Table 2-4: North Segment Alignment Analysis

SRT Extension - Alignment Analysis					
Objectives	**North Option 1 / Markham - CP**	**North Option 2 / Markham - CP**	**North Option 3 (Abandonned Rail Corridor) Above Grade**	**North Option 4 (401, Neilson)**	**Comments**
A) Minimize Adverse Environmental Effects	◕	●	◕	◑	N2 is most preferred as it utilizes existing transportation corridors to minimize the impact on the socio-economic and natural environment. N1 and N3 have greater impacts on the residential community. N4 is least preferred as it has the most significant impact on the natural environment and some community impacts along Neilson Road.
B) Support Population and Employment Growth	●	●	◕	◑	N1 and N2 are most consistent with current planning policy and offer the greatest opportunity for transit supportive development. N4 is situated in existing transportation corridors and is surrounded by stable low density development with limited opportunity to encourage/attract more transit oriented development.
C) Improve rapid transit service to North East Scarborough	◕	◕	●	◑	N3 provides reasonable service to the existing high density areas of Markham and Sheppard and the fastest service to the high density areas within Malvern and therefore is the most preferred. N1 and N2 provide slightly better service to the Markham / Sheppard Area but much slower service to Malvern.
D) Connect SRT to Proposed Sheppard LRT					No difference - not decision relevant
E) Improve Rapid Transit service to Centennial College	◕	◕	◕	●	Although N4 provides a station closer to the main area of campus, all options provide significantly improved transit service to Centennial College.
F) Accommodate Future Increase in Ridership Demand					No difference - not decision relevant
G) Cost	◑	◔	●	◕	N3 will result in the lowest operating costs, potentially the lowest construction cost and is the simplest to construct and thus is most preferred. Even with an underground section through the stable residential areas of Malvern (to mitigate impacts), this can be constructed at equal or less cost in comparison to N1, N2, and N4 N2 (and N1) will have the highest operating costs, would be the most expensive and complex to construct and therefore is least preferred.
Summary (Rank)	2	2	1	3	
			Recommended		

Based on the above analysis (detailed analysis is contained in Appendix A-4), North Alignment 3 is preferred because it:

- Has the greatest opportunity to mitigate adverse socio-economical and environmental effects;
- Provides the fastest and most direct transit service to Centennial College and the Malvern community; and
- Results in the lowest operating costs.

2.2.7.5 Consultation

Input and guidance on the analysis of the north alignment alternative was sought through extensive consultation with directly affected stakeholders. This included public input during three separate rounds of open houses: PIC #2 – June 4th and June 5th, 2008; a Community Meeting – July 31st, 2008 and PIC #3 – June 2nd, 2009.

Although there was general support for Alignment 3, the local community expressed concern over adverse noise and vibration effects as well as adverse effects on the natural environment. Refinements to the design are discussed in Section 2.3.2.3.

2.3 Refinements to Evaluated Options

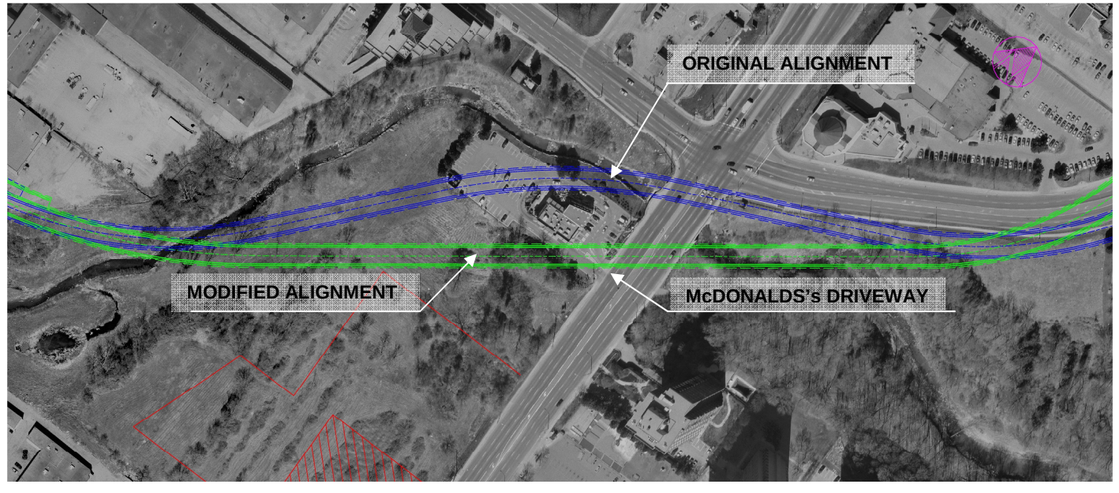
Based on inputs received from various stakeholders and information gathered, several refinements were made to the preferred alignment prior to commencing the TPA process.

