

EXECUTIVE SUMMARY

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E.1. Introduction

The City of Toronto and the Toronto Transit Commission (TTC) have conducted an Environmental Assessment (EA) study with the purpose of finding the preferred way of significantly improving transit service on Sheppard Avenue East from Don Mills Subway Station to Meadowvale Road. The study recommended that the existing bus service be replaced with Light Rail Transit (LRT) - electrically powered "light rail" vehicles operating in reserved lanes in the centre of a widened Sheppard Avenue East.

Study Background and Context:

Study Area:

The primary study area is along Sheppard Avenue East corridor from Don Mills Road to Meadowvale Road (Figure 1.1) – which is the routing for the main branch of the 85 Sheppard bus services that currently operates in this corridor.

City of Toronto Official Plan:

An essential element of the City's Official Plan is that Toronto continues to grow, but in a manner that is much less dependent upon the private automobile, promoting measures to increase trips made by transit, walking and cycling. In order to get more people out of their cars, and onto transit, transit must be faster, more reliable, and a more attractive travel alternative compared to the car. In support of this objective, the Official Plan, and a variety of supporting planning reports and studies, have identified selected corridors for transit to operate in reserved lanes that are protected from the delays and increasing congestion of mixed traffic operation.

Toronto Transit City Light Rail Transit Plan:

In 2007, the TTC developed a plan that built upon the transit concepts in several studies, including the Toronto Official Plan, the TTC Ridership Growth Strategy, Building a Transit City, and Mayor Miller's "Transit City" Platform (2006), and recommended a widely-spaced network of electric light-rail lines throughout the city, each in its own right-of-way, with traffic permitted to cross the tracks only at signalised intersections. There are seven new lines proposed, with a total length of 120 km, all connecting with the City's existing and planned rapid transit routes. By 2031, the new lines would carry 175 million riders per year.

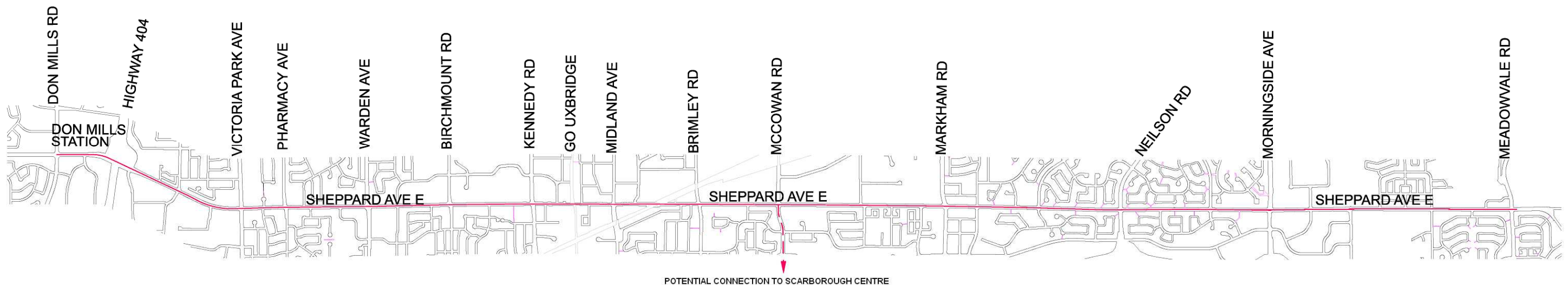


Figure 1.1: Sheppard LRT Study Area

One of the seven new light rail lines proposed in the Toronto Transit City Light Rail Plan is the Sheppard East LRT. This line is proposed to extend from Don Mills Subway Station to Morningside Avenue and potentially further east to Meadowvale Road.

Study Process – the Municipal Class Environmental Assessment

This study was conducted following the requirements for a Municipal Class Environmental Assessment (EA) study. This is a comprehensive planning process as legislated by the Province of Ontario to ensure that certain types of projects are evaluated within an approved procedure that has been designed to protect and, where possible, enhance, the environment.

E.2. Problems and Opportunities to be Addressed in the Study

The first phase of the EA study involves understanding the specific problems and opportunities that this EA study is intended to address. The principal **problem** is that the existing 85 SHEPPARD EAST bus route operates in mixed traffic and does not offer enough incentive, from a travel time and reliability perspective, to be a sufficiently attractive alternative to the private automobile. In resolving this problem, there are **opportunities** to address other important City objectives in this corridor.

