

Appendix A

Conceptual Design Report

Our ref: 11222140

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North York EA Addendum – Conceptual Design Report – Doris Avenue & Sheppard Avenue East Intersection

Dear Mr. Papas

1. Introduction

As part of the North York Centre South Service Road Environmental Assessment Addendum, geometric design alternatives were developed to complement the updated technical traffic analysis needs and navigate significant physical, and qualitative project specific constraints to facilitate the transportation network improvements.

2. Study Area

The study area includes Doris Avenue and Greenfield Avenue and extends southerly from the intersection of Sheppard Avenue East to the intersection of Avondale Avenue and Tradewind Avenue, as illustrated below.



Figure 1 Study Area

3. Major Constraints & Design Considerations

As detailed in the Environmental Study Report (ESR) Addendum and supporting documentation in Appendix C (Traffic Analysis Report), the forecasted traffic, operations and safety environment warrants improvements to the overall road network.

The realignment of Doris Avenue and Tradewind Avenue extension is being proposed as a response to anticipated increased traffic demands within the study area, resulting both from major adjacent City initiatives (i.e., REImagining Yonge), incremental traffic growth and pattern adjustments.

This memo seeks to summarize updated design needs, geometric parameters, and project context for the updated technically recommended functional designs for the Sheppard Avenue East/Doris Avenue/Tradewind Avenue Intersection and study area.

Below is a summary of major constraints and considerations within the immediate project study area which influence the design alternative and methodology.

3.1 Vehicular Transportation Needs

The high percentage of opposing northbound lefts at Bonnington Avenue/Sheppard Avenue East and southbound lefts at Doris Avenue and Sheppard Avenue East in the existing conditions is anticipated to grow as identified in the modelling. Many of the left turning vehicles are attributed to north/south bound traffic, which is mitigated through realignment; however, a significant complement of the southbound left vehicles are destined to Sheppard Avenue EB.

With higher order pedestrian and transit facilities assigned and vehicular lane reductions on parallel routes, geometric, intersection and cross section designs are oriented to favour operational efficiency for vehicular traffic. Transportation Association of Canada (TAC) Geometric Design Guide are used in combination with City of Toronto Standards and practices for geometric designs.

The model forecasts identify a one dedicated Southbound lane and two Northbound Lane requirements for Tradewind Avenue extension from Anndale Drive to Sheppard Avenue East.

For geometric planning purposes and the influences of skewed intersection geometrics, conceptual cross section designs maintain a minimum 3.30m lane width for curb lanes, 3.0 m for all through lanes and auxiliary lanes, and a 0.5 m curb and gutter. Modifications or reductions to 3.0 m for auxiliary and through lane widths may be appropriate in consultation with the City during subsequent design phases.

3.2 Active Transportation Needs

The REImagining Yonge EA has identified Yonge Street as the central transit spine and active transportation route for the area network. As a result, Doris Avenue & Tradewind Avenue are not envisioned to play a higher-order transit or cycling function.

With no identified need for higher order pedestrian accommodation, roadway designs incorporate basic City of Toronto and industry standard facilities for sidewalks and on-road design assuming mixed-use. A significant East-West pedestrian movement on Sheppard Avenue East is noted, and appropriate pedestrian standing, and queue areas are to be incorporated and adequately accommodated.

To support the City of Toronto's Vision Zero Strategy, recommended designs minimize pedestrian/vehicular interaction by reducing pedestrian crossing distances and exposure, number of conflict points with pedestrian facilities, and delineation features and measures where feasible.

For geometric planning purposes, conceptual cross section designs maintain a 2.1 m sidewalk and a 2.0 m boulevard (not including curb). Modifications or reductions to these widths may be appropriate in consultation with the City during subsequent design phases.

3.3 Privately-Owned Publicly Accessible Space

The North-East quadrant of the Doris Avenue and Sheppard Avenue East intersection is designated as Privately-Owned Publicly Accessible Space (POPS) at 90 Sheppard Avenue East. This maintained and illuminated open space parcel contains landscaped and hardscaped features, mature trees and has significant residential and business community use value.

Intersection design alternatives and realignment geometrics consider the property delineation as well as the relative impacts of interim and ultimate intersection needs on existing vegetation and landscaping.

3.4 45 - 47 Sheppard Avenue Underground Garage & Access

The 45 - 47 Sheppard Avenue East property contains a direct frontage access to an underground and surface parking garage from Sheppard Avenue East. The access is permissive of all movements and is the only access point to either the surface or underground parking.

Maintaining direct access to the lot from Sheppard Avenue East is critical avoiding significant modifications to the existing parking structure is of particular importance from an intersection feasibility and viability perspective. Designs maintain access to the surface lot and access through a combination of new and existing access points.

3.5 Residential Access on Bonnington Place

Bonnington Place roadway provides basic access to direct access to eight residential properties on the east side of the roadway and a local intersection with Lyndale Drive. Properties on the west side of Bonnington Place were previously acquired by the City of Toronto. Bonnington Place is to remain in place as a direct frontage access road for existing residences.

Supporting and maintaining access for municipal services (Snow removal, Garbage collection, Emergency Services, etc.) is required and accommodated in the recommended design alternatives.

3.6 Vehicular Parking

The local employment and commercial needs of the study area require a continued focus on parking availability to support short-, medium- and long-term business continuity. Alternatives considered maintaining or expanding on-street public parking opportunities.

3.7 Flexible Alternatives & Adaptable Scenario

The dynamic nature of the study area requires design alternatives which are both context sensitive and adaptable to a continually evolving landscape. We understand that interim implementation of REImagining Yonge, or new or unique development plans within the study area can have significant traffic pressures which may differ from broad network assumptions and microsimulation models.

To support this need, various acceptable design alternatives and strategies are developed and recommended to allow the City to manage needs within the same public impact, mitigation, and approvals processes.

