

10 Traffic Analysis of Short-List Solutions

The road and infrastructure solutions carried forward to the short-list were tested using the Aimsun traffic model to determine the potential traffic benefits and impacts. Ten (10) scenarios were analyzed for each Weekday AM, Weekday PM, and Saturday Middyay peak, as described in **Table 10-1**.

Table 10-1. Short-List Solution Scenarios Analyzed

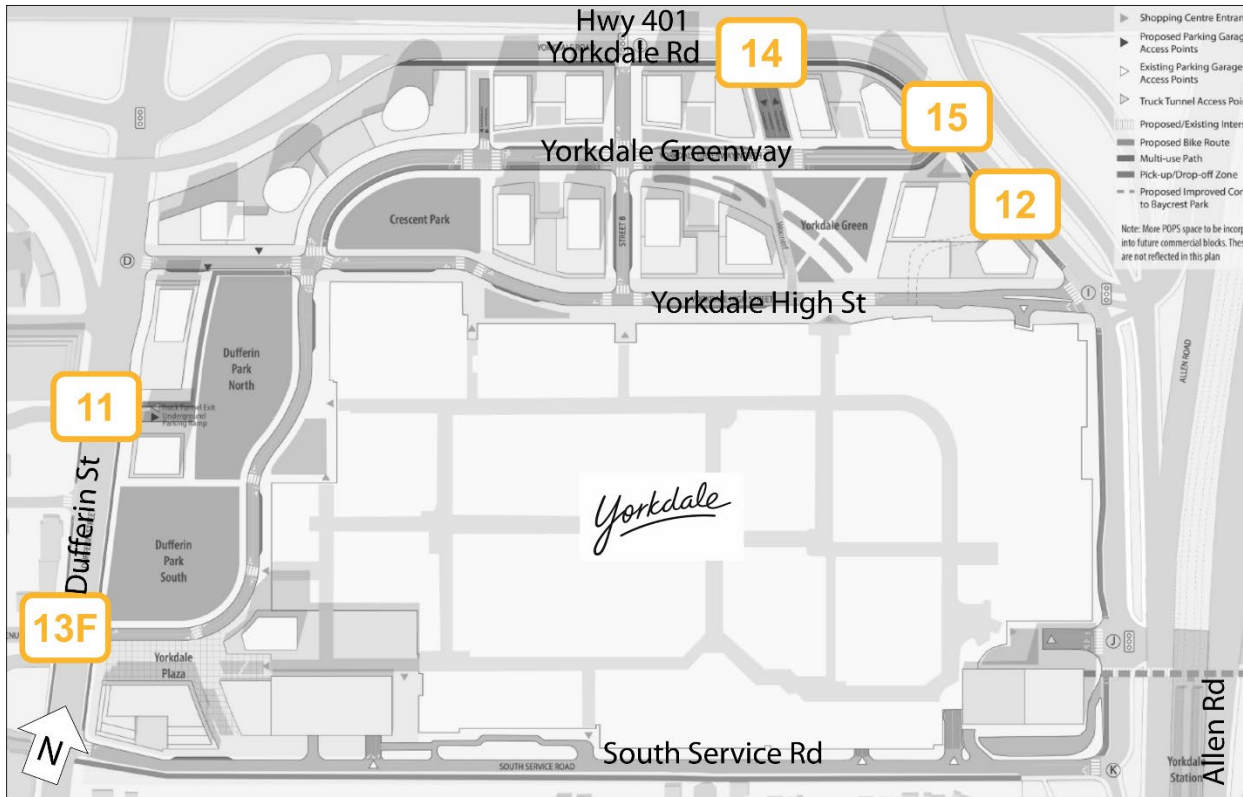
Scenario		Proposed Solutions										
		Boundary Road Access Solutions (11, 12, 13F, 14, 15)	1A	2B	3C	4A	6A	8	16	10	32A	32B
A	Boundary Road Improvements (BRI)											
B	Caledonia Extension											
C	Rustic / Cartwright Grade Separation											
D	Hwy 401 EB Off-ramp at Caledonia											
E	Hwy 401 WB Off-ramp and EB On-Ramp at Dufferin											
F	401 E-W / Allen NB Ramp Realignment and Yorkdale SB Contra-Flow Left Turn											
G	SBL at Dufferin / Bridgeland											
H	SB Transit Lane on Dufferin											
I	Closed SB Curb Lane on Dufferin at 401 EB off ramp											
J	All Improvement Scenario											

- The Boundary Road Improvement Scenario comprised solutions #11, 12, 13F, 14, and 15; these would be the expected “must-have” solutions around the Yorkdale Shopping Centre to support the proposed expansion as they are driveway access related.
- Analyses of Scenario B through Scenario I were conducted to understand the traffic impact results from the proposed solutions (based on stand-alone implementation in most cases but for some cases in combination with other solutions)
- The All Improvement Scenario considered all preferred solutions. However, the final decisions for selecting preferred solutions were not made solely on the reliance of the traffic impacts but the results contributed to the overall evaluation as described in **Section 11**.

10.1 Scenario A – Boundary Road Improvement

The network configuration for the Boundary Road Improvement Condition includes the planned road improvements (as described in **Section 7.3**) and the boundary road intersection improvements as shown in **Figure 10-1**. Those boundary road improvements are the expected “must-have” solutions needed to support the proposed Yorkdale development plan as they represent the proposed driveway access points.

Figure 10-1. Proposed Boundary Road Improvements



The purpose of developing the 2041 Boundary Road Improvement Condition scenario is to determine the network performance without implementing any major infrastructure improvements. In terms of the demand loading, both City-Proposed Plan and Oxford-Proposed Plan (demand profile introduced in **Section 8.4.3**) were loaded into the 2041 Boundary Road Improvement models for the traffic impact analysis.

The network virtual queue and operation measurements for 2041 Boundary Road Improvement Condition are summarized in **Table 10-2** and **Table 10-3**.

