Form Revised: February 2005

TORONTO TRANSIT COMMISSION
REPORT NO.

MEETING DATE: JUNE 18, 2008

SUBJECT: REQUEST FOR APPROVAL OF THE SHEPPARD EAST LRT ENVIRONMENTAL ASSESSMENT STUDY

ACTION ITEM: X

RECOMMENDATIONS

It is recommended that the Commission:

1. Approve the recommendation of the joint City/TTC Sheppard East LRT Environmental Assessment (EA) study, that a Light Rail Transit (LRT) line be constructed on Sheppard Avenue East, between Don Mills Station and Meadowvale Road, to provide transit service in that corridor, as outlined in this report;

2. Forward this report to the City of Toronto, and request that City Council, at it's meeting on July 15, 2008, approve the recommendations of the Sheppard East LRT EA study to allow staff to begin detailed design as soon as possible, and be in a position to begin construction of this first *Transit City* light rail line in 2009;

3. Request that City Council:

    i) authorise staff to submit the final Environmental Assessment Study report for the 30-day public review period, as required to complete the EA process for this project;

    ii) advise the Province of Ontario of its approval of this EA study;

4. Note that City Planning is proceeding to amend the Toronto Official Plan so that Sheppard Avenue East, from McCowan Road to Meadowvale Road, is included as a Transit Priority Corridor, in support of this project;

5. Note that City Planning staff have been full participants in the preparation of this environmental assessment. They have reviewed this report, and they concur with its recommendations; and

6. Forward this report to Metrolinx, to confirm previous information that the Sheppard East light rail line is ready to proceed to implementation and, therefore, should be included in Metrolinx's forthcoming 'first wave' funding approval.

FUNDING

On June 15, 2007, the Province of Ontario announced funding of $17.5 billion for the implementation of the *MoveOntario 2020* rapid transit program in the Greater Toronto and Hamilton area (GTHA) over the next twelve years. *MoveOntario 2020* includes funding for the TTC-City of Toronto *Transit City Light Rail Plan,* which includes the proposed Sheppard East LRT line.

Funds in the amount of $7.1 million for *Transit City* environmental assessments were included in the 2008-2012 TTC Capital Program budget, (pages 1531-1534) as approved by City Council on December 11, 2007. The March 25, 2008 provincial budget announced funding to cover this $7.1 million cost, as part of Metrolinx's Quick Wins initiatives and these funds have been paid to the City. Funding for the Sheppard LRT EA was included under this project; however no funds are available at this time to proceed with the construction of the line.

All *Transit City* initiatives are currently included in the TTC's 2009-2013 Capital Program as "below-the-line" items, all awaiting funding from Metrolinx. Metrolinx is expected to present their Regional Transportation Plan, and funding approval for selected GTHA rapid transit initiatives. Based on Metrolinx's funding decisions, TTC staff will be seeking Commission approval for specific project expenditures for lines and facilities for 2009 and beyond.

BACKGROUND

At its meeting of March 21, 2007, the Commission endorsed the *Toronto Transit City Light Rail Plan* as the basis and priority for rapid transit expansion in the City of Toronto. This plan included the Sheppard East LRT line as one of seven lines forming a network of fast, reliable, environmentally-sustainable light rail transit throughout the City.

At its meeting of June 13, 2007, the Commission approved a report entitled, *Transit City Light Rail Plan – Implementation Work Plan*, which outlined an "aggressive and ambitious" work plan to allow for the start of construction on at least one of the light rail lines by 2010. Following the release of *MoveOntario 2020*, TTC staff were directed to revisit that original implementation work plan, and identify ways that construction could begin on one of the LRT lines, if possible, as early as 2008.

In response to this request, the Environmental Assessment Study for the Sheppard East LRT line was conducted on an accelerated schedule and, conditional upon receipt of the necessary capital funds from the Province of Ontario, staff are currently planning to initiate construction in 2009.

This report provides a summary of the results of the EA study and the rationale supporting the various elements of the recommended 'preferred design' for the Sheppard East LRT line.

