2. PROJECT DESCRIPTION

The objective of the study is to find the best way to provide a fast, reliable and safe transit service to connect Finch Station at Yonge Street and the north-western Toronto Communities in North York and Etobicoke in a manner that:

1. Makes transit a much more attractive travel option relative to the private auto so that more people will choose to use transit instead of their cars;

2. Is affordable;

3. Supports the City's growth objectives of a better variety and density of transit-oriented developments, particularly on the sections along Finch Avenue West that are designated in the Official Plan as 'Avenues'; and

4. Gives appropriate consideration to other important City objectives such as good urban design, and an improved walking and cycling environment.

In addition, the recommended design must be developed in a manner that respects other road users, adjacent properties, and the natural environment.

2.1 Background Studies

This section describes the studies undertaken to determine the design of the Etobicoke-Finch West LRT.

2.1.1 TECHNOLOGY SELECTION

A successful new transit system maintains existing transit ridership and attracts new riders by offering a fast, reliable and safe transit service. In order to attract new riders, the transit service needs to provide a viable alternative to the car in terms of ease of use, reliability and speed to induce private automobile users to alter their travel habits. The existing bus services in the Etobicoke-Finch West Corridor operate in mixed traffic, and therefore do not offer sufficient advantages in time savings or reliability to attract new riders from private automobile use.

2.1.1.1 Identification of Alternative Transit Technologies

Various potential methods for supplying transit services were identified and evaluated in previous TTC studies. These scenarios included a Do Nothing scenario – with or without Transit Priority Improvements, a Travel Demand Management/Transportation System Management scenario, High Occupancy Vehicle (HOV) or reserved curb bus lanes scenario, and scenarios for Bus Rapid Transit, and Light Rail Transit and subway.

Previous studies concluded that in order to attract more people to use public transit, the new transit system must be faster than the existing transit system, and more reliable when compared to using private automobiles. The 'Do Nothing' option with buses operating in mixed traffic represents a continuation of current trends with no significant infrastructure or operational improvements and does not satisfy the principal objectives of the City's program.

Travel Demand Management (TDM) / Transportation System Management provides measures to reduce the number of vehicles, primarily single-occupant vehicles operating on the roadway especially during peak periods. Examples include increasing transit usage and encouraging carpooling. The travel forecasting and modeling developed for this and other Transit City projects shows that TDM alone cannot fully address the projected future demand, existing traffic operation concerns, and safety issues. However, TDM should still be utilized in conjunction with the preferred transit methods for this study.

To achieve the study objective, transit service must have a much greater degree of insulation from the delays associated with mixed traffic operation. HOV lanes in tandem with bus transit may improve the reliability of bus service, especially during peak periods, but examples from existing Yonge Street north of Finch Station and other locations in Toronto have shown that HOV lanes are extremely difficult to enforce, due to the lack of physical separation between the transit lane and general traffic lanes. Also, transit reliability would remain poor during off-peak periods and weekends when HOV lanes are only enforced during weekday peak hours.

For these reasons, the option of curb HOV and bus lanes, as used in other parts of the City, was not carried forward for further consideration.

There are two key elements to be incorporated when designing transit lanes to protect them from the effects of traffic congestion:

1. The lanes must be reserved for transit only and not shared with other traffic; and

2. There must be some form of physical separation to ensure that motorists do not travel in the transit lanes illegally. Experience has shown that enforcement without such separation is difficult.

Given the above criteria, three alternative transit methods were considered for the Finch West and other Transit City program corridors:

1. Subway / Rapid Transit Technology – Electrically powered rail vehicles that operate on a fully exclusive right-of-way – such as a subway or the elevated Scarborough Rapid Transit (SRT) line. With no at-grade operation across any roadways, there is no influence from other traffic. These systems are capable of carrying high volumes of people.

2. Light Rail Transit (LRT) – Electrically powered vehicles that operate on a partially exclusive right-of-way (reserved lanes) with traffic crossings at signalized intersections. These systems are capable of carrying medium to high volumes of people.

3. Bus Rapid Transit (BRT) – Diesel or hybrid powered buses that operate on a partially exclusive right-of-way (reserved lanes) with traffic crossings at signalized intersections. These systems are capable of carrying medium volumes of people.

The results of the evaluation of the remaining scenarios are summarized below.

2.1.1.2 Elimination of Subway/SRT Technologies

Based on the population and employment forecasts in the Finch West Corridor, the City and the TTC have projected that the 2031 transit demand in the corridor will increase to the range of 2,300 to 2,800 persons per hour in the peak direction at the busiest point on the line. A subway with higher speeds might attract some additional riders but the total demand would still be in this range. Subway or other fully grade-separated rapid transit technology is not justified if the peak hour demand does not approach the range of 10,000 people per hour during the peak hour in the busiest direction (as shown in Exhibit 2-1). It is estimated that subways cost four to five times more than LRT. Therefore, the expected future travel demand on Etobicoke-Finch West corridor is

well below what would be required to justify the high costs of subway or elevated transit-ways. As such, subway or SRT technologies were screened out and not carried forward as alternative transit solutions.

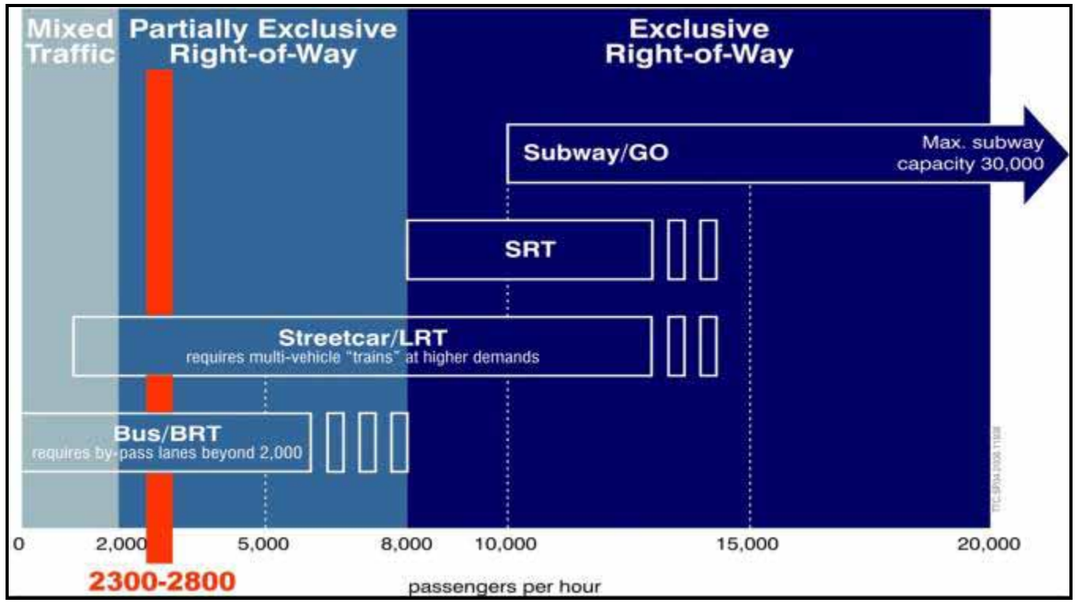


Exhibit 2-1: Transit Forecast Demand and Technology Requirements

The remaining alternatives, LRT and BRT, were evaluated for Transit City against four factors:

1. Air Quality – Must utilize sustainable technologies – Air quality impacts must be minimized in order to achieve the City's design objectives of a walkable, distinctive, and beautiful community;

2. Capacity – Capable of accommodating forecast travel demand – In order to support the development aspirations of the City, the proposed transit systems must be able to satisfy the anticipated transit demand resulting from the forecasted development;

3. Land Use – Must meet City's Official Plan Policies and Principles – This project builds on considerable planning and policy decisions that have already been made for the area, and therefore a solution that is in conflict with one or more of these previous decisions is not considered reasonable; and,

4. Costs - Reduce operational and maintenance costs while simultaneously improving ridership.

2.1.1.3 Bus Rapid Transit (BRT)

In this section and the next, the attributes of Bus Rapid Transit and Light Rail Transit are compared.

Bus Rapid Transit vehicles operate on reserved lanes or a separate right-of-way.

Air Quality

Current BRT technology uses bus vehicles powered by diesel or hybrid systems. These would result in less improvement in emissions at point source locations than LRT.

Capacity

The passenger carrying capacity of buses is smaller than rail vehicles and buses cannot be joined together to operate in trains. Therefore, a local BRT service – one that services all stops - has less carrying capacity than LRT. High capacity BRT would only be feasible with the use of by-pass lanes to allow some buses to operate express and pass one another at stops. However, the Etobicoke-Finch West Corridor Right-of-Way does not have sufficient space for a 3.5 metre by-pass lane while at the same time providing standard facilities for sidewalks, bicycle lanes, four through lanes and left turn lanes for general traffic.

A standard 12 metre bus typically has a peak period design load of 50 people per vehicle. Given the transit forecast demand is between 2,300 and 2,800 customers, approximately 45 to 55 buses would be required per hour to service the demand. Even if longer 18-metre articulated buses were acquired, it would only reduce the minimum number of buses to around 32 to 39 per hour, which would result in buses operating less than two minutes apart and would very often lead to one catching up to another – creating a "bunching" situation.

Land Use

While sufficient study data is not available to conclude that there is a significant difference between BRT and LRT with respect to encouraging development, there is a 'school of thought' that suggests that BRT is not as effective at influencing sustainable land use patterns as is LRT because BRT is not fixed, and is therefore not perceived as a permanent investment that would support development.

According to the former U.S.A. Deputy Secretary of Transportation, Edson Tennyson PE, LRT attracts many more passengers than BRT since buses are generally the less preferred options of travel. Tennyson testifies to this by concluding in a 2003 Discussion Paper that "…busways (BRT) have attracted only one-third of the riders promised, but LRT has attracted 122%" (Source: E. L. Tennyson, "New York considering light rail", personal discussion paper (edited), 9 Nov 2003).

While TTC staff would tend to agree with the preference for LRT over BRT with respect to encouraging better land use development, there is insufficient data available to support this being a critical difference between the two modes.

Cost

The capital costs of implementing BRT are lower than for LRT, roughly $10 million per kilometre in contrast to approximately $40 million for LRT. However, ongoing operating and maintenance costs are dependent on the number of passengers per kilometre and the frequency of service. BRT is cheaper than LRT to operate and maintain only until a peak passenger per hour threshold is reached, which is less than 2000 riders per hour. With an anticipated ridership in excess of this threshold, operations and maintenance for LRT in the Etobicoke-Finch West corridor is anticipated to be cheaper than BRT.

2.1.1.4 Light Rail Transit (LRT)

In this study, the LRT technology being considered is significantly different than the streetcar operation that is in place on several streets in Toronto. The LRT will operate on its own lanes and with a different type of vehicle. The basic vehicle technology proposed for the Finch West LRT system is similar to the streetcar replacement fleet – they are both light rail vehicles, using electrical power from overhead wires that allows them to operate in, or across, traffic lanes. The design and operation of the LRT right-of-way at signalized intersections are also the same as with streetcars but with dedicated lanes on mid block sections. The new light rail vehicles will be significantly different than the existing streetcars in service today. Using a modern European design, they will be twice as long as a standard streetcar, with level loading from platforms – i.e. no steps – and a proof-of-payment fare system that will allow loading from all doors to significantly speed-up passenger loading and alighting. In addition, the new LRT vehicles will be bi-directional – i.e. with operating cabs at both ends and doors on both sides – eliminating the need for turning loops.

Air Quality

Since LRT vehicles are electrically powered, no emissions would be produced on the street.

Capacity

The new Light Rail Vehicle that will be designed for the TTC has a much higher carrying capacity than BRT. A 30-metre LRT can comfortably carry an average of 130 people. A peak point demand of 2,800 people per hour would require a vehicle about every 2 minutes, 45 seconds. If this frequency proved to be difficult to operate, resulting in vehicle 'bunching,' the Light Rail Vehicles would be 'coupled' together and operated in pairs (i.e., 60-m trains), so that the time between vehicles would be about 5 minutes 30 seconds, which makes for a more-manageable operation. Design headway or train spacing on the Transit City lines is assumed to be every 3 minutes in peak times and no greater than every 6 minutes at off peak times.

Land Use

LRT technology supports the Toronto Official Plan objectives with respect to creating transit-oriented development in the corridor and removing vehicles from the road. A recent study, based on a review of BRT and LRT experience in the U.S., by the Region of Waterloo concluded: "Rail transit…is recognised to be a planning tool that can support and encourage the development of more sustainable land use patterns. LRT, like subways, has been shown to influence land development in part because, being tied to tracks, it is both distinct and perceived to be permanent." On this basis LRT would be more effective than BRT in supporting the City's vision for the creation of a more urban 'Avenue', as is planned on Finch Avenue West.

Cost

While LRT costs more in capital funds to construct than BRT – roughly a total average cost of over $40 million per kilometre, LRT can be more efficient than BRT in operational costs.

LRT outperforms BRT in lifespan of vehicles as well. Buses generally last around 15 years, after which they either require major improvements or complete replacement. LRT vehicles have records of operating smoothly for 30 to 40 years, thereby increasing the long-run capital efficiency of the fleet.

New Vehicles for the Etobicoke-Finch West LRT

The Light Rail Vehicles (LRV) that will be used in the Etobicoke-Finch West corridor and all Transit City corridors (examples are shown in Exhibit 2-2) will have the following features:

1. Larger capacity – about twice as long as the existing standard streetcars in Toronto;
2. Enhanced accessibility – low-floor vehicles with level loading from on-street platforms;
3. Doors on both sides – platforms can be located on either side of the vehicle;
4. Loading through all doors – significantly reduces the time spent serving stops;
5. Operator cabs at both ends – the vehicle can operate in either direction and not require a loop to turn around, reducing infrastructure and space needs, as well as noise and vibration; and
6. Modern design – attractive design will be conducive to the long-term goals for the corridor to be a distinct identity area with pleasing streetscapes and public spaces, making the community a distinctive, vibrant, and beautiful area.

TTC's LRT cars will have a length of approximately 30 m and a width of 2.54 m. Trainsets of two cars result in a train length of approximately 60m. The design load for such an LRT train is 260 passengers. Maximum operating speed is 60 km/hr. Trains are powered by electrical power from overhead wires. Train operations, as well as the opening / closing of doors, are controlled by on-board staff.

The track technology to be used is a combination of continuously welded rail embedded in a concrete road bed with a rubber sleeve that isolates the rail from the concrete. This elimination of rail joints combined with the isolating sleeve provides a smooth operation with limited noise and vibration that does not rise above the noise levels of a busy urban street.

Exhibit 2-2: Examples of LRT Vehicles

Porto, Portugal

Enhanced Accessibility

Valencia and Alicante, Spain

Minneapolis, USA

New streetcar for downtown Toronto network

2.1.1.5 Recommended Transit Technology

LRT is the recommended Transit Solution as it fulfills passenger requirements, integrates with the physical environment, and provides flexibility for future growth. It also supports the City's vision – a better integrated transit system, reduced car dependency on roads (thereby lowering emissions), growth in general infrastructure, and increased ridership along this corridor.

2.2 Design Criteria

Design criteria for both LRT alignment and roadway were established for developing the conceptual plan and functional alignment. The criteria were developed based on the TTC - Design and Supply of the Low Floor Light Rail Vehicle – Technical Specification and the Transportation Association of Canada (TAC) – Geometric Design Guidelines.