4. Alternative Designs

4.1 Option 'B' – Realigned Intersection

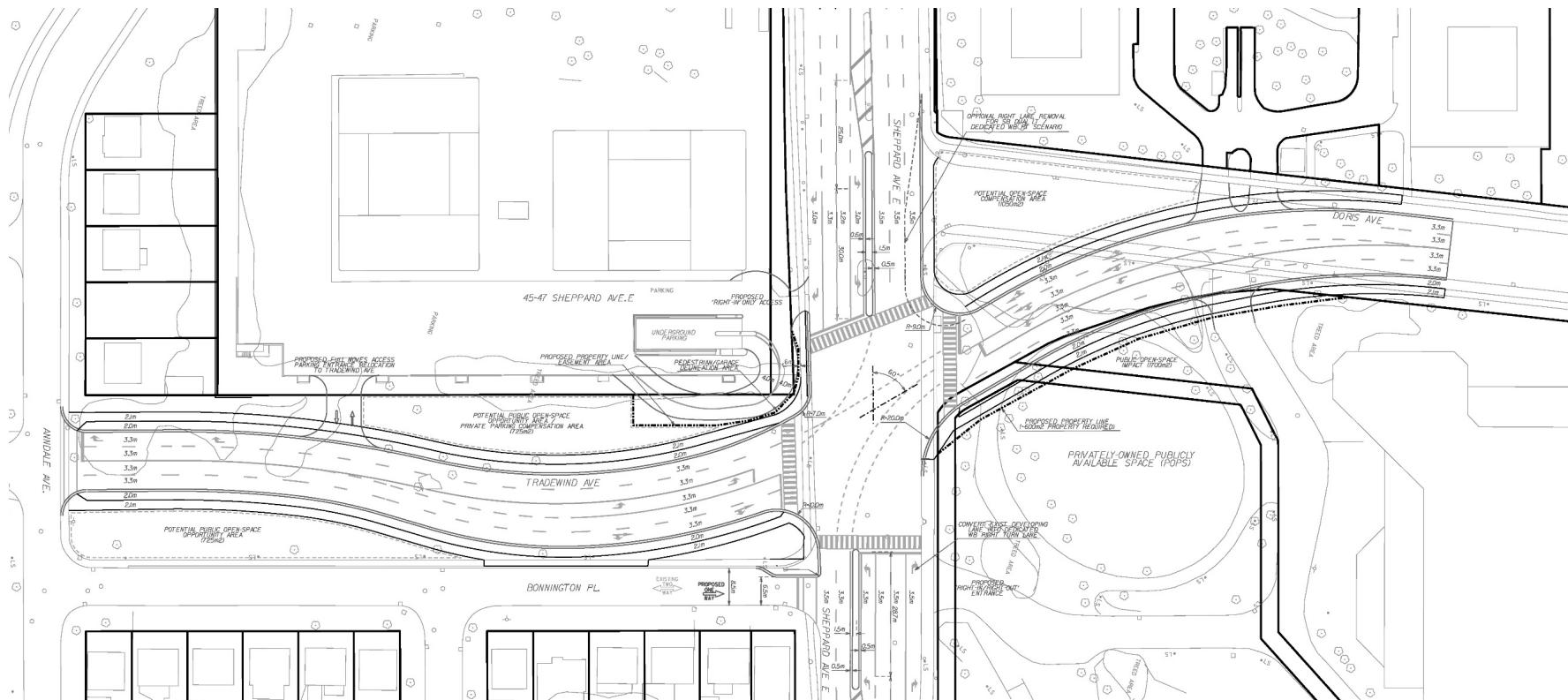


Figure 2 Realigned Intersection

4.2 Option 'C' – Offset Intersection

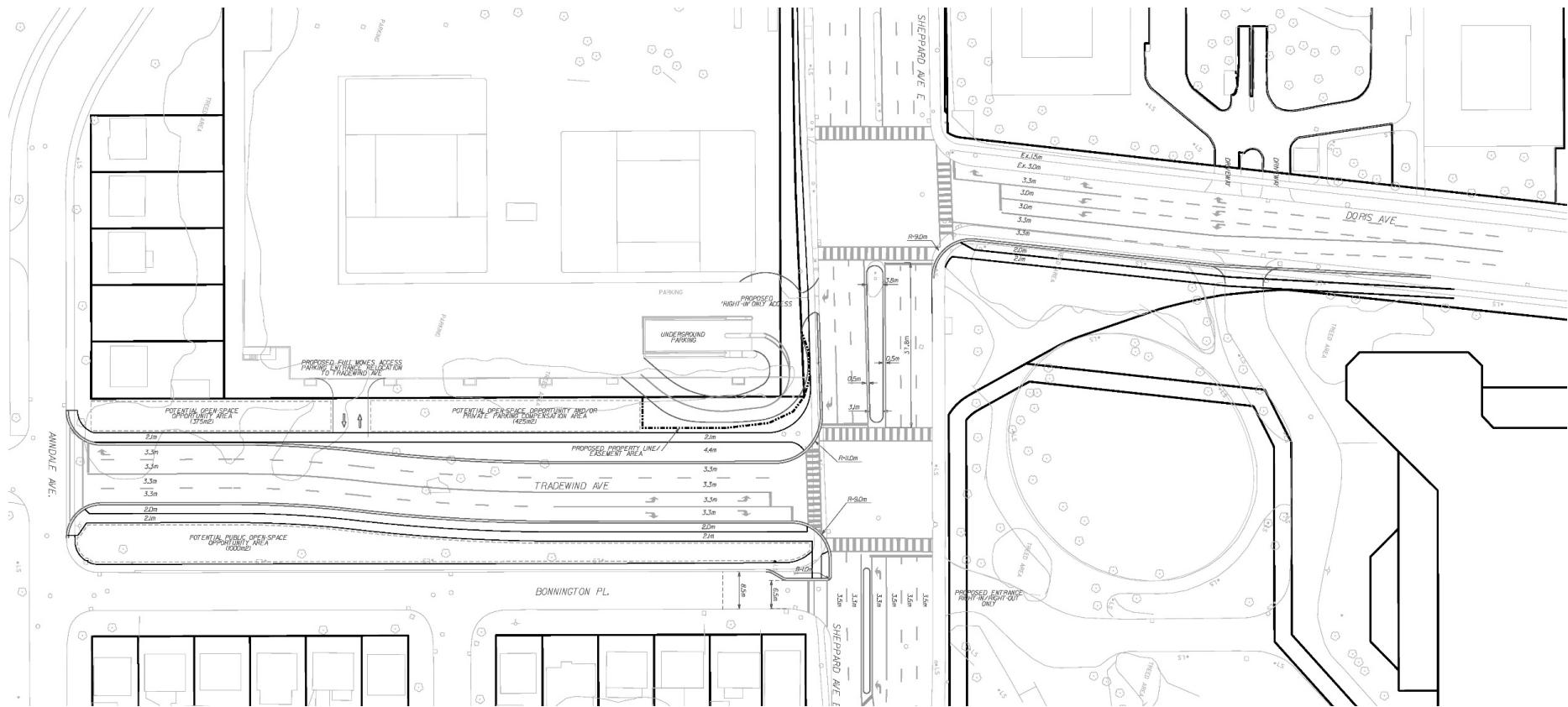


Figure 3 **Offset Intersection**

5. Recommendation

5.1 Ultimate Option 'B' with Interim Optimized Option 'C' Strategy

From a geometric and functional design perspective, the Doris Avenue Realignment alternative is technically recommended for the 2031 Horizon Year.