The objective of this EA study is to find the best way of significantly improving the speed and reliability of the existing transit service on Sheppard Avenue East, between Don Mills Subway Station and Meadowvale Road, in a manner which:

- 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 management objectives which include encouraging new population and employment growth and transit-oriented developments, on lands identified in the Official Plan as an '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.

Existing and Future Conditions

Staff conducted a comprehensive inventory of existing and future conditions within the study area, and focused on transportation, natural and cultural heritage, as well as socio-economic issues. A summary of some key issues follows:

Transportation

The existing road network consists of a grid pattern of arterial roads, with Highway 404 intersecting with Sheppard Avenue east of Don Mills Road, and Highway 401 south of, and parallel to, Sheppard Avenue. The arterial roads and Highway 404 are subject to increasing traffic congestion during rush hours.

The study area is well served by buses. There is currently bus service along Sheppard Avenue and at all major intersecting north-south streets. The two main bus routes that provide service on Sheppard Avenue in

this corridor are the 85 SHEPPARD EAST, operating to, and beyond, Meadowvale Road, and the 190 SCARBOROUGH CENTRE ROCKET, that provides express service between Don Mills Station and the Scarborough Centre area. The peak hour demand at the busiest points on these two services, combined, is about 1100 customers in one direction.

Both services are subject to very congested traffic conditions during the peak traffic hours in the area between Victoria Park and Don Mills Station. Peak period traffic congestion on the remainder of the routes is increasing; the greatest problems occur when a problem arises on Highway 401, and cars on the highway use Sheppard Avenue as an alternate route. The Official Plan identifies Sheppard Avenue East, from Don Mills Subway Station to McCowan Road, as a 'transit priority corridor', which provides for treatments such as reserved transit lanes. At its meeting on September 25, 2008, City Council adopted an amendment to the Official Plan (By-law 1010-2008) to extend the 'transit priority corridor' on Sheppard east of McCowan Road, to Meadowvale Road. The amendment came into full effect following the statutory appeal period.

The Official Plan also identifies a 'higher order transit corridor' on Sheppard Avenue, from Don Mills Station to Kennedy Road, and then diagonally to the Scarborough Centre area. In the early 1990's, an EA was approved for a subway along this alignment.

Existing Natural Environment

There are no wetlands, Areas of Natural and Scientific Interest (ANSI's) or Environmentally Significant Areas (ESA's) in the study area. Four small tributaries of Highland Creek traverse under Sheppard Avenue. Similar to the vegetation communities, the aquatic communities associated with these watercourses are in a disturbed state. Fortunately, only minimal bridge-work will be required at these crossings and further degradation is not expected.

Future Transit Demands

Future transit ridership in the Sheppard corridor was estimated using City and TTC forecasting models. Transit forecasts for longer-term development levels (levels assumed to be in place by the year 2031) were produced using the planned population and employment in the corridor for this future year.

Ridership forecasts were generated for a surface transit option in reserved lanes on Sheppard Avenue East between Don Mills subway station and Meadowvale Road, resulting in a forecast maximum demand of **3000 passengers per hour in the peak direction**. Modeling was also conducted assuming higher, subway speeds; this resulted in a forecast demand of 5,000 passengers per hour in the peak direction.

E.3. Development and Evaluation of Alternatives

The second phase of the EA Study involved identifying and evaluating alternative solutions to the problems and opportunities identified in this corridor. If transit is to have a competitive advantage over the private automobile and attract more people out of their cars, it must be provided with some form of dedicated lanes, and not operate in lanes shared with general traffic. The following alternatives were considered:

- 1) **Subway / Elevated Rapid Transit (such as the Scarborough Rapid Transit (SRT) line):** electric powered rail vehicles that operate on a fully exclusive right-of-way with no influence from other traffic; capable of carrying high volumes of people;
- 2) **Light Rail Transit (LRT)*:** electrically powered vehicles that operate on a dedicated right-of-way with traffic crossings at signalized intersections, capable of carrying medium to high volumes of people; and
- 3) **Bus Rapid Transit (BRT):** diesel or hybrid powered buses that operate on dedicated lanes with traffic crossings at signalized intersections, capable of carrying medium volumes of people.