2.2.1 TRANSIT ELEMENTS

The Finch West LRT, as part of the Transit City improvement initiative, has benefited from the implementation of a city wide defined technology that will improve travel time for transit users and will increase corridor capacity. The design criteria shown in Exhibit 2-3 are based on the technical specifications developed by TTC, named "Design and Supply of the Low Floor Light Rail Vehicle".

Exhibit 2-3: LRT Design Criteria

Design Parameters	Proposed Standards
Vehicle Type	Low Floor Light Rail Vehicle
Propulsion	Electric
Power supply system	Catenary feed pantograph
Trackway location	road median
Trackway type	fully segregated by a raised track bed (150mm high) with at-grade at road crossings.
Maximum Operating Speed	60 km / h
Right-of-way Width	7.38 m – Midblock 7.0 m – Intersection
Maximum Grade	5.0 %
Platform Width	Side platform – 3.0 m Centre Platform – 4.0m
Platform Length	63.0 m (for two coupled cars)
Platform access	Ramp from cross walk
Platform Area Grade	Desired – 0.0% (with transverse drainage) Maximum – 2.0%

2.2.2 ROAD ELEMENTS

Finch Avenue West will be modified to accommodate the LRT runningway along a raised median. The existing horizontal and vertical geometric standards, number of lanes and operating speed will be maintained; bike lanes will be implemented in both directions. Exhibit 2-4 summarizes the design criteria being applied for the road runningway.

Exhibit 2-4: Road Design Criteria

Design Parameters	Proposed Standards
Horizontal Alignment	Maintain existing road alignment
Vertical Alignment	Maintain existing road alignment except as required for LRT operation
Design Speed	60 km/h
Posted Speed	To be determined by sector at the design stage.
Left Turn/U-turn Lanes	1 at major intersections x 3.0 m
Bike lanes	1 per direction x 1.6m
Minimum Grade	0.5%
Maximum Grade (Roadway)	5.0%

2.2.3 URBAN DESIGN

The TTC and the City will enhance the urban design environment on all the Transit City project rights-of-way. The proposed Etobicoke-Finch West LRT presents an opportunity to support the City's objectives to transform the corridor into an identifiable 'great street' appreciated by all who live in, work in and visit the area.

A great street is defined as much by the quality and character of its edges and the buildings and landscaped open space that frame it, as by the design features of the street itself. Ensuring that all these defining elements come together in the right way will enhance the area's image, generate investment, and encourage walking, cycling and transit use. Great streets come in many shapes and forms, but attributes they commonly share include:

- Distinguishing design or architectural characteristics;
- High quality streetscapes;
- Interesting, safe and comfortable pedestrian environments; and,
- Appropriate land uses that frame and animate the street.

Detailed urban design including layout and selection of streetscaping elements will be developed as part of the detailed design stage. Urban Design is the process of shaping changes to the total physical setting to enhance the livability of the city and to respect and enhance the existing character of the area where appropriate. It coordinates the design and configuration of streetscapes with parks and open spaces, buildings, groups of buildings, to create great streets, vital and interesting neighbourhoods as part of the larger city. Urban Design deals with how a person experiences the neighbourhood and requires one to think not only in 'plan' but also in three dimensions. This perspective is necessary to understand how it will feel to stand at a bus stop or transit platform and walk on the sidewalks. Street furniture, including passenger shelters, litter / recycling receptacles, benches, newspaper boxes, etc., can be provided at the LRT stop areas to provide convenience for customers. Streetscape elements with co-ordinated street furniture and landscaping will be incorporated into the project during the design phases.

Tree planting and landscape architectural design decisions will create a more contiguous and healthier tree canopy than currently exists as it is being envisioned as one complete unit as opposed to numerous disparate entities. Tree planting along the Etobicoke-Finch West corridor will primarily focus on the placement of trees in areas where it is possible to obtain the City of Toronto minimum soil volume target of 30m³/tree. An uncompacted soil volume the most important factor (along with adequate irrigation) contributing to urban tree health. It is with this in mind that the proposed tree planting is being designed. The tree planting rationale within the Etobicoke-Finch West corridor will be linked to Toronto Urban Forestry Service's higher-level goal of creating a resilient urban canopy.

The Etobicoke-Finch West corridor urban design work will also conform with the three Secondary Plans in effect for the corridor (Central Finch Area, North York Centre and Emery Village), as well as the findings and recommendations of the citywide Avenues Study, now in preparation.

2.2.4 TYPICAL CROSS SECTIONS

The typical cross sections to be used along the Finch West Corridor were developed by TTC and the City of Toronto based on the following guidelines:

- Locate dedicated transit path in centre of roadway, as per feasibility studies and Transit City program
- Maintain the existing number of vehicular traffic lanes
- Provide bike lanes within roadway
- Provide (maintain) streetscape elements
- Minimize traffic inconvenience
- Avoid (where possible) private property effects.

Based on the above guidelines, the following typical cross sections were developed.

2.2.4.1 At Midblock

Exhibit 2-5 illustrates the official typical section developed for midblock application in a 36 m wide corridor. This section maintains the two existing traffic lanes in each direction plus the centre median location for the LRT.

Exhibit 2-6.illustrates the modified dimensions for the segment of the Finch West Corridor between Jane Street and Weston Road, where three lanes of traffic will be maintained in addition to the centre median location for the LRT.

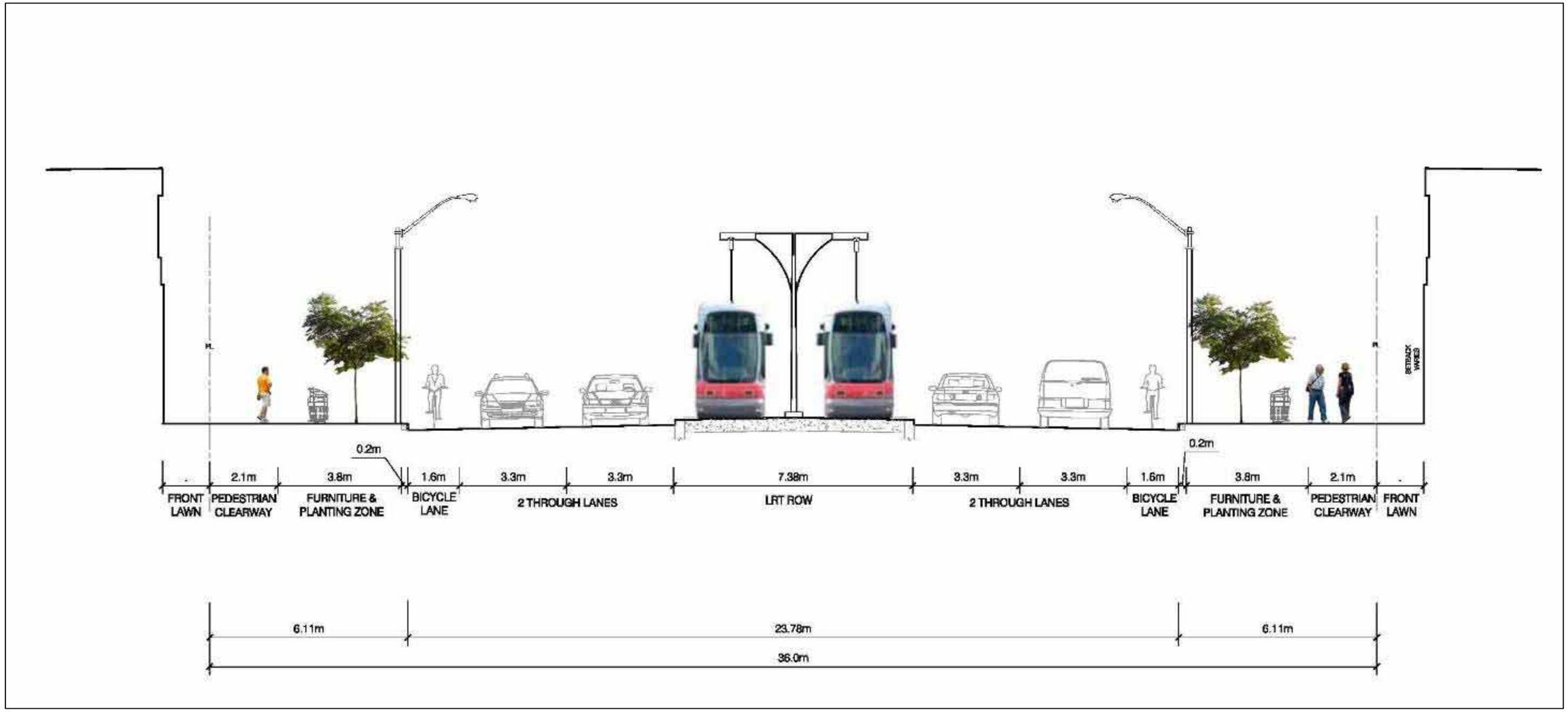


Exhibit 2-5: Typical Midblock Cross Section – 36m
(Sectors Yonge St. to Jane St.; Weston Rd. to Humber College)

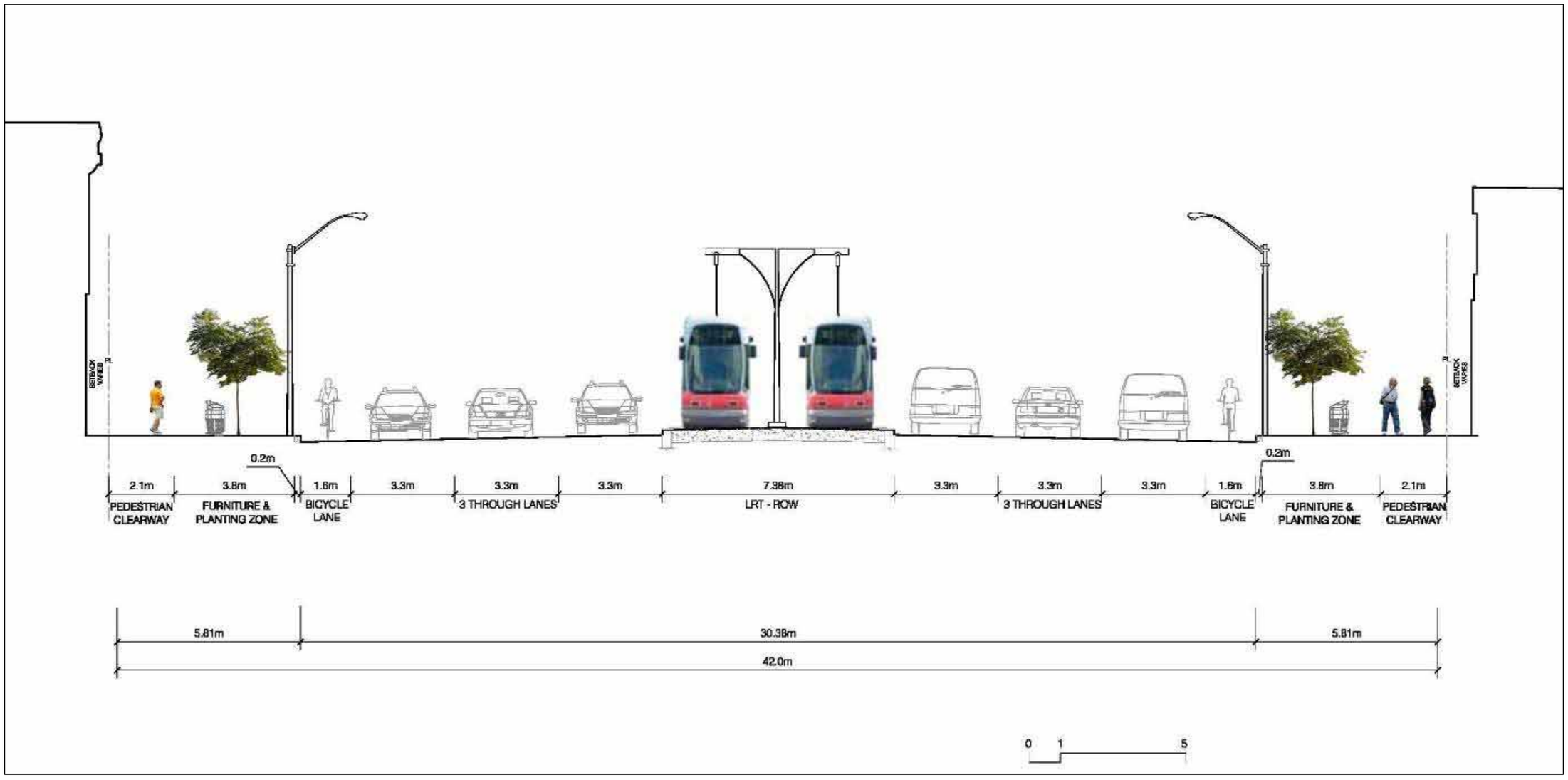


Exhibit 2-6: Typical Midblock Cross Section – 42m
(Sector Jane St to Weston Rd.)

2.2.4.2 At Intersections

Exhibit 2-7 illustrates the official typical 36 m cross section for intersections with LRT stops at far-side platforms.

Exhibit 2-8 illustrates the modified section developed for intersections where a single centre platform is installed, due to curves or grades that would not allow the typical far side platforms to be constructed. This section requires additional width to safeguard the continuity of lanes on each side of the intersection.

