2.5 hour loading	13	28	35	76	18	18	36	13	35	13	36	97
Re-routing left turns & 2.5 hour loading	13	28	35	76	18	18	36	0	35	0	36	71
Two-Stage pedestrian crossing & 2.5 hour loading	13	20.5	24.5	58	18	18	36	13	24.5	13	24.5	75
Pedestrian buttons & 2.5 hour loading	13	22	26	61	18	18	36	13	26	13	27	79
Pedestrian overpass & 2.5 hour loading	13	28	35	76	18	18	36	13	35	13	18	79
Parallel track & 2.5 hour loading	13	28	35	76	18	18	36	13	35	13	36	97
AM Offloading												
30 minute offloading	13	28	35	76	18	18	36	13	35	13	36	97
Reducing Cars per Train	13	28	35	76	18	18	36	13	35	13	36	97
Re-routing left turns	13	28	35	76	18	18	36	0	35	0	36	71
Two-Stage pedestrian crossing	13	20.5	24.5	58	18	18	36	13	24.5	13	24.5	75
Pedestrian buttons	13	22	26	61	18	18	36	13	26	13	27	79
Pedestrian overpass	13	28	35	76	18	18	36	13	35	13	18	79
PM Loading												
30 minute offloading	13	28	35	76	18	18	36	13	35	13	36	97
30 minute back-to-back loading	13	28	35	76	18	18	36	13	35	13	36	97
Reducing Cars per Train	13	28	35	76	18	18	36	13	35	13	36	97
Re-routing left turns	13	28	35	76	18	18	36	0	35	0	36	71
Two-Stage pedestrian crossing	13	20.5	24.5	58	18	18	36	13	24.5	13	24.5	75
Pedestrian buttons	13	22	26	61	18	18	36	13	26	13	27	79
Pedestrian overpass	13	28	35	76	18	18	36	13	35	13	18	79
PM Offloading												
30 minute offloading	13	28	35	76	18	18	36	13	35	13	36	97
Reducing Cars per Train	13	28	35	76	18	18	36	13	35	13	36	97
Re-routing left turns	13	28	35	76	18	18	36	0	35	0	36	71
Two-Stage pedestrian crossing	13	20.5	24.5	58	18	18	36	13	24.5	13	24.5	75
Pedestrian buttons	13	22	26	61	18	18	36	13	26	13	27	79
Pedestrian overpass	13	28	35	76	18	18	36	13	35	13	18	79

Minimum Traffic Signal based on LRT, Pedestrains and Vehicle Requirements

	At Weston				At North Driveway			At Black Creek				
	EWL	EW	NS	Total	EW	NS	Total	EWL	EW	NSL	NS	Total
AM Loading												
1 hour 40 minute loading	13	28	35	76	28	28	56	13	35	13	36	97
1 hour 40 minute loading Back to Back	13	36	35	84	28	56	84	13	35	13	36	97
2.5 hour loading	13	28	35	76	28	28	56	13	35	13	36	97
3 hour loading	13	28	35	76	28	28	56	13	35	13	36	97
Reducing cars per train & 2.5 hour loading	13	28	35	76	23	23	46	13	35	13	36	97
Re-routing left turns & 2.5 hour loading	13	28	35	76	28	28	56	0	35	0	36	71
Two-Stage pedestrian crossing & 2.5 hour loading	13	20.5	24.5	58	28	28	56	13	24.5	13	24.5	75
Pedestrian buttons & 2.5 hour loading	13	22	26	61	28	28	56	13	26	13	27	79
Pedestrian overpass & 2.5 hour loading	13	28	35	76	28	28	56	13	35	13	18	79
Parallel track & 2.5 hour loading	13	36	35	84	28	28	56	13	35	13	36	97
AM Offloading												
30 minute offloading	13	28	35	76	28	28	56	13	35	13	36	97
Reducing Cars per Train	13	28	35	76	23	23	46	13	35	13	36	97
Re-routing left turns	13	28	35	76	28	28	56	0	35	0	36	71
Two-Stage pedestrian crossing	13	20.5	24.5	58	28	28	56	13	24.5	13	24.5	75
Pedestrian buttons	13	22	26	61	28	28	56	13	26	13	27	79
Pedestrian overpass	13	28	35	76	28	28	56	13	35	13	18	79
PM Loading												
30 minute offloading	13	28	35	76	28	28	56	13	35	13	36	97
30 minute back-to-back loading	13	36	35	84	28	56	84	13	35	13	36	97
Reducing Cars per Train	13	28	35	76	23	23	46	13	35	13	36	97
Re-routing left turns	13	28	35	76	28	28	56	0	35	0	36	71
Two-Stage pedestrian crossing	13	20.5	24.5	58	28	28	56	13	24.5	13	24.5	75
Pedestrian buttons	13	22	26	61	28	28	56	13	26	13	27	79
Pedestrian overpass	13	28	35	76	28	28	56	13	35	13	18	79
PM Offloading												
30 minute offloading	13	28	35	76	28	28	56	13	35	13	36	97
Reducing Cars per Train	13	28	35	76	23	23	46	13	35	13	36	97
Re-routing left turns	13	28	35	76	28	28	56	0	35	0	36	71
Two-Stage pedestrian crossing	13	20.5	24.5	58	28	28	56	13	24.5	13	24.5	75
Pedestrian buttons	13	22	26	61	28	28	56	13	26	13	27	79
Pedestrian overpass	13	28	35	76	28	28	56	13	35	13	18	79