* 'LRT', as used in this study is the same basic vehicle technology as the 'streetcars' that operate in separate rights-of-way elsewhere in Toronto such as on Spadina Avenue and St. Clair Avenue but there are significant differences in the vehicle, as discussed in a later section.

Evaluation of the Alternative Solutions

Within this context, a transit technology must be selected which can meet all future travel demands (Figure 1.2), which is environmentally sustainable, and which achieves these objectives in the most cost-effective way possible.

Subway/RT: As illustrated in Figure 1.2, a forecast demand of 10,000 passengers per hour is typically required to justify the very high cost of subway or elevated rapid transit construction. The forecast demand was only 5,000 passengers per hour, with subway technology.

Bus Rapid Transit: BRT would be less expensive to build than LRT, however, because buses are smaller than rail vehicles, in order to carry the forecast ridership of 3,000 passengers per hour, a BRT facility would require some form of by-pass lanes to allow some buses to operate express and pass one another at stops. Although there is typically 36 metres of public right-of-way available on Sheppard Avenue, in addition to two new transit lanes and passenger platforms, the street must accommodate two general traffic lanes in each direction, plus separate left turn lanes, a bicycle lane and a "comfortable" walking environment on the adjacent sidewalk. The 36-metre right-of-way width of Sheppard Avenue is not sufficient to include a by-pass lane for buses.

The forecast demands would require approximately 60 standard buses per hour. Even if a new type of double articulated bus was purchased (twice as long as a standard bus), 30 buses per hour – i.e. A bus every two minutes - would be required to accommodate a demand of 3000 customers. TTC's operating experience has shown that routes that operate at these frequencies are unstable. It becomes very difficult to operate a local transit service at headways of 2 minutes, even if operating in reserved lanes, and avoid having buses catch up to one another and bunching.