Preliminary design concept drawings for the ultimate design of Option 'B' and the Interim Optimized Option 'C' (reduced cross section) design consistent with offset strategy of Option 'C' are appended to this report.

Below is a brief narrative of key geometric design considerations as part of the recommendation and overall alternative development.

- Option B is significantly preferred over Option C with respect to industry guidance for intersection spacing and overall functional performance for vehicular traffic operations. Option C presents intersection spacing of <50 m on a high volume and higher speed vehicular corridors from a vehicular operations perspective. Queuing, large vehicle turning and storage needs between the intersections presents significant long term functional performance issues with high potential of blocking adjacent intersections and cross walks that are unable to be appropriately mitigated through signal timing and coordinated signals. This is of particular concern for westbound (WB) Right turning traffic at Doris Avenue and eastbound (EB) through traffic at Tradewind Avenue. The presence of sequential offset T-intersections has the effect of 'metering' or 'restricting' capacity improvements on existing alignments.
- Ultimate Option B achieves the core design philosophy to address poor operations associated with offset configurations, and the least number of conflict points. The realignment geometrics in Ultimate Option B are not ideal and Option C allows for flatter geometric approaches to Sheppard Avenue East. However, Ultimate Option B geometric intersection skew (approximately 60 degrees) is not uncommon for high-density urban environments, and also exist on Doris Avenue immediately north (in the vicinity of Greenview Avenue). The skew and operational concerns can be mitigated through signage, traffic control devices, and detailed design choices where mitigation of operational concerns associated with Option C are less beneficial.
- Ultimate Option B and Option C are considered equal with respect to access to/from 45 - 47 Sheppard Avenue East. While Option C may have a limited ability to support temporary 'right-out' access and it is not desirable long term. The planned inclusion of higher order cycling infrastructure on Sheppard Avenue and the growing east-west pedestrian demands, the proximity to pedestrian standing area and stop bars at Tradewind Avenue intersection, stopping/decision sight distance to Doris Avenue intersection, and limited availability to re-enter traffic with queuing traffic at the Tradewinds Avenue Intersection, all contribute to significant safety concerns associated with permitting 'right-out' existing traffic to Sheppard Avenue. As well, neither Ultimate Option B or Option C are able to safely permit 'left-in' or 'left out' movement to the site to/from Sheppard Avenue East, triggering the need for a new access point from either Tradewind Avenue Extension or Anndale Avenue.
- Option C is preferred with respect to the POPS, and property impact perspective. However, the cross section and turning lane needs required with traffic demand growth and pedestrian needs will result in disturbances to existing vegetation.
- Ultimate Option B and Option C are considered equal in their ability to support on-street parking. Both require the removal and/or relocation of on-street parking on Doris Avenue north of Sheppard Avenue East.
- Ultimate Option B is preferred over Option C which has more pedestrian conflict points and/or higher potential for pedestrian crossing. The realignment allows for preferred signal operations and timing to prioritize and protect appropriate vehicular and pedestrian crossing locations at a convenient and centralized locations.

5.2 Design Impacts & Mitigation

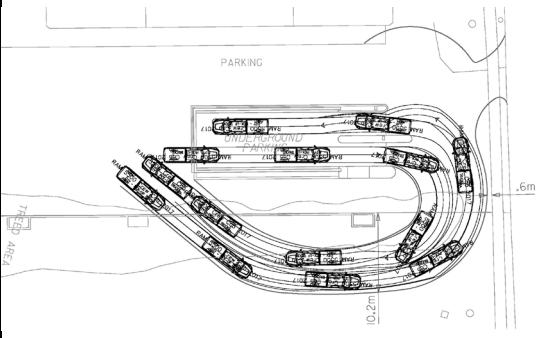
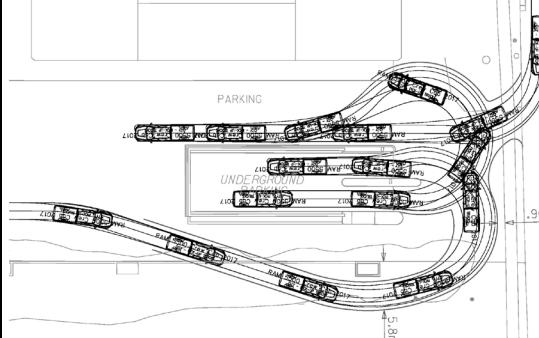
5.2.1 45 - 47 Sheppard Avenue Parking Garage Access

As a result of the position of the existing garage access in relation to the intersection(s) in both the Option B and Option C with anticipated traffic growth, restricting left movements to/from Sheppard Avenue East is recommended. The parking garage egress 'right-out' to Sheppard Avenue is also complicated as a result of the proximity to the stop bar and pedestrian standing areas at the intersection which are significant, and thus not recommended. Maintaining full moves access to the garage at the existing location is not viable.

Access to the garage from Sheppard EB is proposed to be permitted via a channelized 'Right-In' Only. A new access from Tradewind Avenue Extension is proposed to replace vehicle moves from Sheppard Avenue East to a new full moves parking access. This will allow for a safer site parking access by leveraging a new traffic signal to facilitate controlled vehicular movements turning from Sheppard Avenue East and pedestrian conflict point away from congested pedestrian areas to a location with improved visibility.

