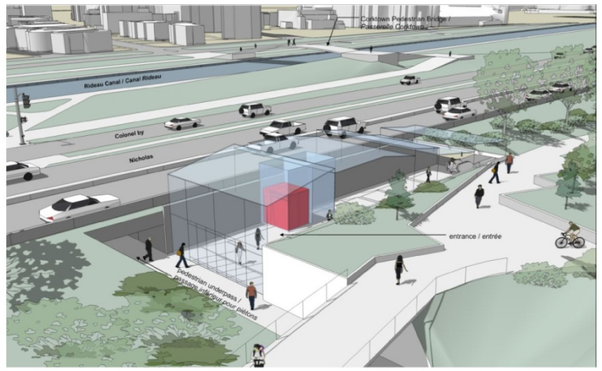
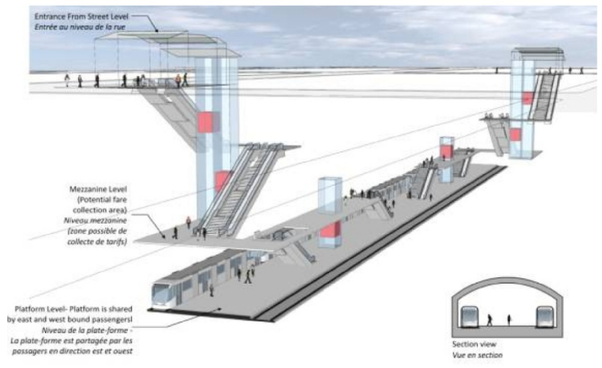
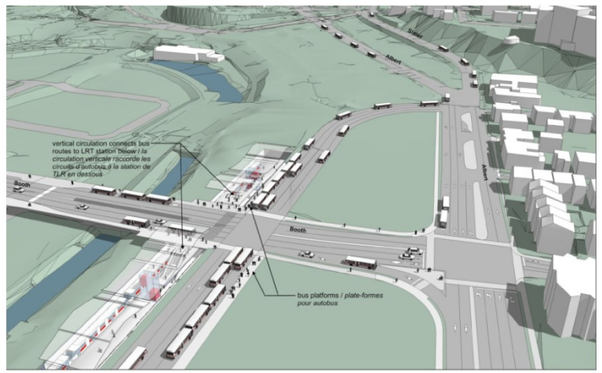
8.0 ALTERNATIVE TRANSIT ALIGNMENTS, STATION DESIGN CONCEPTS AND MAINTENANCE AND STORAGE FACILITY SITES

This section documents the major features in the station areas throughout the corridor, outlines the process that was developed to evaluate the alternatives, summarizes the alternative LRT alignments and station design concepts and presents a preliminary preferred design. The last portion provides similar information on the Maintenance and Storage Facility sites considered, the evaluation process developed and the results of the evaluation.

Sections include:







8.1 Overview of LRT Design Segments

The study area was divided into 10 key design segments in order to develop and evaluate alternative LRT alignments and station design concepts. The preferred design alternative for each segment was then linked to create an overall recommended alignment and design for the entire project.

As the majority of the DOTT project consists of the conversion of an existing rapid transit corridor from bus rapid transit to light rail transit technology, alternative LRT alignments were only considered in cases where existing Transitway geometry was insufficient for conversion to LRT or where a station required major modifications to accommodate LRT facilities, other planned projects or future infrastructure. The chief exception to this is the alignment of the downtown LRT tunnel, which will replace existing on-street bus lanes and therefore requires a new corridor to be developed.