DISCUSSION

The first three phases of the five-phase Environmental Assessment process have now been completed, and the attached report, entitled "Sheppard East LRT Class Environmental Assessment Summary Report" provides additional details on:

Phase 1: the transportation problem being addressed along the Sheppard Avenue East corridor;
Phase 2: the reasons for recommending an LRT as the 'preferred solution', and
Phase 3: the rationale for the design elements selected for the Sheppard East LRT.

Complete details on the Sheppard East LRT line, including plans of the modifications to be made on the entire 14-kilometre section from Don Mills Station to Meadowvale Road, will be contained in the project's comprehensive Environmental Assessment Study report, which is being prepared and will be finalised following the meeting of the Commission on July 10, 2008. Following City Council approval, the EA Study report will be placed on the public record for the mandatory 30-day review period (Phase 4 of the EA process). Phase 5 consists of detailed design and construction.

An overview of the key issues follows.

Study Area

The *Toronto Transit City Light Rail Plan* originally proposed that the Sheppard East LRT line operate between Don Mills Station and Morningside Avenue, to connect with the Scarborough-Malvern LRT line. However, based on projected ridership beyond Morningside Avenue, and to allow for a possible further extension east to Durham Region and to the Toronto Zoo, the study area for the EA was extended to Meadowvale Road.

Purpose of the EA

The purpose of the EA study was to identify the best way of significantly improving the existing transit service on Sheppard Avenue East, in a manner that is affordable, that makes transit on Sheppard Avenue significantly more attractive compared to the private automobile, and that supports other important City objectives in the corridor, such as more dense, transit-oriented development, and an improved walking and cycling environment.

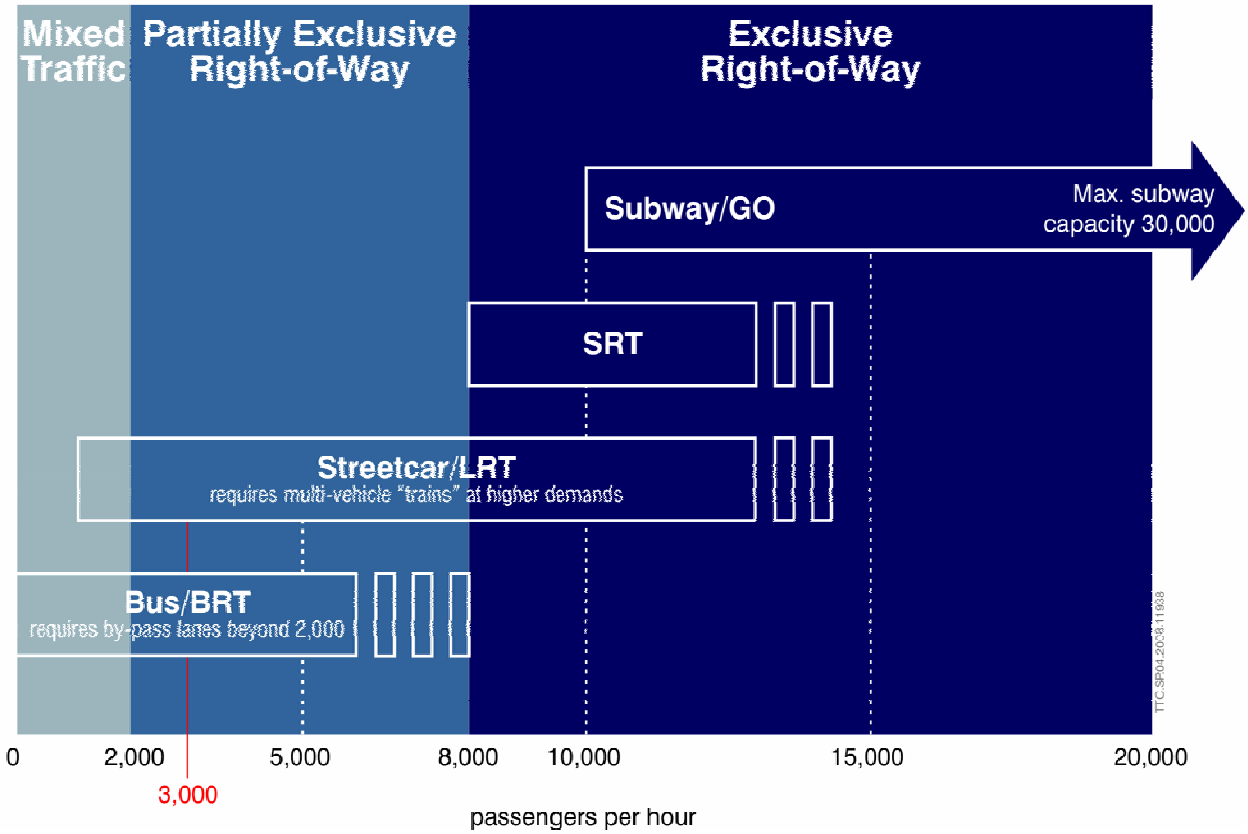
Why is LRT the Preferred Solution?

