TORONTO

REPORT FOR ACTION

North York Centre: Doris Avenue Extension (South Service Road - Environmental Assessment Addendum)

Date: November 17, 2020
To: Infrastructure and Environment Committee
From: General Manager, Transportation Services
Wards: Ward 18 - Willowdale

SUMMARY

The plan for North York Centre - one of four dynamic mixed-use Centres in Toronto - is focused on growth of commercial office and residential uses existing side by side. Centres with a healthy mix of uses help take pressure off public transit infrastructure and roads, as they encourage people to live, work and play within a centralized geography.

The North York Centre Service Roads - comprised of Doris Avenue and Beecroft Road - form a ring road around the North York Centre, east and west of Yonge Street.

The Service Roads serve several purposes, including:

- Connecting North York Centre with a finer grained transportation network in order to better manage traffic flow along Yonge Street and other alternate routes;
- Providing convenient rear access to residential, retail, and office buildings on Yonge Street; and
- Forming a boundary for the high-rise development within North York Centre in relation to the adjacent stable residential neighbourhoods.

The completion of the southeastern portion of the Service Road that would link Doris Avenue and Tradewind Avenue across Sheppard Avenue and east of Yonge Street was first studied in detail in a 1996 Environmental Assessment (EA), followed by an EA Addendum in 1998. In 2013, the study was reopened to address important changes in the study area, including extensive high-rise development in North York Centre.

In the intervening period, various options for connecting Doris Avenue and Tradewind Avenue across Sheppard Avenue have been re-assessed (and presented to both Council and the public) with the objective of improving traffic flow to better accommodate growth in North York Centre and mitigating impacts to private property.

As a result of the review that has been undertaken, this EA Addendum recommends a two phased approach as follows:

Phase 1 – Interim Condition:

- Tradewind Avenue would be extended up to Sheppard Avenue East.
- This would result in an offset intersection at Tradewind Avenue / Sheppard Avenue East and Doris Avenue / Sheppard Avenue.
- Traffic signal phasing would be coordinated at the offset intersection to optimize traffic flow.
- Bonnington Place would be closed off in a cul-de-sac south of Sheppard Avenue East, as proposed in the 1998 EA.
- This was identified as Option C in the Environmental Assessment process, and would complete a portion of the future condition intersection, south of Sheppard Avenue.

Phase 2 – Future Condition:

- Doris Avenue would be realigned approaching Sheppard Avenue East to meet the northern extension of Tradewind Avenue, as described above.
- This would result in a single four-legged intersection, with a skew on the north-east quadrant.
- The appropriate timing of implementation of this future condition would be subject to property acquisition and completion of detailed design to minimize impacts where possible.
- This is a revised version of Option B identified in the Environmental Assessment process.

Based on the traffic analysis completed, while ultimately a single intersection would provide the most improvement for traffic flow in the North York Centre, the interim condition would also improve the overall performance of the future network when compared to the Future Do Nothing Scenario, and could be implemented sooner, at less cost, and with less impact to private property. As such, it is recommended that detailed design and property acquisition required for the Interim Condition be initiated following the formal completion of the North York Centre South Service Road Municipal Class Environmental Assessment Addendum.

North York Centre - Transportation Network Integration

The Doris Avenue extension (South Service Road) is one of two integral pieces of transportation network infrastructure (the other being Beecroft Road extension north to Drewry Avenue) required to support growth and development priorities in North York Centre. The North York Centre: REimagining Yonge EA, is being reported concurrently with this report on the Doris Avenue Extension. It is recommended that in order for the vision of REimagining Yonge to proceed, at least the initial phases of both the Doris Avenue and Beecroft Avenue extensions will need to be in place.

RECOMMENDATIONS

The General Manager, Transportation Services recommends that:

1. City Council authorize the General Manager, Transportation Services to issue a Notice of Completion and to file the Environmental Study Report Addendum for the North York Centre South Service Road Environmental Assessment Addendum Study in the public record for a minimum 30 days in accordance with the requirements of the Municipal Class Environmental Assessment.

FINANCIAL IMPACT

The estimated cost of detailed design and construction is approximately $7 million.

Funding for implementation and construction, excluding remaining property acquisition needs, is available within the approved 2020 – 2029 Capital Budget and Plan for Transportation Services.

The cost of property acquisition will be confirmed as part of the design and property valuation process which will be considered as part of the future capital budget process.

The Chief Financial Officer and Treasurer has reviewed this report and agrees with the financial impact information.

DECISION HISTORY

At its meeting of June 10, 11, 12 and 13, 2014, City Council adopted the item PW31.9 which directed the General Manager, Transportation Services, to refine Option B to address any deficiencies and then reassess all Options, with priority given to the traffic capacity and operations at the Service Road/Sheppard Avenue intersection, to determine the preferred alternative. Council also directed that the results of the reassessment and the recommended preferred Option be presented at a public information meeting in the community and to report to Council through the Public Works and Infrastructure Committee on the outcome of the reassessment and the community consultation.
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2014.PW31.9

The North York Centre Secondary Plan (which is primarily based on the Former City of North York's North York Centre Secondary Plan) was approved as part of the Official Plan in 2002, and subsequently approved by the Ontario Municipal Board in 2006. The Secondary Plan provides area-specific policies to guide the redevelopment of North York Centre. Map 8-10 of the Secondary Plan identifies a notional line representing the

extension of Doris Avenue south of Sheppard Avenue, to Avondale Avenue (Map 8-10 is included in Attachment 1)
https://www.toronto.ca/wp-content/uploads/2017/11/8fe9-cp-official-plan-SP-8-North-York-Centre.pdf

COMMENTS

Existing Conditions

North York Centre is a designated urban centre in the City of Toronto surrounding the intersection of Yonge Street and Sheppard Avenue and north of Highway 401, containing high levels of new residential and commercial development.