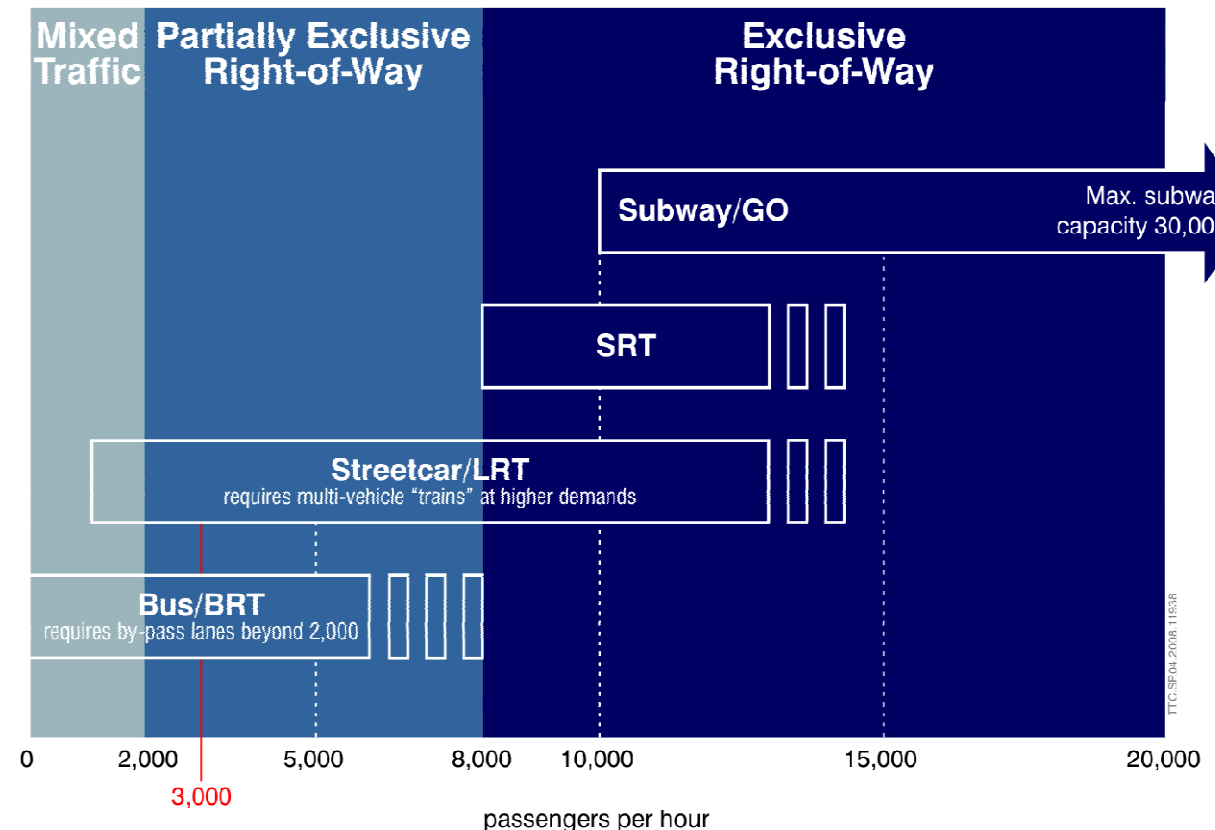


Figure 1.2: Transit Technology and Associated Demand Requirements

Light Rail Transit (LRT):

The TTC is in the process of acquiring new light rail vehicles that are to be designed to carry average loads of 130 people. A peak-point demand of 3000 people per hour would require a vehicle about every 2 minutes, 40 seconds. As with BRT, this very frequent service would be expected to result in incidences of LRV's catching up to one another and 'bunching'. To avoid this, the Light Rail Vehicles can be 'coupled' together and operated in pairs, so that the time between vehicles would be about 5 minutes, which would make the service more manageable, stable, and more reliable for customers, without the need for any by-pass lanes.

The Preferred Solution – The Sheppard East LRT

The study concluded that LRT is best suited to the forecast demands on Sheppard Avenue. It also supports the objective of supporting the creation of more continuous, transit-oriented development in the corridor.

Transit forecasts for Sheppard Avenue suggest a peak point demand of 3000 people per hour. Subways are far more costly than LRT and normally require a projected demand of at least about 10,000 people per hour to justify their cost. The forecasts for Sheppard are easily accommodated by LRT (Figure 1.3), particularly given that the new light rail vehicles being designed for the TTC will be about twice the size of a standard Toronto streetcar, and can be easily 'coupled' to operate as two-car trains.

The light rail vehicles that will be used on Sheppard Avenue will have the following features:

- Larger capacity – about twice as long as standard streetcars in Toronto;
- Fully accessible – low-floor vehicles with level loading from on-street platforms;
- Loading on all doors – significantly reduces the time spent serving stops;
- Bi-directional – the vehicle can operate in either direction and not require a loop to turn around, reducing infrastructure and space need, as well as noise and vibrations; and
- Modern design – attractive design will be conducive to the long-term goals for the corridor to be distinct with pleasing streetscapes and public spaces, making the community a distinctive, vibrant, and attractive area.



Figure 1.3: Examples of Transit Vehicles

E.4. Evaluation of Alternative Design Concepts

Alternative ways of designing the Sheppard East LRT line are considered in the third phase of the EA study. The key design elements are described below:

Design of the LRT Right-of-Way

The only practical way to provide separate lanes on Sheppard Avenue, exclusively for the use of light rail transit, is to place them in the middle of the street. It would not be feasible to place the LRT along the side of the road because a traffic signal is required at every place that traffic might wish to cross the LRT tracks and it is not practical to install traffic signals at every unsignalized intersection and driveway on Sheppard Avenue.

At midblock locations, the LRT right-of-way will typically consist of a raised median – approximately 150mm (6 inches) in height. This design discourages general traffic from coming onto the tracks, but still allows access by emergency vehicles. At signalised intersections, where the tracks must come down to street level, and in mid-block sections that are relatively short, the LRT lanes will be separated from adjacent traffic by a raised concrete curb.

Grade Separation at Stouffville GO Line (Agincourt Station)

Currently, the Stouffville GO line is at the same level as Sheppard Avenue, causing traffic to stop at the rail crossing when a train is passing. In order for the Sheppard East LRT to run efficiently, it is recommended that it pass under the GO rail line. Given that GO Transit and the City of Toronto are in the process of eliminating all at-grade crossings on major arterials, where possible, the LRT project will include the reconstruction of the entire road under the GO line.