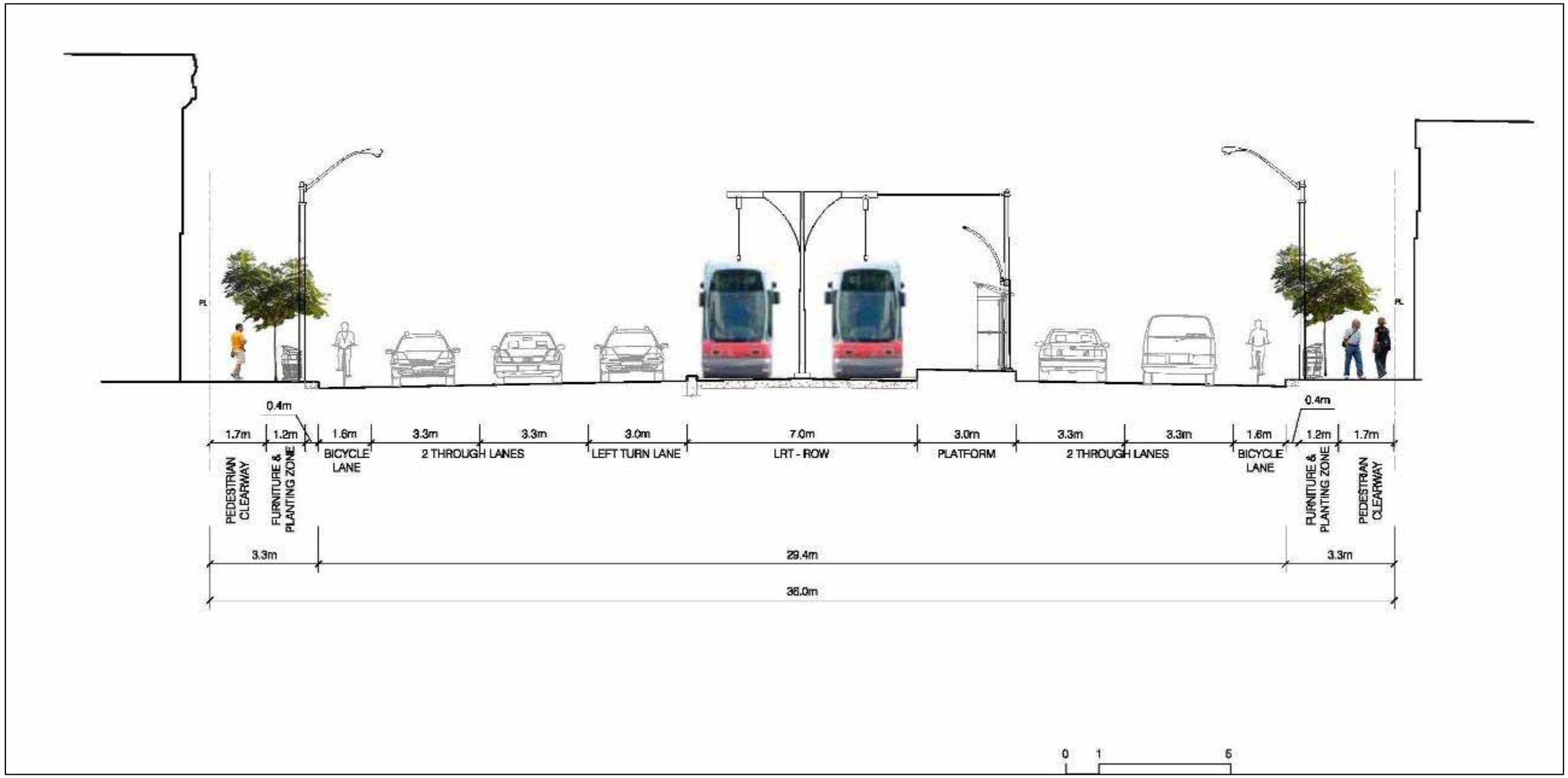


Exhibit 2-7: Typical Intersection Cross Section (Side Platform Stop)

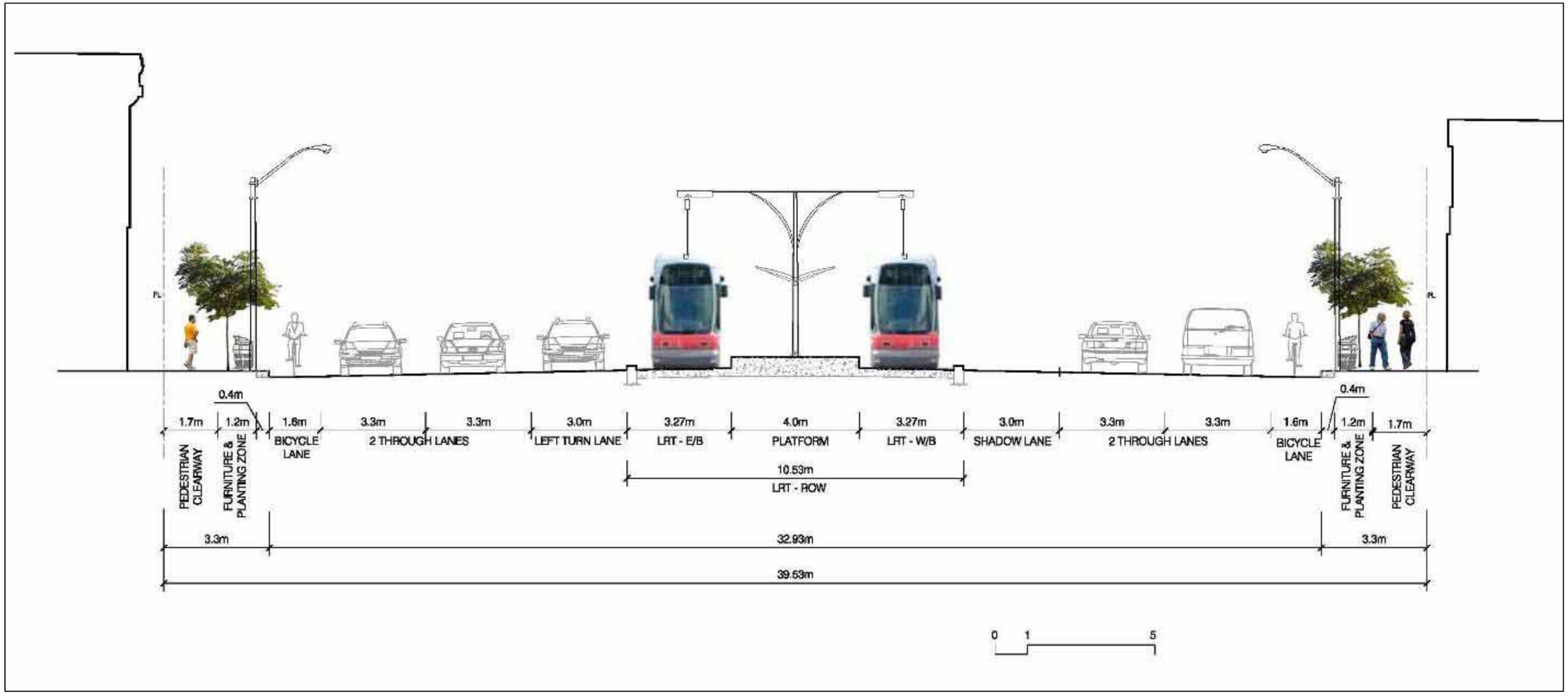


Exhibit 2-8: Typical Intersection Cross Section
(Centre Platform Stop)

2.2.5 STOP SPACING

LRT stops are selected based on a balance between good local access and high route speed. The greater the distance between stops, the higher the speed of travel. There were two general scenarios considered for stop separation for the Etobicoke-Finch West Transit City Corridor:

1. LRT stops every 800 - 1,000 metres like a 'surface subway', with stops at major intersections with parallel bus service (such as every 20 minutes) serving bus stops in between. At LRT stops, customers can transfer to the centre LRT platform from the side of road bus stop.
2. LRT stops more closely spaced, every 400-600 metres, with no parallel local bus service.

TTC developed a micro-simulation to examine the impacts of stop spacing on the example of the Sheppard East LRT. A stop spacing of 800 metres resulted in a route speed of 26-27 km/h, while a stop spacing of 400 metres had a route speed of 22-23 km/h. The wider spacing did not result in as much of a speed advantage as expected; while the LRT stopped less often, the time for customers to board took twice as long per stop (same number of passengers collected at half the stops) and the LRT still had delays due to red lights at signalized intersections in between stops (although the model accounted for possible signal priority to reduce such delays).

The wider spacing scenario was not selected because the full impact of the increased speed of the LRT applies only to those walking directly to LRT stops. Those boarding local buses at bus stops in between LRT stops have a shorter walk, but a longer waiting time for service and a transfer to the LRT after a very short bus ride.

In recognition of these results, the recommendation for stop spacing for the Etobicoke-Finch West line is in the order of 400 to 600 metres, depending upon the pattern of development and the location of cross-streets, with an expected average speed of 22 to 23 km/h; this is considered to be the best balance between the overall route speed and good local access. The stop spacing may be greater at some locations for the Etobicoke-Finch West LRT due to terrain and undeveloped zones along the corridor, as well as the interchange and related roadways at Highway 400. For purposes of comparison, during peak operating conditions, the average speed of the Bloor-Danforth subway line is 30 km/h, the 36 Finch West bus service is 17 km/h, and the 510 Spadina streetcar service is 14 km/h.

2.2.6 STOP LOCATIONS

The criteria used by the study team to determine stop locations were based on the following considerations:

- Providing a stop in the range of 400 m to 600 m, to provide a balance between local access/transfer opportunities, and travel time;
- Crossing major transit facilities, such as the Yonge Subway and the Spadina Subway Extension;
- Providing a presence at major intersections and/or other potential transit ridership generators such as Humber College and Albion Mall;
- Avoiding adverse existing road conditions, such as steep grades and curvature, as well as other physical constrains such as presence of bridge piers.

2.3 Development of Preferred Design

2.3.1 RAPID TRANSIT INTERFACES

The Etobicoke-Finch West LRT line crosses the TTC's subway network at two locations: the Yonge Subway at the existing Finch Station, and the Spadina Subway extension at the future Finch West Station at Keele Street. The Etobicoke-Finch West LRT line also crosses the future Transit City Jane Street LRT.

According to the ridership forecast, the two subway crossings will represent the highest level of transfer activity along the entire LRT corridor. Alternative horizontal and vertical alignments and platform locations were identified and evaluated prior to the selection of the preferred alternatives. The east terminal station at Yonge Street represents the second highest passenger load point on the Etobicoke-Finch West LRT line, with an estimated 1700 passengers transferring between the LRT and the Yonge Subway in the morning peak hour. The Finch West Station at Keele Street, where the LRT crosses the Spadina Subway Extension, represents the highest passenger load point on the line, with an estimated 2,700 passengers transferring between the LRT and the Spadina Subway in the morning peak hour.

2.3.1.1 Yonge Street Subway Interface

To select the preferred option for the eastern terminus of the LRT line, the alternative evaluation process included three screening levels (see Exhibit 2-9.)

First Screening Level. - The first screening level included an evaluation of routing and platform location alternatives with the EFW LRT facility built at surface level only. Three options were originally identified:

Option S1 Station platform on Finch Avenue, west of Yonge Street (Exhibit 2-10)

Option S2 Station platform on Yonge Street, north of Finch Avenue (Exhibit 2-11)

Option S3 Single track loop with alignment exiting Finch Avenue along TTC bus terminal, turning west on Bishop Avenue/Hendon Avenue, then south on the future widening of the Beecroft Road extension, returning to Finch Avenue (Exhibit 2-12). Station platform would be adjacent to TTC bus terminal.

As a result of this first screening level, Option S1 was carried forward responding to the following factors:

- Option S1 represented a short and convenient passenger transfer from/to the subway.
- Option S1 provided the best operational arrangement for a potential future extension along Finch Avenue East.
- Option S1 represented the least transit travel time
- Option S1 represented the least capital and O&M costs.
- Option S2 represented a severe traffic impact to the Yonge-Finch intersection.
- Option S3 represented a major disturbance to the traffic patterns of the entire area
- Option S3 would have a significant operational staging conflict with TTC bus operations during construction and implementation of the LRT and before implementation of a possible Yonge Subway extension to the north.

Second Screening Level. - Having selected Option S1 in the first screening level, in the second screening level, shifting the alignment north or south within Finch Avenue right-of-way was evaluated. The three options considered were:

Option S1A Alignment on centre line of Finch Avenue. Passengers would transfer from the centre platform to the existing subway entrance on the northwest corner of the Finch-Yonge intersection by using the surface crosswalk at the end of the platform.

Option S1B Alignment shifted to the north side of Finch Avenue; shifting general traffic lanes to the south of the road allowance.

Option S1C Alignment shifted to the south side of Finch Avenue; shifting general traffic lanes to the north of the road allowance. An underground pedestrian walkway would lead from the south plaza sidewalk area to the entrance of the existing subway mezzanine. Access to and from the northerly platform would take place on the surface as in the previous option.