As identified in the North York Centre Secondary Plan, the North York Centre Service Roads are intended to provide access to development in the Centre and form a boundary between the Centre and surrounding stable residential neighbourhoods. Access to Centre development is encouraged via the Service Roads, as Yonge Street experiences high traffic demand for trips through and beyond the Centre.

Currently, the completed portion of the North York Centre Service Road consists of two main north-south branches – Beecroft Road from Poyntz Avenue to Finch Avenue West and Doris Avenue from Sheppard Avenue East to Finch Avenue East, connected by several east-west streets.

The focus of the study area (as seen in Figure 1 below) for the North York Centre South Service Road Environmental Assessment Addendum currently underway is east of Yonge Street at Sheppard Avenue – at the intersections of Doris Avenue, Tradewind Avenue, and Bonnington Place.

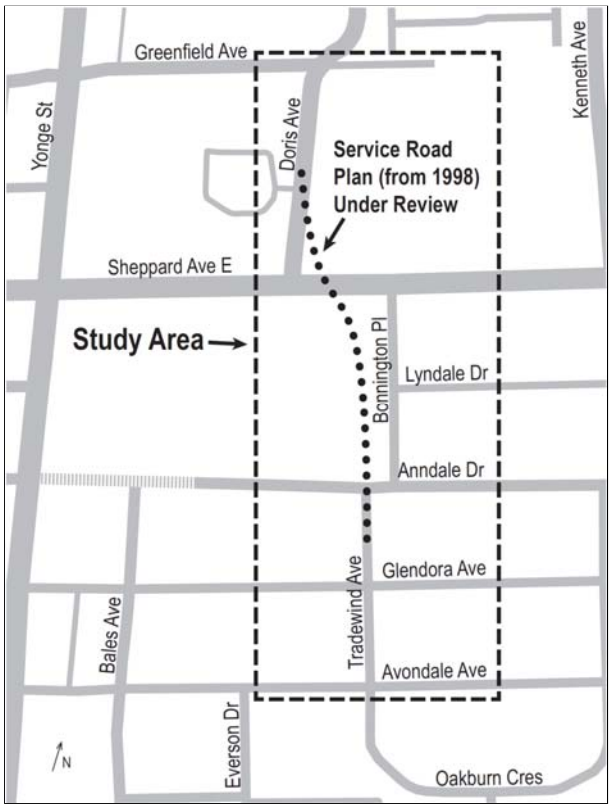

Figure 1. Study Area

- Doris Avenue is a north/south minor arterial road, which extends from Finch Avenue to Sheppard Avenue. It has a consistent four lane cross-section, two lanes in each direction (with auxiliary lanes at key intersections). Based on traffic counts taken during 2013, there are approximately 1,200 vehicles during the weekday AM peak hour (representing the busy period throughout the day) travelling northbound on this corridor (north of Sheppard Avenue), and approximately 1,100 vehicles travelling southbound towards Sheppard Avenue.
- Tradewind Avenue is a north/south local road, which extends from Anndale Drive to Avondale Avenue. It has two travel lanes, one in each direction. Once the extension north to Sheppard Avenue is in place, the future road classification of Tradewind Avenue would be reviewed.
- Bonnington Place is a north/south local road, which extends from Sheppard Avenue to Anndale Drive. It has two travel lanes, one in each direction.

The intersection of Yonge Street and Sheppard Avenue currently experiences significant delays and queuing during the AM and PM peak periods. Once fully implemented, the North York Centre Service Roads (including the Doris Avenue and Beecroft Avenue extensions) will provide additional capacity and help manage congestion along Yonge Street for north/south travel. Further, the Doris Avenue/Tradewind Avenue extension will provide a northbound/southbound bypass of the Yonge Street/Sheppard Avenue intersection, and an alternative route for vehicles exiting the northbound off-ramp from Highway 401/Yonge Street interchange to residential and office towers east of Yonge Street.

The preliminary design (30 per cent) of the Beecroft Road extension from Finch Avenue West north to Drewry Avenue is currently underway and is expected to be completed by mid-2021. Detailed design is planned for 2023-2024, with construction targeted for 2025-2026.

Environmental Assessment Process
A timeline of the history of this project is outlined below:

- 1996: Municipal Class EA completed, which first established the need for the south service road project.
- 1998: Municipal Class EA Addendum completed, which reflects the new North York Centre Secondary Area boundary.
- 2006: North York Centre Secondary Plan completed, which reinforced the need for this project.
- 2013: A Municipal Class EA Addendum was initiated, to address important changes in the study area, including extensive high-rise development in North York Centre. If more than 10 years elapse before implementation following the completion of the EA, or if conditions sufficiently change requiring modification of the preferred design, an addendum to the Environmental Study Report (ESR) is required.

Since 1998, development in the North York Centre has proceeded at a rapid pace, especially following the opening of the Sheppard Subway line from Yonge Street to Don Mills Road in 2002. Implementation of the Service Road has been incremental and ongoing, with both Beecroft Avenue and Doris Avenue segments completed between Sheppard and Finch by 2013.