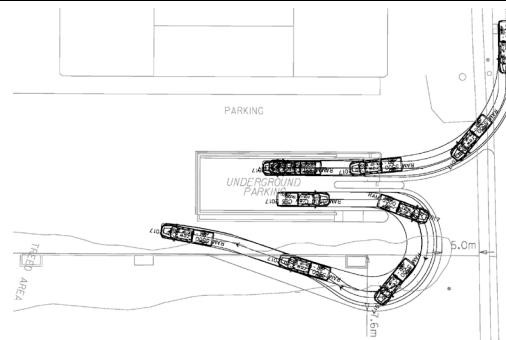
To address this impact, three alternative site access configurations were designed and evaluated, in combination with a new access point from new extension of Tradewind Avenue. The alternatives designed include:

Table 1 45 - 47 Sheppard Avenue East Garage Access Alternatives

Alternative 1 – Access and egress to the underground garage from the east.	
<ul style="list-style-type: none">Facilitates all existing surface moves from Sheppard Avenue to new Tradewind Avenue future accessResults in the least desirable intersection skew, and subsequent impact to POPSProvides least offsets to pedestrian facilitiesLargest potential impact to existing number of surface parking spaces (requires bi-directional traffic on east side of garage entrance)Bidirectional traffic difficult for large vehicles (May consider yield sections)Most amount of property/easement of City owned property required.	
Alt 1 – Geometrically Least Preferred	
Alternative 2 – Egress vehicles 'crossing-over' ingress, with vehicles turning towards the westerly	
<ul style="list-style-type: none">Facilitates all existing surface moves from Sheppard Avenue to new Tradewind AvenueSignificantly Improved intersection skew and subsequent impact to POPS compared to Alternative 1Moderate improved offset to pedestrian facilities compared to Alternative 1Least impact to existing number of parking spaces (Maintains existing directional flow of traffic on surface parking area)Some operational concerns with respect to 'cross-over' and associated signing and functional space requirements	
Alt 2 – Geometrically More Preferred than Alt 1 but less preferred than Alt 3	

Alternative 3 – Access to the underground garage restricted to access from Sheppard Avenue East Eastbound (No access to Underground from Tradewind Avenue Entrance)

- Most desired intersection skew – Moderate improvement over Alternative 2
- Most desirable offset to pedestrian facilities – Significant improvement compared to alternative 2
- Least impact to POPS – moderately reduced impacts to POPS compared to Alternative 2
- Moderate impact to existing number of surface lot parking spaces (requires re-direction of traffic east of the garage entrance)
- Least amount of vehicular conflict points and potential
- Least amount of property/easement area required



Alt 3 – Geometrically Most Preferred

The most geometrically preferred alternative for on-site access to the underground garage is Alternative 1, but restricts underground garage access from Sheppard Avenue Eastbound. Alternative 3 presents the most favourable on-site conditions and flexibility to the property owner, and represents worst case outcome with respect to other significant project factors and impacts.

The proposed alignment and position of the Tradewind Avenue extension is positioned to protect for on-site two-way opposing traffic on the 45 - 47 Sheppard Avenue East Site entering and exiting the garage identified in Alternative 1. The protection for this scenario positions the Tradewind Avenue at the furthest position east, and represents the maximum impact to the remainder of the study area including geometric intersection design and anticipated safety performance as well as impacts to the POPS.

Approximately 200 m² of City owned property is required to facilitate this movement, requiring the largest area of City owned property. This property is comprised of vacant land of previously acquired by the City on Bonnington Place. It currently does not serve another official function. Facilitating this property need may be appropriate through land transfer or permanent easement.

Implementation of Alternative 2 and 3 would result in significantly improved intersection geometrics and associated study area impacts described in the following sections, and should be considered further in subsequent design stages.

5.2.1.1 Structural Considerations & Modifications

A desktop review of available information was completed to assess the feasibility of the proposed modifications of the surface access from a structural perspective for the parking garage. Given the presence of existing vehicular use of parking stalls and the existing exit at the locations identified and maintaining the low-speed nature and size of vehicles traversing from earth fill to the structure surface, GHD is of the opinion that the relocated at-grade access points are structurally viable as this does not attribute to a different set of structural loading criteria. The new surface entrance from Tradewind Avenue, and realigned at-grade access to the existing underground garage do not present new or significant changes to the structural design loading which is anticipated to have been required and established in the design of the original facility. GHD has investigated previous structural feasibility alternatives for the City to assess costs and impacts of relocating the underground parking garage entrance as well as segments of the garage within public right of way which considered the full vehicular live loading required by the Canadian Highway Bridge Design Code (CHBDC). However, since the recommendations in this addendum will still have the ability to limit the size of the vehicles which are able to access the footprint of the parking garage, the full CHBDC loading need not apply and the scale of potential impacts are reduced substantially.

To account for minor structural considerations, minor costs contingency should be added to the overall capital estimate to account for approach slabs at locations where vehicles traverse the side of the garage and address differential earth settlement, as well as for the potential need for localized reinforcement to address surcharged earth conditions at new surface lot access location from Tradewind Avenue. A structural field review is recommended at the detailed design stage to confirm the overall cost impact, identify any condition/deterioration related changes, which are anticipated to be minor based on the scale.

Minor at-grade modifications to the underground garage portal may be required to accommodate turning vehicles with the proposed access reconfiguration as well as parking gate and tolling infrastructure. Similarly, to the above, these costs are anticipated to be minor in nature.

5.2.2 Intersection Skew, Design Vehicles & Geometric Properties

The resulting position, approach geometry and intersection skew for Option B is directly connected to the access and egress needs of the 45 - 47 Sheppard Avenue East. The details of the on-site garage vehicle movement and access as discussed in Section 5.2.1 are critical to further mitigate geometric design in the preliminary design phase.

Horizontal design plan has been developed to accommodate WB-20 design vehicles as the critical movement. Right Turn Movements for WB-20 vehicles are assumed to be able to utilize the adjacent through lanes.

We recommend that the south leg of the intersection be restricted to commercial vehicles from Sheppard Avenue to address concerns with skew given the unlikelihood of large commercial trailers in a residential neighbourhood and multiple alternative connection points (i.e., Yonge/ Anndale). Restricting the use of commercial trucks to the south leg and requiring access from Yonge Street is preferred to address concerns with skew, swept path and resulting positions of lanes and stop bars and can be controlled through signage. During preliminary and detailed design, movements to/from the south leg of the intersection may be suitable as smaller design vehicles (TAC HSU). This condition may be alleviated with geometric access modifications to 45 - 47 Sheppard Avenue.

The conceptual design includes an absolute maximum 60 degree intersection skew for the critical move (Doris SB through) through the intersection with Sheppard Avenue East. While the design exceeds preferred skew as per TAC guidance, this is not unusual for high-density, lower speed (DS = 60 km/h) collector crossing roads within the City of Toronto. Approach geometry utilizes a maximum of 130 m radii in compliance with urban horizontal geometric design criteria for urban roadways.

5.2.2.1 Protection for SB Dual and Single Left Turn Scenarios

The Doris Avenue realignment accommodates for a five lane cross-section. North of Sheppard Avenue East the southbound lanes may be repurposed from a dedicated SB dual left turn (including shared left-through) or 2 through lanes with 1 left turn to accommodate future travel pattern shifts beyond 2031.