Table 10-2. 2041 Peak Period – Boundary Road Improvement Condition Aimsun Network Performance Metrics – City Proposed Development

Measurements (Network-Based)	AM	PM	Saturday
Virtual Queue* Measurements			
Max. Virtual Queue (veh)	271	3117	4209
Mean Virtual Queue (veh)	45	1747	1977
Vehicles Waiting to Enter Study Area (veh)	3	2731	3317
Network Operations Measurements			
Total Travel Time** (min/veh)	6.0	8.2	7.9
Average Speed (km/hr)	49	39	41
Average Delay (sec/veh/hr)	49	64	74

Table 10-3. 2041 Peak Period – Boundary Road Improvement Condition Aimsun Network Performance Metrics – Oxford Proposed Development

Measurements (Network-Based)	AM	PM	Saturday
Virtual Queue* Measurements			
Max. Virtual Queue (veh)	300	3156	4245
Mean Virtual Queue (veh)	52	1843	1572
Vehicles Waiting to Enter Study Area (veh)	2	2689	3242
Network Operations Measurements			
Total Travel Time** (min/veh)	5.9	8.2	7.3
Average Speed (km/hr)	49	39	42
Average Delay (sec/veh/km)	31	63	72

Compared to the Base Condition, the number of virtual queues and vehicles waiting to enter the study area will increase as the demand increases as the proposed Yorkdale development plan cannot be fully absorbed by the network capacity even with the implantation of the boundary road improvements.

Similar to the base condition, the majority of the virtual queues were observed at the network boundary intersections at the following intersections / movements:

- Northbound at Benton Road and Lawrence Avenue
- Northbound at Caledonia Road and Lawrence Avenue
- Northbound at Dufferin Street and Lawrence Avenue

Figure 10-2 through **Figure 10-7** provide an overview of the intersection operations for all signalized intersections within the larger study area for the 2041 Boundary Road Improvement Condition. Signal timings have been adjusted where needed based on the future demand volumes and patterns.

Figure 10-2. 2041 Boundary Road Improvement Condition Level of Service – Weekday AM Peak Hour – City Proposed Development

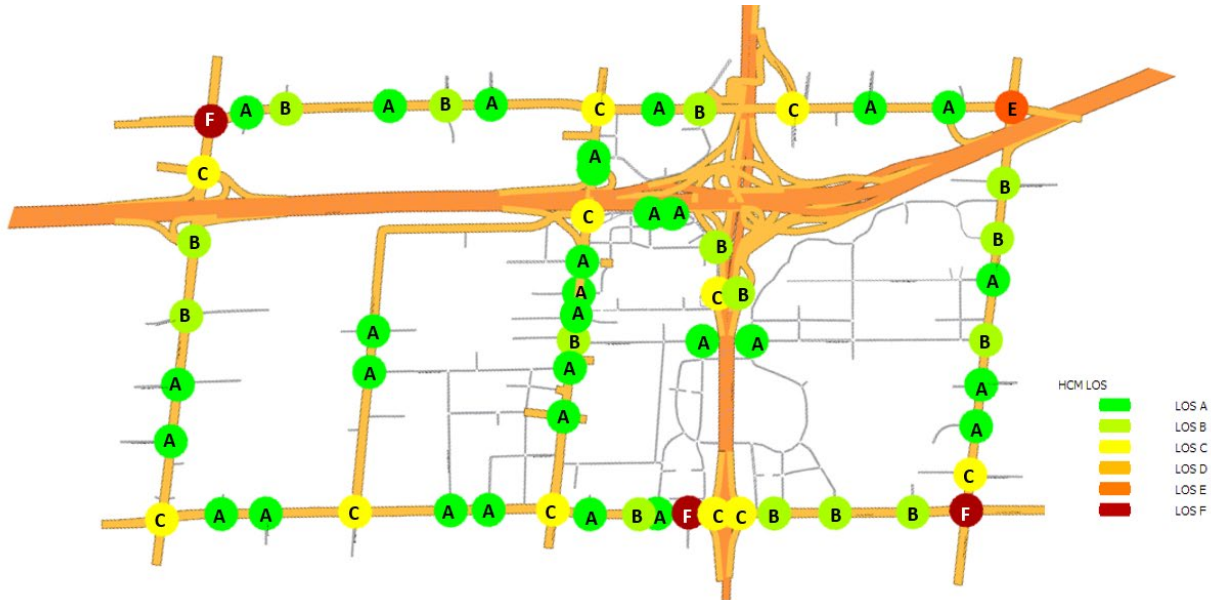


Figure 10-3. 2041 Boundary Road Improvement Condition Level of Service – Weekday AM Peak Hour – Oxford Proposed Development

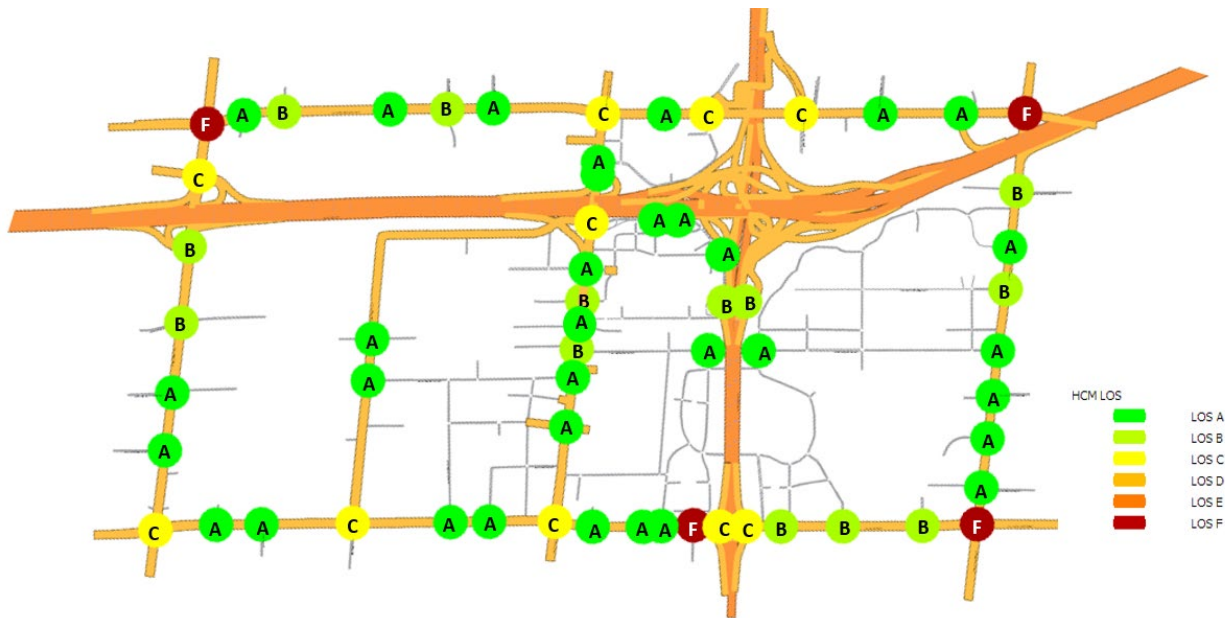


Figure 10-4. 2041 Boundary Road Improvement Condition Level of Service – Weekday PM Peak Hour – City Proposed Development