The plan recommended in 1998 contained a significant impact on private property in relation to the parking garage of 45-47 Sheppard Avenue which has required the development of alternative designs in the current Addendum.

In 2014, a recommendation was made to Council to proceed with an offset intersection at Sheppard Avenue East and Doris Avenue/ Tradewind Avenue and Council directed staff to complete further analysis. Upon completion of the analysis, a preliminary recommendation was shared with the public in 2015, identifying a single four-legged intersection, as the preferred option.

Public Consultation

Public involvement is an integral part of the study process for any Municipal Class EA, including the North York Centre South Service Road Class EA Addendum Study.

Public consultation for this study was generally conducted over three periods:

- September 2013 to March 2014;
- May 2015 to June 2015; and
- February 2020.

Each period included direct engagement with stakeholders and affected property representatives, public notification, a public drop-in event, a detailed web page

(www.toronto.ca/nyc-south-road), and multiple feedback mechanisms, including online, email, phone and postal mail.

Public notification methods used included:
- Letters to potentially affected property owners and residents;
- Advertisements published in the North York Mirror (East);
- Flyers delivered by Canada Post in the area of Yonge Street to Dudley Avenue, 401 to Empress Avenue; and
- Emails to the project email list of stakeholders.

Each consultation period presented variations of single and offset intersection designs, with updated design details and context. Throughout the consultation process, trends in public opinion received were relatively consistent:
- Preference for a single intersection that will optimize traffic flow and pedestrian safety;
- Interest in having the project implemented without further delay;
- Appreciation for the Bonnington Place cul-de-sac design that will avoid residential driveways directly abutting onto the service road;
- Concerns about any changes that may increase traffic infiltration on to residential streets; and
- Some opposition to impacting the existing private green space (east of Doris Avenue).

Stakeholder consultation will continue following City Council consideration and approval of next steps, as part of the process to finalize the detailed design and required property acquisition.

A public consultation summary report will be included and published as part of the final Environmental Assessment Addendum Summary Report.

Preliminary Evaluation of Alternative Designs for Preferred Solution

Four options were reassessed in this EA Addendum:

- Option A: Single Intersection (Right Angle) as shown in Figure 2 – Realign Doris Avenue to pass through the open space at 80-90 Sheppard Avenue, meeting Bonnington Place at a right angle at Sheppard Avenue. South of Sheppard Avenue, the Service Road would connect to the existing Tradewind Avenue. Several houses on Bonnington Place would have driveways extending to the Service Road, which is generally contrary to Secondary Plan policy.

Figure 2. Option A (Single Intersection)

- Option B: Single Intersection (Skewed) as shown in Figure 3 – Realign Doris Avenue to meet the northern extension of Tradewind Avenue, resulting in a skewed intersection at Sheppard Avenue. Bonnington Place would be closed off in a cul-de-sac, as proposed in the 1998 EA.

Figure 3. Option B (Single Intersection)

- Option C: Offset Intersection (Maintain Existing Doris Avenue alignment) as shown in Figure 4 – Create an offset intersection by extending Tradewind Avenue up to Sheppard Avenue, and installing coordinated traffic signals at Doris Avenue and Tradewind Avenue. Bonnington Place would be closed off in a cul-de-sac.

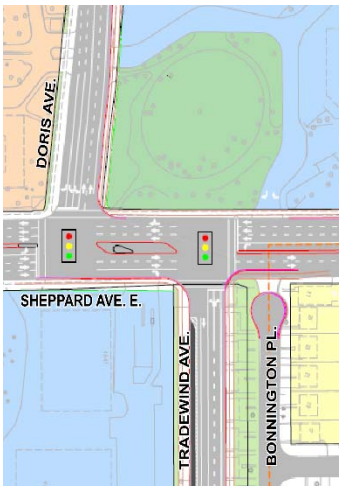

Figure 4. Option C (Offset Intersection)

- Option D: Offset Intersection (Realign Doris Avenue) as shown in Figure 5 – Realign Doris Avenue to meet Sheppard Avenue at a right angle, and extend Tradewind Avenue to Sheppard Avenue, creating an offset intersection with synchronized traffic signals and a reduced offset compared to Option C. Bonnington Place would be closed off in a cul-de-sac.

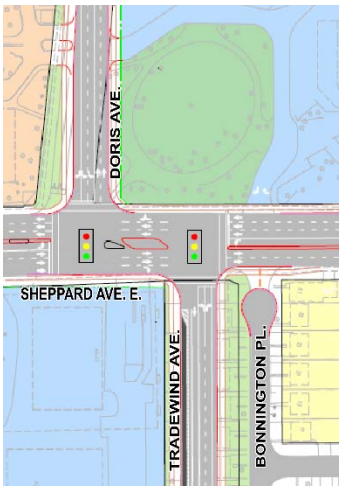

Figure 5. Option D (Offset Intersection)

All options underwent a preliminary evaluation for their impacts relating to property, cost, traffic operations, and other factors identified in Attachment 3 of PW31.9: http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2014.PW31.9

Traffic Analysis

Following the preliminary evaluation completed in 2014/2015, the traffic analysis for this study has been updated. Two options have been re-assessed – a single intersection design (Option A/B) and an offset intersection design (Option C/D). The analysis was updated with traffic volumes forecasted for post-2022 construction. The update also considered the impacts on traffic flow at this intersection if Yonge Street was to be

reconstructed with either 6 lanes or 4 lanes (under study concurrently within the REimagining Yonge Street Environmental Assessment). The North York Centre: REimagining Yonge EA is being reported concurrently with this report on the Doris Avenue Extension.