With a high compliment of SB Left traffic, the intersections 60 degree skew does provide favourable configuration for the operation of a SB dual left movement simultaneously with NB single left. However, north bound left turns may require short protected phases to address potentially poor visibility and swept path conflicts with dual SB operation. Subsequent designs will require refinement to confirm simultaneous operations.

5.2.2.2 Dedicated WB Right Turn at Doris Avenue

The analysis of the Sheppard Avenue East. reveals a high compliment of WB Right Turn traffic mirroring the Doris Avenue SB dual left scenario. Based on the ultimate analysis and need of the area, converting the existing curb lane to a dedicated WB right turn is preferred. The taper and development of the lane originates only 100m east of the Bonnington Place intersection.

Conversion of this lane will permit the WB RT traffic to operate during the SB left lane phase, allowing the high volume WB pedestrian crossing traffic to operate without conflict with WB RT. Right turns may be precluded on red as a result of the visibility to the standing area and offset position of the stop bar.

5.2.3 POPS Property Impacts

For the preferred Option B, impacts and future mitigation to the POPS is directly related to the approach geometry and intersection skew, associated with the access and egress needs of the 45 - 47 Sheppard Avenue East. The details of the on-site garage vehicle movement and access as discussed in Section 5.2.1 are critical to further mitigate geometric design in the preliminary design phase. Initial estimates identify approximately 600 m² of property acquisition, and approximately 1700m² of public open-space impacts.

The realignment of Doris Avenue and the extension of Tradewind Avenue associated with Option B also provide an aggregate opportunity area of 1050 m² of potential open-space compensatory area north of Sheppard Avenue East and 1450 m² of potential area south of Sheppard Avenue East.

As discussed in Sections 5.2.1 and 5.2.2 the property and POPS impacts can be significantly mitigated during subsequent design stages through the implantation of Alternative 2 or Alternative 3 at 45 - 47 Sheppard Avenue East.

A 'Stress Test' on the implementation of either Alternative 2 or 3 for 45 - 47 Sheppard Avenue East, identified the potential to reduce overall property impacts to <300 m² and open space impacts to <1300 m², in isolation from other cross section modifications.

5.2.4 Bonnington Place

To maintain basic municipal service access to Bonnington Place, a northbound 'right-out' northbound access to Sheppard Avenue East is recommended. The original EA identified a cul-de-sac near Sheppard Avenue East to facilitate turning of large municipal service vehicles. A minimum of a 20.0 m diameter would be required to access the frontage of the 3 residences north of Lyndale Drive. The space that the cul-de-sac would otherwise occupy complicated maintaining access to the parking garage discussed in Section 5.2.1, which determined the position of Tradewind Avenue Extension in the ultimate, and allows for an improved offset intersection for interim use as discussed in Section 5.2.6.

To maintain the occasional access of service vehicles to Bonnington Place, a 'right-out' access is preferred over a cul-de-sac. This will permit service vehicles to continue northbound on Bonnington Place in a similar fashion to existing service vehicle operations. The detailed designs should consider a depressed median island on Sheppard Avenue East and flexible delineator traffic control devices which would permit emergency access use.

5.2.5 88 - 89 Sheppard Avenue East – Partial Access Restrictions

The median island required for both intersection alternatives require the conversion of the full moves access at 88 - 90 Sheppard Avenue East to a 'Right-In Right-Out' only access. Two existing full moves access points to 88 - 90 Sheppard Avenue on Doris Avenue are maintained.

Based on the Sheppard Avenue East volumes and number of lanes, the left turning movements and through movement to Bonnington Place are challenging due to limited available gaps under stop control and pose right angle collision concerns. Restricting these left movements to/from 88 - 90 Sheppard Avenue East from Sheppard Avenue East is an improvement on existing conditions from a safety perspective.

5.2.6 Interim Optimized Option 'C' Strategy – Basic Traffic Needs

We recognize that the 2031 Horizon Year traffic growth and travel pattern shifts will take some time to be fully realized, and that the interim traffic needs may be different than the ultimate scenario. As a result, the use of a reduced cross section and offset scenario (Reduced 'Option 'C') as an interim improvement is appropriate to permit the City to implement improvements while consultation and mitigation measures are determined with major stakeholders.

The primary benefits of this interim strategy are to avoid disruption to the POPS and allow for access out of the 45 - 47 Sheppard Avenue garage without property transfer until ultimate traffic volumes are realized.

For the interim, with a lower complement of Northbound and Southbound through traffic and a higher complement of Southbound Left turning vehicles in the near term, Doris Avenue would comprise of 1 NB Through lane, 1 SB Right Lane and a Dual SB Left Lane. To avoid widening and disturbances to the POPS, on-street parking would be removed in this area.

The Tradewind Avenue extension would comprise of 2 NB lanes terminating with a dedicated NB left-turn and a NB right-turn, with 1 SB lane. The north curb could be constructed to ultimate position of the ultimate realignment to provide interim on-street parking compensation from impacts on Doris Avenue.