Stop Spacing / Bus Routes

In the attempt to strike the right 'balance' between the competing objectives of higher overall route speed and good local accessibility, and with the current distance between arterial roads on much of Sheppard Avenue being about 800 metres, a choice had to be made between two typical scenarios:

- 1) **LRT stops every 800 metres:** people walk further to LRT stops, or are provided with an infrequent parallel bus service (e.g. every 20 minutes) serving close bus stops in between. At LRT stops, customers transfer to the centre LRT platform from the side-of-road bus stop.
- 2) **LRT stops every 400 metres:** slower route speed but shorter walk to stops, and the route is accessible as a local service, with no one relegated to a parallel bus service.

Staff developed a detailed micro-simulation model of these two scenarios and determined that a stop spacing of 800 metres resulted in an average route speed of 26-27 kph while a stop spacing of 400 metres resulted in an average route speed of 22-23 kph. By comparison, the 85 SHEPPARD EAST bus service has a scheduled p.m. peak period speed of 17 kph and the Bloor-Danforth Subway line has an average speed of 32 kph.

After assessing the overall customer service provided in each scenario, it was concluded that LRT stop spacing every 400 metres should be used, with wider spacing on sections of Sheppard Avenue where the arterial roads were not so closely spaced. This resulted in typical stop spacing of between 400 and 500 metres, and this was considered to provide the best balance between high overall route and acceptable local access for those walking to an LRT stop.

LRT Stops are proposed at the following locations:

- Consumers Road / Brian Drive
- Victoria Park Avenue
- Pharmacy Avenue
- Palmdale Drive
- Warden Avenue
- Bay Mills Rd / Aragon Avenue
- Birchmount Road
- Allanford Road
- Kennedy Road
- Agincourt GO Station
- Midland Avenue
- Brimley Road
- Brownspring Road
- McCowan Road
- 4725 Sheppard Avenue East
- Shorting Road
- Massie Street
- Markham Road
- Progress Avenue / Malvern Street
(exact location dependent on the future alignment of the SRT Extension)
- Washburn Way / Lapsley Road
- Midblock between Washburn Way and Neilson Rd
- Neilson Road
- Murison Boulevard
- Brenyon Way / Breckon Gate
- Morningside Avenue
- Rouge River Drive / Dean Park Road
- Idagrove Gate
- Meadowvale Road

The approvals resulting from this EA process must allow sufficient flexibility to install additional stops, if warranted. For example, additional stop locations between Morningside Avenue and Dean Park Road will be considered during detailed design, based on further discussion with City Planning as to future development scenarios for this largely undeveloped area. Assuming two stops are added in this section in the future, the average LRT stop spacing on the line would be about 470 metres. This compares to a stop spacing within the study area, on the current bus route, of 290 metres.

Traffic Operations/Impacts

East of Pharmacy Avenue, Sheppard Avenue has two through traffic lanes in each direction, and the road will be widened to maintain these lanes. There are several bus bays/right-turn lanes on the street and they will be removed to allow more space for a better pedestrian/cycling environment and better urban design. West of Pharmacy Avenue, where there are three through lanes in each direction, a reduction to only two through lanes is proposed, consistent with the section to the east. However, the design does not include a reduction to the number of lanes on Sheppard Avenue in the vicinity of the Hwy 404 overpass. To assist with the intersection operation at several intersections – for example, at Warden Avenue, Birchmount Road and Midland Avenue - it is proposed that the north-south right-turn lanes be lengthened and the bus bays be moved to the far side of these intersections.

Left-turns across the right-of-way will be permitted only where there is a traffic signal. Between traffic signals, there will be no left-turns permitted from Sheppard Avenue into unsignalized intersections or driveways, or from those locations, onto Sheppard Avenue. However, there will be separate left-turn lanes provided at the signalized intersections and motorists will be able to make “U” turns from these lanes. A motorist on Sheppard Avenue who now makes a left-turn into a mid-block driveway could, with the LRT in

place, simply would go past the driveway, to the next signalized intersection, and make a “U” turn to return to his/her destination.