Slots per Moovement per Cycle; Cycle Length and Period

	At Weston				North Driveway						At Black Creek				Cycle Length and Period			
	EB On Service	EB to CH	WB On Service	WB from CH	EB On Service	EBL to CH	SBR from CH	SBL from CH	WBR to CH	WB On Service	EB On Service	EB from CH	WB On Service	WB to CH	Cycle Length	Analysis Period (sec)	Cycles per hour	Outbound Tracks
AM Loading																		
1 hour 40 minute loading	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	3600	36	2
1 hour 40 minute loading Back to Back	1	1	1	2	1	1	2	1	1	1	1	1	1	1	100	3600	36	2
2.5 hour loading	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	3600	36	2
3 hour loading	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	3600	36	2
Reducing cars per train & 2.5 hour loading	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	3600	36	2
Re-routing left turns & 2.5 hour loading	1	1	1	1	1	1	1	1	1	1	1	1	1	1	80	3600	45	2
Two-Stage pedestrian crossing & 2.5 hour loading	1	1	1	1	1	1	1	1	1	1	1	1	1	1	75	3600	48	2
Pedestrian buttons & 2.5 hour loading	1	1	1	1	1	1	1	1	1	1	1	1	1	1	80	3600	45	2
Pedestrian overpass & 2.5 hour loading	1	1	1	1	1	1	1	1	1	1	1	1	1	1	80	3600	45	2
Parallel track & 2.5 hour loading	1	1	2	2	1	1	1	1	1	1	1	1	1	1	100	3600	36	2
AM Offloading																		
30 minute offloading	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	1800	18	2
Reducing Cars per Train	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	1800	18	2
Re-routing left turns	1	1	1	1	1	1	1	1	1	1	1	1	1	1	80	1800	22	2
Two-Stage pedestrian crossing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	75	1800	24	2
Pedestrian buttons	1	1	1	1	1	1	1	1	1	1	1	1	1	1	80	1800	22	2
Pedestrian overpass	1	1	1	1	1	1	1	1	1	1	1	1	1	1	80	1800	22	2
PM Loading																		
30 minute offloading	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	1800	18	2
30 minute back-to-back loading	1	1	1	2	1	1	2	1	1	1	1	1	1	1	100	1800	18	2
Reducing Cars per Train	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	1800	18	2
Re-routing left turns	1	1	1	1	1	1	1	1	1	1	1	1	1	1	80	1800	22	2
Two-Stage pedestrian crossing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	75	1800	24	2
Pedestrian buttons	1	1	1	1	1	1	1	1	1	1	1	1	1	1	80	1800	22	2
Pedestrian overpass	1	1	1	1	1	1	1	1	1	1	1	1	1	1	80	1800	22	2
PM Offloading																		
30 minute offloading	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	1800	18	2
Reducing Cars per Train	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	1800	18	2
Re-routing left turns	1	1	1	1	1	1	1	1	1	1	1	1	1	1	80	1800	22	2
Two-Stage pedestrian crossing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	75	1800	24	2
Pedestrian buttons	1	1	1	1	1	1	1	1	1	1	1	1	1	1	80	1800	22	2
Pedestrian overpass	1	1	1	1	1	1	1	1	1	1	1	1	1	1	80	1800	22	2