The traffic analysis assumed both the weekday AM and PM peak hour conditions for the year of implementation, post-2022. The annual travel demand was increased by a growth factor[1] of 0.5% in the AM, and 1.0% in the PM from 2016 to 2022, equal to an increase of 3% during the AM peak hour, and 6% during the PM peak hour. This increase in travel demand was applied to the microsimulation focus area[2] used in the REimagining Yonge model for accuracy and consistency purposes, and represents a conservative approach for addressing traffic growth, in an area that has experienced very little to no traffic growth over the last few years. No additional modifications to the street network were assumed as part of the modelling analysis (i.e. Beecroft Road was not assumed to be extended by 2022).

Based on the traffic analysis completed, while ultimately a single intersection would provide the most improvement for traffic flow in the North York Centre, the interim offset intersection would also improve the overall performance of the future network when compared to the Future Do Nothing Scenario. As such, it is recommended that detailed design and property acquisition required for the Interim Condition be initiated following the formal completion of the North York Centre South Service Road Municipal Class Environmental Assessment Addendum. See Attachment 2 for more detailed analysis on the traffic operations.

Design Considerations

The extensions of Doris Avenue and Tradewind Avenue would both include sidewalks, and a 4-5+ metre boulevard where feasible.

From a safety perspective, a single intersection design (Option A and B) is less likely to cause driver and pedestrian confusion. An offset intersection design (Option C and D) would require appropriate signage and pavement markings to direct road users through the intersection. As part of detailed design, a safety audit will be undertaken to optimize safety – for instance, wider sidewalks, designated crossing areas, signage, and lane markings will improve the overall safety of the intersection for all road users.

All options under consideration have associated property impacts, with all four requiring properties south of Sheppard Avenue. The single intersection design (Option A and B) would impact one or both of the south west and north east quadrants of Doris Avenue and Sheppard Avenue.

The north east quadrant includes a privately owned feature in the form of a round landscaped grassy mound, which City Planning identifies as a privately-owned, publicly

[1] Annual traffic growth factors for the AM and PM conditions is based on review of 5-year growth patterns in the focus area

[2] The model developed for ReImagine Yonge AM Existing Conditions (base year 2016 – updated in 2019) was used for this study to ensure consistency between the two studies.

accessible space (POPS). The mound is an important feature to the local community, and business patrons. In consultation with City Planning, impacts to the mound will be minimized, and/or avoided, when finalizing the design of the road skew north of Sheppard Avenue.

In Option A, the impact on the north east quadrant would be focused on 90 Sheppard Avenue East, impacting the existing landscaped mound described above, and adjustments to the driveway off of Doris Avenue at 80 Sheppard Avenue East.

In Option B, the impact on the south west quadrant would be isolated to a small sliver of land required from 45-47 Sheppard Avenue East. However, the land required currently has an underground parking structure beneath it. This parking structure is integral to the operations of the property, and adds more complexity and cost to any alignment over this structure.

Staff have refined the design of Option B from the original EA, to minimize impact to the POPS north of Sheppard Avenue, and the underground parking structure at 45-47 Sheppard Avenue East. Minor realignment opportunities were identified south of Sheppard Avenue, where the skew of the road is aligned further east. This refinement however eliminates the proposed cul-de-sac on Bonnington Place. In its place, Bonnington will remain as a 2-way road, with one-way access connecting to Sheppard Avenue East, where right-out access is proposed. The refinement is conceptually shown in Figure 7 below.

The offset intersection design (Option C) minimizes impacts for properties at the intersection and would be conducive to a phased implementation which may be preferable from a costing and delivery perspective.

Driveway access to 45-47 Sheppard Avenue East would be impacted by all options (single and offset intersection) under consideration, and would require the existing full moves access from Sheppard Avenue become right-in, right-out. The City would work with the property owner to provide additional automobile access (inbound/outbound turns) to the site from Anndale Drive or from the future Service Road alignment.

Recommended Plan and Next Steps

As a result of the review, this Environmental Assessment Addendum recommends a two phased approach to implementation, where an offset intersection (seen in Figure 6 below) maintaining Doris Avenue alignment (Option C), and extending Tradewind Avenue up to Sheppard Avenue, is being recommended as an interim solution. The extension of Tradewind Avenue would represent the south portion of the ultimate condition.

The City would advance the implementation of a single four-legged intersection (conceptually shown in Figure 7 below) (representing a refinement to Option B), subject to minimizing property impacts, required property acquisition, and further detailed design, as a single intersection provides improved operational and safety benefits over an offset intersection. Through the detailed design work of Phase 2, one key objective

of the final condition is to ensure the road alignment is designed to minimize, and/or avoid, impact to the open space to the greatest extent possible, in consultation with City Planning.