The 10 design segments, illustrated in Figure 8-1, and their key features are:

- Tunney's Pasture – interim western terminal serving the large employment node through an expansion and reorganization of the existing station.
- Bayview – transfer station for the O-Train and potential inter-provincial route via the Prince of Wales Bridge and future development area.
- LeBreton (West Tunnel Portal) – central to LeBreton Flats and a transfer point for buses crossing into Gatineau.
- Downtown (Downtown West Station, Downtown East Station, Rideau Station) – majority of the underground portion of the line serving the downtown, Rideau Centre, Byward Market.
- Laurier – Lees (Campus Station and East Tunnel Portal) – serving the University and development lands to the south.
- Hurdman – providing a major connection to the Southeast Transitway and connection to the development lands immediately north of the station.
- Train – providing a connection to the inter-city rail service and adjacent development lands.
- St. Laurent – connecting to the local bus level (above the corridor) and the adjacent shopping centre.
- Cyrville – providing a connection to development lands northeast and northwest of the station.
- Blair – eastern terminal of the line, providing connections to the East and Cumberland Transitways, local buses, development in the area and the Gloucester Centre.

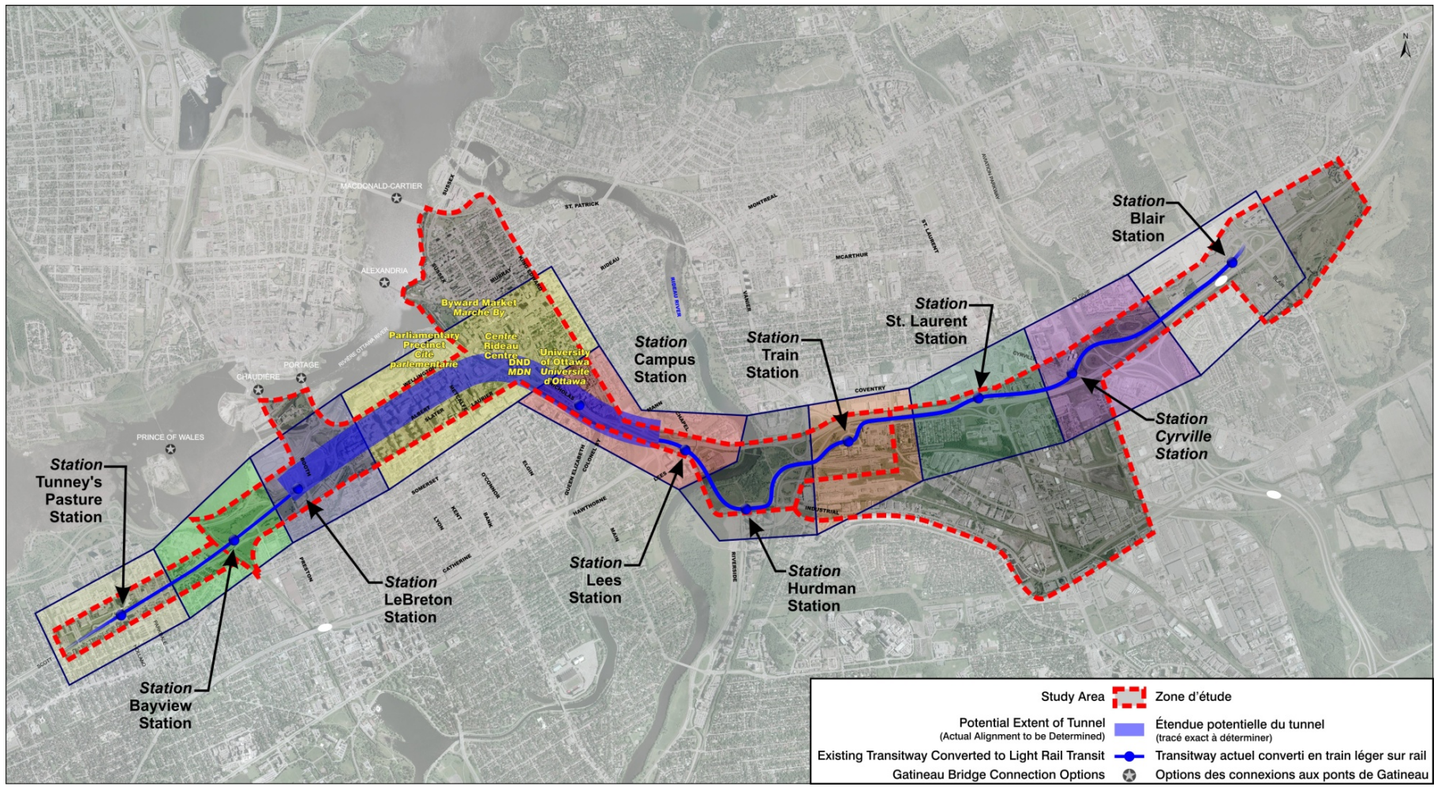


Figure 8-1 - DOTT Design Segments

8.2 *Evaluation Process for Alternatives Within Design Segments*

The alternatives developed for the ten design segments were evaluated using the criteria and methodology outlined below, with the exception of Lees and Cyrville, where only one design alternative for each was developed.

8.2.1Evaluation Criteria

The criteria described below were adopted for the evaluation of alternative alignments and stations for the DOTT project. They are based on the Project Planning Objectives and Design Criteria described in Section 7.0 of this report and were applied to the alternative alignments and station design concepts developed by the Study Team to a level of detail that allows all benefits and effects to be determined.

The Project Planning Objectives and Design Criteria were reviewed to determine the ones that would influence the choice of alternative alignments and stations. Some, such as designing to meet the Ontario Building Code, were applicable to all designs and were not included in the development of Indicators to evaluate the alternatives. From the short list quantifiable and qualitative Indicators were identified as factors considered important to compare alternatives.

The Planning Objectives and related Design Criteria, along with the draft Indicators, were reviewed with the Consultation Groups to ensure that they were appropriate and reflect the effects of the alternatives in relation to each area. After integrating comments from the Consultation Groups where appropriate, the evaluation of alternatives was conducted by the Project Study Team and the results were presented to the Consultation Group members for their feedback.

Table 8-1: Evaluation Criteria for Alternative LRT Alignments and Station Design Concepts

Design Criteria		Indicator
Objective A: Increase Transit Ridership and Mobility		
A-1	Modal Split Target	Ability to accommodate high service frequencies
		Compatibility with existing or planned transit, pedestrian and cycling networks
		Existing and future population/employment densities served
A-2	Rapid Transit Travel Time	Number of curves that restrict speed
		Overall length of the alignment
		Station spacing
A-3	Travel Comfort	Number of curves that restrict speed (or require maximum superelevation)
		Maximum % grade
		Maximum station depth
		No. of curves less than 100 m radius
A-4	Rapid Transit Network Connectivity	Connections to existing and future rapid transit links