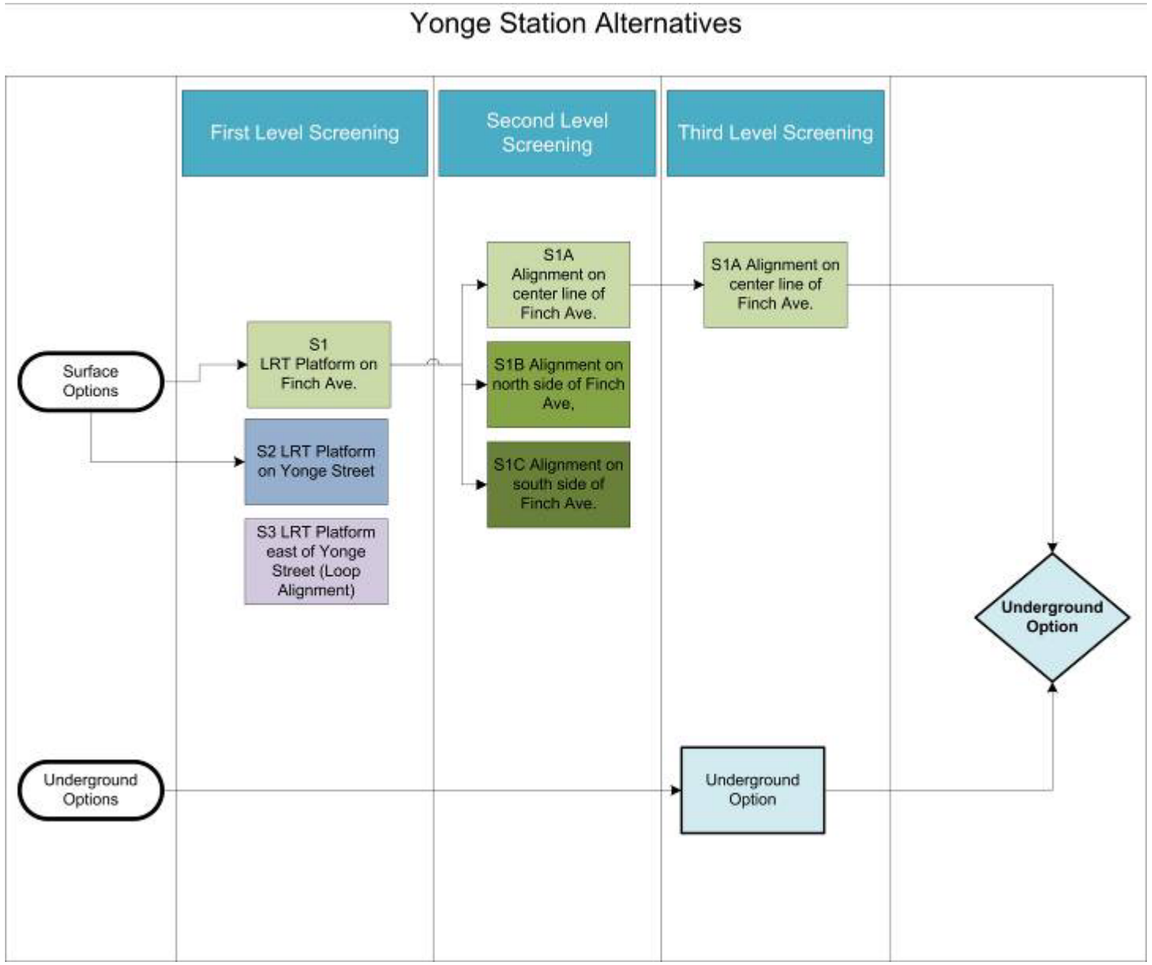


Exhibit 2-9: Etobicoke-Finch West Yonge Station Alternative Evaluation Process

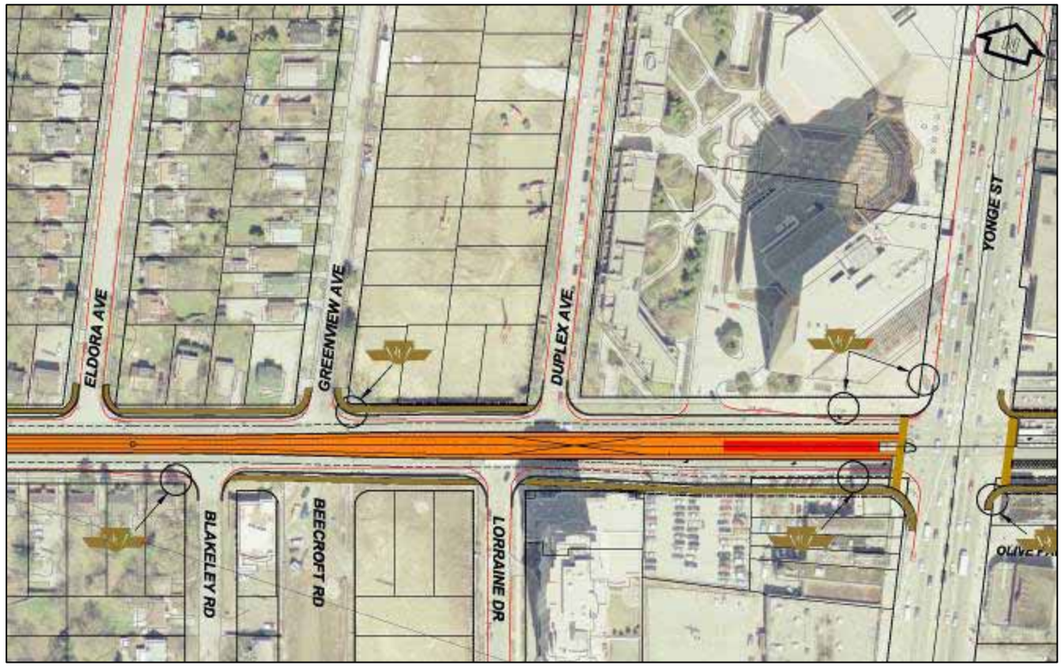


Exhibit 2-10:
Option S1: Centre Station Platform on Surface

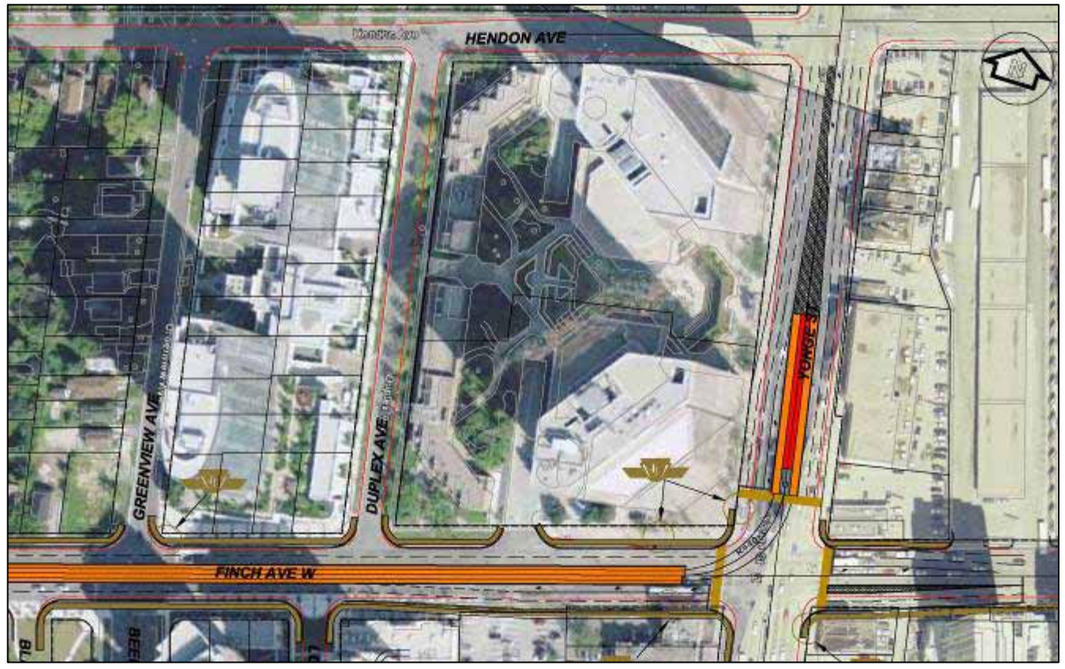


Exhibit 2-11:
Option S2: Station Platform on Yonge Street, North of Finch Avenue

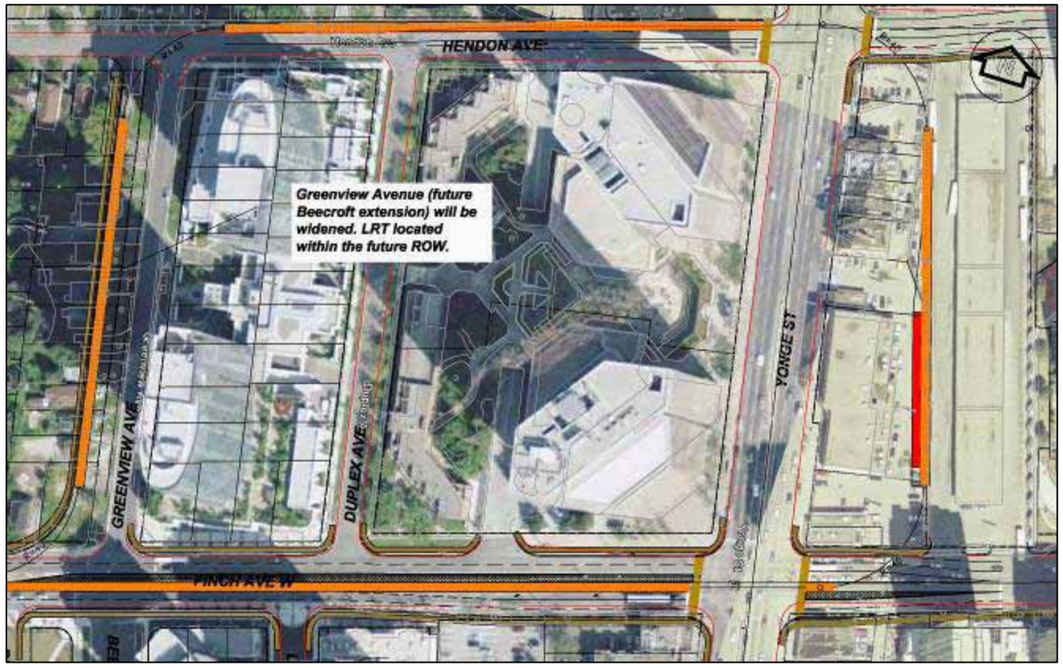


Exhibit 2-12:
Option S3: Single Track Loop

Option S1A was carried forward for the following reasons:

- Option S1B would obstruct access to the North American building.
- Option S1A, a potential future extension of the LRT service to the east would have an impact on a building recently constructed on the southeast corner of the Yonge-Finch intersection,
- Having the alignment on either side of the road (Options S1A and S1B) would represent an operational advantage to the curb platform passengers but an inconvenience to the opposite platform users.
- Both Options S1A and S1B would require controlled transit and general traffic signals where the tracks are shifted from centre of the road to either side of the road and vice versa.

Third Screening Level – The Yonge-Finch area is considered among the busiest areas in the City of Toronto, due to pedestrian, transit and general traffic activity mainly generated by the presence of the Yonge Subway terminal station, a very busy bus facility and the largest park and ride lot of the entire TTC subway system. The addition of even more pedestrian and vehicular activity generated by the EFW LRT station would represent a significant impact to the entire area, particularly to the intersection between the two arterial roads.

To mitigate this situation, an LRT underground alternative was evaluated. The LRT could either be located between surface level and the subway box or under the subway. The LRT under the subway was considered an unfeasible option due to operational and cost issues. The station platforms would need to be about 25 metres below surface level, representing inconvenience and safety concerns to the users. Consequently, it was concluded that the only feasible underground option (See Exhibit 2-13) would be to locate the LRT between the surface and the subway box.

In addition, the underground alternative would have many advantages:

- Separating passenger flows from the street level,
- Providing a level of comfort,
- Giving protection from the elements,

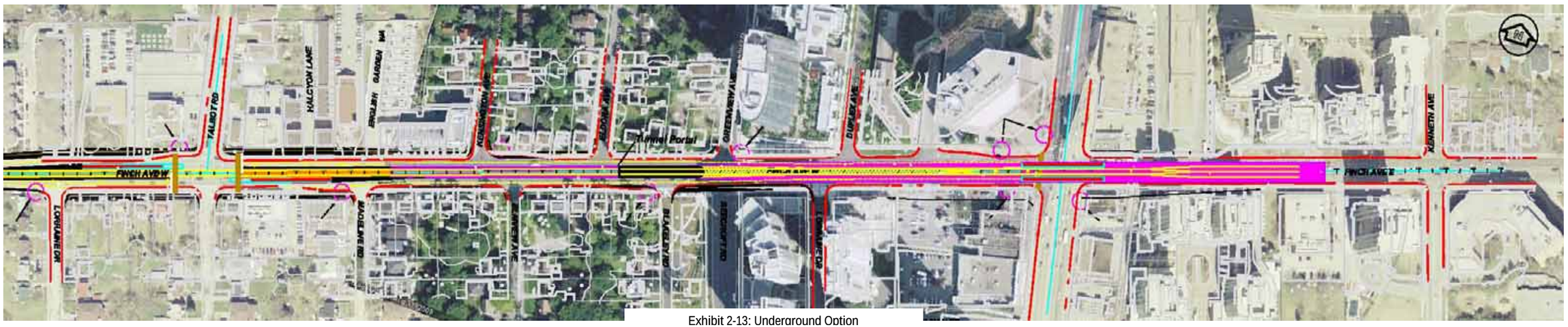


Exhibit 2-13: Underground Option

- Establishing a direct connection to subway and bus transfers,
- Increasing safety throughout the transit facilities.

Although more costly than the remaining surface option, the underground alternative was selected as the preferred interface with the Yonge Subway, mentioned above. The description of this preferred alternative is included in Section 2.4. Exhibit 2-14 below provides a basic matrix overview of the evaluation process between the at-grade and underground station for the Yonge and Finch intersection.

Exhibit 2-14 – Evaluation Matrix for Yonge and Finch Station

IMPROVE MOBILITY				
Maximize transit connectivity and transfer convenience	◔	Inconvenient transfer activity with subway and Bus/bus transfer requires pedestrian crossing of Finch. Transfer to buses requires navigation of one level down and one level up to bus island	●	Provides efficient and safe connectivity with the subway and one upward level transfer to bus island.
Alignment geometry that maximizes speed, ride comfort and service reliability and minimizes safety risks	◔	Greater potential for incidences with road vehicles and customers crossing traffic. Speeds through station areas could be reduced by traffic signal visit time.	●	Less potential for incidences with road vehicles and customers not crossing traffic. Speed through station area reduced by lower acceleration or approach ramps.
Overall Responsiveness	◔		●	
PROTECT AND ENHANCE SOCIAL ENVIRONMENT				
Minimize adverse effects and maximize benefits for communities in corridor	◔	Increases vehicular traffic congestion with increased pedestrian crossings for transferring passengers but also increases pedestrian traffic and potential increases retail opportunities.	●	Separate passenger transfer circulation from surface pedestrian movements and from vehicular traffic. Offers direct underground access to retail and commercial establishments underground, above station and in the vicinity.
Provide a secure transit stop and transfer location for customers and local residents	◔	"Eyes on the street" will provide for a secure transfer location for customers and local residents. By generating more pedestrian traffic in the area through LRT and potential increased development, more people are available to monitor the environment.	●	With full time staff in station areas, multiple customers and CCTV cameras, proper lighting and CPTED principles incorporated into the design, the underground station has the potential to provide a secure environment.
Minimize adverse noise and vibration effects	◔	Stop and start warning chatter of LRT on street. Introduces another noise source.	●	Underground station has the potential to minimize any noise concerns. Vibration will require attenuation in track structure.
Minimize disruption of community views and adverse effects on street and neighbourhood aesthetics	◔	Overhead catenary adds to intersection utility clutter, but the LRT at grade streetscaping could improve existing neighbourhood aesthetics	●	Provides the minimum disruption to community views and adverse effects on street and neighbourhood aesthetics
Overall Responsiveness	◔		●	
PROTECT AND ENHANCE THE NATURAL ENVIRONMENT				
Minimize adverse effects on aquatic ecology	●	No aquatic habitat in the vicinity	●	No aquatic habitat in the vicinity
Minimize adverse effects on Terrestrial Ecology	●	No adverse effects anticipated	●	No adverse effects anticipated
Minimize adverse effects on corridor hydrogeological, geological, and hydrological conditions	●	Station environment does not encompass any sensitive water features.	●	Station environment does not encompass any sensitive water features.
Overall Responsiveness	●		●	
PROMOTE SMART GROWTH AND DEVELOPMENT				
Protect provisions for goods movement in corridor	◔	New station at intersection may cause greater congestion in the intersection	●	Greater protection for goods movement in the corridor without having to cross LRT guideway
Minimize adverse effects on urban design	●	At grade alternative can more easily be integrated with overall urban design of right-of-way and streetscape.	◔	Access ramps and portals will have a negative effect on the appearance of the urban design.
Overall Responsiveness	●		◔	
MAXIMIZE COST-EFFECTIVENESS OF TRANSIT SYSTEM				
Minimize capital cost of vehicles, facilities and systems required	●	Less expensive capital, facilities and systems required	○	Capital cost of facilities and systems required for the underground station are approximately one significantly higher
Minimize property acquisition cost to implement facilities	◔	Requires significant property access to accommodate platform including demolition of existing structure at south west corner of Finch and Yonge	◔	Temporary property requirements will be higher for tunnel staging and development.
Minimize adverse effects of alignment, characteristics on operating and maintenance costs	●	Lower operating and maintenance costs with station at grade	○	Higher operating and maintenance costs for underground station including staffing, systems and station features.
Overall Responsiveness	●		○	

LEGEND: Poor Responsiveness ○ ◔ ◑ ◕ ● Very Good Responsiveness

2.3.1.2 Finch West Station - Spadina Subway Interface

This station will represent the highest passenger load point on the Etobicoke-Finch West LRT line, with an estimated 2,700 passengers transferring between the LRT and the Spadina Subway Extension in the morning peak hour.

Option 1: Crossing Keele Street on Surface

Similar to the case of the Yonge Subway interface, as a first step, an assessment of a surface crossing was made. This alternative presented the following characteristics:

- Staggered side platforms facing the opposite left turn lanes were not feasible at this location because the width of platform required to provide adequate transfer operation for the forecast transfer demand would require platforms of over 5 metres in width (wider than the opposite left turn lane). Consequently, a centre platform was considered. A centre platform of at least 8.5 m width would provide access from both directions of the LRT service to an underground pedestrian passageway to the subway mezzanine level.
- This option would have significant property effects on both sides of Finch Avenue to meet the required capacity and safety for pedestrian movement and remaining traffic operations. Exhibit 2-15 illustrates Option 1.