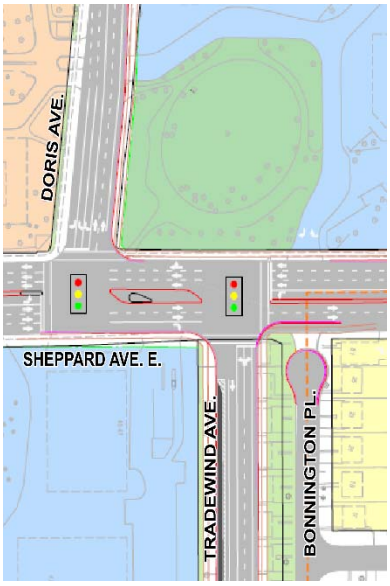

Figure 6. Phase 1 – Offset Intersection

Figure 7. Phase 2 – Single Intersection

If City Council endorses the study recommendations, the ESR Addendum will be filed in the public record for a minimum 30-day review period. During this period, any interested party may request that the Minister of the Environment issue a Part II Order under the EA Act. The City is then obliged to work with the requestor to resolve their concerns or to advise the Ministry of the rationale for setting aside the request. If a Part II Order is not granted or objections received during the filing period are resolved, the City would

be authorized to proceed to detailed design and implementation, subject to conditions placed on the project by the Minister, if applicable.

Following detailed design, Real Estate Services will determine an appropriate value for any additional properties required and initiate necessary steps for the acquisition of required property south of Sheppard Avenue, consistent with the Interim Condition identified in this report, and north of Sheppard Avenue for the future condition.

In order to optimize traffic flow in North York Centre, construction of the Interim Condition connection of Doris Avenue and Tradewind Avenue via an offset intersection would be programmed to take place in advance of the reconstruction of Yonge Street between Sheppard Avenue and Finch Avenue.

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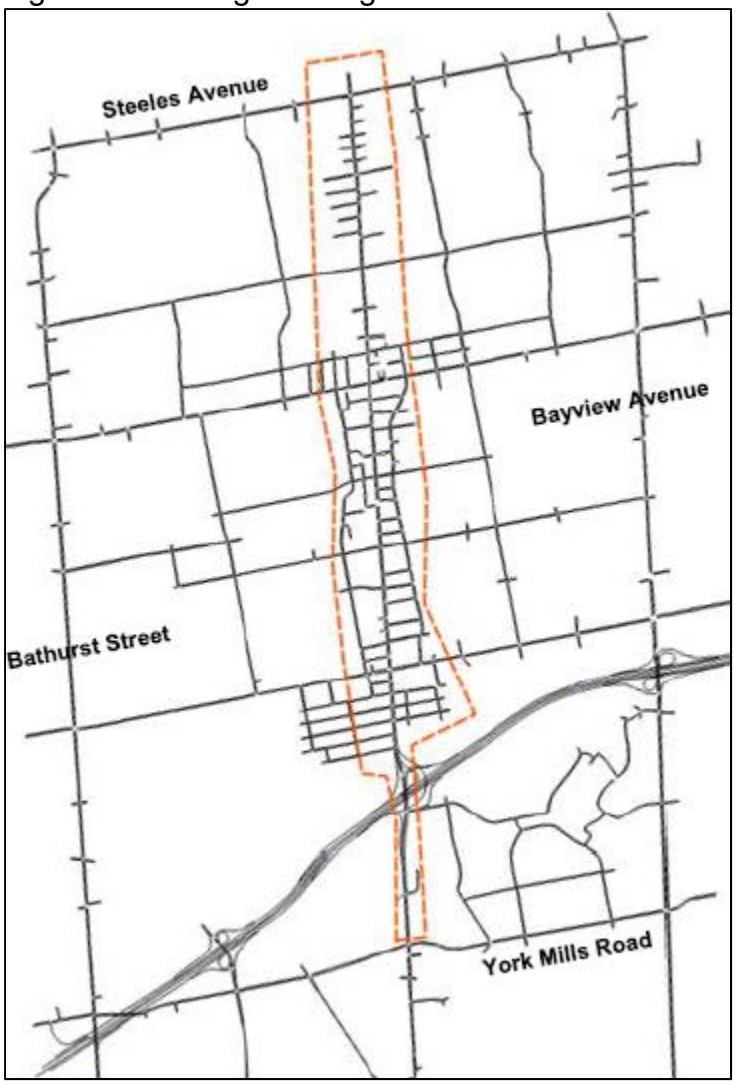
ATTACHMENTS

Attachment 1: Updated Traffic Analysis

Attachment 1: Updated Traffic Analysis

As part of the updated traffic assessment, the operations of a single intersection (Options A/B) were evaluated against an offset intersection (Options C/D). The evaluation was carried out using traffic analysis software. The analysis assumed both the AM and PM peak hour conditions for the year of implementation, proposed for 2022. The annual travel demand was increased by a growth factor[3] of 0.5% in the AM, and 1.0% in the PM from 2016 to 2022, equal to an increase of 3% during the AM peak hour, and 6% during the PM peak hour. This increase in travel demand was applied to the REimagine Yonge microsimulation area[4] (as shown in Figure 1). The REimagine Yonge model was used for this work to ensure accuracy and consistency between the two studies.

Figure 1: REimagine Yonge Microsimulation Area



[3] Annual traffic growth factors for the AM and PM conditions is based on review of 5-year growth patterns in the focus area

[4] The model developed for REimagine Yonge AM & PM Existing Conditions (base year 2016 – updated in 2019) was used for this study to ensure consistency between the two studies.