Cycle Distribution

	At Weston				North Driveway						At Black Creek			
	EB On Service	EB to CH	WB On Service	WB from CH	EB On Service	EBL to CH	SBR from CH	SBL from CH	WBR to CH	WB On Service	EB On Service	EB from CH	WB On Service	WB to CH
AM Loading														
1 hour 40 minute loading	100%	0%	21%	79%	100%	0%	100%	100%	0%	100%	40%	60%	100%	0%
1 hour 40 minute loading Back to Back	100%	0%	34%	66%	100%	0%	100%	100%	0%	100%	40%	60%	100%	0%
2.5 hour loading	100%	0%	38%	62%	100%	0%	100%	100%	0%	100%	59%	41%	100%	0%
3 hour loading	100%	0%	42%	58%	100%	0%	100%	100%	0%	100%	63%	38%	100%	0%
Reducing cars per train & 2.5 hour loading	100%	0%	38%	62%	100%	0%	100%	100%	0%	100%	59%	41%	100%	0%
Re-routing left turns & 2.5 hour loading	100%	0%	38%	62%	100%	0%	100%	100%	0%	100%	59%	41%	100%	0%
Two-Stage pedestrian crossing & 2.5 hour loading	100%	0%	38%	62%	100%	0%	100%	100%	0%	100%	59%	41%	100%	0%
Pedestrian buttons & 2.5 hour loading	100%	0%	38%	62%	100%	0%	100%	100%	0%	100%	59%	41%	100%	0%
Pedestrian overpass & 2.5 hour loading	100%	0%	38%	62%	100%	0%	100%	100%	0%	100%	59%	41%	100%	0%
Parallel track & 2.5 hour loading	100%	0%	38%	62%	100%	0%	100%	100%	0%	100%	59%	41%	100%	0%
AM Offloading														
30 minute offloading	45%	55%	100%	0%	100%	100%	0%	0%	100%	100%	100%	0%	45%	55%
Reducing Cars per Train	45%	55%	100%	0%	100%	100%	0%	0%	100%	100%	100%	0%	45%	55%
Re-routing left turns	45%	55%	100%	0%	100%	100%	0%	0%	100%	100%	100%	0%	45%	55%
Two-Stage pedestrian crossing	45%	55%	100%	0%	100%	100%	0%	0%	100%	100%	100%	0%	45%	55%
Pedestrian buttons	45%	55%	100%	0%	100%	100%	0%	0%	100%	100%	100%	0%	45%	55%
Pedestrian overpass	45%	55%	100%	0%	100%	100%	0%	0%	100%	100%	100%	0%	45%	55%
PM Loading														
30 minute offloading	100%	0%	63%	38%	100%	0%	100%	100%	0%	100%	71%	29%	100%	0%
30 minute back-to-back loading	100%	0%	77%	23%	100%	0%	100%	100%	0%	100%	71%	29%	100%	0%
Reducing Cars per Train	100%	0%	63%	38%	100%	0%	100%	100%	0%	100%	71%	29%	100%	0%
Re-routing left turns	100%	0%	63%	38%	100%	0%	100%	100%	0%	100%	71%	29%	100%	0%
Two-Stage pedestrian crossing	100%	0%	63%	38%	100%	0%	100%	100%	0%	100%	71%	29%	100%	0%
Pedestrian buttons	100%	0%	63%	38%	100%	0%	100%	100%	0%	100%	71%	29%	100%	0%
Pedestrian overpass	100%	0%	63%	38%	100%	0%	100%	100%	0%	100%	71%	29%	100%	0%
PM Offloading														
30 minute offloading	44%	56%	100%	0%	100%	100%	0%	0%	100%	100%	100%	0%	50%	50%
Reducing Cars per Train	44%	56%	100%	0%	100%	100%	0%	0%	100%	100%	100%	0%	50%	50%
Re-routing left turns	44%	56%	100%	0%	100%	100%	0%	0%	100%	100%	100%	0%	50%	50%
Two-Stage pedestrian crossing	44%	56%	100%	0%	100%	100%	0%	0%	100%	100%	100%	0%	50%	50%
Pedestrian buttons	44%	56%	100%	0%	100%	100%	0%	0%	100%	100%	100%	0%	50%	50%
Pedestrian overpass	44%	56%	100%	0%	100%	100%	0%	0%	100%	100%	100%	0%	50%	50%