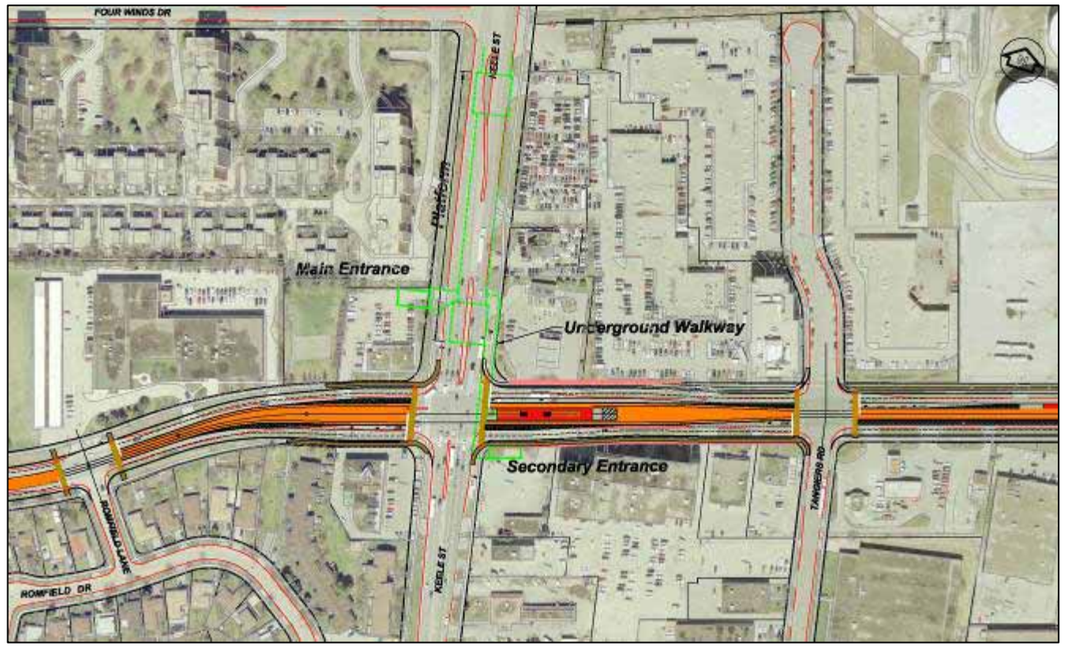


Exhibit 2-15
Option 1: Surface Option, Finch West Station at Keele

Option 2: Crossing Keele Street Underground.

An additional analysis examined the opportunities and constraints of an underground LRT alignment at the Spadina Subway crossing.

Similar to the Yonge subway underground crossing, the LRT would be located between surface level and the proposed subway box.

Due to forecasted ridership at this location, TTC wants to preserve the option to accommodate short turn LRT operations. This would require the construction of a special track structure. An alternative that provided the opportunity of adding an underground pocket track immediately past the station platforms implied a long underground section with the portals located west of Romfield Lane and east of Tangiers Road. This option was eliminated due to:

- The main access to Cardinal James McGuigan Catholic Secondary School is located on the north side of Finch Avenue across from Romfield Lane, where full-movement traffic operation at the intersection of Finch Avenue and Romfield Lane would need to be maintained. To comply with this requirement, the portal would need to be about 150 metres west of the intersection, representing a solution that has a large capital cost and is not considered cost effective.
- Similarly at the east end, full-movement traffic operation at the intersection of Finch Avenue and Tangiers Road would need to be maintained due to high activity of the oil depot trucks at that intersection. To comply with this requirement, the portal would need to be about 150 metres east of the intersection, also representing a solution that is not considered cost effective.

For these reasons, a shorter tunnel bringing the portal closer to the Station (east of Romfield Lane and west of Tangiers Road), and allowing for full-movement operation at both intersections with Finch Avenue represents a more cost efficient option. From the operational perspective, this option would eliminate the opportunity to have an underground special track structure for turn-back service. A substitute pocket track will be constructed on the surface east of Tangiers Road to allow such turn-back operations. Exhibit 2-16 shows the underground option. A detailed description of this preferred option is included in Section 2.4. Exhibit 2-17 below provides a basic matrix overview of the evaluation process between the at-grade and underground station for the Keele and Finch intersection.

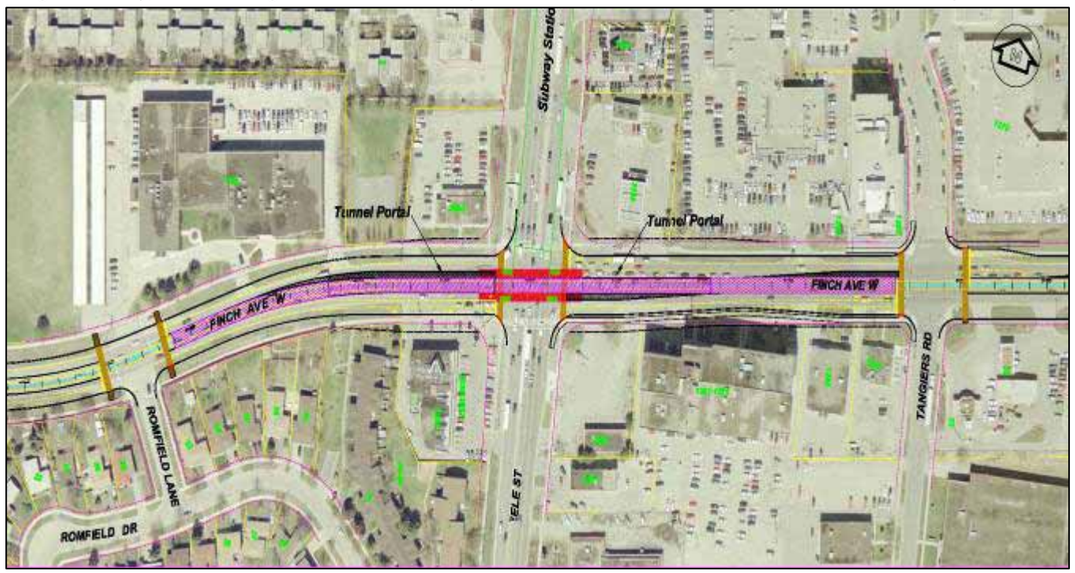


Exhibit 2-16 - Option 2: Keele Underground Station

Exhibit 2-17 – Evaluation Matrix for Keele and Finch Station

OBJECTIVES AND GOALS		A: Keele and Finch Station At Grade		B: Keele and Finch Station Underground
IMPROVE MOBILITY				
Maximize transit connectivity and transfer convenience	◑	Requires passengers to drop one level to access subway with bus access via the street.	◕	Provides efficient and safe connectivity with the subway and one upward level transfer to bus island.
Alignment geometry that maximizes speed, ride comfort and service reliability and minimizes safety risks	◔	Greater potential for incidence with road vehicles and customers crossing traffic. Speeds through station area could be reduced by traffic signal wait time.	●	Less potential for incidence with road vehicles and customers not crossing traffic Speed through station area reduced by lower acceleration on approach ramps.
Overall Responsiveness	◑		●	
PROTECT AND ENHANCE SOCIAL ENVIRONMENT				
Minimize adverse effects and maximize benefits for communities in corridor	◑	LRT pedestrian traffic separated from regular street traffic and does not provide as direct access to street level retail. Could have commercial building linkages for direct access.	●	Separate passenger transfer circulation from surface pedestrian movements and from vehicular traffic. Offers potential direct underground access to retail and commercial establishments underground, above station and in the vicinity.
Provide a secure transit stop and transfer location for customers and local residents	◕	"Eyes on the street" will provide for a secure transfer location for customers and local residents. By generating more pedestrian traffic in the area through LRT and potential increased development more people are available to monitor the environment.	◕	With full time staff in station area, multiple customers and CCTV cameras, proper lighting and CEPTED principles incorporated into the design, the underground station has the potential to provide a safe and secure environment.
Minimize adverse noise and vibration effects	◑	Stop and start warning devices of LRT on street introduces another noise source.	●	Underground station has the potential to minimize noise concerns. Vibration will require attenuation in track structure.
Minimize disruption of community vistas and adverse effects on street and neighbourhood aesthetics	◑	Overhead catenary adds to intersection utility clutter, but the LRT at grade streetscaping could improve existing neighbourhood aesthetics	●	Provides the minimum disruption to community vistas and adverse effects on street and neighbourhood aesthetics
Overall Responsiveness	◑		●	
PROTECT AND ENHANCE NATURAL ENVIRONMENT				
Minimize adverse effects on aquatic ecology	●	No aquatic habitat in the vicinity	●	No aquatic habitat in the vicinity
Minimize adverse effects on Terrestrial Ecology	●	No adverse effects anticipated	●	No adverse effects anticipated
Minimize adverse effects on corridor hydrogeological, geological, and hydrological conditions	●	Station environment does not encompass any sensitive water features.	●	Station environment does not encompass any sensitive water features.
Overall Responsiveness	●		●	
PROMOTE SMART GROWTH AND DEVELOPMENT				
Protect provisions for goods movement in corridor	◔	New station at intersection may cause greater congestion for traffic and in particular for oil delivery trucks at the oil refinery in the near vicinity	●	Greater protection for goods movement in the corridor without having to cross LRT guideway.
Minimizes adverse affects on urban design	●	At grade alternative can more easily be integrated with overall urban design of right-of-way and streetscape.	◕	Access ramps and portals will have a negative effect on the appearance of the urban design.
Overall Responsiveness	◕		◕	
MAXIMIZE COST EFFECTIVENESS OF TRANSIT SYSTEM				
Minimize capital cost of vehicles, facilities and systems required	◑	Less expensive capital, facilities and systems required	◑	Capital cost of facilities and systems required for the underground station are significantly higher
Minimize property acquisition cost to implement facilities	◔	Requires significant property acquisition at Keele to accommodate centre platform long enough to accommodate anticipated ridership	◕	Temporary property requirements will be higher for tunnel staging and development, but most property can be returned. Permanent property requirements will be less.
Minimize adverse effects of alignment characteristics on operating and maintenance costs	●	Lower operating and maintenance costs with station at grade	◔	Higher operating and maintenance costs for underground station including staffing, systems and station furniture.
Overall Responsiveness	◕		◑	

LEGEND: Poor Responsiveness ○ ◔ ◑ ◕ ● Very Good Responsiveness

2.3.1.3 Jane LRT Interface

The Etobicoke-Finch West LRT alignment crosses the planned Jane Street LRT. Similar to the case of the two subway line interfaces, surface and underground station options were assessed based on forecasted transfer demand, environmental impacts and costs, as summarized below:

- The forecasted transfer volumes (which do not exceed 1000 passengers per peak hour) can be accommodated without a grade separated crossing of the two rapid transit facilities.
- The surface right-of-way required at Finch Avenue to accommodate the LRT runningway and station platforms does not affect private property.
- The cost of an underground option would be substantially higher.

As a result of the assessment, a surface option was selected as the preferred option to cross Jane Street.

2.3.2 HIGHWAY 400 CROSSING BETWEEN JANE STREET AND WESTON ROAD

Provincial Highway 400, a limited access freeway from Toronto to Central Ontario, crosses Finch Avenue West in a north-south direction midway between Jane Street and Weston Road. There is a full interchange between Highway 400 and Finch Avenue West at the crossing point. This is the only complete interchange between the Highway and the arterial road network in the northwest portion of the City of Toronto (the connections to Highway 400 at Steeles Avenue West only allow access to or from the city, not the northern suburbs) and is an important connection for industrial truck movements, as well as for general traffic. Exhibit 2-18 provides both a view of the affected area and a description of the road modifications.

Unlike other sections of Finch Avenue West, which have two through traffic lanes in each direction, the Jane Street to Weston Road section has three lanes in each direction to serve demand at the Highway 400 interchange and at the service roads on each side of Highway 400 (Norfinch Drive and Oakdale Road on the east, Signet Drive and Arrow Road on the west).

The Highway 400 bridge over Finch Avenue has two spans that allow for four lanes in each direction, plus sidewalks on each side. Currently, the fourth outside lane carries the far-side on-ramp from Finch Avenue to Highway 400 (speed change lanes). In this configuration, there is insufficient space to add LRT trackways without either removing a lane from general traffic in each direction or rebuilding the interchange structure and ramps. Reducing the general traffic lanes from three to two would downgrade the level of service and result in an unacceptable increase in traffic congestion through the interchange.

The findings of an assessment and evaluation of alternative solutions considered are summarized below:

1. ***Reconstruction of the Highway 400 overpass bridge*** to increase spans allowing the LRT to remain in the centre of the street right-of-way through the interchange. This alternative, which includes modifications to interchange ramps, becomes a costly undertaking with severe direct and indirect costs as a result of traffic impacts and delays on both Highway 400 and Finch Avenue West during the construction period.

2. ***An elevated LRT alignment*** bypassing the interchange would require a lengthy and costly LRT route detour to find an acceptable location to cross over the highway while avoiding the approach ramps of the interchange. Right-of-way acquisition, high construction costs and increased maintenance costs are significant disadvantages of this alternative. Also, the length of this option and its distance from the existing Finch Avenue West alignment would require that adjacent transit stops be relocated or eliminated, so that the LRT ramps could be aligned to connect with the overhead segments. The impacts of relocating the LRT line away from the centre of Finch Avenue West would extend for a considerable distance in both directions.

3. ***An underground alternative*** with a tunnel under existing through traffic lanes was analyzed. This solution would require portals within the roadway. In addition to the high capital cost and disruption from tunnel construction, the portals necessitate realignment of the existing Finch traffic lanes from their current locations, as well as complex engineering measures to deal with the impacts to the existing Highway 400 bridge. Construction impacts, especially traffic delays for all modes and routings, would be severe and lengthy.

4. ***At-grade LRT alignment occupying existing median traffic lanes exclusively with modifications to the geometrics of the street, highway and ramp systems*** to improve traffic flow and maintain roadway capacity in the interchange area. Following consultations with the MTO and City of Toronto, this fourth alternative was analyzed based on road modifications that included:

   - Dedication of median general-purpose traffic lanes for LRT use in both directions.
   - Conversion of all on-ramp access lanes, including lanes under the bridge, to through and right turn access lanes in each direction, plus extension of the through lanes ahead (to replace median lanes re-assigned for LRT use).
   - Replacement of free flow right off-ramps (from Highway 400 southbound to Finch westbound and from Highway 400 northbound to Finch eastbound) with double right turn lanes controlled by traffic lights at Finch Avenue.
   - Addition of second left turn lane from Finch Avenue westbound to Arrow Road southbound to provide additional storage capacity for high volume traffic movement.

Exhibit 2-18: Highway 400 Segment Road Modifications.

Legend and map key

1. Retain three through lanes in each direction from Jane Street to the CPR overpass
    a) Convert Highway 400 on ramp transition lanes to general traffic lanes
    b) Eliminate dedicated right turn lanes
2. Dual left turn lanes for the westbound left turn from Finch Ave. to Arrow Road
3. Replace free flow right turn off ramps with dual right turn lanes which are signalized plus changes to green times at traffic signals.

The feasibility of this significantly lower cost alternative was confirmed by conducting a micro-simulation of future road traffic and LRT operations through the modified segment, with signal timings adjusted to reduce queuing but without priority for LRT service. The simulation showed that although levels of service at intersections would deteriorate from the already congested 'D' levels to LOS 'E,' traffic speeds in the 15-20 km/hr range can be maintained through the segment. Level of service (LOS) refers to the amount of congestion at an intersection, with the higher the later signifying the higher the amount of congestion. Elimination of the right-turn channelization at the Hwy 400 ramps has largely addressed the merging/weaving problems along Finch Avenue and the implementation of the signal cycles modelled can avoid spillback of off-ramp queues onto the Hwy 400 through lanes.