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 dedicated lanes, not operate in lanes shared with general traffic. Within this context, a transit technology must be selected which can meet all future travel demands, which is environmentally sustainable, and which achieves these objectives in the most cost-effective way possible. Light rail transit (LRT) best meets these objectives. The projected future peak point demand on Sheppard Avenue, east of

Don Mills Station, of 3,000 passengers per hour, is well below the volume typically required to justify subway construction. However, this volume is too high to be practically accommodated by buses in dedicated lanes (BRT) in the absence of separate space-consuming by-pass lanes to allow buses to operate express and by-pass local buses at stop locations.

The chart below helps illustrate that LRT technology provides ample capacity to accommodate the future demands projected for the Sheppard East corridor which are, as noted above, in the area of 3,000 passengers per hour.

Transit Rights of Way and Technologies



Comparative costs of light rail versus subway show the high cost difference between the two options: $40 million per kilometre for LRT versus $222 million per kilometre for subway (2007 dollars, for the capital cost of facility construction, plus vehicles).

The Preferred Design for the Sheppard East LRT

The basic design proposed on Sheppard Avenue East consists of two LRT lanes on an approximately six-inch high raised median in the middle of the road. Midblock, there would be two traffic lanes, plus a bicycle lane (east from Pharmacy Avenue), on either side of the LRT. At intersections, the cross-section would also accommodate a left-turn lane and 3-metre-wide LRT passenger platform. This will require a major road widening on the section of Sheppard Avenue East, east of Pharmacy Avenue, where there are now only two through traffic lanes in each direction. On the section west of Pharmacy Avenue, which currently has three traffic lanes in each direction, two of the existing six traffic lanes would be converted to LRT right-of-way, so only a minor widening would be necessary.

Traffic would be permitted to cross the tracks only at signalised intersections. All unsignalised intersections and driveways would be limited to right-in/right-out operation. U-turns would be permitted from all left-turn lanes at signals to assist motorists, who can no longer make left-turns at unsignalised locations, to make the equivalent movement. There will continue to be sufficient capacity to accommodate all existing travel demand on Sheppard Avenue; however, motorists will encounter some extra delays.

LRT stops would be provided every 400-to-500 metres. Passenger platforms will be 60 metres long to accommodate two-vehicle 'trains' in the future.

This project recognizes the importance of designing an "entire street". As outlined in the City's *Vibrant Streets* document, a key objective is to create a street that is more attractive, and pedestrian-friendly. Urban design, cycling, and pedestrian-realm issues have been paramount throughout the development of the environmental assessment. During the detailed design phase, urban design considerations will continue to be integrated throughout the project, focusing on accessibility, treatments in areas such as LRT platforms, crosswalks, and boulevards that would be unique to *Transit City* LRT lines, adequate space for street furniture, as well as specific areas along Sheppard Avenue where special urban design treatments may be possible. The project will include a public art component.