2.3.1 Refinements to South Segment of Extension Alignment

In late 2009, it was determined that the SRT would utilitize the same LRT vehicles as will be used on all Transit City Lines and that the fleet for SRT could be accommodated within the Sheppard East Maintenance and Storage Facility on Sheppard Ave. until such time that additional planned Transit City lines are constructed in the area. As a result, the proposed Maintenance and Storage Facility at Bellamy is not required in the short term. In addition, TTC has elected to defer the implementation of the Bellamy Station until transit supportive development is planned in the area. The reduced emphasis on the station location and timing of the yard construction results in a change in analysis and evaluation as documented in Section 2.2.5. Specifically, South Alignment 3 becomes the preferred alternative as it has the lowest impact on the local business community in the short term and can be constructed at the lowest cost (see Appendix A-4 for details).

The interface of South Alignment 3 and the North Alignment 3 was examined in greater detail. Under specific consideration was the section from Markham Road to Highway 401 (See Exhibit 2-20).

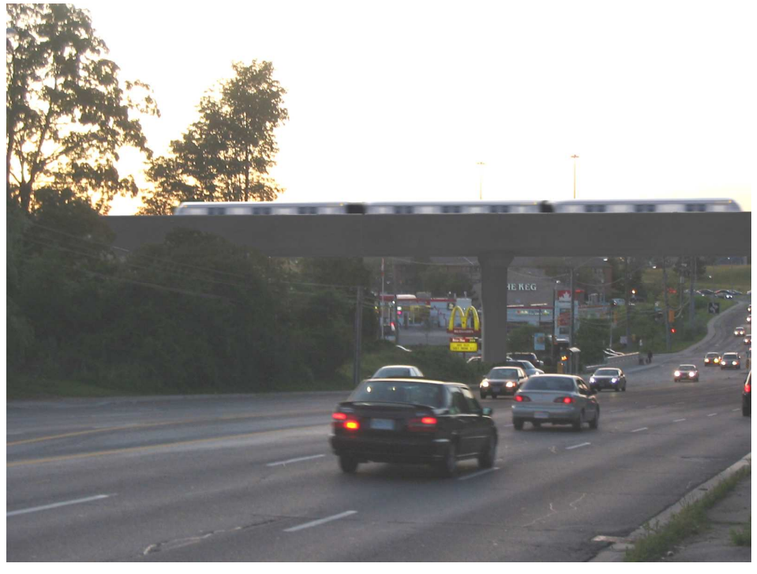
Exhibit 2-20: Alignment Options



The first alignment (Option 1) runs north of the McDonald's Restaurant, crosses Markham Road, continues adjacent to the north side of East Highland Creek and subsequently follows Progress Avenue to the north before reaching the curve transitioning into Centennial College Station. Technical issues with this alignment include horizontal geometry of the alignment, which results in a lower operating speed and potentially higher maintenance needs and the potential for additional noise associated with curved track operations.

The second alignment (Option 2) runs south of the McDonald's Restaurant and continues in a northeasterly direction on tangent until the curve that transitions into Centennial College Station. Technical issues with this alignment include impacts to the McDonald's Restaurant and the placement and height of columns along this section within the valley lands and at the Markham Road Crossing. There is opportunity to mitigate the impacts of the columns within the valley lands by coordinating with stream restoration / relocation works already planned and designed by the City of Toronto and the column locations near McDonald's across Markham Road will be finalized in consultation with Toronto Transportation and McDonald's.

Exhibit 2-21: Elevated structure across Markham Road with columns in middle of road



The operational and maintenance advantages in combination with the ability to mitigate adverse effects provided by Option 2 would be much more beneficial. As such, Option 2 is recommended as the preferred alignment through this section.