The evaluation takes into account two scenarios for Yonge Street; 4-lane ("Transform Yonge" alternative) and 6-lane cross-sections under study in the REimagine Yonge assessment. These scenarios are compared against existing conditions, which for modelling purposes, were assessed in 2016, and a Future Do Nothing condition, which assumes by 2022, no infrastructure improvements are implemented within the study area.

Please refer to Table 1 for the full list of scenarios examined.

Table 1: List of Scenarios

Scenario (Year)	**Analysis Period**	**Growth Rate**	**Doris Avenue Extension Option**	**Yonge Street Configuration**
Existing Conditions (2016)	AM & PM peak hour	0%	N/A	6 lanes*
Future Do Nothing (2022)	AM peak hour	3%		
	PM peak hour	6%		
Future Conditions (2022)	AM & PM peak hour	3% (AM) & 6% (PM)	Single Intersection	4 lanes "Transform Yonge"
				6 lanes*
			Offset Intersection	4 lanes "Transform Yonge"
				6 lanes*

* Existing configuration

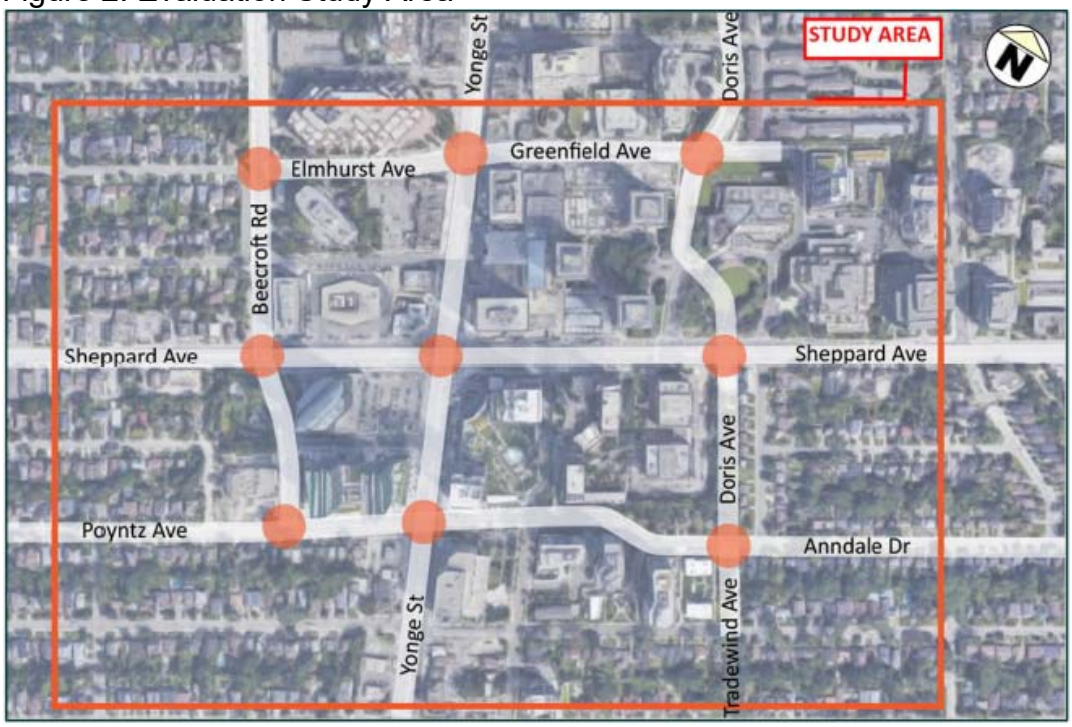
Scenario Evaluation

Each scenario was evaluated and summarized using three levels of outputs:

1. Traffic Analysis Results

Traffic Analysis Results assesses each scenario using a smaller evaluation study area (seen in Figure 2), focusing on overall delay (measured in minutes), and the number of vehicles able to enter and exit the evaluation study area.

Figure 2: Evaluation Study Area



As can be seen in Table 2 below, both AM and PM peak hour analysis periods were assessed for all scenarios. This table has multiple evaluation criteria built in. Please refer to the definitions table for details of each evaluation criterion.

Definitions Table

Delay Time - Sum of Section Delays - (minutes)	Represents the total number of road segment delays within the study area. For example, if the study area has 3 road segments (a, b, and c), and each segment experiences 1 minute travel delay, the value will be equal to “Average Delay(a) + Average Delay(b) + Average Delay(c)” = 3 minutes
Count of Vehicles Entered the Evaluation Area (veh)	Represents the number of vehicles able to enter the evaluation area during the peak hour of analysis
Count of Vehicles Exited the Evaluation Area (veh)	Represents the number of vehicles able to exit the evaluation area during the peak hour of analysis
Delay Input Vehicles (veh Hour)	This number is obtained by “Delay Time” which defined above is multiplied by “Vehicles Entered the Evaluation Area”. Interpretation of this measure must be done with caution since it is subject to the count of vehicles entering the evaluation area, which is not the same for all scenarios.
Average Travel Time (Minutes per veh)	This number identifies the average time a vehicle entering the evaluation area will take to travel through it.