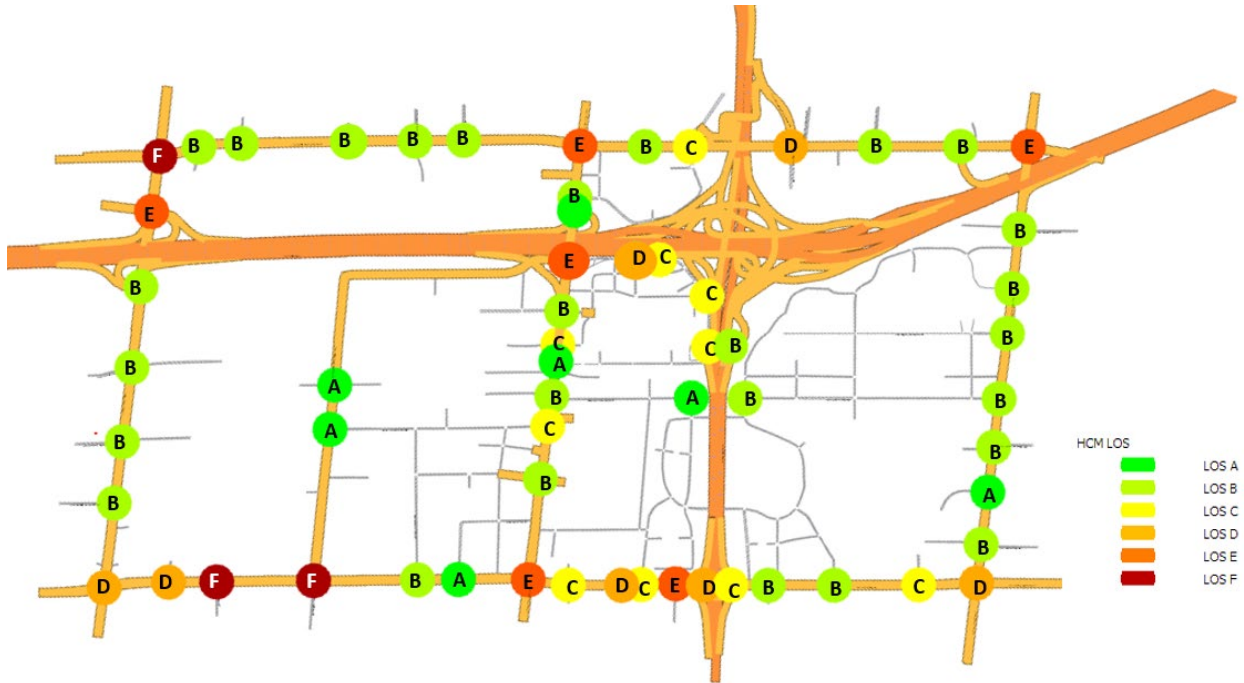


Figure 10-5. 2041 Boundary Road Improvement Condition Level of Service – Weekday PM Peak Hour – Oxford Proposed Development

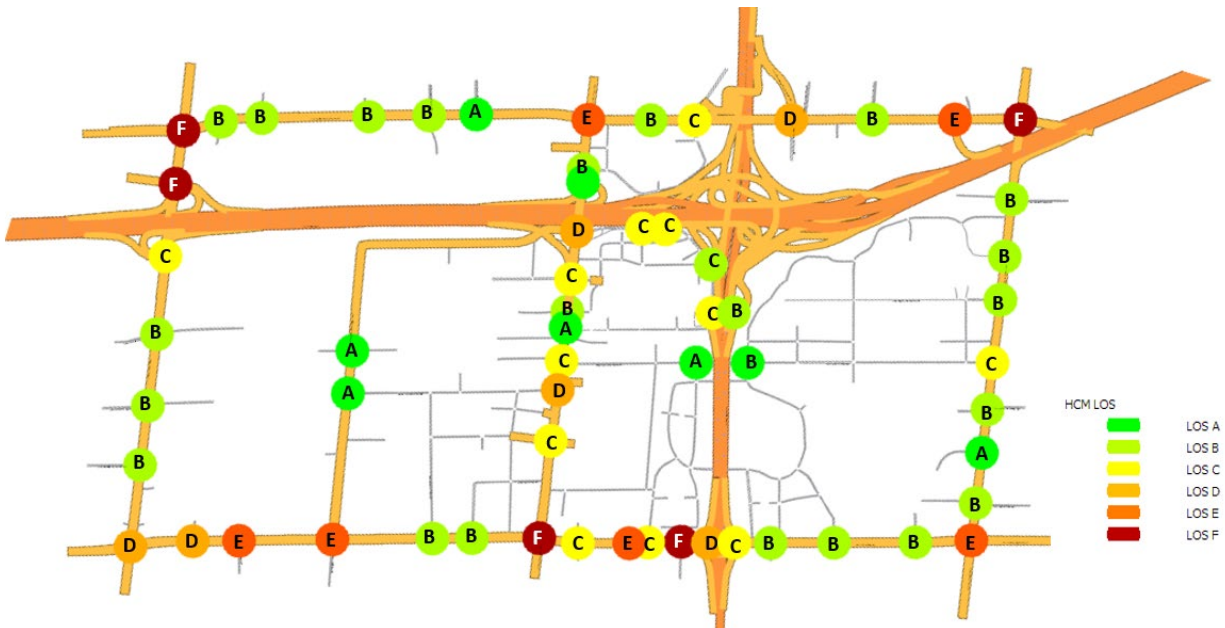


Figure 10-6. 2041 Boundary Road Improvement Condition Level of Service – Saturday Midday Peak Hour – City Proposed Development