LRT Connection at Don Mills Subway Station

A high priority has been placed upon providing an excellent transfer connection between the LRT and the subway (Figure 1.4), given the large volume of customers expected to make this transfer. After considering several design options, a short-list was developed of the following three ‘finalists’:

- 1) **Surface LRT Connection** – expand the bridge over Highway 404 to maintain the existing number of traffic lanes on Sheppard Avenue and incorporate two lanes for LRT in the centre of the road. On the east side of Don Mills Road intersection, eliminate two through traffic lanes from Sheppard Avenue, and widen the roadway to allow an LRT station in the centre of the road - a wide centre platform would include stairs and elevators connecting to the mezzanine level of the subway station – This option is estimated to cost approximately \$125 million;
- 2) **Underground LRT Connection:** tunnel under Highway 404, beginning west of Consumers Road and connecting to the east end of the subway platform level – This option is estimated to cost approximately \$235 million;
- 3) **Subway Extension:** extend the subway from Don Mills Station to Consumers Road (there is already EA approval for an easterly extension of the subway) and build an LRT connection there. The surface LRT platform would be in the middle of the street, and the subway directly beneath it – This option is estimated to cost approximately \$355 million.

(Note that options 2 and 3 would include tracks in mixed-traffic lanes on Sheppard Avenue, between Consumers Road and Don Mills Road, to run vehicles into and out of service in the event that a Don Mills LRT – currently the subject of a separate EA study – is constructed.)

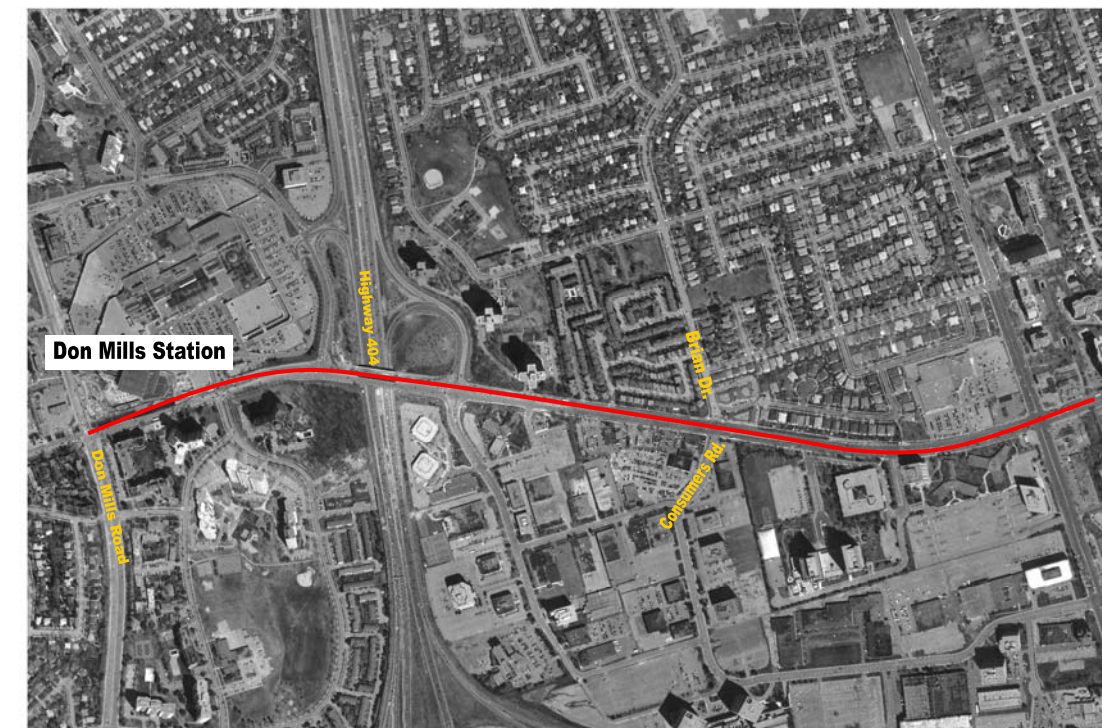


Figure 1.4: Aerial visual of study area between Don Mills and Consumers Road

The three alternative LRT connections were evaluated based on the following criteria:

- Capital Cost
- Consistency with a future subway extension
- Ease of transfer – LRT to subway
- Ease of transfer to transit services on Don Mills Road
- Impact on traffic
- Catalyst for transit-oriented development at Consumers Business Park
- Impact on adjacent property