Available Slots

	At Weston				North Driveway						At Black Creek			
	EB On Service	EB to CH	WB On Service	WB from CH	EB On Service	EBL to CH	SBR from CH	SBL from CH	WBR to CH	WB On Service	EB On Service	EB from CH	WB On Service	WB to CH
AM Loading														
1 hour 40 minute loading	36	0	7	29	36	0	36	36	0	36	14	22	36	0
1 hour 40 minute loading Back to Back	36	0	12	47	36	0	72	36	0	36	14	22	36	0
2.5 hour loading	36	0	14	22	36	0	36	36	0	36	21	15	36	0
3 hour loading	36	0	15	21	36	0	36	36	0	36	23	14	36	0
Reducing cars per train & 2.5 hour loading	36	0	14	22	36	0	36	36	0	36	21	15	36	0
Re-routing left turns & 2.5 hour loading	45	0	17	28	45	0	45	45	0	45	26	19	45	0
Two-Stage pedestrian crossing & 2.5 hour loading	48	0	18	30	48	0	48	48	0	48	28	20	48	0
Pedestrian buttons & 2.5 hour loading	45	0	17	28	45	0	45	45	0	45	26	19	45	0
Pedestrian overpass & 2.5 hour loading	45	0	17	28	45	0	45	45	0	45	26	19	45	0
Parallel track & 2.5 hour loading	36	0	28	44	36	0	36	36	0	36	21	15	36	0
AM Offloading														
30 minute offloading	8	10	18	0	18	18	0	0	18	18	18	0	8	10
Reducing Cars per Train	8	10	18	0	18	18	0	0	18	18	18	0	8	10
Re-routing left turns	10	12	22	0	22	22	0	0	22	22	22	0	10	12
Two-Stage pedestrian crossing	11	13	24	0	24	24	0	0	24	24	24	0	11	13
Pedestrian buttons	10	12	22	0	22	22	0	0	22	22	22	0	10	12
Pedestrian overpass	10	12	22	0	22	22	0	0	22	22	22	0	10	12
PM Loading														
30 minute offloading	18	0	11	7	18	0	18	18	0	18	13	5	18	0
30 minute back-to-back loading	18	0	14	8	18	0	36	18	0	18	13	5	18	0
Reducing Cars per Train	18	0	11	7	18	0	18	18	0	18	13	5	18	0
Re-routing left turns	22	0	14	8	22	0	22	22	0	22	16	6	22	0
Two-Stage pedestrian crossing	24	0	15	9	24	0	24	24	0	24	17	7	24	0
Pedestrian buttons	22	0	14	8	22	0	22	22	0	22	16	6	22	0
Pedestrian overpass	22	0	14	8	22	0	22	22	0	22	16	6	22	0
PM Offloading														
30 minute offloading	8	10	18	0	18	18	0	0	18	18	18	0	9	9
Reducing Cars per Train	8	10	18	0	18	18	0	0	18	18	18	0	9	9
Re-routing left turns	10	12	22	0	22	22	0	0	22	22	22	0	11	11
Two-Stage pedestrian crossing	11	13	24	0	24	24	0	0	24	24	24	0	12	12
Pedestrian buttons	10	12	22	0	22	22	0	0	22	22	22	0	11	11
Pedestrian overpass	10	12	22	0	22	22	0	0	22	22	22	0	11	11