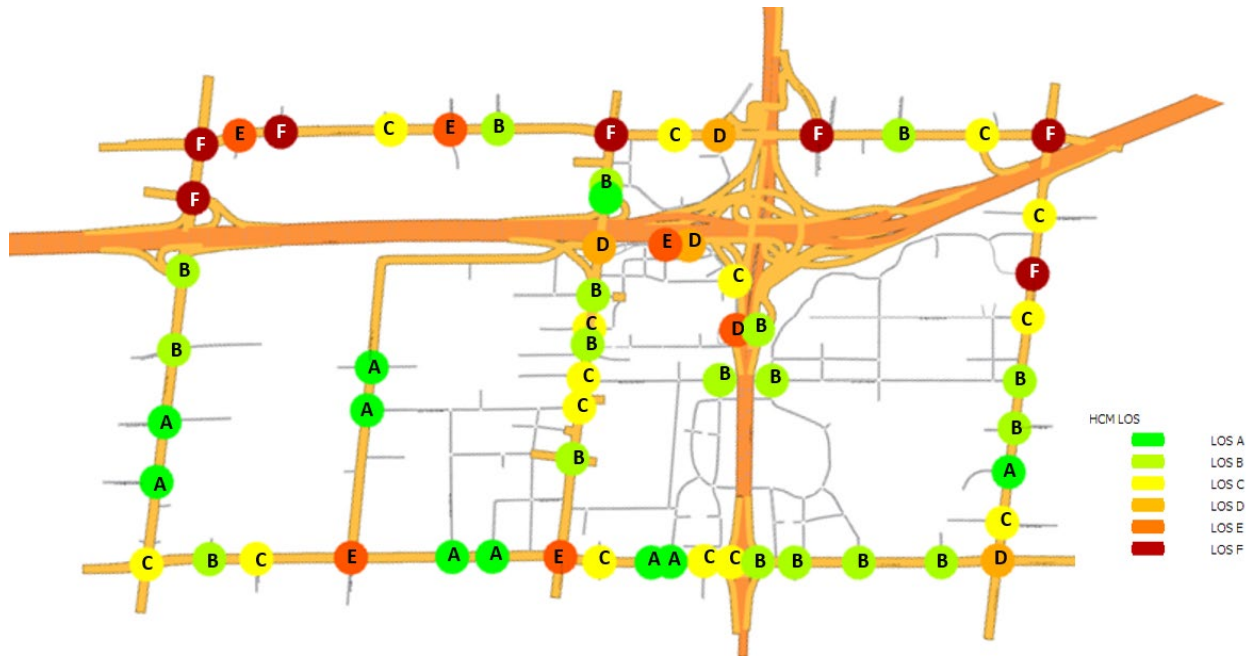
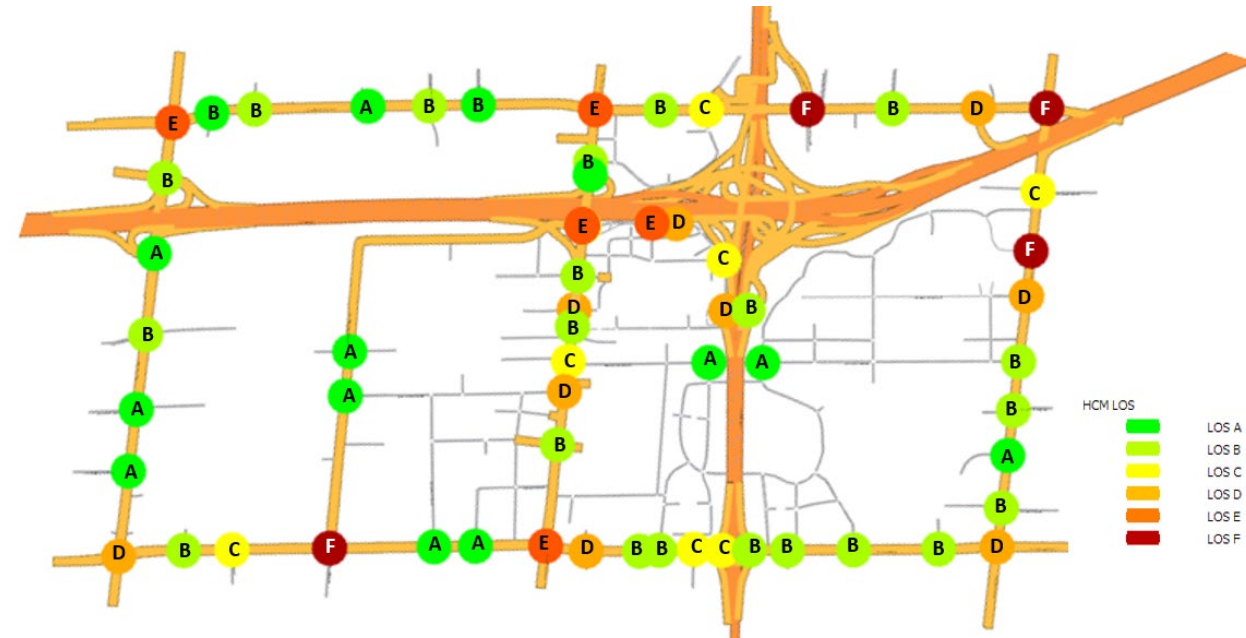


Figure 10-7. 2041 Boundary Road Improvement Condition Level of Service – Saturday Midday Peak Hour – Oxford Proposed Development



In general, the intersection operation between City proposed development and Oxford proposed development plans are comparable. Intersections that were already operate approaching/at/over capacity under the Base Condition will experience higher delays due to the additional demand because of the development. Dufferin Street and Yorkdale Road observed noticeable bottlenecks even with the implementation of the boundary road

improvements; therefore, further improvements should be explored to reduce the traffic congestion within the study area.

10.2 Scenario B through Scenario H – Sensitivity Analysis

Sensitivity analyses were conducted to evaluate the traffic impacts of each alternative. The key findings are summarized **Table 10-4**.