Special Design Areas

Connection at Don Mills Station: There are two preferred options for the LRT connection to the subway that are included in the EA study report. Both of these options require further evaluation during the detailed design phase of the project in order to allow a final recommendation to be presented in the fall of 2008. Therefore, both are included for approval as part of the EA report at this time:

(1) an LRT tunnel under Highway 404 connecting to the Sheppard Subway at the east end of the subway platform level at Don Mills Station; and,

(2) a subway extension to Consumers Road with an integrated surface LRT terminal being part of a station at Consumers Road.

Given the complexity and cost of these two options, a decision between the two requires a greater level of design detail than is provided at the EA stage.

Full Grade Separation at the Stouffville GO line: It is not operationally acceptable for a high-frequency, high-capacity light rail service to intersect at-grade with a heavy-rail operation such as a GO line. For this reason, and given the long-standing goal of City of Toronto and GO Transit of eliminating, where possible, level rail-crossings at major arterial roads, the Sheppard East LRT project includes a complete grade separation of Sheppard Avenue at the GO rail line, east of Kennedy Road.

Costs

The capital costs of constructing the Sheppard East LRT line, between Don Mills Road and Meadowvale Road, including an allowance of approximately $5.5 million per kilometre for urban design (not including undergrounding of hydro), is 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. If the subway were to be extended to Consumers Road, with a surface LRT station constructed there, the facility capital cost 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, exclusive of property, 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. The 2009-2013 Capital Budget will include appropriate costs for escalation and for property acquisition.

The current cost estimates are significantly higher than the $555 million presented in the original March, 2007 *Transit City* report - $435 million for capital costs and $120 million for vehicles ($2007). There are two main reasons for this increase:

1. the original plan was premised on the LRT connection at Don Mills Subway Station being on the surface. However, given the TTC's commitment to much-more user-friendly and convenient passenger transfer facilities and the public's expressed strong support for such improved facilities, the two options being considered for the LRT connection to the Sheppard Subway, at $235 million and $355 million, respectively, are much-more expensive designs than included in the original estimate.

2. the original number of vehicles projected for this LRT line was premised on certain assumed operating speeds and vehicle capacities. However, subsequent detailed modelling and design work determined that the originally-assumed speeds and capacities were too high, and this resulted in a need to increase the vehicle requirements for the line, causing a cost increase of $90 million.

Further Work

Official Plan Amendment: Map 5 of Toronto's Official Plan, "Transit Priorities" identifies Sheppard Avenue as a Transit Priority corridor from Don Mills Station to McCowan Road. City Planning staff are conducting an Official Plan Amendment to also identify the section of Sheppard Avenue East, between McCowan Road and Meadowvale Road, as a Transit Priority corridor, in support of this initiative. The final City Planning staff report will be on the July 2, 2008, Planning and Growth Management Committee agenda.

Additional Environmental Assessments on Potential LRT Extensions: Staff will be conducting additional EA work on a branch of the Sheppard East LRT which would operate south to the Scarborough Centre area via McCowan Road. EA work will also be undertaken to assess the request, from Scarborough Community Council, for an extension of the Sheppard East LRT via Meadowvale Road, to the Toronto Zoo.

JUSTIFICATION

The recommendations of the Sheppard East LRT Environmental Assessment study should be approved by the Commission because a new LRT line on Sheppard Avenue is a cost-effective way of providing excellent, reliable, high-capacity, environmentally-sustainable transit service on Sheppard Avenue East and to, thereby, reduce auto dependency in this corridor and create a more liveable, attractive, and sustainable city.

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June 12, 2008
11-31-42
Attachment: Sheppard East LRT – Class Environmental Assessment Summary Report

1. Introduction

The City of Toronto and the Toronto Transit Commission (TTC) have conducted an Environmental Assessment (EA) study of ways to significantly improve 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.

1.1 Study Background - Related Plans and Studies

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. It promotes measures to increase trips made by transit, walking and cycling. To make public transit faster, more reliable, and a more attractive travel alternative compared to the car, 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.