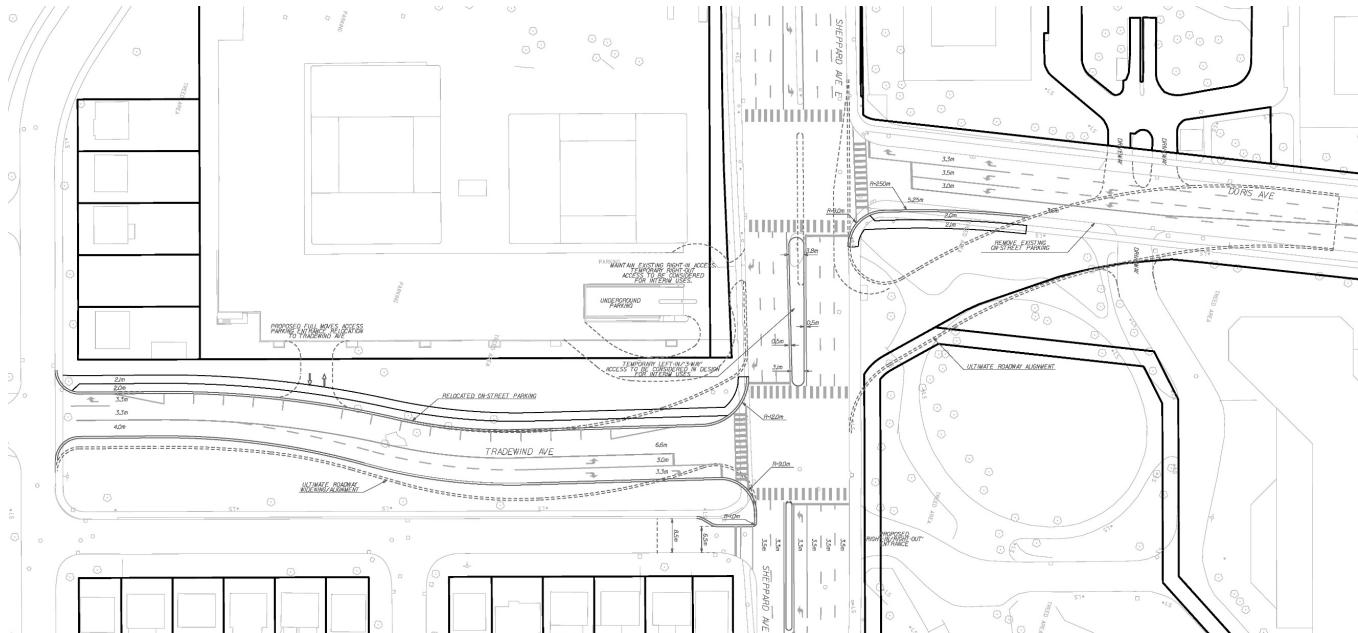


Figure 4 *Interim Option 'C' Strategy*

The Interim Option C 'Offset' Intersection does not introduce any new impacts or approvals that would otherwise be required for the ultimate scenario. We do not recommend that the full 4-lane ultimate cross section and/or the skew of the south leg be implemented without the complementary north leg as a means of mitigating these impacts. The position of the south leg and the number of lanes can be positioned in a way to use part of the ultimate realignment and maximize intersection spacing from Doris Avenue, and permit temporary "right-in right-out" access for 45 - 47 Sheppard Avenue as a basic interim measure.

The primary caveats to this alternative is that the south leg and associated traffic signals would require additional 'throw-away' cost and area disruption as well as introducing several more pedestrian conflict points with vehicles and operational challenges associated with closely spaced signals and the associated degradation of traffic operations on Sheppard Avenue East.

5.2.7 Interim 'Realigned' Strategy – Extended Traffic Needs & Optimized Costs

In the event that design details associated with site parking access with 45 - 47 Sheppard Avenue are established in advance of the implementation of an interim design, and alternative 2 or 3 are selected, an interim realigned strategy may be feasible. This would reduce the number of pedestrian conflict points and improve the value of interim improvements by eliminating additional 'throw-away' costs with an Interim 'Realigned' Strategy.

Similar to the Interim 'Offset' Strategy, with a lower complement of Northbound and Southbound Through traffic and a higher complement of Southbound Left turning vehicles in the near term, 1 NB Through lane, 1 SB Through Lane and a Dual SB Left-turn lanes are appropriate for short term improvements.



Figure 5 Alternative Interim Option 'B' Concept Strategy

If Alternative 1 at 45 - 47 Sheppard Avenue is selected, the Interim 'Realigned' strategy cannot eliminate or sufficiently mitigate the property impacts to the POPS to be implemented.