Based on the findings of the micro-simulation of traffic and LRT operations, the modification of the road and traffic signal system was selected as the preferred alternative because:

- Project implementation and operating costs to take LRT through the Hwy 400 interchange are significantly lower than all other alternatives;
- LRT service speed and hence travel time through the interchange will be significantly better than currently achieved with bus service in mixed traffic.
- The planned re-arrangement of roadway lanes and interchange operations will safely accommodate future traffic demand and movements, albeit with a reduction in general through traffic speed.
- Improved LRT-based transit service in this portion of the corridor will attract a greater proportion of trips to transit, thus reducing the growth in auto-based trips, some of which will also be diverted to parallel routes that could offer more favourable travel time through the segment.

2.3.3 HUMBER COLLEGE TERMINUS

In defining the western limit of the Finch Corridor LRT line within the Finch Avenue right-of-way the TTC Transit City network plan calls for the service to extend to the Highway 27 area, which is in the vicinity of Humber College, a major trip-generating node immediately west of Highway 27 and on the north edge of the Humber River Valley. Given that the Humber College campus is located a short distance south of Finch Avenue itself, it was necessary to develop and evaluate alternative alignments to reach and enter the campus to provide transit access to the core of the Humber College facilities. Three routing alternatives to reach Humber College from Finch Avenue were considered:

1. South from Finch Avenue along the existing Hydro One right-of-way east of Highway 27 as far as Humber College Boulevard and then continuing west along that street to reach Humber College;
2. South on Highway 27 and west on Humber College Boulevard to the campus, and
3. West along Finch Avenue to the Humber College Boulevard intersection, then south and east into the college campus.

While the Hydro corridor routing has the desirable advantage of serving the William Osler Health Centre (Etobicoke General Hospital) on its route to Humber College, there are significant disadvantages:

- There is insufficient space between the existing hydro towers and the adjacent residential areas to install a two-track right-of-way.
- The hydro corridor bisects Tamarisk Park, an active City of Toronto park, which would be affected by constant rail traffic in this active open space.
- The cost of land acquisition in the hydro right-of-way would be high compared to the available alignment on public streets.
- Technical issues regarding isolation of currents in parallel high voltage electric transmission lines could be overcome, but would require additional construction and maintenance measures to control.

This option was therefore removed from consideration.

The second step of the alignment evaluation entailed development of additional alignment options along the two remaining routes and potential terminal station locations within the Humber College campus. In defining these alignments, several factors were considered:

1. A strong desire by the Humber College administration to integrate the LRT station on the campus with their ongoing master planning of expansion and development of the college.
2. Protection for a future extension of the LRT line across the Humber River Valley to the Woodbine Live development and beyond to Pearson Airport, as noted in Section 4.1, is a key factor in establishing the orientation of the alignment and station within the campus.
3. Inclusion of a stop(s) serving the William Osler Health Centre (Etobicoke General Hospital), on Highway 27 and the residential communities adjacent to the college.

Alignment alternatives identified and evaluated are shown in Exhibit 2-19 with the evaluation findings summarized in Exhibit 2-20. The recommendation of the eastern red alignment .was made in consultation with Humber College administrators and takes into account protections for possible further extension of the line. See Section 2.4.2.4.

Exhibit 2-19: Alternative Alignments at Humber College

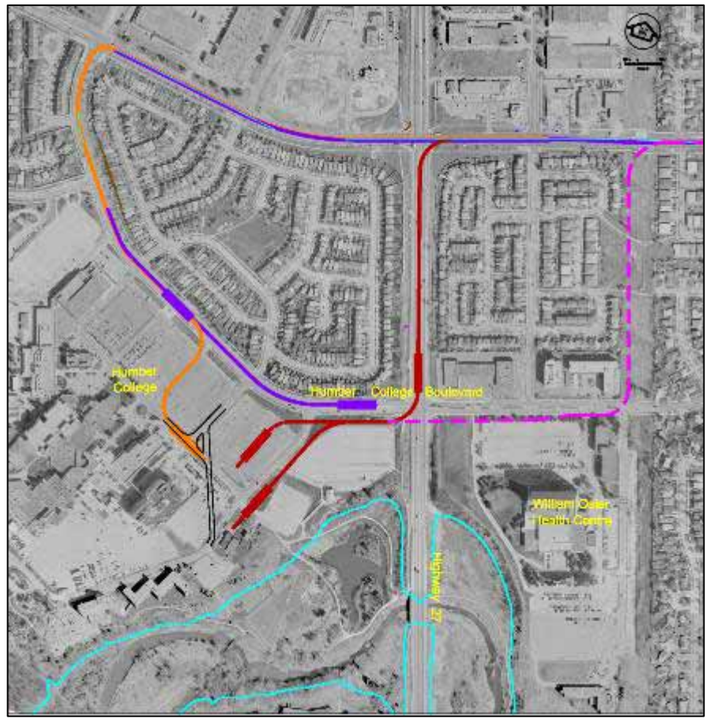


Exhibit 2-20: Evaluation of Alternative Alignments at Humber College

Planning Objectives	Evaluation Criteria and Indicators	Alignment Alternatives Orange Finch – Humber College Blvd W – Internal College Sta.	Purple Finch - Humber College Blvd W – Hwy 27 (Ext. Coll. Sta.)	Red 1 and Red 2 Finch – Hwy 27 – Internal College Station
IMPROVE MOBILITY				
Increase attractiveness of rapid transit service and maximize transit connectivity	Maximize access to LRT and connectivity to other transit routes such as York Region Transit, Brampton Transit, and Mississauga Transit and GO Transit buses.	Has potential to serve redevelopment west of Humber College but makes Hospital access less convenient. All routes allow transfers to/from main transit providers.	Has potential to serve redevelopment west of Humber College Blvd. but makes Hospital access less convenient All routes allow transfers to/from main transit providers.	Provides more convenient access to hospital but more remote from western redevelopment. All routes allow transfers to/from main transit providers.
Alignment geometry that maximizes speed and ride comfort, and minimizes safety risks and maintenance costs	Reliable and safe service during peak periods due to the location of alignment.	Longer travel time for all trips originating from Humber College (and further west in future). Sharp turning radius at the intersection of Finch Avenue and Humber College Boulevard (30 metre radius).	Longer travel time for all trips originating from Humber College (and further west in future). Sharp turning radius at the intersection of Finch Avenue and Humber College Boulevard (30 metre radius).	Most direct route for all trips from Humber College (and further west in future).
Overall Responsiveness ○ ◔ ◑ ◕ ●		◑	◑	●
PROTECT AND ENHANCE SOCIAL ENVIRONMENT				
Station locations that maximize ridership potential of rapid transit service	Maximize route access to Humber College and Etobicoke General Hospital –William Osler Health Centre	Direct connection to Humber College campus and residential area. There is no stop near the hospital.	Connection to Humber College and residential area, but on street, plus a stop located at Humber College Blvd. and Highway 27 – within 200 metres of the hospital.	Direct connection to Humber College, service to east side of residential area, a stop located at Humber College and Highway 27 - within 200 metres of the hospital.
Minimize disruption of community and adverse effects on street and neighbourhood	Required widening of right-of-way and effects on travel and parking patterns.	Right-of-way widening will cause disruption to residential areas. Line is intrusive on campus and narrow right of way disrupts the College's traffic and parking patterns.	Right-of-way widening will cause disruption to residential areas.	Minimal disruption since routes will use existing main roads and Humber College right-of-way. Red lines are to be integrated into College's campus plan.
Overall Responsiveness ○ ◔ ◑ ◕ ●		◔	◑	◕
PROTECT AND ENHANCE THE NATURAL ENVIRONMENT				
Minimize adverse effects on corridor hydro-geological, geological, and hydrological conditions (in the future)	Effects on Humber River Valley and Humber Arboretum	Minimal impact on the Valley and Humber Arboretum. Route uses Humber College Blvd. to reach Highway 27 bridge.	Minimal impact on the Valley and Humber Arboretum. Route uses Humber College Blvd. to reach Highway 27 bridge.	Routes reach Highway 27 for future extension. Multiple locations for River crossing are possible; and can be designed to minimize impacts on Humber River Valley.
Overall Responsiveness ○ ◔ ◑ ◕ ●		◑	◑	◕
PROMOTE SMART GROWTH/ECONOMIC DEVELOPMENT				
Support Regional and Municipal Planning Policies and approved urban structure	Compliant with Provincial, Regional and Municipal Plans.	All routes are supportive of Regional and Municipal planning policies.	All routes are supportive of Regional and Municipal planning policies.	All routes are supportive of Regional and Municipal planning policies.
Provide convenient access to social and community facilities in corridor	Maximize route access to Humber College and Etobicoke General Hospital – William Osler Health Centre	Direct connection on campus to Humber College, however there is no stop near the hospital.	Street Stop for Humber College, plus a stop located at the intersection of Humber College Blvd. and Highway 27, within 200 metres of the hospital. Routes does not access College entrance directly.	Direct connection on campus to Humber College, plus a stop located at the intersection of Humber College Blvd. and Highway 27 - within 200 metres of the hospital. Routes are part of College's campus plan.
Overall Responsiveness ○ ◔ ◑ ◕ ●		◑	◕	●
MAXIMIZE COST-EFFECTIVENESS OF RAPID TRANSIT SYSTEM				
Minimize capital cost of vehicles, facilities and systems required	Relative infrastructure costs expressed as length of route from Westmore Drive stop to Humber College terminal.	Route is approximately 1500 metres.	Longest route - approximately 1600 metres.	Shortest routes - approximately 900 metres.
Minimize property acquisition cost to implement facilities	Possibility of property acquisition	Requires property acquisition along Humber College Blvd. plus easement on Humber College property.	Requires property acquisition on Humber College Blvd.	Requires property or easement with Humber College.
Overall Responsiveness ○ ◔ ◑ ◕ ●		◔	◑	◑
PREFERRED ALTERNATIVE				◕

Future Extensions

During the transit project assessment study period, the City of Toronto considered an Official Plan and Zoning Amendment Application by the proponents of the Woodbine Live retail, entertainment and residential complex on property owned by Woodbine Racetrack at Rexdale Boulevard. As a condition of approval of this Application, City Planning requested a Transit Strategy study to address phasing and implementation of potential future transit enhancements to facilitate service by area transit operators to, from and within the lands. As an element of this strategy development, a feasibility study was initiated to consider extending the Finch West LRT from its current planned terminus on the Humber College property to the Woodbine Live development site at Highway 427 and Rexdale Boulevard, adjacent to the existing Woodbine race track complex. In addition, the study scope includes investigation of a subsequent further extension from the Woodbine Live site to the Toronto Pearson International Airport.

2.4 Preferred Design

2.4.1 TRACK ALIGNMENT

The Etobicoke-Finch West LRT Line extends from the Finch Subway Station at the Yonge Street-Finch Avenue intersection to the campus of Humber College, a distance of approximately 17 km.

The double track alignment follows the centre line of the existing Finch Avenue, turns south to the median of Highway 27 and then west to the south side of Humber College Boulevard to terminate at Humber College Station.

The two tracks run parallel at 3.72m centre to centre except at centre platform stations where the separation increases to 6.87m. The vertical alignment also follows the existing profile of Finch Avenue, except at the Yonge Subway and the Spadina Subway Extension crossing where underground stations are proposed to mitigate congestion effects due to the high vehicular and pedestrian activity forecast for these intermodal connections.

Both horizontal and vertical alignments were developed in accordance with the design criteria included in Section 2.2. Map plates 1 to 50 illustrate the plan and profile of the LRT facility and are included at the end of this chapter. Note that only in the sections where the vertical alignment of the LRT diverges from the road alignment (Yonge and Keele areas) does the profile include the proposed LRT vertical geometry; in all at-grade segments the LRT profile essentially follows the existing road profile.

The presence of the double track LRT trackway in the median of Finch Avenue will require modifications to the roadway on either side of the trackway to accommodate the LRT and new bicycle lanes. As indicated in Section 2.2.2, the existing number of traffic lanes will be maintained and bicycle lanes will be provided throughout, along with sidewalks with street furnishing zones on either side of the alignment. The remainder of the existing centre left turn median lane will be eliminated where it currently exists. Except in the most easterly section of the route, the existing available right-of -way will not be changed. “U” turns will be allowed from left turn lanes at all signalized intersections.

2.4.2 RAPID TRANSIT INTERFACE

2.4.2.1 Yonge Subway Interface

The multimodal transfer station at Yonge Street represents the east terminus of the Finch West LRT Corridor. Surface and grade separated (underground) options were identified and evaluated. As a result of the evaluation, the underground option as summarized in the Exhibit 2-21 and illustrated in Exhibit 2-22 and Exhibit 2-23, was selected as the preferred alternative at this location.

Exhibit 2-21: Yonge Subway Interface

Design Element	Description
Horizontal Alignment	Follows centre line of Finch Avenue
Vertical Alignment	LRT underground; located between road surface and Yonge Subway Station. Transition ramp from surface to the underground station starts east of the Talbot Road stop on the LRT line. Portal in the vicinity of Kensington Avenue.
Station Platforms	6m. wide, 63m. long side platforms across Yonge Street ROW.
Pedestrian Connectivity	Walkways under the LRT box connecting to mezzanine level of Yonge Subway Finch Station.
Special Track	Tail track east of the station platforms, crossover west of station.

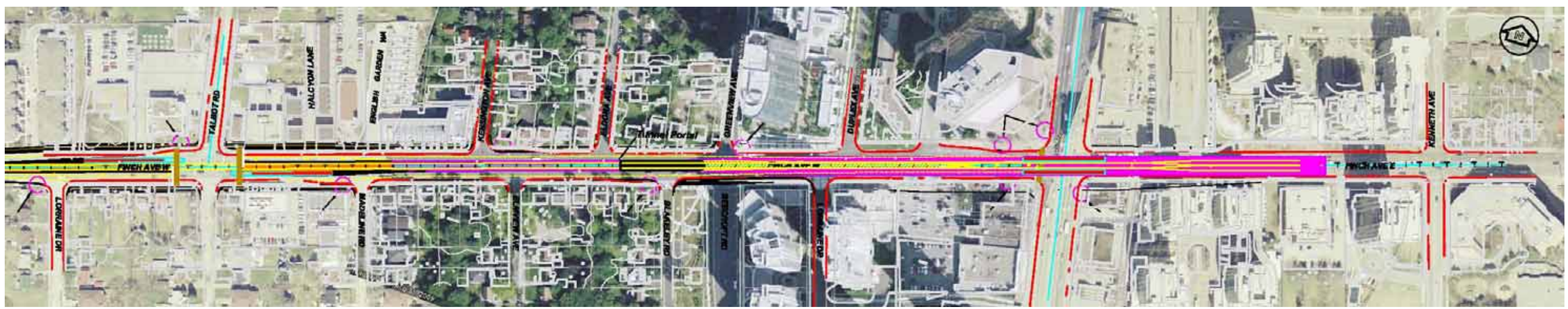


Exhibit 2-22: Yonge Subway Terminus

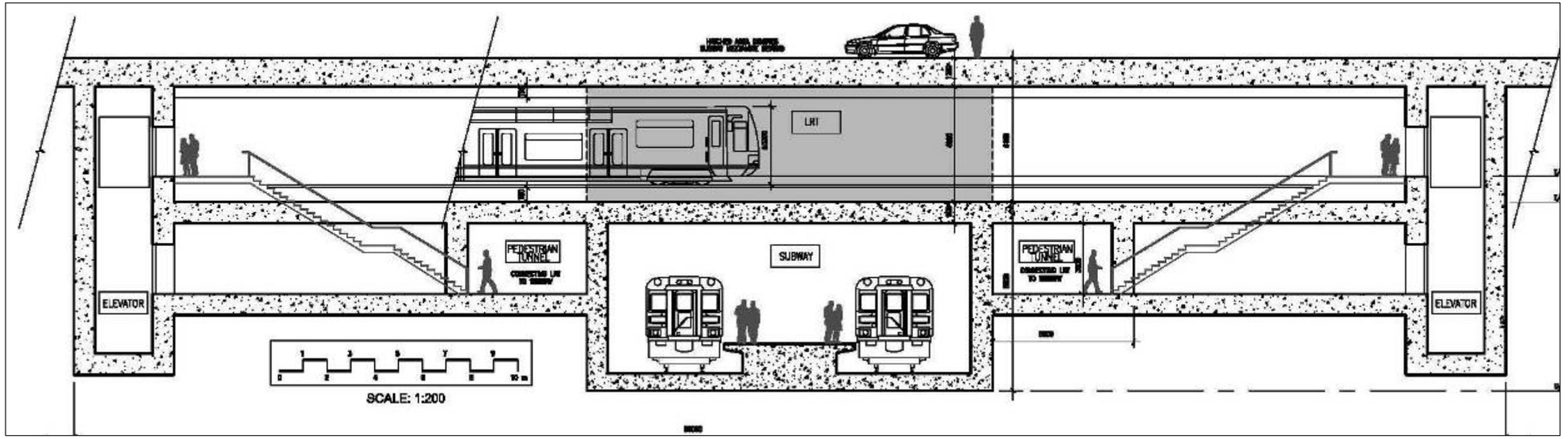


Exhibit 2-23: Plan View and Cross Section of Underground Solution at Finch Station