		Directness of transfers to/from different rapid transit lines
		Ability to interline services
A-5	Bus Transit Network Connectivity	Connections to existing local OC Transpo bus routes
		Ability to provide dedicated local transit facilities
		Directness of transfers to/from local bus routes
A-6	Interprovincial Transit Connectivity	Connections with existing STO transit service
		Provides opportunity for future Ottawa-Gatineau rapid transit links
		Directness of transfers to/from STO transit
A-7	Passenger Rail Connectivity	Directness of link to VIA Rail Station
		Directness of transfers to/from VIA Rail Station
A-8	Pedestrian Network Integration	Connections to dedicated pedestrian facilities
		Number of pedestrian crossings closed/diverted
		Compatibility with future pedestrian networks in planned development areas
A-9	Cycling Network Integration	Connections to cycling facilities
		Ability to provide accommodate bicycle parking, access
		Number of cycling crossings closed/diverted
		Compatibility with future cycling networks in planned development areas
A-10	Recreational Pathway Integration	Connections to multi-use pathway system
		Provision of parallel pathways
		Number of recreation pathway crossings closed/diverted
		Compatibility with future pathway networks in planned development areas
A-11	Road Network Integration	Connections to road network
		Provision of pick-up/drop-off facilities
		Number of roads closed/diverted
		Compatibility with future local road networks in planned development areas
Objective B: Enhance Ottawa's Urban Character and National Stature		
Design Criteria		Indicator
B-1	National Capital Symbolism	Connections to important Capital destinations
		Supports NCC Plan for Canada's Capital
B-2	Downtown Ottawa	Compatibility with Downtown Urban Design Strategy
		Supports NCC Core Area Sector Plan
		Compatibility with the Escarpment Plan
B-3	Arrival Route	Offers scenic views on approach to downtown
		Portal locations integrate into landscape
B-4	Civic Places	Connections with existing or planned civic spaces
		Ability to create vibrant public spaces
		Ability to revitalize underutilized public spaces/areas
B-5	Architectural Quality	N/A
B-6	Views	Maintains and enhances existing and protected views and vistas
		Provides opportunities for riders to experience views
B-7	Streetscaping	Ability to integrate station entrance locations into streetscape
B-8	Private Property Integration	Ability to integrate station entrances into private property
		Provides multiple options for entrance locations
		Ability to provide seamless and cohesive station access locations within private property
		Supports downtown development objectives
B-9	Public Art	N/A
Objective C: Stimulate Smart Growth		
Design Criteria		Indicator
C-1	TOD Intensification	Station locations in proximity to existing or planned higher density uses
		Station locations in proximity to vacant or underutilized lands with the potential for higher density development
C-2	Mixed Use Centres	Station locations support designated Mixed-Use Centres
		Ability to provide station entrances in Mixed-Use Centres
C-3	Brownfield Reinvestment	Ability to stimulate private investment in brownfield redevelopment
C-4	Downtown Business Vitality	Station locations in proximity to major downtown office and retail destinations
Objective D: Create Successful Rapid Transit Stations		
Design Criteria		Indicator
D-1	Capture Area	Existing and future population/employment densities within 300/500 m walking distance of stations
		Percentage of downtown inside 300/500 m walking distance to a station
D-2	Building Integration	Opportunities for station integration with existing or planned development
		Opportunities for station integration with existing or planned tourist destinations
		Ability to provide below-grade retail connections at stations