The decision to change to this new alignment was discussed with key stakeholders. The general public was provided an opportunity to comment on this final decision during the March 2010 series of public open houses.

2.3.2 Refinements to North Segment of Extension Alignment

2.3.2.1 Centennial College/Progress Road Re-alignment

Centennial College Station

A station in the vicinity of Centennial College will serve the students and staff of the institution with higher-order transit. As illustrated in Exhibit 2-22, there are 2 possible locations where this station can be placed - on the east side of Progress Avenue, adjacent to the Centennial College parking lot, or on the west side of Progress Avenue, adjacent to the Centennial College Student Residence.

East Side of Progress Ave – Not recommended

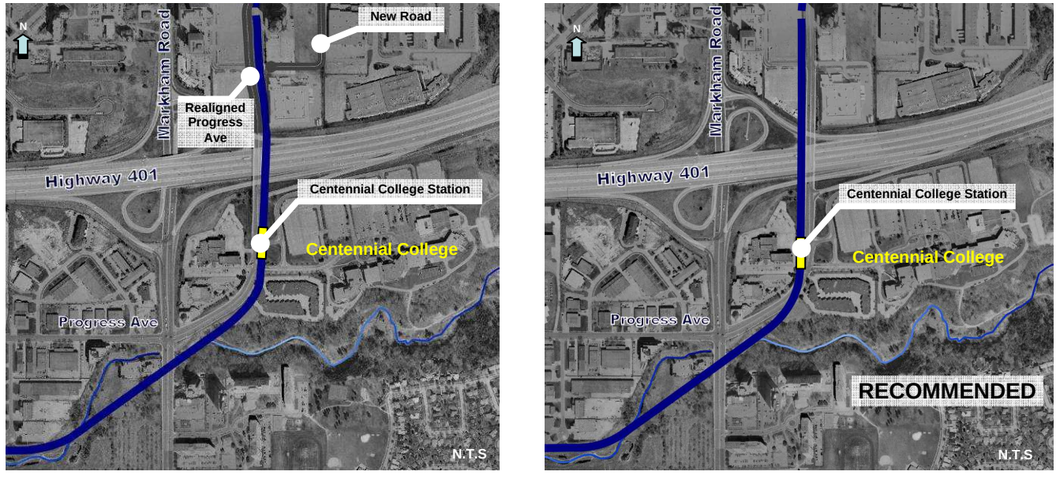
There is a preference for locating the Centennial College station on the east side of Progress Ave. to facilitate a better connection for the Centennial College students. As a result, a new bridge structure would be required on the east side of Progress Ave to cross over Highway 401. Due to the location of the existing ramp onto the highway, the commercial property on the east side of Progress (north of the highway) and the requirements for the SRT service connection, the alignment through Centennial Station would be higher than, and would partially overhang, the current Progress Avenue bridge over Highway 401.This would result in significant challenges for future maintenance of both the existing Progress Avenue bridge and the new SRT structure. Furthermore, this option would require the realignment of Progress Avenue north of Highway 401, which would add costs and adversely affect driveways for the commercial properties on the east side of Progress Avenue, between Highway 401and Milner Avenue.

West Side of Progress Ave - Recommended

As with the east side option, due to the geometry of the west side alignment, the structure may be slightly higher than that of the Progress Avenue bridge. However, with this option, horizontal separation between the two structures can be created, which facilitates easier maintenance in the future. The alignment then transitions from an above ground to an underground section, with limited impact on the existing Progress Avenue road alignment. The only impacts associated with this alignment are the displacement of some existing surface parking and the required closure of the Milner Business Court / Progress Avenue intersection. The latter can be mitigated through the introduction of a new set of traffic signals at Milner Avenue and Milner Business Court.

Consultation with MTO, Centennial College and the business north of Highway 401, was undertaken as part of the preliminary planning activities. All three key stakeholders preferred the west side solution.

Exhibit 2-22: Assessment of East Side versus West Side



2.3.2.2 Abandoned Rail Corridor

The preferred alignment (North Alignment 3) utilizes an abandoned rail corridor (currently owned by Hydro One/City of Toronto) between Milner Avenue and McLevin Avenue. Between Milner and Sheppard, the land has been developed as a park with a community centre at the north end. North of Sheppard, the corridor is open space and is approximately 30m wide with houses on both sides. There is no built form or utilities within this corridor (other than at the Mammoth Hall Trail and Greenspire Road crossings). Environmental impacts associated with the Highland Creek crossing and the presence of stable residential development on both sides are important considerations (see Chapter 3 for details). There are limited opportunities for an at-grade option (see Appendix A-2 for details). With this in mind, there are two potential options for developing an exclusive right of way at grade in this corridor; above grade and below grade.