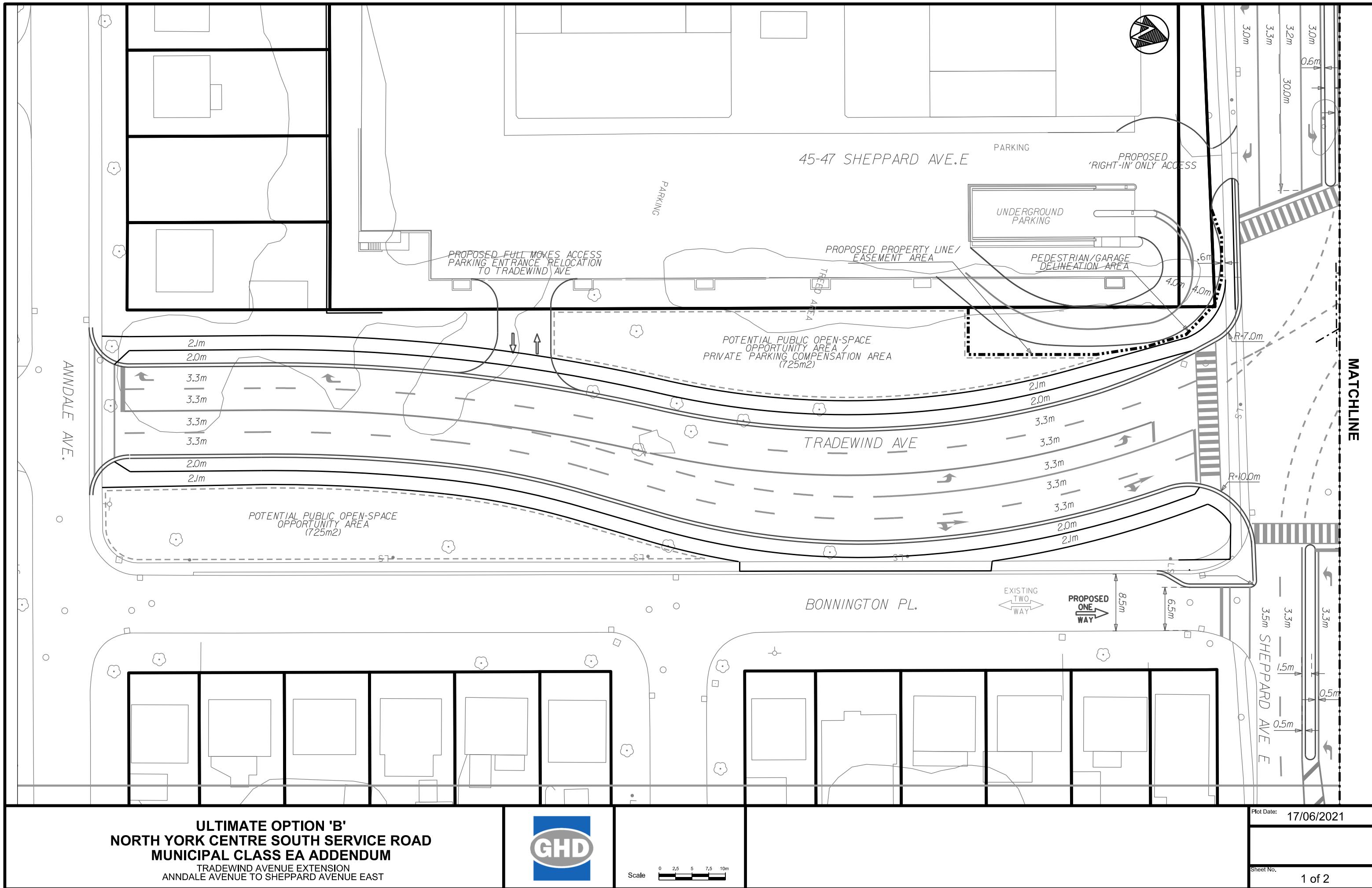
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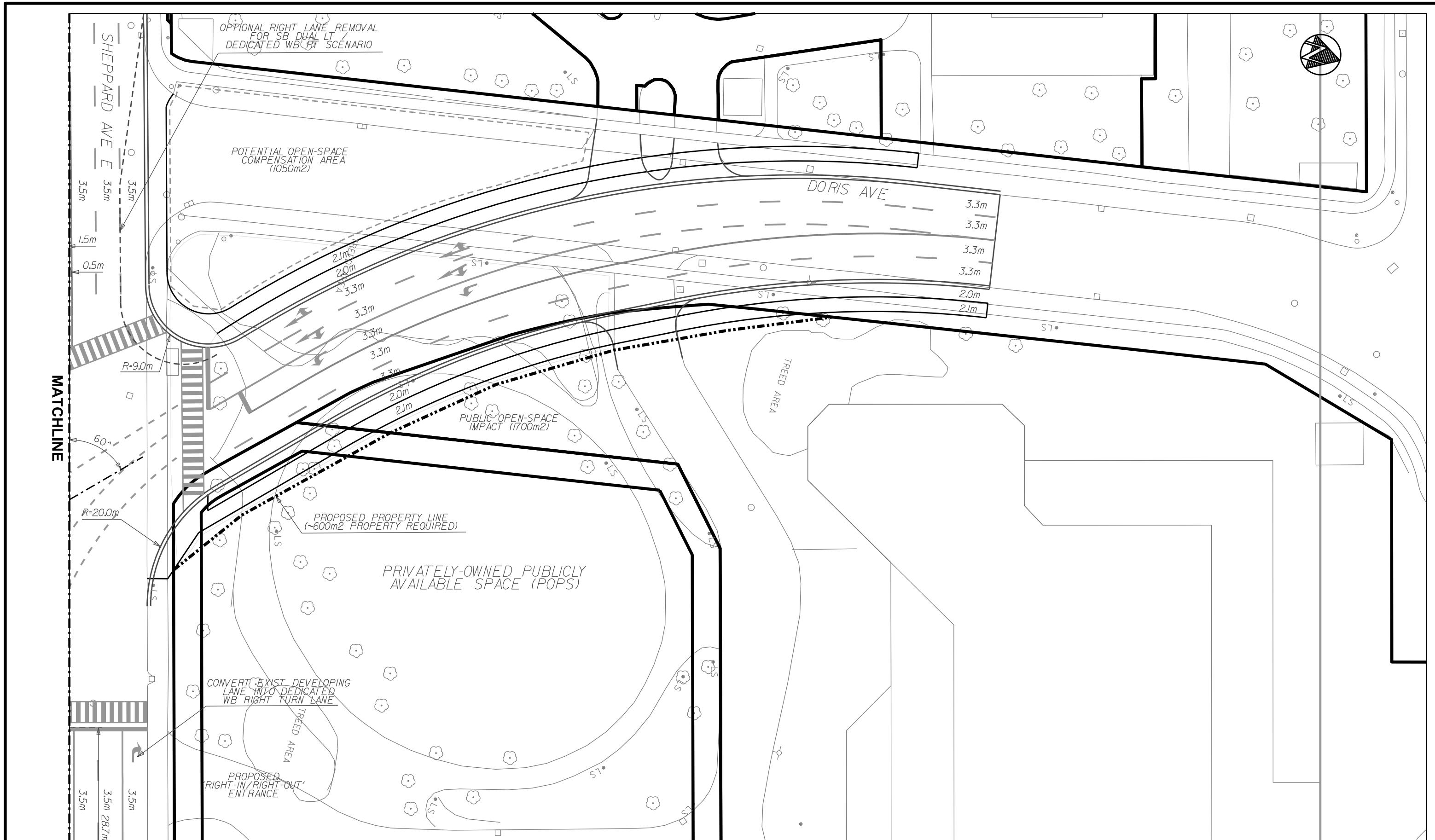
Attachment 1: Preliminary Design Concept – Ultimate Option 'B'.pdf (2 Drawings)

Attachment 2: Preliminary Design Concept – Interim Option 'C'.pdf (2 Drawings)