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 2021, the new lines would carry 175 million riders per year.

One of the seven new light rail lines proposed in the Toronto Transit City Light Rail Plan is the Sheppard East LRT. This line was proposed to extend from Don Mills Subway Station at least as far as Morningside Avenue.

Designated Growth Areas

Toronto's Official Plan focuses on city-building and future growth will be directed towards designated areas which, in the Sheppard East area, include a number of Employment Districts, the nearby Scarborough Centre, and the Avenue on the section of Sheppard Avenue East, west of McCowan Road. The City wants to ensure that any improved transit in this corridor supports its objectives for making the street more-lively, more-attractive, and more-pedestrian-oriented. Improvements to the streetscape will support Toronto's Climate Change and Clean and Beautiful City initiatives to make all of Toronto a more liveable and pleasant place to live and work.

The City Bicycle Lane Network

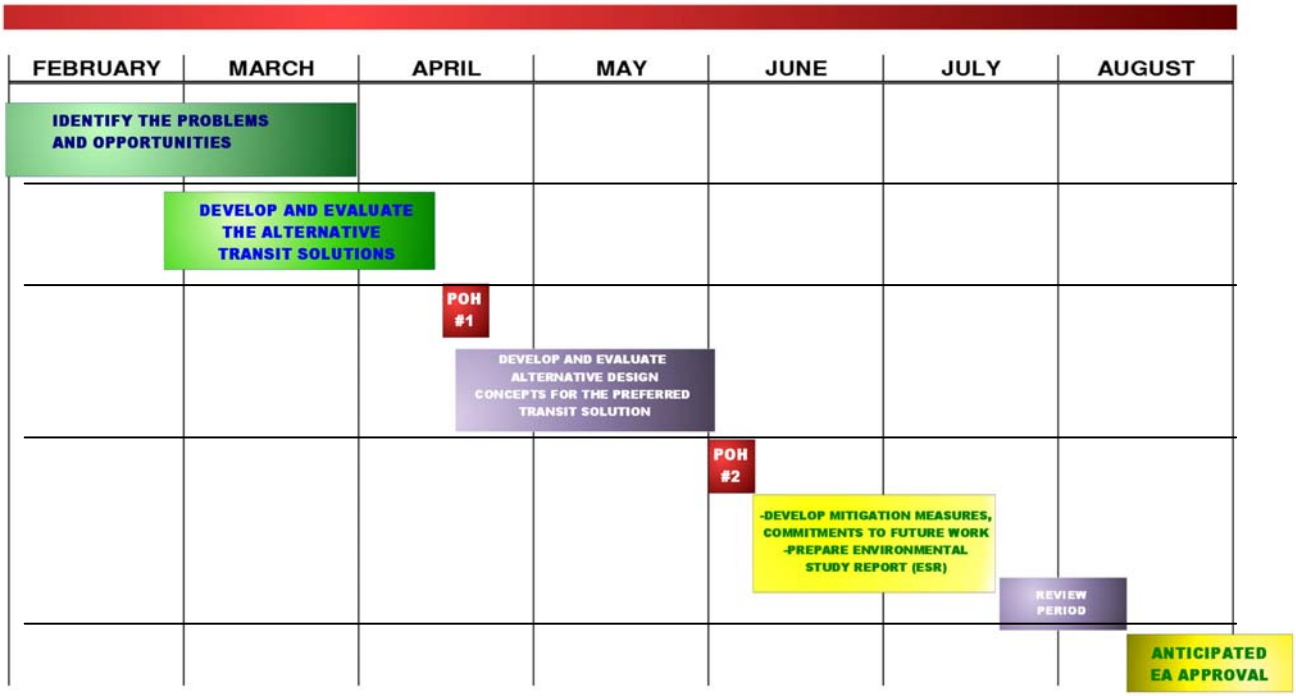
The City's integrated bicycle lane network plan includes Sheppard Avenue East, between Pharmacy Avenue and Meadowvale Road for the installation of on-road bicycle lanes.