Table 2: Evaluation Area Results

Analysis Period	Scenario	Delay Time - Sum of Section Delays - (minutes)	Count of Vehicles Entered the Evaluation Area (veh)	Count of Vehicles Exited the Evaluation Area (veh)	Delay Input Vehicles (veh Hour)	Average Travel Time (Minutes per veh)
AM Peak Hour	Existing Condition	30.1	9,244	8,413	4,632	3.06
	Future Do Nothing	35.1	8,916	7,971	5,213	3.30
	Single (Yonge 6-Lanes)	33.9	9,522	8,599	5,376	3.17
	Offset (Yonge 6-Lanes)	40.0	9,217	8,277	6,137	3.63
	Single (Yonge 4-Lanes)	38.8	8,944	8,165	5,791	3.86
	Offset (Yonge 4-Lanes)	48.7	8,512	7,799	6,915	4.35
PM Peak Hour	Existing Condition	44.2	8,932	9,733	6,588	3.52
	Future Do Nothing	97.1	9,051	9,647	14,652	5.36
	Single (Yonge 6-Lanes)	96.3	9,017	9,600	14,469	5.03
	Offset (Yonge 6-Lanes)	96.8	9,195	9,896	14,833	4.99
	Single (Yonge 4-Lanes) *	112.0	6,436	6,831	12,008	7.50
	Offset (Yonge 4-Lanes) *	129.9	6,409	6,978	13,875	8.05

* denotes additional mitigation measures were applied to improve overall travel conditions – these measures are discussed later in the report.

As indicated in Table 2, during the AM peak hour (within the Evaluation Study Area), when compared to an offset, a single intersection operates with 12% and 16% less vehicle-hour delay (see second column from the right) under Yonge Street with 6-lane and 4-lane (cross-section conditions. Average travel time per vehicle under a single intersection (first column from the right) is less than an offset by 13% and 11% under Yonge Street with 6-lane and 4-lane cross-section conditions. This means the single intersection will potentially allow cars to move faster through the evaluation area during the AM peak hour.

Similarly during the PM, the single intersection provides better operational results with 2% and 13% less vehicle-hour of delay (second column from the right) under Yonge Street with 6-Lane and 4-Lane cross-section conditions respectively. Average travel time per vehicle under Yonge Street with 6-lane cross-section is almost similar between the two options while it is 7% less in the single intersection option under Yonge Street with 4-lane cross-section condition.

Overall, the single intersection's operational performance is slightly better than the offset under most Yonge Street cross-section conditions during the weekday AM and PM peak hours.

Under the 6-lane Yonge scenarios, it is important to note a single intersection reduces overall delay over the Future Do Nothing scenario. While an offset intersection under the 6-lane Yonge scenario improves overall delay in the PM over the Future Do Nothing scenario.

2. Travel Time

In order to determine which option provides efficient travel time alternatives within the evaluation area, the following key routes were evaluated:

- Beecroft to Doris along Sheppard in both eastbound and westbound directions;
- Avondale to Greenfield along Yonge in both northbound and southbound directions; and
- Yonge northbound to Avondale, eastbound to Tradewind, northbound to Greenfield (as a means to avoid Yonge/Sheppard intersection).

All travels routes are illustrated in Figure 3.

Figure 3: Travel Routes Evaluated

Travel time measurements are calculated along the specific route, and based on the sum of each segment's travel time. These segments are illustrated in Figure 3.

Travel time results for the three key routes evaluated are detailed in Table 3 below.

Table 3: Travel Time of Key Routes

Analysis Period	Scenario	Sheppard EB Travel Time (Minutes)	Sheppard WB Travel Time (Minutes)	Yonge St NB Travel Time (Minutes)	Yonge St SB Travel Time (Minutes)	Yonge-Avondale-Doris Avenue NB Route Travel Time (Minutes)
AM Peak Hour	Existing Condition	3.7	2.3	5.0	2.5	3.4
	Future Do Nothing	4.0	2.3	5.6	2.5	3.6
	Single (Yonge 6-Lanes)	4.2	2.9	4.3	2.5	3.3
	Offset (Yonge 6-Lanes)	4.8	5.1	4.9	2.8	3.6
	Single (Yonge 4-Lanes)	5.0	3.4	7.0	2.7	3.8
	Offset (Yonge 4-Lanes)	5.7	6.1	7.5	2.5	4.4
PM Peak Hour	Existing Condition	3.7	2.6	3.6	3.3	2.9
	Future Do Nothing	5.8	3.5	5.5	5.0	3.5
	Single (Yonge 6-Lanes)	5.8	3.0	4.2	4.6	3.2
	Offset (Yonge 6-Lanes)	6.5	4.9	4.0	4.7	3.2
	Single (Yonge 4-Lanes)*	6.4	4.2	21.5	4.3	7.2
	Offset (Yonge 4-Lanes)*	7.6	7.2	19.8	4.5	8.0

* denotes additional mitigation measures were applied to improve overall travel conditions – these measures are discussed later in the report.

As can be observed in Table 3, a single intersection provides a more efficient travel time along most of the routes during the weekday AM and PM peak hours and under both Yonge Street cross-section conditions. There are few exceptions where an offset intersection provides minor improvements:

- Southbound direction along Yonge Street during the AM peak hour, under Yonge Street with 4-lane cross-section
- Northbound direction along Yonge Street during the PM peak hour, under Yonge Street with 6-lane cross-section

- Northbound direction along Yonge Street during the PM peak hour, under Yonge Street with 4-lane cross-section

Overall, from a travel time perspective, although a single intersection is preferred, an offset intersection also performs adequately.

Under the 6-lane Yonge scenarios, it is important to note Options B and C provide northbound/southbound relief along Yonge Street between Avondale and Greenfield over the Future Do Nothing scenario.