Exhibit 2-23: Existing Abandoned Rail Corridor, north of Sheppard Avenue

With this in mind, a total of four options were carried forward. They are elevated, elevated covered, below grade open cut and below grade covered. (See Exhibit 2-24 to Exhibit 2-27).

Exhibit 2-24: Elevated Option

Exhibit 2-25: Elevated Covered

Exhibit 2-26: Below Grade Open Cut

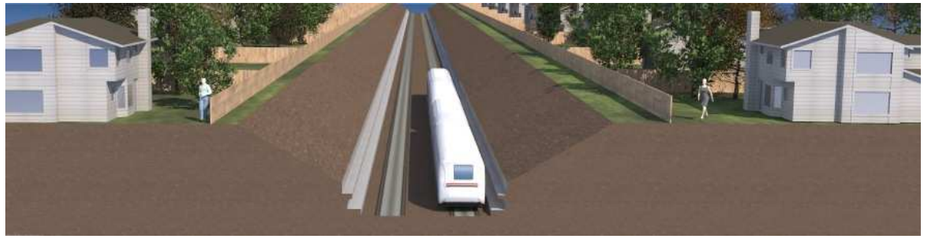
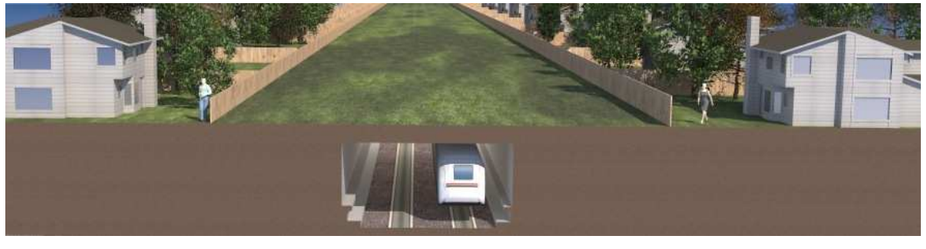


Exhibit 2-27: Below Grade Covered



Initial analysis determined that all four alternatives were similar in impacts and advantages for the majority of the evaluation criteria used during preliminary planning activities up to this point (see Appendix A-4 for details). The key deciding factors are summarized in Table 2-5.

Table 2-5: Summary of considerations in selecting the preferred design within the abandoned rail corridor

	Elevated		Below Grade	
Issues	**Elevated**	**Elevated boxed**	**Open Cut**	**Cut and Cover**
Visual	Limited opportunities to mitigate visual impacts	Limited opportunities to mitigate visual impacts	Visual mitigation includes trees which could be included in slope	Minimal or no visual impacts
Potential for Noise Impacts	Moderate	None	Moderate	None
Snow	Potential for snow accumulation within structure and tracks	No issues	Potential for snow accumulation within structure and tracks	No issues
Shadowing	High shadowing issue - above grade	Highest shadowing issues - larger structure	No shadowing issues	No shadowing issues
Costs	Moderate	Moderate	High	High
Impact on open space / parkland	Some loss of park/ open space. Elevated structure will limit growth of vegetation below structure.	Some loss of park/ open space. Elevated structure will limit growth of vegetation below structure.	417 m of tunneling or cut and cover is required for road/creek crossing. Complete loss of park/open space	Impacts are limited to construction period only RECOMMENDED

The above grade option, while less costly, would result in a high adverse effect on the existing community due to potential noise impacts, visual issues and loss of park/open space. The below grade open cut option may mitigate aesthetic concerns and provide moderate noise mitigation but completely displaces park/open spaces in the community. For TTC, issues of operational challenges due to snow accumulation is of concern. The below grade (cut and cover) option, although more costly, would minimize impacts to the community and address TTC's operational concerns. Therefore, it is the preferred option. Refer to Appendix A-4 for detailed analysis.