Results of Evaluation:

Option 1, the surface connection, was eliminated for the following reasons – while the lowest cost, at \$125 million, it ranks the lowest of the three in terms of customer convenience, impact on traffic, including Highway 404, and has the greatest ‘throwaway cost’ in the event that the subway is extended in the future as none of this capital cost would be reusable. It provides the ‘bare minimum’ space for customers on the surface platform and requires the longest transfer to/from the subway. The removal of traffic lanes at the busy Sheppard Avenue/Don Mills Road intersection would significantly increase traffic congestion and also worsen traffic back-ups on Highway 404 off-ramps, an impact that is not acceptable to the Ministry of Transportation.

Options 2 and 3 are both being carried forward for EA approval.

Given the complexity of these two options, and in view of the very high costs involved, they require a more-detailed level of design than would normally be conducted in an EA study before a final decision is made.

Option 2 would provide the most convenient transfer for customers on the Sheppard East LRT line who would be transferring to or from the Sheppard subway as the LRT and subway would be at the same level. Forecasts show that 2000 of the 3000 persons on the Sheppard East LRT would be making this transfer.

Option 3 would act as a greater catalyst for transit-oriented development in this area. Since transit customers from the Consumers Office Park and travelling to and from the west via the Sheppard subway would have direct access to the subway at Consumers road. In option 2, these customers would have to use the LRT, and then transfer to the subway after traveling a single stop. However, the cost of this alternative is much-higher and a more in-depth assessment is required to assist in determining if the additional cost can be justified.

Property Acquisition

Property acquisition is required by both alternative LRT design alternatives that are recommended for approval at Consumers Road, due to the need for some widening of Sheppard Avenue in the vicinity of this intersection, and for the tunnel itself which would be constructed outside of the Sheppard Avenue road allowance to avoid crossing highway 404 directly under the existing bridge structure. There are some specific areas where the road right-of-way on Sheppard Avenue East is less than the typical 36 metres, and a number of property impacts resulting from the proposed grade separation of Sheppard Avenue at the Stouffville GO line, east of Kennedy Road.

Permanent easements are required for the tunnel sections between Don Mills Station and Consumers Road, where the tunnels are outside the Sheppard Avenue Right-of-Way.

In addition, there are nine new electrical substations required along the Sheppard LRT line. These facilities reduce the voltage from the Toronto Hydro power supply to the 750 volts required for the LRT and help maintain consistent power levels along the line. The structures are roughly 12 metres by 4 metres by 4 metres high, not including treatments around the outside façade, and property must be acquired for their construction. None of the sites that have been identified for this purpose are residential.

Public Consultation

Public open houses were held at the end of Phase 2 of the EA - which recommended LRT as the preferred transit solution – and at the end of Phase 3 of the EA – where the public were presented with the preferred design for the new LRT line. A summary of the comments received at these public open houses are included in this report.

Public Consultation in Phase 2

The first Public Open Houses were held on April 15, and April 17, 2008 to explain to the public the rationale for selecting LRT as the preferred solution on Sheppard Avenue. Members of the Study Team were available to address questions, comments and concerns.

Over 500 people attended the two open houses and staff received 239 comment sheets / e-mails with questions and comments.

Public Consultation in Phase 3

The second round of public consultation was held on June 3, and June 4, 2008. Over 350 people attended the two open houses, in total, and 148 comment sheets were received.

There were a considerable number of people who supported the recommendation. There were also a considerable number who felt that a subway should be built and not an LRT.

Summary of the Recommended Design for the Sheppard East LRT

In summary, this project includes the construction of a LRT along Sheppard Avenue East between Don Mills Subway Station and Meadowvale Road, with key design components as follows:

- the LRT will operate on a separate lanes in the centre of existing Sheppard Avenue, typically on a raised median but coming to grade when travelling through signalized intersections;
- the average spacing of the stops on Sheppard Avenue is 460 metres. All stop locations will be signalized to provide safe crossing for pedestrians from the LRT platform to the sidewalk.
- the existing City-owned right-of-way on Sheppard Avenue is generally 36 metres. However, there are sections where the right-of-way where some property acquisition will be required;
- a grade separation is proposed at the Stouffville GO rail crossing;

The following cross section (**Figure 1.5**) shows a typical intersection on Sheppard Avenue which includes the LRT, the station platforms two through lanes in each direction, bike lanes on both sides and sidewalks.