1.2 Study Process – the Municipal Class Environmental Assessment

This EA is being conducted as a Schedule 'C' project under the Municipal Class Environmental Assessment (EA). Schedule 'C' projects generally include the construction of new facilities and major expansions to existing facilities that have the potential for significant environmental effects. The five phases of this EA process are:

- **Phase 1:** Identify the problems or opportunities to be addressed in the study;
- **Phase 2:** Evaluate alternative ways of addressing the problems and identify the 'preferred solution';
- **Phase 3:** Examine alternative design concepts; identify the 'preferred design' for the project;
- **Phase 4:** Document, in an Environmental Study Report (ESR), a summary of the rationale, and the planning, design and public consultation process; and
- **Phase 5:** Complete detailed design, contract drawings and documents, and proceed to construction

Study Schedule



2. Phase One: Problems and Opportunities

The specific **problem** that this EA study addresses in the study is how to make transit more attractive so that more people will use transit rather than driving their cars. 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 an attractive alternative to the private automobile.

This study provides the **opportunity** to find a way to improve transit that, at the same time, supports other City's objectives in this area.

2.1 Study Purpose and Objectives

The primary 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) Is affordable;

2) Makes transit a much more attractive travel option relative to the private auto; and

3) Supports the City's growth objectives of a better variety and density of transit-oriented developments, particularly on that section west of McCowan Road which is designated in the Official Plan as an 'Avenue'.

In addition, the recommended design must be developed in a manner that respects other road users, adjacent properties, and the natural environment; and must consider other important City objectives such as good urban design, and an improved walking and cycling environment.

2.2 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 crossing Sheppard Avenue east of Don Mills Road, and Highway 401 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 Town Centre. 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 reserved transit lanes.

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

The existing industrial, commercial and residential uses in the Sheppard Avenue study area long ago replaced any features of environmental significance. As the study area extends only as far east as Meadowvale Road, 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. Staff use transportation models to i) generate trips based on future population and employment, ii) determine the various origins and destinations of these future trips, based on extensive survey information of existing travel behaviour, iii) determine how many of these future trips will be taken on transit, and then, iv) assign these transit trips to the most likely transit route.

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 forecasted maximum demand of **3000 passengers per hour in the peak direction.**

3. Phase Two: Development and Evaluation of Alternatives

The second phase of the EA Study involved identifying and evaluating alternative solutions to the problems and opportunities in this corridor. 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 partially exclusive right-of-way (dedicated lanes) 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.*

3.1 Evaluation of the Alternative Solutions

The main issues used to compare the alternatives are summarised below.

i) Subway/Elevated Rapid Transit (SRT):

The future demand expected on Sheppard Avenue East - 3000 people in a single direction in the peak hour – is well below what would be required to justify the very high costs of subway or elevated transitways. Subway/Elevated Rapid Transit (e.g. SRT) technology is required if the peak hour demands are approaching the range of 10,000 people per hour in the busiest direction.

Recent estimates of subway costs are $222 million per kilometre, while LRT costs are in the order of $40 million per kilometre (both costs in 2007 dollars and include vehicles but not property, yards, or urban design elements).

Subway and SRT were not carried forward because the projected demands were not sufficient to justify the very high capital costs of such facilities.

ii) Bus Rapid Transit (BRT):

While BRT is less expensive to build than LRT, this alternative was inferior to an LRT system in two significant areas.

Capacity:

BRT vehicles are smaller than rail vehicles and have less carrying capacity than LRT and cannot easily accommodate higher demands without some form of by-pass lanes to allow some

buses to operate express and pass one another at stops. At transit stop locations on Sheppard Avenue, there must be two new lanes reserved for transit, plus passenger loading platforms, two general traffic lanes, 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 scenario of acquiring property at stop locations to allow the road to be further widened to accommodate a bus by-pass lane in each direction is clearly not an acceptable options given the planning and urban design objectives for the Sheppard corridor.

The forecasted 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 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 is 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.