Attachment 1

**Preliminary Design Concept –
Ultimate Option 'B'**





**ULTIMATE OPTION 'B'
NORTH YORK CENTRE SOUTH SERVICE ROAD
MUNICIPAL CLASS EA ADDENDUM**



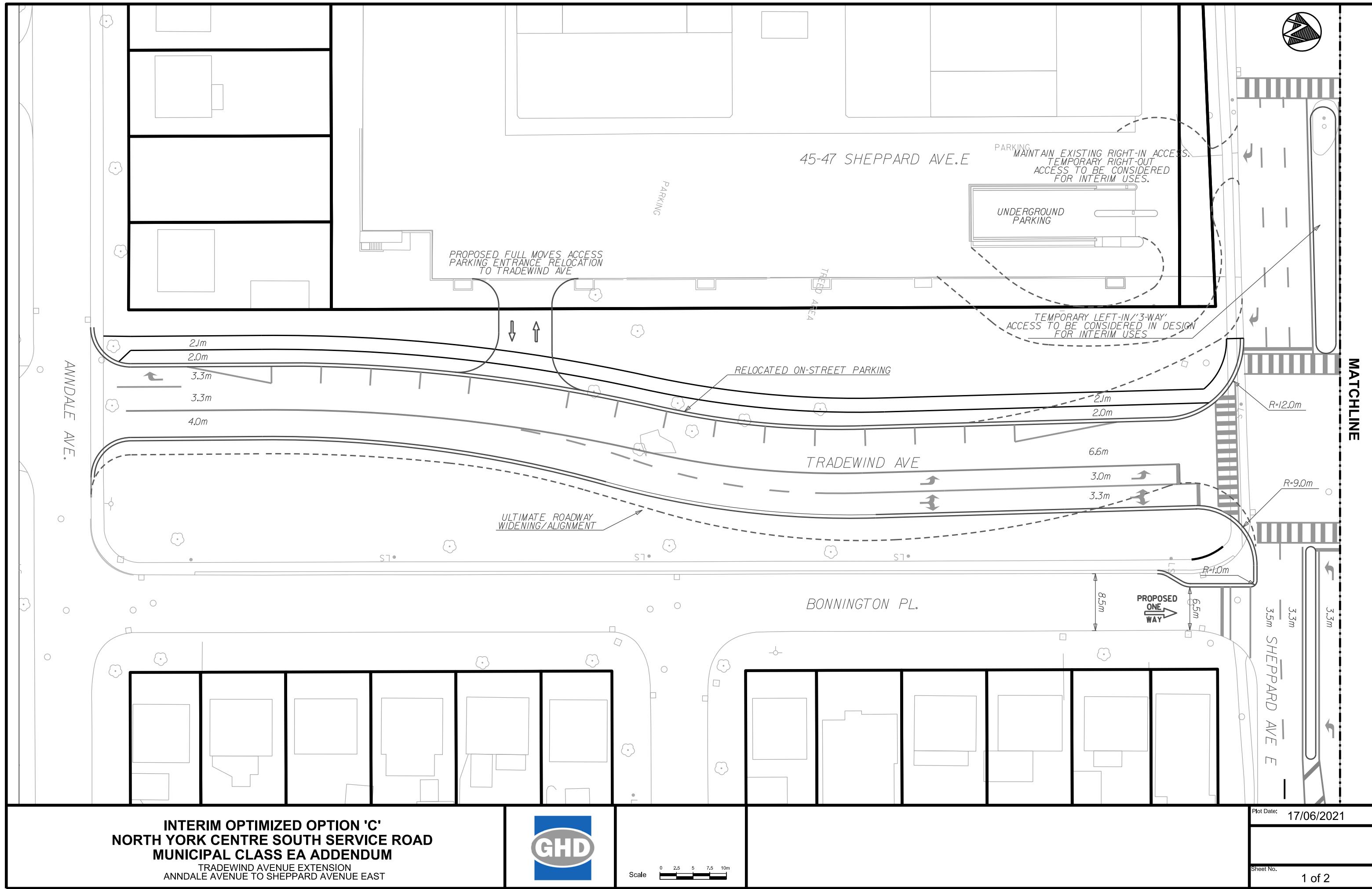
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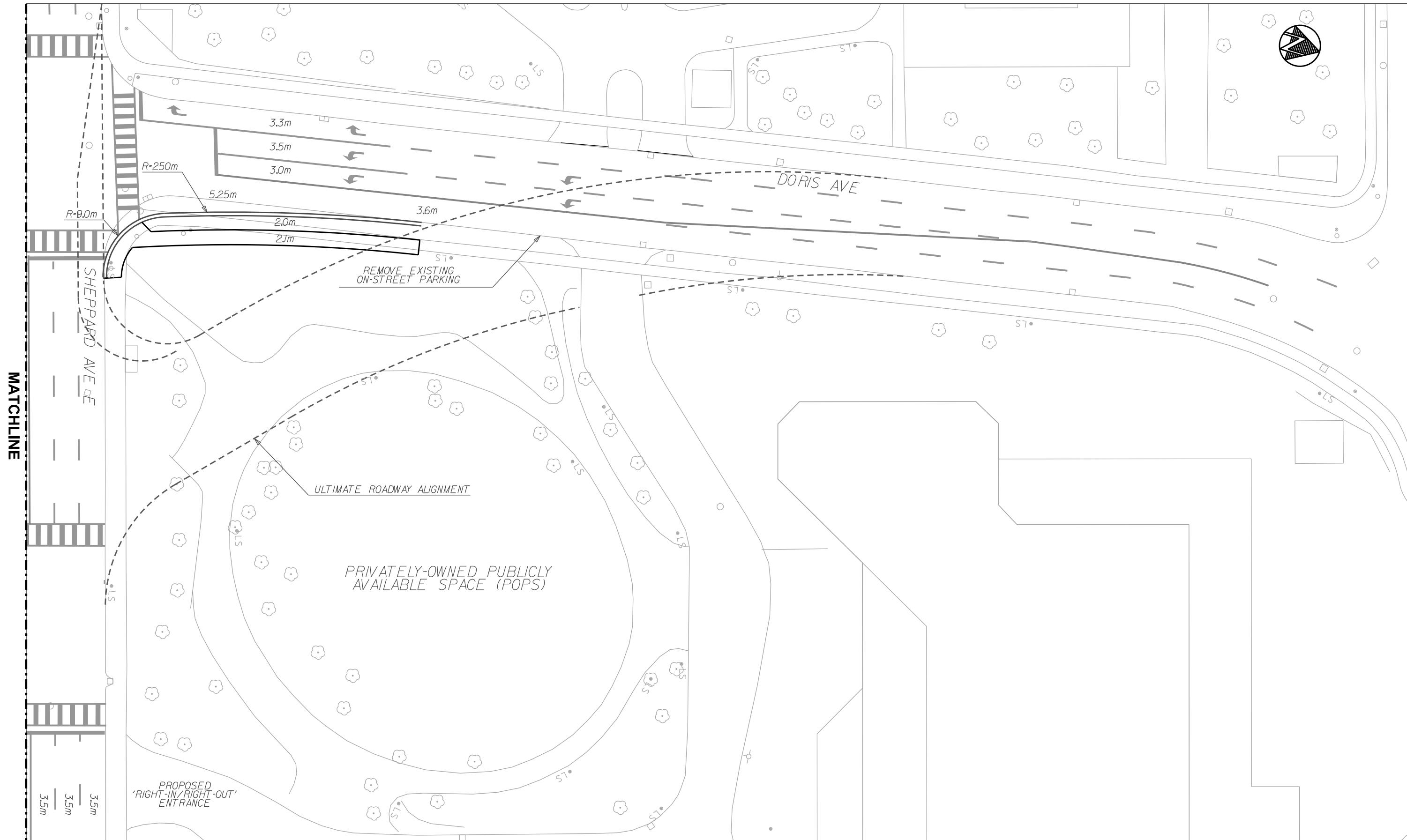
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Attachment 2

**Preliminary Design Concept –
Interim Optimized Option 'C'**





INTERIM OPTIMIZED OPTION 'C'
NORTH YORK CENTRE SOUTH SERVICE ROAD
MUNICIPAL CLASS EA ADDENDUM
DORIS AVENUE REALIGNMENT
SHEPPARD AVENUE EAST TO GREENFIELD AVENUE



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