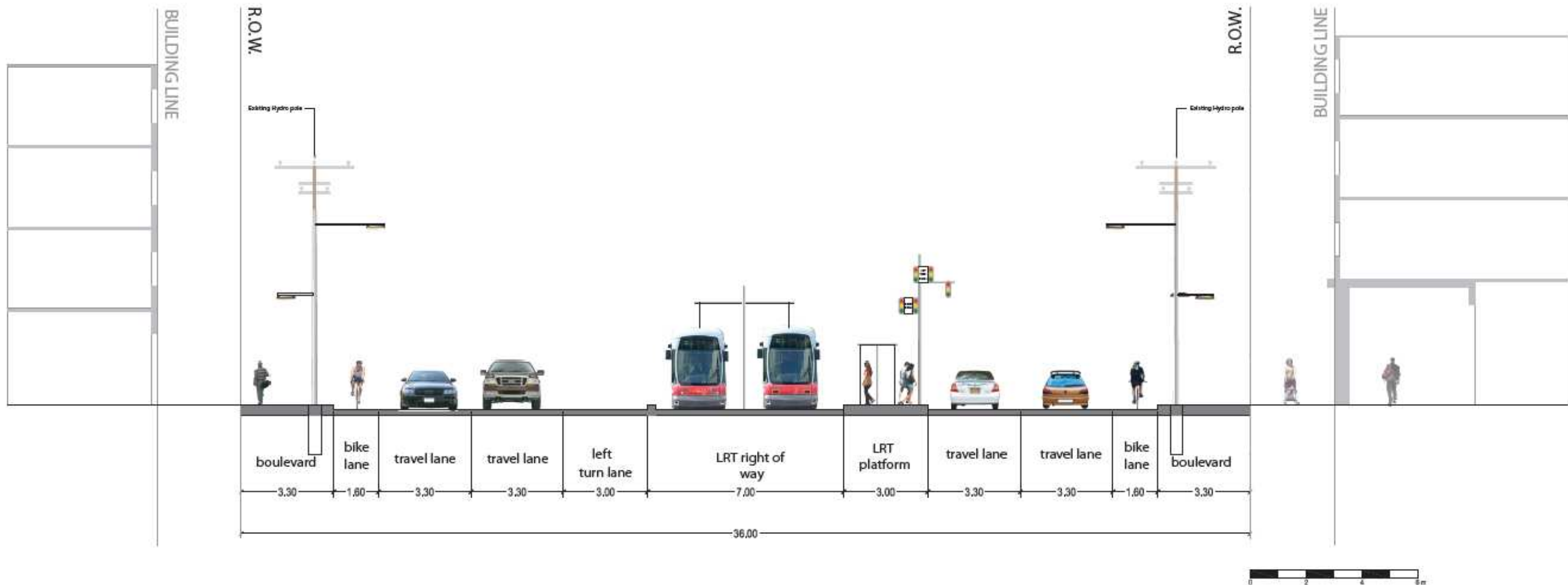


Figure 1.5: Proposed Sheppard LRT Cross-Section (at Urban Intersections)

Costs

Preliminary capital costs have been developed for the Sheppard East LRT line, between Don Mills Road and Meadowvale Road. The costs are estimated to be in the order of \$655 million, assuming the LRT connects with the subway at the subway platform level of Don Mills Subway Station. With the alternative option of the subway being extended to Consumers Road, and a surface LRT station constructed there, the facility capital cost on the facility would increase to \$775 million.

The estimated cost of purchasing 35 new light rail vehicles for this line, to accommodate the projected future ridership up to 2031, including additional vehicles for maintenance, is \$210 million.

Therefore, the total order-of-magnitude of cost of the line is \$865 million with the LRT connecting at Don Mills Station, and \$985 million, if the subway were to be extended to Consumers Road. These cost estimates will undergo significant refinements as the project moves into the detailed design and engineering phases. These costs do not include property acquisition nor the appropriate factor for escalation over the duration of the construction.