Land Use:

BRT does not influence sustainable land use patterns as strongly as LRT which is fixed, permanent, long-term investment in the street.

iii) Light Rail Transit (LRT):

Capacity:

In the absence of by-pass lanes, LRT has a much higher carrying capacity than BRT. The new Light Rail Vehicles that will be designed for the TTC will have a capacity 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

Land Use:

LRT is best suited to the forecasted demands on Sheppard Avenue and supports the objective of supporting the creation of more continuous, transit-oriented development in the corridor. Based on a review of BRT and LRT experience in the U.S., a recent study 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."

3.2 The Preferred Solution – The Sheppard East LRT

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. The forecasts for Sheppard are easily accommodated by LRT, 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.

ES- 3: Examples of LRT Vehicles

Amsterdam, Netherlands

Strasbourg, France

3.3 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 preceding information and to present 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.

A total of over 500 people attended the two open houses and staff received 239 comment sheets or e-mails with questions and comments. A summary of the comments received at these public open houses, as well as the meetings held in early June at the end of Phase 3 of the EA, will be made available at the June 18 meeting of the Toronto Transit Commission, and at the City Planning and Growth Management Committee meeting of July 2, 2008.

4. Phase Three: Evaluation of Alternative Design Concepts

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

4.1 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. Any crossings by other traffic must occur at a traffic signal. It would not be feasible to place the LRT along the side of the road because a traffic signal would be required at every place that traffic might wish to cross the LRT tracks and it is not practical to install traffic signals at every un-signalized intersection and driveway on Sheppard Avenue.

Based on previous discussions with Fire and Emergency Services, at midblock locations, the LRT right-of-way will typically consist of a raised median – approximately 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, the LRT lanes will be separated from adjacent traffic by raised concrete curbs on both sides of the intersection.

4.2 Eastern Extent of the Line

The study has concluded that the LRT should extend as far east as Meadowvale Road, given the projected strong transit ridership in that area. An LRT storage and maintenance facility is proposed roughly midway between Morningside and Meadowvale (subject to a separate EA process).

4.3 Grade Separation at Stouffville GO Line

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 should be designed to pass under the GO rail line. GO Transit and the City of Toronto are in the process of eliminating all at-grade crossings on major arterials, where possible, so the LRT project should re-construct the entire road under the GO line.

4.4 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, the current street network on much of Sheppard Avenue led to a choice between two 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 400-500 metres should be used, in concert with the existing road network and traffic signals.

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

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.

4.5 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 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 operations 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 un-signalized 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 go past the driveway, to the next signalized intersection, and make a "U" turn to return to his/her destination.

4.6 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, given the large volume of customers expected to make this transfer. Five LRT connection alternatives were generated:

1) **Surface LRT Connection:** Highway 404 bridge expanded to maintain existing traffic lanes and incorporate two lanes for LRT in the centre. Traffic lanes would be reduced near Don Mills Road to allow an LRT station in the centre of Sheppard Avenue just east of Don Mills Road - a wide centre platform would include stairs and elevators connecting to the mezzanine level of the subway station - ($125 million);

2) **Underground LRT Connection:** tunnel under Highway 404, beginning west of Consumers Road and connecting to either:

   a) the mezzanine level of the subway (one level below the surface) – ($215 million);

   b) the east end of the subway platform level – ($235 million);

3) **Subway Extension:** east to Consumers Road and build an LRT connection there:

   a) with an underground LRT connection above the subway; the entrance to the LRT tunnel would begin a short distance west of Victoria Park Avenue - ($450 million); and

   b) with a surface LRT platform in the middle of the street, similar to 1) above, and the subway directly beneath it – ($355 million).

(Note that all options other than the Surface Option would require connecting tracks in mixed-traffic lanes on Sheppard Avenue, to run vehicles into and out of service on the future Don Mills LRT, depending on the location of future yards.)