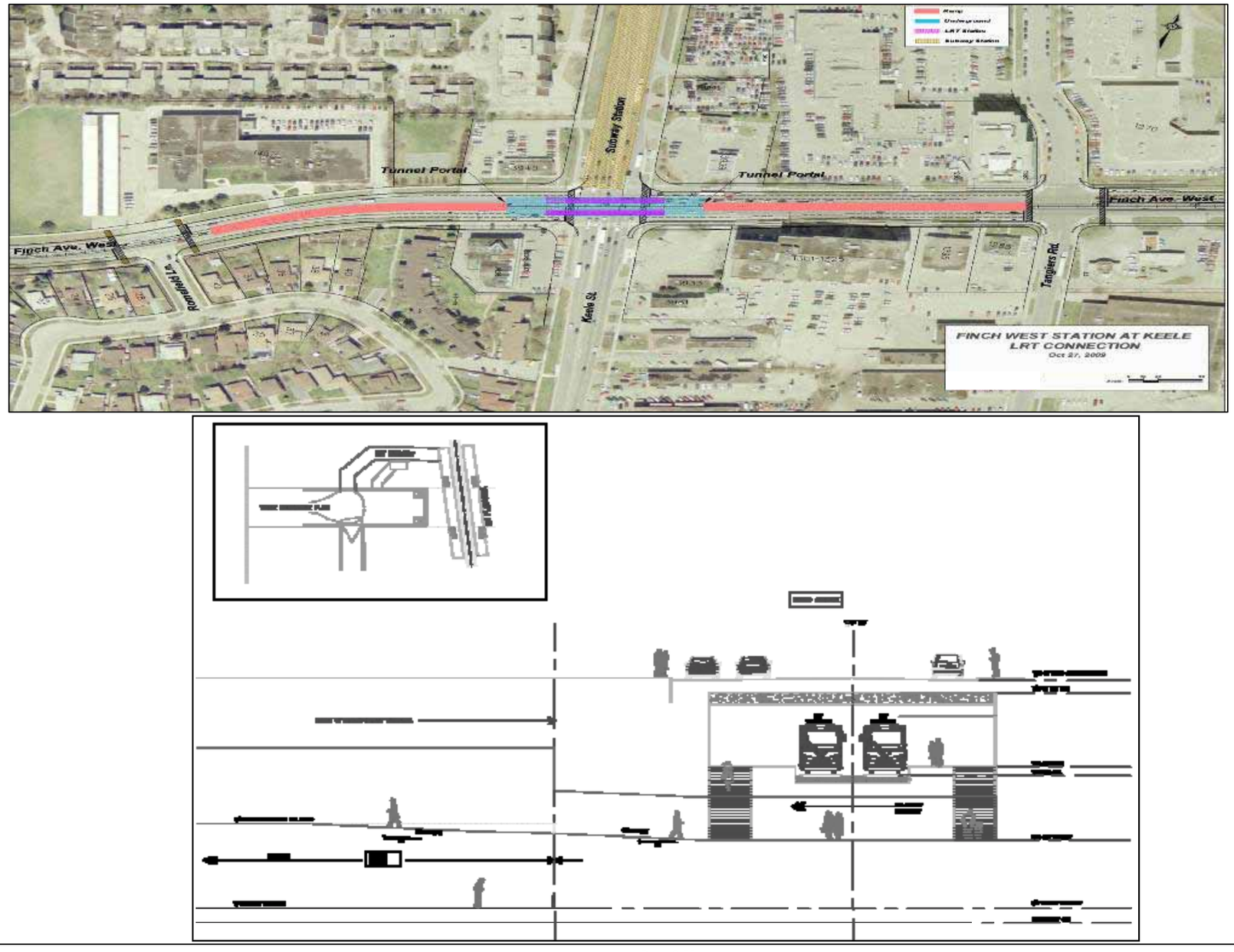
2.4.2.2 Spadina Subway Extension Interface

The Finch West LRT will cross the Spadina Subway Extension currently under design at Keele Street in proximity to the Subway Finch West Station. Surface and grade separated (underground) options were identified and evaluated. The alternative evaluation is discussed in Section 2.3.1.2. As a result of the evaluation, the underground option summarized below in Exhibit 2-24 and illustrated in Exhibit 2-25 was selected as the preferred alternative at this location.

Exhibit 2-24: Spadina Subway Extension Station at Keele/Finch

Design Element	Description
Horizontal Alignment	Follows centre line of Finch Avenue West
Vertical Alignment	LRT underground; located between road surface and Spadina Subway Extension box (just north of Spadina Subway Finch West Station platform). East transition ramp from surface to the underground station starts west of Tangiers Road; west transition ramp from surface to the underground station starts east of Romfield Lane.
Station Platforms	6m wide, 63m long side platforms across Keele Street ROW.
Pedestrian Connectivity	Walkway under the LRT box connecting to mezzanine level of Spadina Subway Finch West Station. Access from street will be integrated with Subway pedestrian access currently under design.
Special Track	A pocket track for short turn operations will be located on the surface alignment east of Tangiers Road. It will not be located underground immediately east of the Keele Street transfer platforms.

Exhibit 2-25: Plan View and Cross Section of Underground Interface at Finch West Station

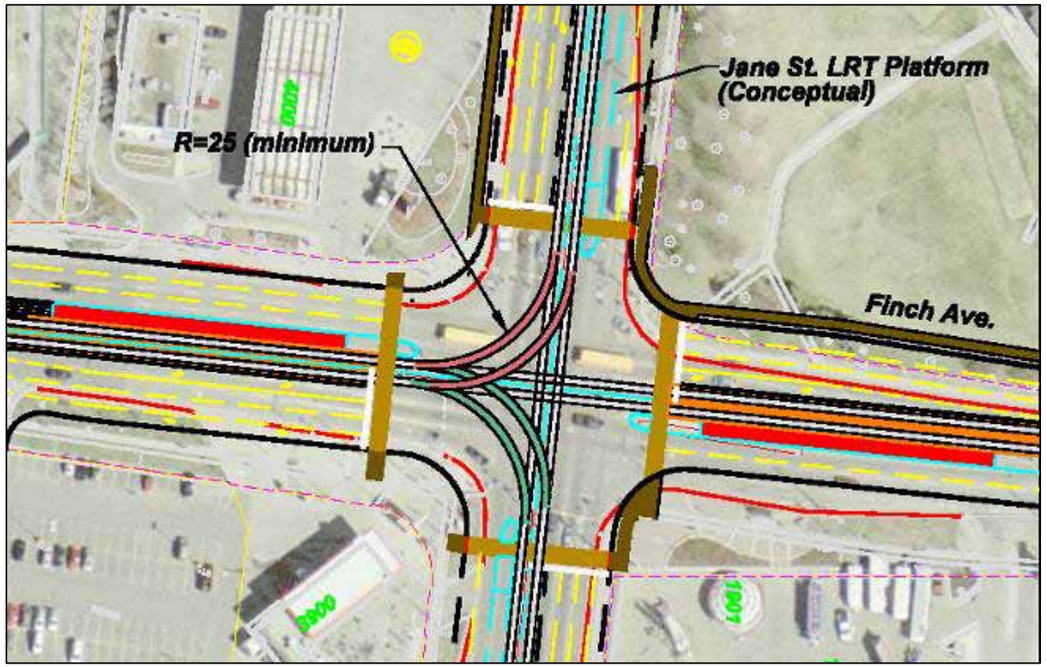


2.4.2.3 Jane LRT Interface

At Jane Street, the Etobicoke-Finch West LRT alignment crosses a future Transit City LRT line planned to operate in the Jane Street corridor at grade.

An Operations and Maintenance facility is proposed to be located in the vicinity of the Finch West near the Jane intersection. Consequently, special trackwork that will allow vehicles to interchange between the two lines and to reach the facility site will be provided. Final definition of this special trackwork will be determined during the design phase and upon definition of the Jane Street LRT line and the Operations and Maintenance facility. A conceptual track layout for the junction is shown in Exhibit 2-26.

Exhibit 2-26 – Jane LRT Crossing

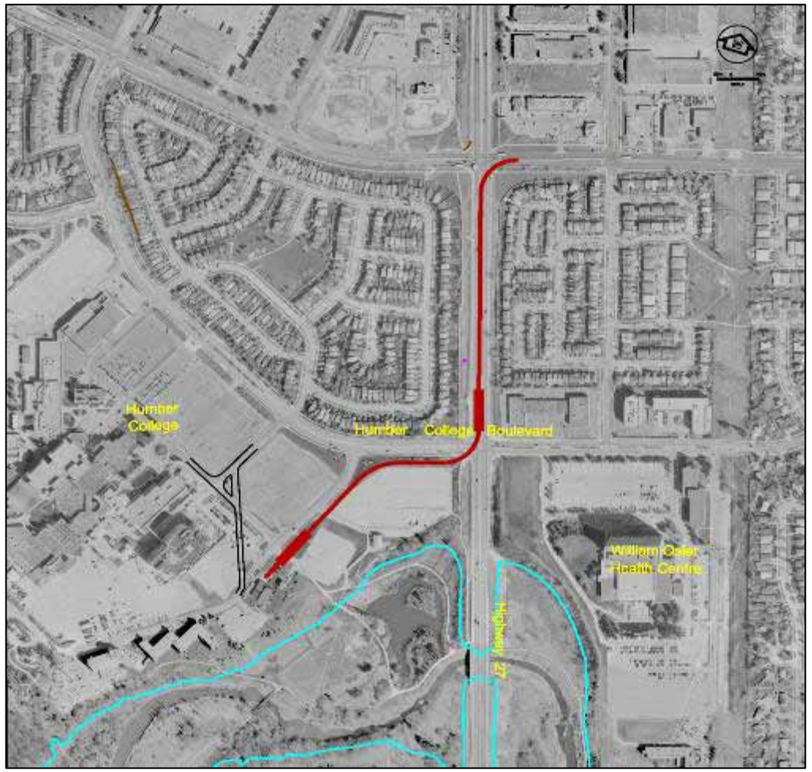


2.4.2.4 Humber College Terminus Area

The TTC Transit City Network Plan calls for the Etobicoke-Finch West LRT to terminate at Humber College campus, considered an important trip generator.

Various options were evaluated, as described and illustrated in Section 2.3.3. Based on the evaluation and further discussions with the College administration, an alignment turning west from the median of Highway 27 to the south side of Humber College Boulevard with a terminus station within the campus was selected as the preferred alternative. Exhibit 2-27 provides a graphic of this preferred alignment. The exact final location of the station will be defined in coordination and integration with the Humber College Expansion and Development Master Plan currently being undertaken. The selected alignment will protect for a future extension of the LRT line west to the Woodbine Live development and ultimately to Pearson Airport.

Exhibit 2-27 – Preferred Humber Alignment



2.4.2.5 Other Special Areas

<u>GO Barrie Line Crossing</u>

GO Transit's Newmarket Subdivision, used by the GO Transit Barrie Line, crosses over Finch Avenue West between Dufferin and Keele The overpass structure carries two tracks and has two spans over Finch Avenue West allowing the underpass of two traffic lanes and a sidewalk per direction in addition to a centre unused paved strip. This unused paved strip will accommodate the LRT tracks without affecting the bridge structure.

There is currently no plan for GO Transit to locate a commuter rail station near this crossing. The GO Rail station at York University is less than 2 km north of Finch Avenue West and is accessible from Steeles Avenue and Keele Street. A new GO Transit station on this line is being considered adjacent to the future Sheppard West Station on the Toronto-York Spadina Subway Extension project, south of Sheppard Avenue, less than 2 km south of Finch Avenue.

CP MacTier Subdivision Crossing

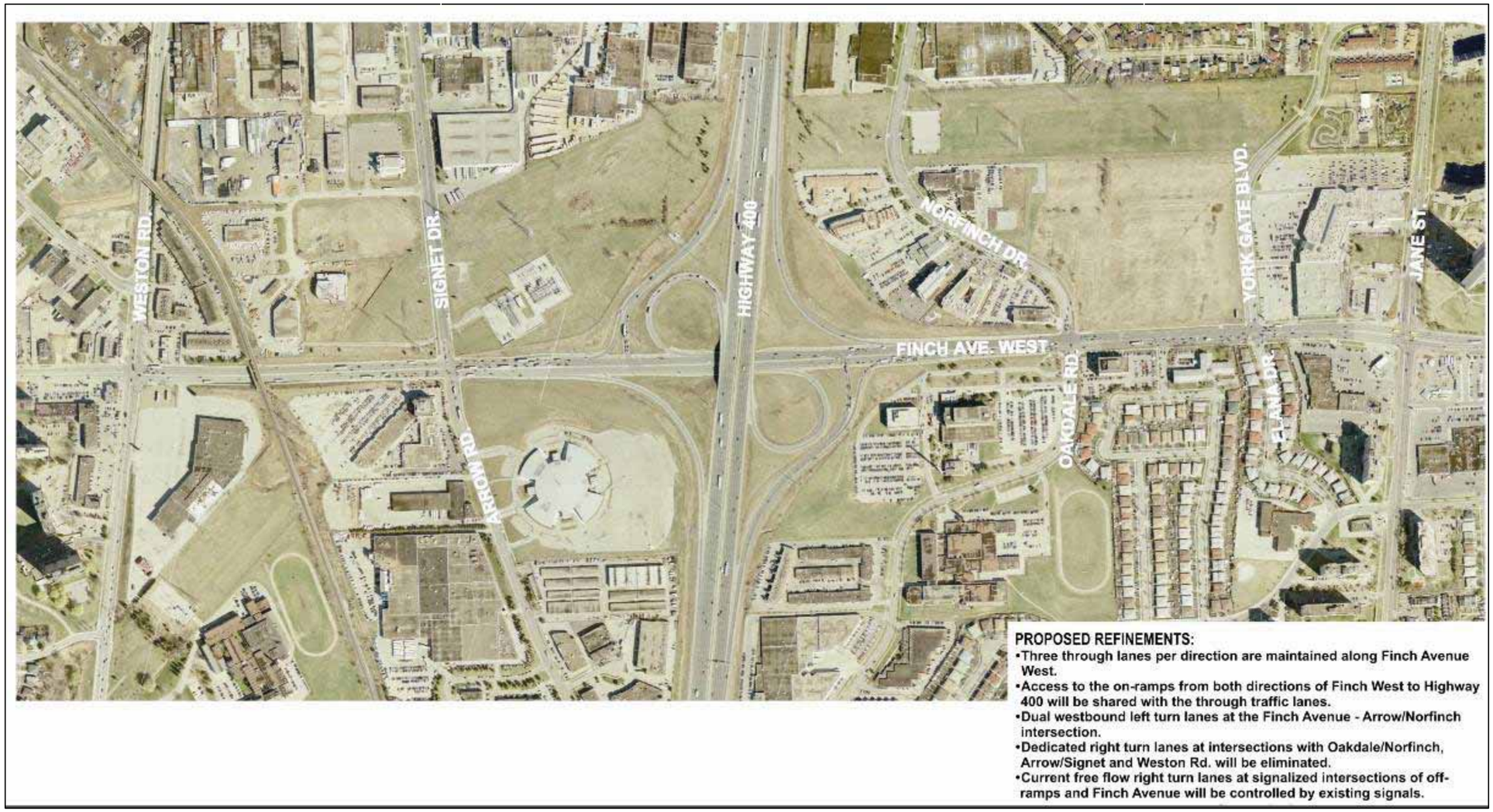
The Canadian Pacific Railway's MacTier Subdivision crosses over Finch Avenue West between the Highway 400 Interchange and Weston Road. The overpass structure carries two tracks. The width of the structure allows the underpass of 6 traffic lanes and sidewalks of Finch Avenue West.