Design Criteria		Indicator
D-3	Personal Services	N/A
D-4	Spacing	Average station spacing
		Number of stations less than 500 m apart
		Number of stations more than 1000 m apart
D-5	Capacity	Ability to provide station facilities matching expected ridership for the year 2031
		Ability to provide capacity for special events crowds
D-6	Passenger Circulation in Stations	Station depth
		Ability to provide direct connections from grade
		Minimizes number of level changes required from platform to grade
D-7	Transfer Stations	Directness of transfer movements
		Avoids conflicts between vehicles
		Supports safe and efficient movement of vehicles
		Supports safe and efficient movement of people
D-8	Platform Length	180 m platform length accommodated easily
D-9	Platform Access	Ability to provide multiple platform access points
D-10	Building Code	N/A
D-11	Barrier Free Design	Maximum station depth
		Ability to provide direct platform to grade connections
		Minimizes number of level changes required in underground and transfer stations
D-12	Elevating Devices	Ability to provide elevator and escalator redundancy
		Minimizes number of level changes
D-13	Wayfinding	Ease of orientation
		Station depth
		Station access locations in proximity to major destinations
D-14	Branding	N/A
D-15	Durability and Maintenance	N/A
D-16	Noise and Vibration Management	Station locations in proximity to sensitive uses
		Station locations in proximity to residential uses
D-17	Ventilation	N/A
D-18	Ventilation Exhaust	N/A
D-19	Fare Collection	Ability to provide adequate space at station locations
D-20	Signals and Communication	N/A
D-21	Climate Control	N/A
D-22	Personal Safety	N/A
D-23	System Security	N/A
Objective E: Provide Safe and Efficient Linear Infrastructure		
Design Criteria		**Indicator**
E-1	Route Length	Minimizes length of route
		Minimizes length of tunnel
E-2	Transitway Co-alignment	Length of existing Transitway alignment reused