The five 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
- Possible storage LRT tracks at terminal
- Impact on adjacent property

Options Eliminated:

Option 1: 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 would worsen traffic back-ups on Highway 404 off-ramps, an impact that is not acceptable to the Ministry of Transportation. While the lowest cost - $125 million - none of the expenditure required for the surface connection would be consistent with a future subway extension.

Option 2a: ($215 million) is very similar to Option 2b, but less of the facility would be "reusable" in the event of a subway extension to the east, and it would cause some negative impacts on a new development planned on the south side of Sheppard Avenue.

Option 3a: ($450 million) was rejected due to its very high cost.

Preferred LRT/Subway Connection:

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

Given the complexity of the options, and in view of the very high costs involved, a proper comparison of these two options requires a more-detailed level of design than would normally be conducted in an EA study. The construction-related impacts of the two options in the vicinity of the Consumers Road/Brian Drive intersection are similar – both require property acquisition beyond the 36-metre road right-of-way – but, as explained below, that impact on adjacent properties is greater for Option 3b. In both options, it is assumed that the three existing traffic lanes would continue to Consumers Road, with the curb lane becoming a right turn lane at that intersection and only two traffic lanes continuing through the intersection.

In **Option 2b,** the underground connection of the LRT to the east end of the subway platform, it is assumed that the tunnel portal must begin just west of Consumers Road, and that a single centre-platform will be provided on the east side of the intersection, 5 metres in width. This width of platform, with the tracks tapering back to standard separation on the west side of the intersection before entering the tunnel, cannot be accommodated within the 36-metre right-of-way on Sheppard Avenue, which results in the need for acquisition of a property.

Option 3b: an easterly extension of the subway to Consumers Road, also requires a centre platform on the east side of Consumers Road for a surface LRT station. This LRT platform must accommodate a collector's booth, elevators and stairways, and should be 7-to-8 metres wide. This design requires a special cross-over tracks at the east end of the LRT station to allow the LRT to 'turn' back to the east after serving the stop; this special trackwork results in the overall LRT station facility being about 100 metres longer than the LRT platform in Option 2b. Therefore, the width of the required land acquisition is greater as is the length of that impact. The tail tracks for the subway may require the removal of the existing westbound-to-southbound underground ramp that crosses under Sheppard Avenue to a parking facility on the south side of Sheppard Avenue. This is dependent on the depth of the subway and is subject to more-detailed design.

With Option 3b, transit customers from the Consumers Office Park would not require a transfer to the subway after traveling a single stop, as they would in Option 2b. As such, this option would act as a greater catalyst for transit-oriented development in this area. However, the cost of this alternative is much-higher and, to determine if a 'shallow' subway is feasible, detailed design is required on how deep the tunnel must be at when constructing near the Highway 404 bridge, to avoid any settlement, and to avoid the large, 6-metre deep sanitary sewer near Consumers Road.

4.7 Property Acquisition

In addition to the property acquisition required by the LRT design alternatives at Consumers Road, 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. The impacted properties will be identified and contacted once the tunnel alignment is finalized.

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 and property must be acquired for their construction. None of the sites that have been identified for this purpose are residential.

The areas where property acquisition is required along Sheppard Avenue East, as a result of this project, will be presented at the Commission meeting on June 18, 2008.

4.8 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 have been received at the time of writing this report. A summary of the comments received will be made available at the June 18, 2008 meeting of the Toronto Transit Commission, and at the City Planning and Growth Management Committee meeting of July 2, 2008.

4.9 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 and includes the following design components:

- the LRT follows the same alignment of Sheppard Avenue;
- a grade separation is proposed at the Stouffville GO rail crossing;
- the LRT will operate on a raised median in the centre of existing Sheppard Avenue;
- the existing R-O-W on Sheppard Avenue is generally 36-metre. However, there are sections where the R-O-W is reduced (less than 36-metre) to minimize property impacts; and
- the average spacing of the stops on Sheppard Avenue is 460-metre. All stop locations will be signalized to provide safe crossing for pedestrians from the platform to the sidewalk.

The following cross section 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.

E4- 1: Proposed Sheppard LRT Cross-Section (at Urban Intersections)