Table 10-4. Traffic Impacts Key Findings

Solution	Key Findings
Solution 1A Caledonia Extension	<ul style="list-style-type: none"> • Could attract 450 veh/hr and 350 veh/hr for the northbound and southbound, respectively • Helps to relieve congestion on parallel streets (Dufferin Street and Keele Street)
Solution 2B East-West Connection Rustic Avenue to Bridgeland Avenue	<ul style="list-style-type: none"> • Could attract 550 veh/hr and 350 veh/hr for the eastbound and westbound, respectively • Helps to relieve congestions on parallel streets (Wilson Avenue and Lawrence Avenue); however, adds infiltration traffic to Rustic Avenue through the stable neighbourhood west of the Barrie GO Line
Solution 3C Highway 401 EB Off- Ramp to Bridgeland	<ul style="list-style-type: none"> • Could attract 800 veh/hr • Would provide direct access to employment areas via Bridgeland and Caledonia but would increase traffic at the Dufferin/Bridgeland intersection • Helps to relieve congestions on the Highway 401 eastbound off-ramp on Dufferin
Solution 4A and 6A Highway 401 WB Off- Ramp to Dufferin Street	<ul style="list-style-type: none"> • Could attracts 200 veh/hr • There will be sufficient storage at the signal • Helps to relieve congestions at the Yorkdale Road / Highway401 Off-Ramp • Less by-pass traffic along Yorkdale Road • Creates additional delays to northbound and southbound traffic along Dufferin Street due to new signal
Solution 6A EB On-Ramp Dufferin Street to Highway 401	<ul style="list-style-type: none"> • Could attracts 350 veh/hr • Helps to relieve congestions at the Yorkdale Road / Highway401 On-Ramp • Less by-pass traffic along Yorkdale Road • Minor delays were observed occasionally at the weaving section (traffic going to Highway 401 collector ramp vs. traffic going to Allen Road southbound ramp); however, no queuing back-up to the off-ramp



Solution	Key Findings
Solution 8 Modified On-Ramp EB to Highway 401	<ul style="list-style-type: none"> No significant impacts to traffic operations Weaving distance: 124m Conflicting volumes: 400 vph (contra-flow lane) vs. 800 (EBL at the signal) Compared to existing condition, vehicles will merge on a straight line instead of a curvature
Solution 10 Allow Southbound Left-Turn for All Vehicles at the Intersection of Dufferin Street and Bridgeland Avenue	<ul style="list-style-type: none"> Could attracts 100 veh/hr Sufficient storage length to accommodate the southbound left-turn demand Needs to implement an advanced southbound-left turn phase due to high northbound demand which could be overlap with the advanced northbound left-turn phase that is currently exist
Solution 16 Contra-flow southbound left-turn on Yorkdale Road and Dual Right-Turn at the Intersection	<ul style="list-style-type: none"> Dual right turn helps to increase intersection capacity Contra-flow southbound left-turn has no significant improvement to the intersection capacity; however, could provide an opportunity for on-ramp traffic to access the highway before the signal and reduce the conflicts at the signal Creates additional delays to northbound traffic
Solution 32A 401 EB Off-Ramp to Dufferin Street (Retain Southbound Curb Lane for Transit Priority Lane)	<ul style="list-style-type: none"> Could increases throughputs at the off-ramp by approximately 300 vehicles Could reduce significant delay time for the off-ramp traffic Assumed the southbound curb lane will be converted to a transit priority lane and the off-ramp traffic can use the transit priority lane to pass through the signal. Off-ramp traffic can stay on the transit priority lane if they are going to McAdam loop. Improves the off-ramp merging Significantly improves through-puts and delays at the off-ramp No obvious negative impacts to the southbound traffic on Dufferin Street at the signal since the upstream intersection at Bridgeland Avenue has only two through-lane Allow southbound buses to navigate through the congested area more efficiently
Solution 32B 401 EB Off-Ramp to Dufferin St (Closed SB Curb Lane)	<ul style="list-style-type: none"> Similar traffic impacts compared to 32A Could increases throughputs at the off-ramp by approximately 300 vehicles Could reduce significant delay time for the off-ramp traffic

Both solution #32A and #32B will benefit the eastbound off-ramp in terms of throughputs and delays. Traffic performance at the off-ramp and at the signal are comparable between these two solutions. Overall, solution #32A is selected as a preferred improvement over #32B consider the additional benefits to local transit/bus while resulting similar benefits to the eastbound off-ramp compared to #32B.

The traffic impact findings from the sensitivity analysis build into the evaluation matrices to determine the preferred solutions. It should be noted that the final decisions for the

preferred solutions are not only made on traffic impacts but an overall evaluation that considers the natural environment, policy, technical, economic, and cultural / social aspects, which are discussed in **Section 11**.

10.3 Scenario J - All Improvement Condition

The 2041 All Improvement Condition scenario builds on the 2041 Boundary Road Improvement Condition models with the introduction of the following major road and infrastructure improvements:

- Solution 1A: Caledonia extension
- Solution 8: Contra-flow and dual right at the Yorkdale Road / Highway 401 off-ramp
- Solutions 10: Allow Southbound Left-Turn for All Vehicles at the Intersection of Dufferin Street and Bridgeland Avenue
- Solution 16: Modified on-ramp to the northbound Allen Road
- Solution 32A: 401 eastbound off-ramp to Dufferin Street – converting the southbound curb lane to a transit priority lane

The above solutions were selected due to their higher feasibility and preferences considering all detailed evaluation criteria as documented in **Section 11**.

The network virtual queue and operation measurements for 2041 All Improvement Condition are summarized in **Table 10-5** and **Table 10-6**.

Table 10-5. 2041 Peak Period – All Improvement Condition Aimsun Network Performance Metrics – City Proposed Development

Measurements (Network-Based)	AM	PM	Saturday
Virtual Queue* Measurements			
Max. Virtual Queue (veh)	241	2814	3074
Mean Virtual Queue (veh)	36	1565	1850
Vehicles Waiting to Enter Study Area (veh)	2	2052	3070
Network Operation Measurements			
Total Travel Time** (min/veh)	5.9	8.2	7.6
Average Speed (km/hr)	49	40	42
Delay Time (sec/veh/hr)	30	60	71

Table 10-6. 2041 Peak Period – All Improvement Condition Aimsun Network Performance Metrics – Oxford Proposed Development

Measurements (Network-Based)	AM	PM	Saturday
Virtual Queue* Measurements			
Max. Virtual Queue (veh)	272	2882	3370
Mean Virtual Queue (veh)	41	1559	1753
Vehicles Waiting to Enter Study Area (veh)	2	2334	2783
Network Operation Measurements			
Total Travel Time** (min/veh)	5.9	7.9	7.7
Average Speed (km/hr)	49	40	42
Delay Time (sec/veh/hr)	30	59	69

Compared to the network measurements of 2041 Boundary Road Improvement Condition, the additional solutions of #1A, #8, #16, #10, and 32A (mainly because Solution #1 Caledonia Extension) will reduce the congestion along Dufferin Street, allow more traffic to enter the network during the peak periods, and improve averaged delay time for auto trips. For Weekday PM and Saturday Midday, the additional solutions could allow at least 300 more vehicles to enter the network during the peak period while reducing the delay time for all vehicles by 3 sec per kilometer travelled.