Design Criteria		Indicator
E-3	Transitway Conversion	Provides interface with existing Transitway facilities
E-4	Mainline Track Curvature	Minimum curve radius
		# of curves under 150 m
		# of curves between 150 – 425 m
E-5	Balanced and Unbalanced Superelevation	Length of track required to use maximum balanced superelevation
		Length of track required to use maximum unbalanced superelevation
E-6	Clearance Envelope Calculation	N/A
E-7	Track Centres	N/A
E-8	Track Gauge	N/A
E-9	Track Structure	Amount of special track structure required
E-10	Vertical Curves	Maximum vertical curve radius
E-11	Track Grades	Maximum grade (% and length)
		Length of grade exceeding 3.5%
E-12	Station Grades	Maximum station grade
		Avoids station placement on crest curves
E-13	Special Trackwork and Storage Tracks	Ability to provide special trackwork and storage tracks
		Maximum grade for special trackwork
		Ability to provide storage tracks at key locations
E-14	Electrical Power Substations	Ability to integrate substations at station locations
E-15	Municipal Services and Utilities	Avoids major utilities
		Minimizes relocation of utilities
		Allows utilities to cross alignment at a right-angle
E-16	Emergency Vehicle Access	Ability to provide emergency vehicle access at key points
		Number of road closures/diversions required
E-17	Underground Structures	N/A
E-18	Bridge Structures	N/A
E-19	Seismic Rating	N/A
E-20	Aesthetic	N/A
Objective F: Provide a Safe and Efficient Tunnel and Compatible Portals		
Design Criteria		**Indicator**
F-1	Design Life	N/A
F-2	Tunnel Clearance Envelope	N/A
F-3	Seismic Rating	N/A
F-4	Services and Utilities	Number of main/trunk utilities to be relocated
		Number of deep structures impacted
F-5	Groundwater and Settlement	Length alignment with groundwater and/or settlement potential

Design Criteria		Indicator
F-6	Landscape Integration	Ability to integrate portal locations into existing or planned development
		Portal locations make use of existing natural features
F-7	Environmental Features	Alignment avoids environmental resources or contaminated soils
		Alignment avoids archaeological resources
		Alignment avoids built heritage structures
F-8	Drainage	Minimize surface runoff into tunnel at portal locations
		Stations and alignment low points can be easily connected to adjacent storm/sanitary sewers
Objective G: Be Compatible with Adjacent Communities and Buildings		
Design Criteria		**Indicator**
G-1	Community Cohesion	Ability to integrate alignment into surrounding community
G-2	Business Asset	Supports existing and planned commercial activity areas
		Maximizes connectivity with existing and planned commercial buildings
G-3	Open Space Integration	Ability to provide parallel recreational pathways
		Number of recreational pathway closures/diversions
G-4	Noise and Vibration Reduction	Ability to minimize noise impacts on adjacent land uses
		Ability to minimize vibration impacts on adjacent land uses
		Direct impact on sensitive receptors
G-5	Air Quality	Maximizes reduction in bus traffic
		Efficient bus movements at transfer stations
G-6	Lighting	N/A
G-7	Heritage Resources	Number of heritage structures impacted
		Minimizes impact to heritage conservation districts
G-8	Archaeological Resources	Number of archaeological sites potentially impacted
G-9	Visual Environment	Visual impact on people living/working in proximity to corridor
		Opportunity to provide views for riders of system
		Avoids/minimizes impact on protected views
G-10	Private Property Requirements	Minimizes need for encroachment on private lands
		Minimizes private property acquisition
		Minimizes number of easements required
G-11	Property Access	Number of private property accesses impacted
Objective H: Maintain or Improve Natural and Physical Environments		
Design Criteria		**Indicator**
H-1	Terrestrial Habitats	Number and area of terrestrial habitats displaced or disturbed
		Type of terrestrial habitat displaced or disturbed
		Significance of terrestrial habitat displaced or disturbed
H-2	Aquatic Habitats	Number and area of aquatic habitats displaced or disturbed
		Type of aquatic habitat displaced or disturbed
		Significance of aquatic habitat displaced or disturbed
H-3	Urban Forest	Number of street trees disturbed or displaced
		Amount of urban forest disturbed or displaced
		Opportunity to provide new urban forest