Spare Slots

	At Weston				North Driveway						At Black Creek			
	EB On Service	EB to CH	WB On Service	WB from CH	EB On Service	EBL to CH	SBR from CH	SBL from CH	WBR to CH	WB On Service	EB On Service	EB from CH	WB On Service	WB to CH
AM Loading														
1 hour 40 minute loading	28	0	-1	-2	28	0	5	24	0	28	6	10	28	0
1 hour 40 minute loading Back to Back	28	0	4	16	28	0	41	24	0	28	6	10	28	0
2.5 hour loading	26	0	4	6	26	0	20	29	0	26	11	8	26	0
3 hour loading	26	0	5	7	26	0	22	30	0	26	13	8	26	0
Reducing cars per train & 2.5 hour loading	26	0	4	6	26	0	20	29	0	26	11	8	26	0
Re-routing left turns & 2.5 hour loading	35	0	7	12	35	0	29	38	0	35	16	12	35	0
Two-Stage pedestrian crossing & 2.5 hour loading	38	0	8	14	38	0	32	41	0	38	18	13	38	0
Pedestrian buttons & 2.5 hour loading	35	0	7	12	35	0	29	38	0	35	16	12	35	0
Pedestrian overpass & 2.5 hour loading	35	0	7	12	35	0	29	38	0	35	16	12	35	0
Parallel track & 2.5 hour loading	26	0	18	28	26	0	20	29	0	26	11	8	26	0
AM Offloading														
30 minute offloading	3	4	13	0	13	12	0	0	12	13	13	0	3	4
Reducing Cars per Train	3	4	13	0	13	12	0	0	12	13	13	0	3	4
Re-routing left turns	5	6	17	0	17	16	0	0	16	17	17	0	5	6
Two-Stage pedestrian crossing	6	7	19	0	19	18	0	0	18	19	19	0	6	7
Pedestrian buttons	5	6	17	0	17	16	0	0	16	17	17	0	5	6
Pedestrian overpass	5	6	17	0	17	16	0	0	16	17	17	0	5	6
PM Loading														
30 minute offloading	13	0	6	4	13	0	15	16	0	13	8	3	13	0
30 minute back-to-back loading	13	0	9	5	13	0	33	16	0	13	8	3	13	0
Reducing Cars per Train	13	0	6	4	13	0	15	16	0	13	8	3	13	0
Re-routing left turns	17	0	9	5	17	0	19	20	0	17	11	4	17	0
Two-Stage pedestrian crossing	19	0	10	6	19	0	21	22	0	19	12	5	19	0
Pedestrian buttons	17	0	9	5	17	0	19	20	0	17	11	4	17	0
Pedestrian overpass	17	0	9	5	17	0	19	20	0	17	11	4	17	0
PM Offloading														
30 minute offloading	4	5	14	0	14	13	0	0	14	14	14	0	5	5
Reducing Cars per Train	4	5	14	0	14	13	0	0	14	14	14	0	5	5
Re-routing left turns	6	7	18	0	18	17	0	0	18	18	18	0	7	7
Two-Stage pedestrian crossing	7	8	20	0	20	19	0	0	20	20	20	0	8	8
Pedestrian buttons	6	7	18	0	18	17	0	0	18	18	18	0	7	7
Pedestrian overpass	6	7	18	0	18	17	0	0	18	18	18	0	7	7