2.3.2.3 SRT Extension – Alternative Sheppard Bus Terminal

With Phase 1 terminating at Sheppard, a bus terminal is required to provide a fast and convenient connection between the buses serving northeast Scarborough and the SRT. Two possible locations (Exhibit 2-28) were considered.

Exhibit 2-28: Sheppard Bus Terminal Options

Through a detailed analysis (see Table 2-6 for summary), it was determined that the north option is preferred because it provides better connections to passengers.

Table 2-6: Evaluation of alternative bus terminal locations for Sheppard East Station

Table 1: Sheppard Station Bus Terminal Options			
Objectives	**North**	**South**	**Comments**
A) Minimize Adverse Environmental Effects	◕	●	North Option affects more residences and is closer to a multi storey residential building. It requires two commercial properties. South option affects the park property and the Chinese Cultural Center. The impacts to the community are higher for the North option. The business impacts are higher for the North Option.
B) Transit connections	●	◕	Both Options have similar walking distance from Sheppard LRT to SRT. The South platform option, however, is off away from Sheppard Ave. and therefore requires a much longer connection to other transit. North Option offers a concentrated transfer between all transit system while reducing bus routing times.
C) Cost	●	◕	Capital costs can be considered comparable but operational costs are greater for the South Option.
Overall Summary	●	◕	
	Recommended		

2.3.2.4 Service Connection

The LRT vehicles which will operate on the SRT will initially be stored and maintained at the Sheppard East Maintenance and Storage Facility, which is the subject of a separate Transit Project Assessment. As the mainline tracks on the SRT do not connect to the Sheppard East LRT, a non-revenue service connection will be required between the Sheppard East LRT tracks and the SRT tracks. A range of alternatives (see Exhibit 2-29), including underground and surface connections, were assessed related to community impacts, transit and traffic operations, and cost.

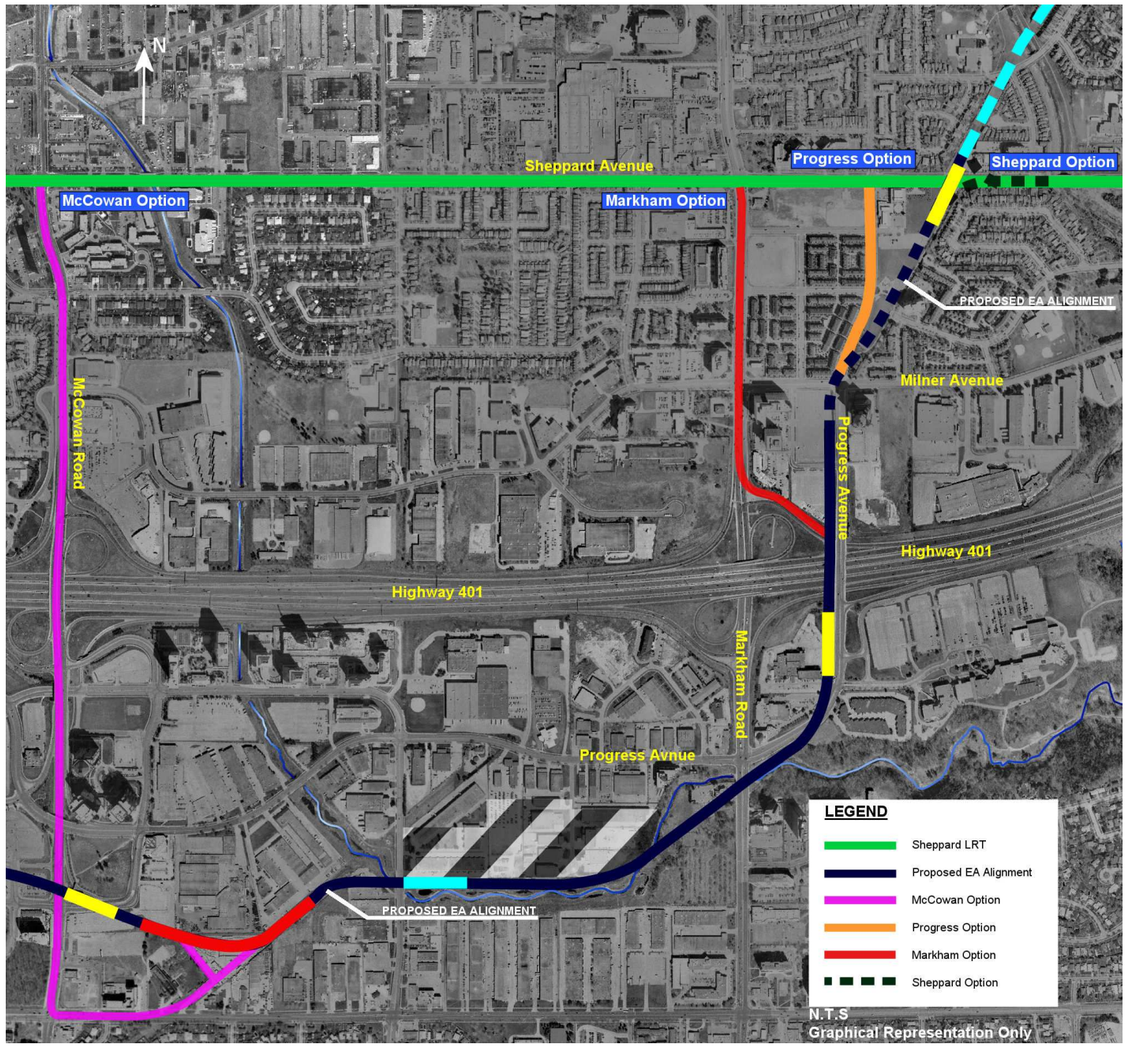
Four alternatives were evaluated as follows:

- **McCowan Option:** The McCowan service connection would connect to Sheppard Avenue at McCowan Road. The vehicles would travel in a semi-exclusive right of way down the middle of McCowan Road and a short section of Ellesmere Ave., thereafter connecting to the SRT alignment in the area currently occupied by McCowan Yard, via the current TTC private driveway. It is the longest and has the highest operating and capital cost of all the options but could eventually become a revenue service line.
- **Markham Option:** The Markham service connection connects to Sheppard Avenue at Markham Road, running south at-grade until Milner Ave. Thereafter the tracks become elevated, roughly following the Highway 401 westbound Markham Road exit ramp alignment to reach Progress Avenue. Elevated connections are then made to SRT main line through a series of complex structures over the Highway 401.
- **Progress Option:** The Progress service connection connects to Sheppard Avenue, running south at-grade until Milner Ave., thereafter becoming elevated as it joins the main line alignment exiting from its portal below grade. Utilizing this option would introduce a fifth-leg at the intersection of Milner Ave and Progress Avenue.
- **Sheppard Option:** This option involves a portal on Sheppard Avenue east of the Sheppard East SRT station connecting to the line underground. This option is the shortest, but is also the most complex due to the numerous utilities and geometric track constraints. The required trackwork necessitates the removal of signals and restrictions of movements at Gateforth as well as major modifications to the Highland Creek crossing on Sheppard Avenue East.

An initial screening determined that due to costs and potential adverse operating effects, the McCowan and Markham option should not be carried forward (see Appendix A-6 for details).

During the final round of consultation (PIC #4 – March 2010) during the preliminary planning stage, it was recommended that only the Progress and the Sheppard option be carried forward into the Transit Project assessment process.

Exhibit 2-29: Service Connections to allow the SRT to utilize the Sheppard East Maintenance and Storage Facility



Both Sheppard Ave. below grade connection and Progress Ave at grade to elevated connection have adverse effects within the community although each affect different areas. Specifically:

- The Sheppard below grade option

1. requires full expropriations of private property (the Progress option does not require any property acquisitions – additional property that is required is currently owned by the City)
2. Accessibility to the community north of Sheppard is reduced as the signalized intersection of Gateforth will be changed to an unsignalized intersection that accommodates right-in/right-out movements only.
3. The below grade connection would impact the Highland Creek
4. The cost of below grade option is approximately double the Progress at grade option.

- The Progress service connection:

- Accessibility is reduced for the Chinese Cultural Centre and the townhouse complex (west side of Progress) for the Progress option
- The operations on Progress will result in noise impact along Progress Avenue for the townhouse on the west side of Progress and north east corner of Sheppard at Progress.

The preferred alternative is the provision of a non-revenue track on Progress Avenue between Sheppard Avenue and Milner Avenue as it provides significant cost savings over other options assessed.