Design Criteria		Indicator
H-4	Ground Water and Soils	Minimizes groundwater impacts
		Minimizes impact to load bearing capacity of soils
H-5	Surface Water	Ability to maintain or improve run-off quality
H-6	Snow Management	Ability to provide for snow storage within corridor
		Minimizes likelihood of snow accumulation
Objective I: Showcase Sustainable Design Best Practices		
Design Criteria		**Indicator**
I-1	Reduced Energy Demand	Provides opportunities for energy efficient station and system design
		Ability to integrate design solutions to minimize energy use
I-2	Energy Conservation	Ability to accommodate energy conservation plan
I-3	Alternative Energy Supply	Ability to accommodate alternative energy sources
I-4	Corridor Greening	Amount of additional landscape area provided
		Ability to provide new greenspace
I-5	Naturalized Drainage	Maximizes natural drainage opportunities
1-6	Green Roofs	Ability to accommodate green roof technology
1-7	Natural Lighting	Station Depth
		Ability to provide natural light penetration at underground station locations
1-8	Infrastructure Reuse	Maximizes use of existing infrastructure
		Numbers of new structures required
1-9	Recycled Materials	N/A
1-10	Local Materials	N/A
1-11	Waste Management	Ability to accommodate spoil storage
		Minimizes construction waste
1-12	Toxics Reduction	N/A
Objective J: Manage Construction Disruption and Risk		
Design Criteria		**Indicator**
J-1	Construction Mitigation Strategy	Ability to minimize construction disruptions
J-2	Communications	N/A
J-3	Community Organizations	N/A
J-4	Traffic Management	Number of signalized intersections impacted
		Number of road closures/diversions required
		Number of sidewalk closures/diversions required
		Number of recreational pathway closures/diversions required
J-5	Project Streamlining	Ability to integrate with other planned infrastructure projects
J-6	Business Access	Number of businesses impacted
J-7	Project Work Sites	Ability to provide adequate project work sites
J-8	Contaminated Sites	Minimizes number of contaminated sites impacted
J-9	Hazardous Materials, Spills and Accidents	N/A
J-10	Monitoring	N/A

Design Criteria		Indicator
Objective K: Result in a Wise Public Investment		
Design Criteria		**Indicator**
K-1	Capital Cost	Length of route
		Length of tunnel
		Minimizes complex infrastructure requirements
		Length of route where special provisions will have to be made
K-2	Maintenance and Operating Cost	Minimizes operating cost
K-3	Replacement Cost	Minimizes complex infrastructure requirements
		Minimizes initial capital cost
K-4	Total Life Cycle Cost	Minimizes total life cycle cost
K-5	Social and Environmental Benefits	N/A
K-6	Private Landowner Benefits	Maximizes private development opportunities
		Maximizes potential "uplift"
K-7	Public Fiscal Benefits	Maximizes economic spin-off

8.2.2 Evaluation Methodology

A comparative evaluation methodology was followed, with each alternative ranked in terms of its "Responsiveness" to the relevant Design Criteria on a scale of 0-3, from most to least responsive, using the Indicators identified. The overall most responsive alternative was then identified by summarizing the degree to which each of the Design Criteria and associated Indicators were met, creating a score for each Design Criteria.

The score for each Design Criteria was then averaged to create a summary score for each of the eleven Objectives.

The evaluation of alternatives resulted in a single option for each design segment being adopted. The preferred alternative for each design segment was then linked together in order to create a preferred alignment for the entire DOTT study corridor.

8.3 Evaluation of Alternative LRT Alignments and Station Design Concepts

The number of alternatives developed for each of the ten segments was largely dependent on the amount of Transitway infrastructure already in place, future development plans, and the functions that need to be accommodated at each site. In this section there is an overview of each of the 10 design segments, a description of the alternatives, a summary of the analysis and a recommended alternative.