Still, there are some bottlenecks inside the network preventing vehicles from being served during the simulated peak periods (3-hour). In reality, those vehicles cannot enter the network during simulation period will likely seek alternative routes or enter the network at an earlier/later time causing peak period spreading.

Figure 10-8 through **Figure 10-13** provide an overview of the intersection operations for all signalized intersections within the larger study area for the 2041 With-Improvement Condition. Signal timings have been adjusted where needed based on the future demand pattern.

Figure 10-8. 2041 All Improvement Condition Level of Service – Weekday AM Peak Hour – City Proposed Development

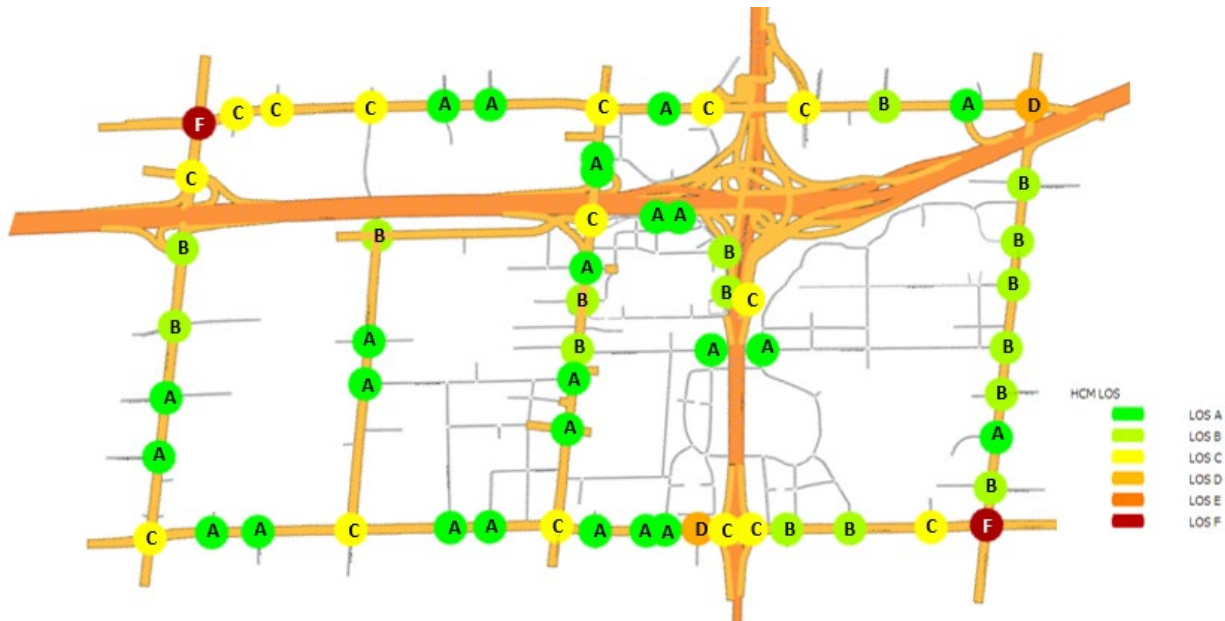


Figure 10-9. 2041 All Improvement Condition Level of Service – Weekday AM Peak Hour – Oxford Proposed Development

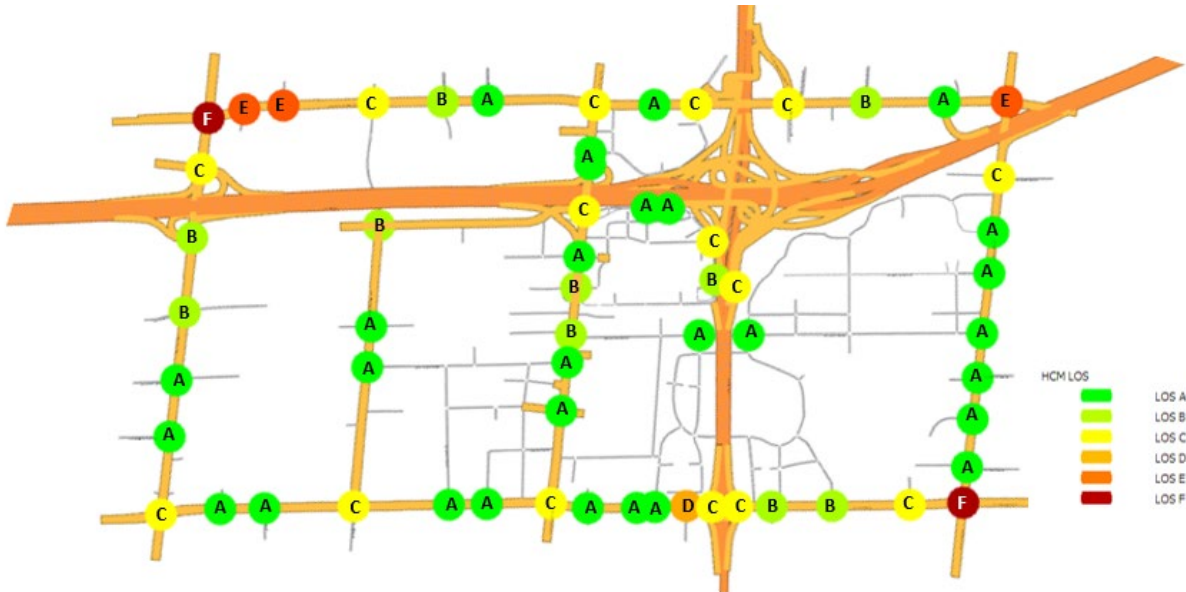


Figure 10-10. 2041 All Improvement Condition Level of Service – Weekday PM Peak Hour – City Proposed Development