Spare Slots/Available Slots and Summary - Spare Slots

	Spare Slots/Available Slots – At Weston		North Driveway			At Black Creek		Summary - Spare Slots – At Weston		North Driveway			At Black Creek		Trick	Overall	%	Cycle Defined By:
	EB	WB	EB	N/S	WB	EB	WB	EB	WB	EB	N/S	WB	EB	WB				
AM Loading																		
1 hour 40 minute loading	78%	-8%	78%	14%	78%	44%	78%	28	-3	28	5	28	16	28	-3.0008333	-3	-8%	Black Creek
1 hour 40 minute loading Back to Back	78%	34%	78%	67%	78%	44%	78%	28	20	28	24	28	16	28	16.0044444	16	44%	Black Creek
2.5 hour loading	72%	28%	72%	56%	72%	53%	72%	26	10	26	20	26	19	26	10.0027778	10	28%	Black Creek
3 hour loading	72%	33%	72%	61%	72%	57%	72%	26	12	26	22	26	21	26	12.0033333	12	33%	Black Creek
Reducing cars per train & 2.5 hour loading	72%	28%	72%	56%	72%	53%	72%	26	10	26	20	26	19	26	10.0027778	10	28%	Black Creek
Re-routing left turns & 2.5 hour loading	78%	42%	78%	64%	78%	62%	78%	35	19	35	29	35	28	35	19.0042222	19	42%	Weston
Two-Stage pedestrian crossing & 2.5 hour loading	79%	46%	79%	67%	79%	65%	79%	38	22	38	32	38	31	38	22.0045833	22	46%	Black Creek
Pedestrian buttons & 2.5 hour loading	78%	42%	78%	64%	78%	62%	78%	35	19	35	29	35	28	35	19.0042222	19	42%	Black Creek
Pedestrian overpass & 2.5 hour loading	78%	42%	78%	64%	78%	62%	78%	35	19	35	29	35	28	35	19.0042222	19	42%	Black Creek
Parallel track & 2.5 hour loading	72%	64%	72%	56%	72%	53%	72%	26	46	26	20	26	19	26	19.0052778	19	53%	Black Creek
AM Offloading																		
30 minute offloading	39%	72%	72%	67%	72%	72%	39%	7	13	13	12	13	13	7	7.0038889	7	39%	Black Creek
Reducing Cars per Train	39%	72%	72%	67%	72%	72%	39%	7	13	13	12	13	13	7	7.0038889	7	39%	Black Creek
Re-routing left turns	50%	77%	77%	73%	77%	77%	50%	11	17	17	16	17	17	11	11.0050000	11	50%	Weston
Two-Stage pedestrian crossing	54%	79%	79%	75%	79%	79%	54%	13	19	19	18	19	19	13	13.0054167	13	54%	Black Creek
Pedestrian buttons	50%	77%	77%	73%	77%	77%	50%	11	17	17	16	17	17	11	11.0050000	11	50%	Black Creek
Pedestrian overpass	50%	77%	77%	73%	77%	77%	50%	11	17	17	16	17	17	11	11.0050000	11	50%	Black Creek
PM Loading																		
30 minute offloading	72%	56%	72%	83%	72%	61%	72%	13	10	13	15	13	11	13	10.0055556	10	56%	Black Creek
30 minute back-to-back loading	72%	64%	72%	89%	72%	61%	72%	13	14	13	16	13	11	13	11.0061111	11	61%	Black Creek
Reducing Cars per Train	72%	56%	72%	83%	72%	61%	72%	13	10	13	15	13	11	13	10.0055556	10	56%	Black Creek
Re-routing left turns	77%	64%	77%	86%	77%	68%	77%	17	14	17	19	17	15	17	14.0063636	14	64%	Weston
Two-Stage pedestrian crossing	79%	67%	79%	88%	79%	71%	79%	19	16	19	21	19	17	19	16.0066667	16	67%	Black Creek
Pedestrian buttons	77%	64%	77%	86%	77%	68%	77%	17	14	17	19	17	15	17	14.0063636	14	64%	Black Creek
Pedestrian overpass	77%	64%	77%	86%	77%	68%	77%	17	14	17	19	17	15	17	14.0063636	14	64%	Black Creek
PM Offloading																		
30 minute offloading	50%	78%	78%	72%	78%	78%	56%	9	14	14	13	14	14	10	9.0050000	9	50%	Black Creek
Reducing Cars per Train	50%	78%	78%	72%	78%	78%	56%	9	14	14	13	14	14	10	9.0050000	9	50%	Black Creek
Re-routing left turns	59%	82%	82%	77%	82%	82%	64%	13	18	18	17	18	18	14	13.0059091	13	59%	Weston
Two-Stage pedestrian crossing	63%	83%	83%	79%	83%	83%	67%	15	20	20	19	20	20	16	15.0062500	15	62%	Black Creek
Pedestrian buttons	59%	82%	82%	77%	82%	82%	64%	13	18	18	17	18	18	14	13.0059091	13	59%	Black Creek
Pedestrian overpass	59%	82%	82%	77%	82%	82%	64%	13	18	18	17	18	18	14	13.0059091	13	59%	Black Creek