3. Intersection Approach Levels of Service (LOS)

To determine travel delay along a segment of roadway, traffic simulation results were used based on the ratio of travel speed and compared against the segment's posted speed limit. During congested periods, it is typical for vehicles to travel below the posted speed limit. Through the analysis, the traffic analysis software was able to simulate the typical travel speed during the weekday AM and PM peak hours, and a ratio of the typical travel speed versus the free flow travel speed (e.g. speed assuming no traffic congestion) was developed to determine the LOS for the intersection approaches based on the Highway Capacity Manual (HCM) 6th Edition for Urban Street Facilities. The travel speed depicted in the model, shown as a percentage, is matched with the corresponding level of service letter, from "A" (free-flow speed) to "F" (sever congestion), as seen in Table 4 below.

Table 4: LOS Based on Average Speed

Actual Average Speed as % of Base Free Flow Speed	**Level of Service**
> 80%	A
67 - 85%	B
50 - 67%	C
40 - 50%	D
30 - 40%	E
< 30%	F

Note that the version of the traffic analysis software used for the evaluation does not directly produce HCM results. The speed and delay outputs from the model were used as inputs in the calculation of LOS, and may not be compatible with the HCM methodology. Therefore, LOS results documented in this study are for scenario comparison purposes only.

Table 5: Network LOS Summary

Analysis Period	Scenario	Number of Approaches with LOS E/F	% of Approaches with LOS E/F
AM Peak Hour	Existing Condition	20	63%
	Future Do Nothing	21	66%
	Option B	19	56%
	Option C	22	61%
	Option B (Yonge 4-Lanes)	20	59%
	Option C (Yonge 4-Lanes)	21	58%
PM Peak Hour	Existing Condition	20	63%
	Future Do Nothing	25	78%
	Option B	23	68%
	Option C	24	67%
	Option B (Yonge 4-Lanes)	27	79%
	Option C (Yonge 4-Lanes)	30	83%
	Option B (Yonge 4-Lanes) + Mitigation	27	79%
	Option C (Yonge 4-Lanes) + Mitigation	29	81%

Table 5 above outlines all the segments which experience LOS exceeding D. As can be observed from the table, the single intersection has less road segments at LOS E/F when compared to the offset in the Weekday AM peak hour and almost equal number of LOS E/F segments to the offset in the Weekday PM peak hour under the 6-lane Yonge Street option. Under the 4-Lane Yonge Street scenario, the offset generally has more segments at LOS E/F than the single intersection.

On balance, the single and offset intersection have comparative LOS results, and in most cases, outperform the Future Do Nothing LOS during the AM and PM peak hours.

The Network LOS analysis identified candidate locations within the network where minor mitigation measures could be undertaken that would yield benefits to the network as a whole under the 4-lane Yonge scenario. The next section discusses these mitigation measures and their potential impacts.

Mitigation Measures Applied to PM 4-Lane Yonge Street

Under the PM 4-lane Yonge scenarios for the single and offset intersections, additional traffic mitigation measures were applied to improve the overall traffic conditions. These mitigation measures include:

- Prohibit the on-street parking within the model for the entire PM peak period starting from 3:00 PM. The prohibition begins at 4:00 PM in the rest of the scenarios consistent with the base model.
- Increase the weekday PM peak period traffic signal cycle length from 120 seconds to 130 seconds at Doris/Sheppard intersection, allowing more green time for the critical approaches. 130-second cycle length is consistent with the Yonge/Sheppard intersection cycle length during the PM peak period.

Summary of the mitigation results are provided at the evaluation area level in Table 6, and the travel time results of specific routes are summarized in Table 7. As can be observed in the two tables, both number of vehicles entering and exiting the study area have increased by 16% to 35%, demonstrating the positive impacts of the mitigation measures.

The average travel time of a vehicle within the evaluation area is improved by 28% for the single intersection, and 18% for the offset intersection, when compared to the scenario results without the mitigation measures, shown in Table 2.

Table 6: Evaluation Area Results, PM Mitigation 4-Lane Yonge Street

Scenario	Delay Time - Sum of Section Delays - (minutes)	Count of Vehicles Entered the Evaluation Area (veh)	Count of Vehicles Exited the Evaluation Area (veh)	Delay Input Vehicles (veh Hour)	Average Travel Time (Minutes per Veh)
Single (Y.S. 4L) + Improvements	92.5	7,494	7,931	11,554	5.38
% of Change	-17%	16%	16%	-4%	-28%
Offset (Y.S. 4L) + Improvements	128.3	8,681	9,339	18,570	6.63
% of Change	-1%	35%	34%	34%	-18%

Table 7: Travel Time Measurements, PM Mitigation 4-Lane Yonge Street

Scenario	Sheppard EB Travel Time - (Minutes	Sheppard WB Travel Time - (Minutes	Yonge St NB Travel Time - (Minutes	Yonge St SB Travel Time - (Minutes	Yonge-Avondale-Doris Avenue NB Route Travel Time - (Minutes	Sum of Travel Time Measurements (Minutes
Single (Y.S. 4L) + Improvements	5.8	3.5	8.2	3.9	4.0	25.5
% of Change	-9%	-16%	-62%	-9%	-44%	-42%
Offset (Y.S. 4L) + Improvements	9.5	6.1	8.6	4.4	4.3	32.9
% of Change	26%	-16%	-57%	-1%	-46%	-30%