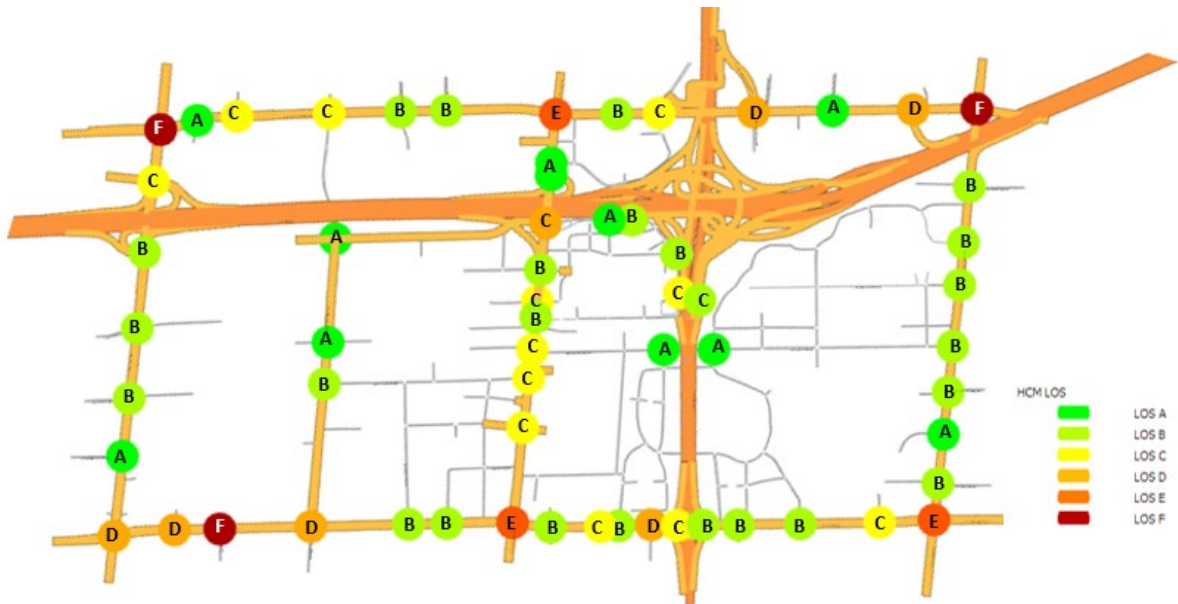


Figure 10-11. 2041 All Improvement Condition Level of Service – Weekday PM Peak Hour – Oxford Proposed Development

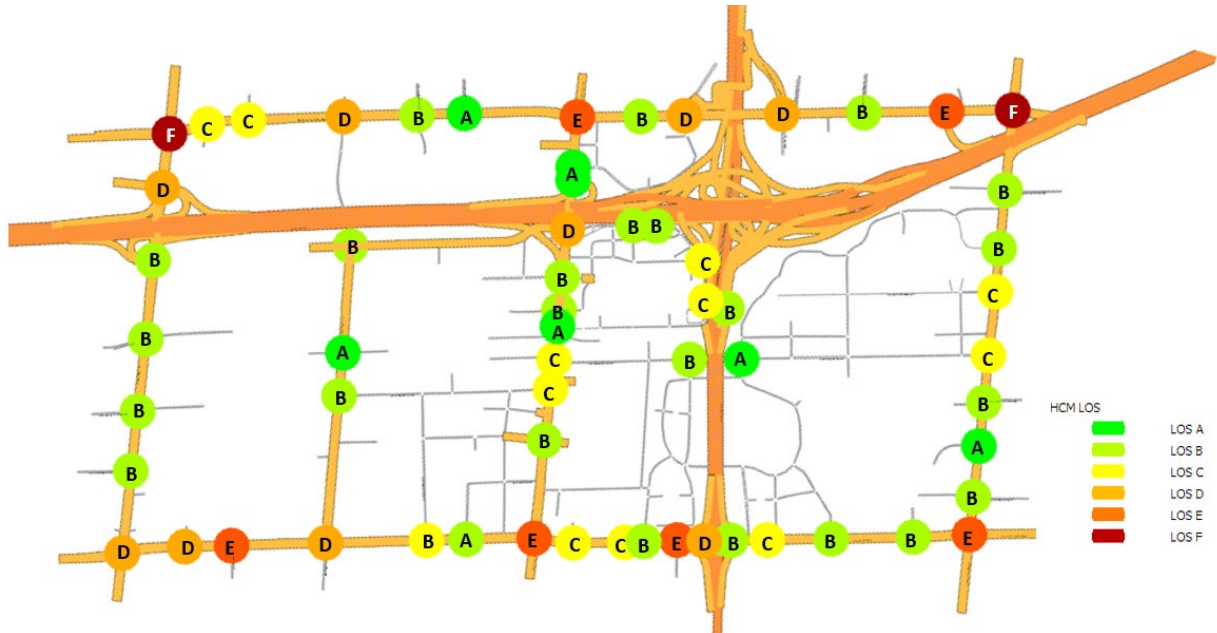


Figure 10-12. 2041 All Improvement Condition Level of Service – Saturday Midday Peak Hour – City Proposed Development