To avoid replacing the existing railway bridge, the Finch Avenue West cross section under the structure will consist of two LRT tracks (one on either side of the centre pylon) with two lanes of traffic and a bike lane on each side under the overpass. This will transition back to 3 lanes of traffic on the east side of the overpass but have 2 lanes of traffic west of the overpass through Weston Road.

Highway 400 Crossing

The Provincial Highway 400 has a full movement interchange with Finch Avenue West. Under the Highway 400 Bridge, Finch Avenue consists of three through traffic lanes. To maintain three through traffic lanes, in addition to the LRT tracks and roadway, traffic operation refinements will be implemented. These refinements (illustrated and described in Exhibit 2-28), were determined in consultation with the Ministry of Transportation of Ontario (MTO) and the City of Toronto. Based on the findings of the micro-simulation of traffic and LRT operations, the modification of the road and traffic signal system was selected as the preferred alternative. Detailed assessment of the alternatives was discussed in Section 2.3 and the documentation of the microsimulation modeling is found in Appendix D.

Exhibit 2-28: Highway 400 Interchanges Study Area Proposed Refinements to Accommodate Dedicated LRT Lanes



2.4.3 LRT STOPS AND STATIONS

As noted in Section 2.3, the LRT Etobicoke-Finch West Line will have underground stations at the crossings of the two north-south subway lines located at Yonge Street and Keele Street (Spadina Subway Extension). In addition to the stations, stops were located following the spacing criteria listed in Section 2.2.5. The platforms of the stops will be approximately 350 mm above top of rail elevation to allow for level boarding into a low-floor vehicle. Each stop will consist of either two 3.0 m side-loading platforms or one 4.0 m centre-loading platform. Exhibit 2-29 designates the stop locations and type of platform. The platforms will be furnished with a canopy and windscreen for weather protection, trash receptacles and self-service fare equipment. Accessibility ramps will be provided at the end of the platforms near the intersection to connect to the crosswalks. Exhibit 2-30 shows the approximate location of the stops with their stop configuration

Exhibit 2-29: Stop Location and Type of Platform

Stop name	Stop type
Humber College Terminal Station	Terminus station
Highway 27	Centre platform
Westmore Dr.	Far Side Platforms
Martin Grove Rd.	Centre platform
Albion Rd.	Far Side Platforms
Stevenson Road	Centre Platform
Kipling Ave.	Centre Platform
Islington Ave.	Far Side Platforms
Peardale Ave./ Ardwick Blvd. E	Far Side Platforms
Duncanwoods Dr.	Far Side Platforms
Milvan Dr./ Rumike Rd..	Far Side Platforms
Weston Rd.	Far Side Platforms
Signet Dr./ Arrow Rd.	Far Side Platforms
Oakdale R./Norfinch Dr.	Far Side Platforms
Jane St	Far Side Platforms
Driftwood Ave.	Far Side Platforms
Tobermory Dr.	Far Side Platforms
Sentinel Rd.	Far Side Platforms
Finch West Station (Keele St.)	Underground LRT and subway transfer station
Alexdon Rd.	Far Side Platforms
Chesswood Dr.	Far Side Platforms
Alness St.	Far Side Platforms
Dufferin St.	Centre Platform
Wilmington Ave.	Centre Platform
Torredale Ave. /Virgilwood Dr.	Offset side Platforms
Bathurst St.	Far Side Platforms
Finchhurst Dr.	Far Side Platforms
Grantbrook St./Senlac Rd.	Parallel Side Platforms
Talbot Rd.	Far Side Platforms
Finch Station – (Yonge St.)	Underground LRT and subway transfer station

The above list of 30 stops has been modified from the list of 24 stops initially proposed initially in the feasibility study. The changes are based on the evaluation of alignment geometry and input from public consultation. Alignment conditions include horizontal curvature in the existing Finch Avenue West roadway as well as grades through the ravines that cross the alignment. The stops that have been added or relocated are the following:

- Humber College Terminal Station, which replaces the terminal loop at Woodbine Downs Boulevard
- Highway 27 and Humber College Boulevard
- Westmore Drive, which replaces the original Highway 27 location
- Stevenson Road, which is a name change from Silverstone Drive
- Duncanwoods Drive, added by public request
- Driftwood Avenue, added by public request
- Alexdon Road, added by public request
- Alness Street, added by public request
- Finchurst Drive, added by public request

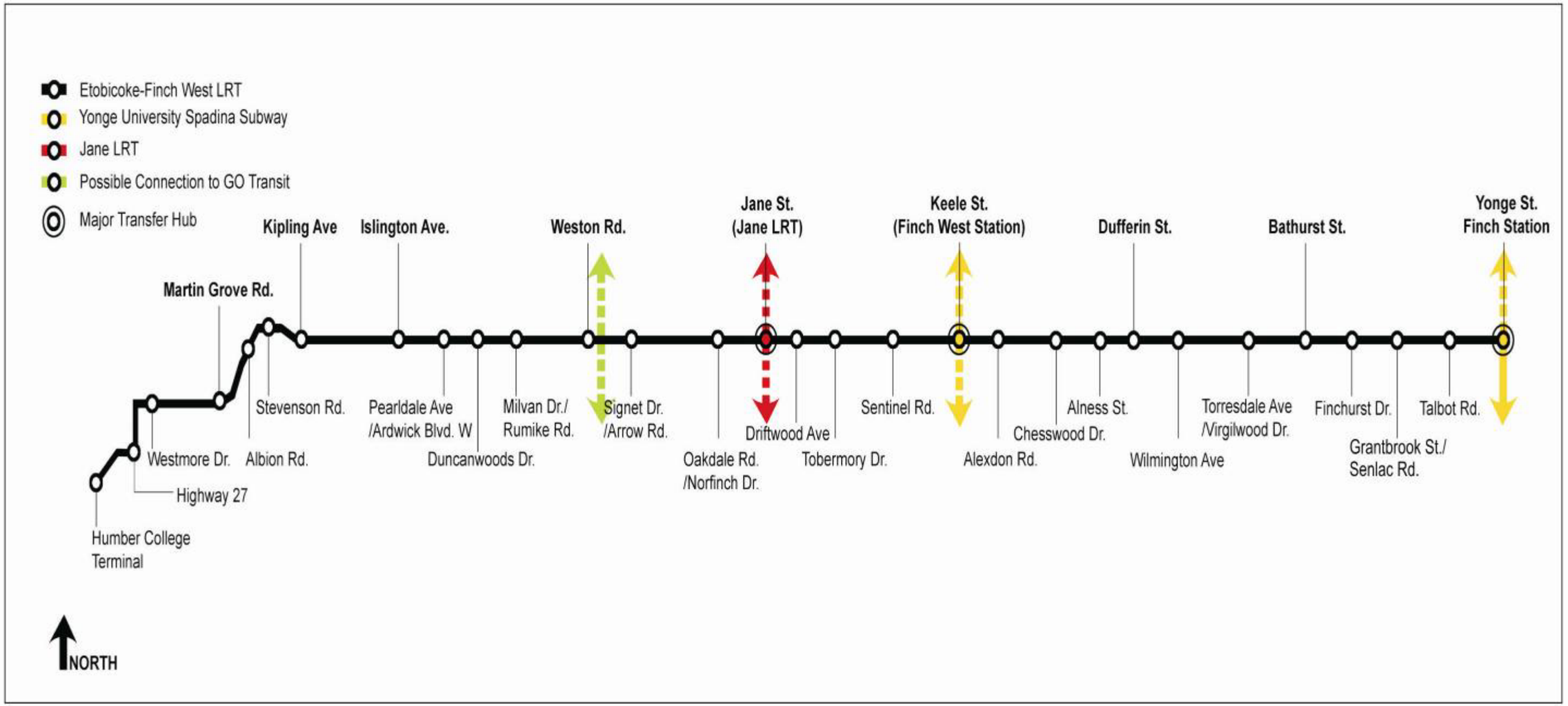


Exhibit 2-30: Proposed Stop Locations

2.4.4 STRUCTURES

An inventory and high level evaluation of the condition, cross section, geometry and clearance characteristics of the existing structural crossings of the Finch West corridor were performed to assess their adequacy for continued use with the deployment of LRT in the future. A summary of the results is listed below:

- **West Don River Bridge.** The bridge will require widening by 2.6m on each side of the structure to accommodate the LRT standard cross section.
- **The West Don River Culvert.** The culvert will require a perched embankment supported by mechanically stabilized earth (MSE) or will be required to be lengthened. This will be defined during the detailed design stage.
- **CNR Overhead.** The overhead can accommodate the cross section of two travel lanes per direction without impact to the structure.
- **The Black Creek Culvert.** The culvert can accommodate the additional width either by use of perched embankments, similar to the solution proposed at the West Don River culvert or by reconfiguring the natural slope at 2:1.
- **The Highway 400 Overpass.** The overpass will accommodate the proposed cross section without any major significant changes to the structure itself, but with a reallocation of lanes in the interchange area.
- **The CPR Overhead.** The overhead will accommodate the standard LRT cross section of two travel lanes per direction without impact to the structure.
- **Islington Avenue Bridge over the Humber River**. The bridge will require minor widening at the two acute corners of the structure to accommodate the proposed LRT platforms, which is deemed to be feasible. In addition, the fixation of the LRT track to the deck of the bridge is also judged to be feasible but will be re-examined during the detailed design phase.
- **Farr Ave (Walkers) Pedestrian Bridge**. The pedestrian bridge will not require modifications; no impacts are expected to its approaches and abutments, which are behind the existing noise barriers.

2.4.5 SPECIAL TRACKWORK

Crossovers will be installed at strategic locations (in front of both Terminal stations, in the York Gate Boulevard area and west of Romfield Lane) to allow the LRT vehicles to change tracks for operational purposes. Conceptual locations for these crossovers are:

- West of Finch Subway Station
- West of Finch West Subway Station
- West of Jane Street as part of access to maintenance facility
- East of Kipling Avenue
- East of Humber College Station.

A double-ended centre pocket track to allow short turn-back opportunity and emergency storage will be installed east of the Finch West Subway Station. Tail tracks for storage will be installed at Yonge and Humber College Stations.

2.5 Electrical Substations

The electrically powered catenary system requires the placing of traction power sub stations (TPS) along the corridor to ensure reliable voltage supply for the operation of the vehicle and any other element of the system fed by electrical energy.

The document “Transit City, Traction Power Overview” by TTC dated March 12, 2009 (included in Appendix L) provides a comprehensive review of the power needs system wide and potential Traction Power Substations (TPS) for each of the seven projects of the Toronto Transit City – Light Rail Plan. Plan and profile plates included at the end of this section provide a view of the approximate location of these substations. Final locations will be defined in the detailed design stage.

The reference study identifies the preliminary need for 12 TPS’s (listed below) along the main line for a total connected capacity of 19.5MW; and 2 additional TPS’s within the Storage & Maintenance Facility (S&MF) with a combined capacity of 2,000kW. The TPS’s are preliminary sized at 11 m by 4.6 m and 4 m high. The average spacing of the TPS is 1.5km and their output voltage to the system would be 750 Volts.

Electrical Substation Locations

1. EF1 – Humber College Terminus Station;
2. EF2 – Martin Grove Road;
3. EF3 – Kipling Avenue;
4. EF4 – Islington Avenue;
5. EF5 – Weston Road;
6. EF6/J3 - Jane Street, shared with Jane LRT
7. EF7 – West of Keele Street;
8. EF8 - East of Keele Street;
9. EF9 - Dufferin Street;
10. EF10 – West of Bathurst Street;
11. EF11 – East of Bathurst Street;
12. EF12 – Yonge Street Terminus Station.

The EF# code is used for each TPS, EF stands for Etobicoke-Finch. A forward slash J # is used to indicate sub-stations that are envisaged to serve more than one LRV system, in this case, the Jane LRT.

2.6 Property Requirements

Exhibit 2-31 outlines the estimated property requirements at this time. The temporary requirements for staging and construction will be determined during preliminary engineering.

Exhibit 2-31: Property Requirements

Scope	Limits	No. of Properties		
		Full Permanent	Partial Permanent	Temporary Requirement
Surface Guideway	Humber College to Romfield Lane	0	49	TBD
Surface Guideway	Tangiers Road to Beecroft Road	0	142	TBD
Connection to Finch West Station	Romfield Lane to Tangiers Road	0	5	TBD
Connection to Finch Station	Beecroft Road to east of Yonge Street	0	0	TBD

One of the criteria used to define the typical cross sections along the corridor illustrated in Section 2.2.4 was to avoid, where possible, private property encroachment. To comply with this criterion, the typical cross sections accommodate the LRT trackway, the existing number of traffic through lanes, bike lanes, sidewalks and streetscape within the road right-of-way. However, there are sectors where the LRT alignment requires additional width due to the in/out swing factor in curve sections or due to the presence of central platform stops. In these sectors, partial encroachment occurs as also illustrated in the plan and profile plates at the end of this section. Section 4 describes the property effects and mitigation measures in more detail.

2.7 Funding

On April 1, 2009, the Provincial Government announced $1.2 Billion in funding for a Finch LRT line.

The Etobicoke-Finch West LRT is designated as a Priority Project in the City of Toronto and TTC's Transit City Plan and has received funding through the Province of Ontario's Move 2020 Program. Metrolinx's Regional Transportation Plan includes the Etobicoke-Finch West LRT for implementation in the 1 to 15 year timeframe. The EA approval will establish this project as ready for design and construction.