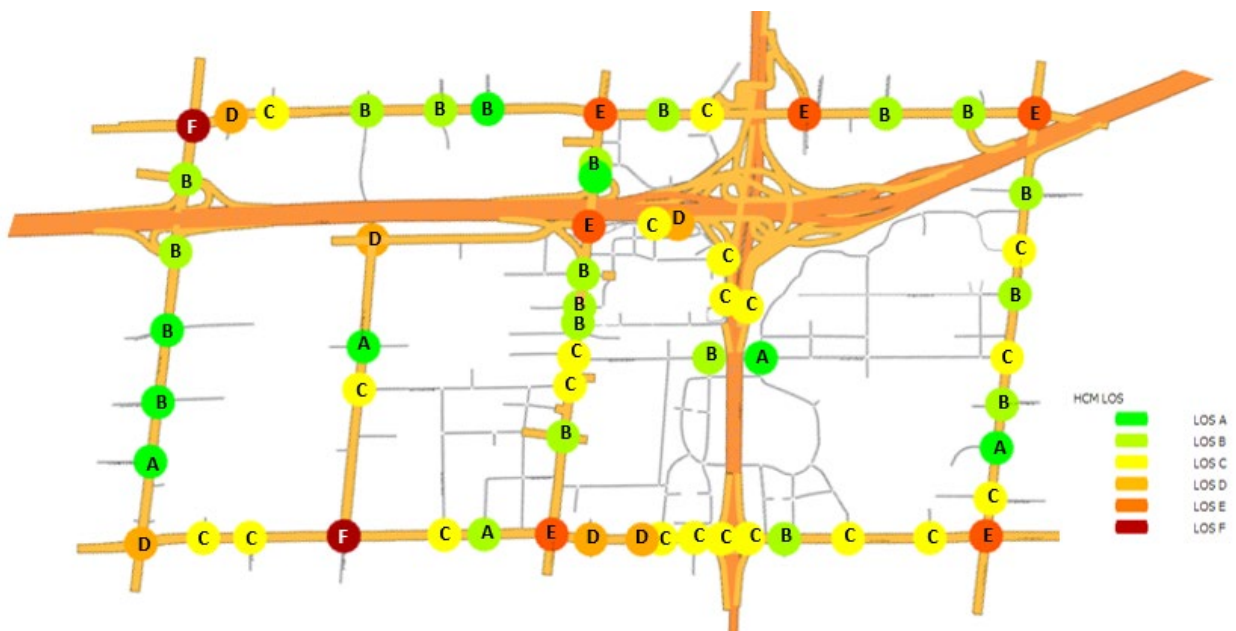
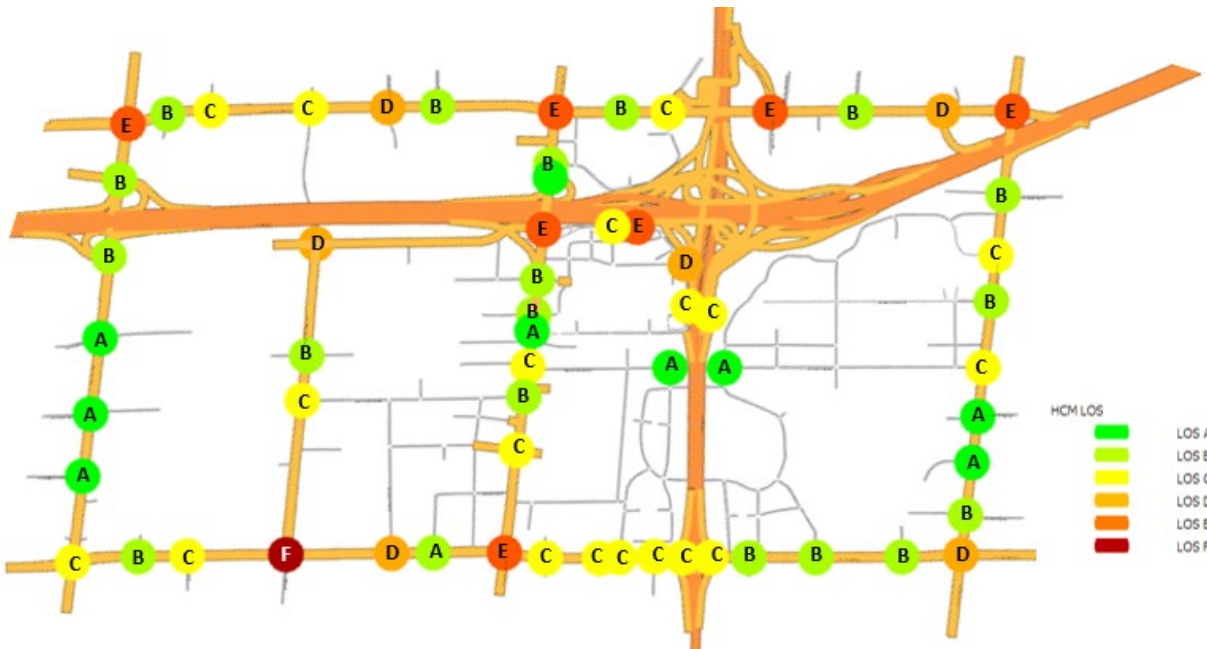


Figure 10-13. 2041 All Improvement Condition Level of Service – Saturday Midday Peak Hour – Oxford Proposed Development



Within the project focus area around the Yorkdale Shopping Centre, Saturday Midday is the busiest period due to higher retail trips compared to weekday peaks, where most of the intersections along Yorkdale road will be operating at LOS C or worse.

In general, the intersection operation between City proposed development and Oxford proposed development plans are comparable. Major-major intersections at the network boundary observed congestions and are expected to operate at LOS D or worse at the following locations:

- Wilson Avenue / Keele Street
- Wilson Avenue / Dufferin Street
- Wilson Avenue / Wilson Height Boulevard
- Wilson Avenue / Bathurst Street
- Lawrence Avenue / Keele Street
- Lawrence Avenue / Caledonia Road
- Lawrence Avenue / Dufferin Street
- Lawrence Avenue / Bathurst Street

10.4 Finding Summary

The proposed pedestrian, cycling, and transit improvements will encourage a mode shift from auto to transit or active mode; hence reducing overall traffic congestion. While most of the proposed road and infrastructure improvements are expected to improve the network connectivity and to relieve the localized congestions inside the study area,

especially around the Yorkdale Shopping Centre; nonetheless, they have very limited benefits to the capacity at the network boundary intersections.

With all preferred solutions implemented, the network can support the projected demand for the 2041 Weekday AM peak period. For the Weekday PM and Saturday Midday peak periods, there are 2000-3000 vehicles that cannot enter the study area during the peak period due to limited capacity, which is approximately 2% of the projected peak period demand. In reality, those vehicles that cannot enter the network will likely seek alternative routes or enter the network at an earlier/later time causing peak period spreading.

Compared to the network measurements of the 2041 Boundary Road Improvement Condition, the All Improvement Condition reduces the congestion along Dufferin Street, allows more traffic to enter the network during the peak periods, and improved the average delay time for auto trips within the study area. The traffic improvements achieved in the All Improvement Condition are mainly contributed by the proposed Caledonia extension solution. In order to understand more details of traffic impacts resulting from Caledonia extension (for example, the volume-to-capacity ratio at key intersections which is not the purpose of the Aimsun model), as well as the trigger/timeline for development phasing, a trigger analysis has been conducted as documented in **Section 13.5.1**.