8.3.1 Tunney's Pasture

Overview

The Tunney's Pasture segment includes the western limits of the preferred LRT alignment which follows the existing Transitway alignment from Tunney's Pasture Station to Parkdale Avenue. Tunney's Pasture Station will serve as the western terminus for BRT service from the west and southwest until such time that the LRT system is expanded further in accordance with the Transportation Master Plan (TMP). The Station will accommodate bus and rail transfers for approximately 9,000 passengers per hour during peak operating times. Tunney's Pasture is a major employment node for the federal government (second only to downtown Ottawa). The station will be designed to accommodate transfers between LRT and BRT for trips not destined to Tunney's Pasture on an interim basis until LRT is extended to Baseline Station. The facility will provide a turn-around for BRT. There will be a need to have some transit continuing on Scott Street to facilitate connections to the O-Train and Gatineau services at Bayview and LeBreton stations. Bus operation on Scott Street will be minimized to mitigate the impact on adjacent lands and allow the federal campus to proceed with its development initiatives.

Two station design concepts were developed and evaluated:

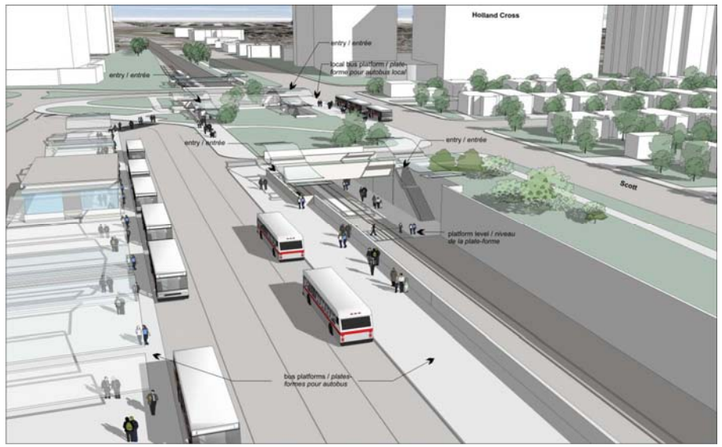
- Parallel Option
- Linear Option

Parallel Option

In this concept, a temporary BRT facility would be constructed on open lands (owned by Public Works and Government Services Canada) located north of the existing Transitway station. This temporary facility would be reached via the existing bus access ramp located west of the station, which

would be modified to lessen the grade of the ramp. The temporary BRT facility would be linked to the lower level LRT platforms via a fully accessible underground passageway and would be capable of accommodating BRT services arriving from the west and turning them around without impact to the adjacent road network. A small bus lay-up facility can be accommodated to the west of the temporary BRT platforms.

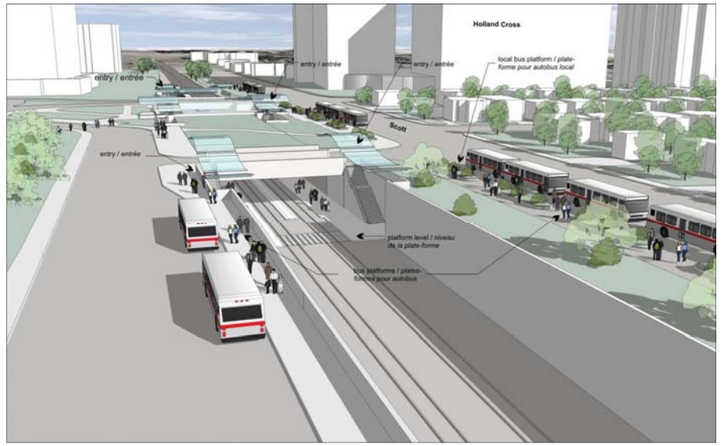
Figure 8-2: Tunney's Pasture Parallel Option



Linear Option

In this concept, temporary bus platforms would be located on the north side of Scott Street, along the southern frontage of the existing Transitway station. Buses would use the existing bus access ramp located to the west of the station to access Scott Street via the Tunney's Pasture complex and continue further east. This concept does not require any additional land and would be cheaper to construct but has greater impacts to traffic and residential development along Scott Street. The westernmost stops, when required, will not permit buses to access the Transitway at Tunney's Pasture. Buses using this stop would have to use Scott Street to access the Transitway at Westboro Station.

Figure 8-3: Tunney's Pasture Linear Option



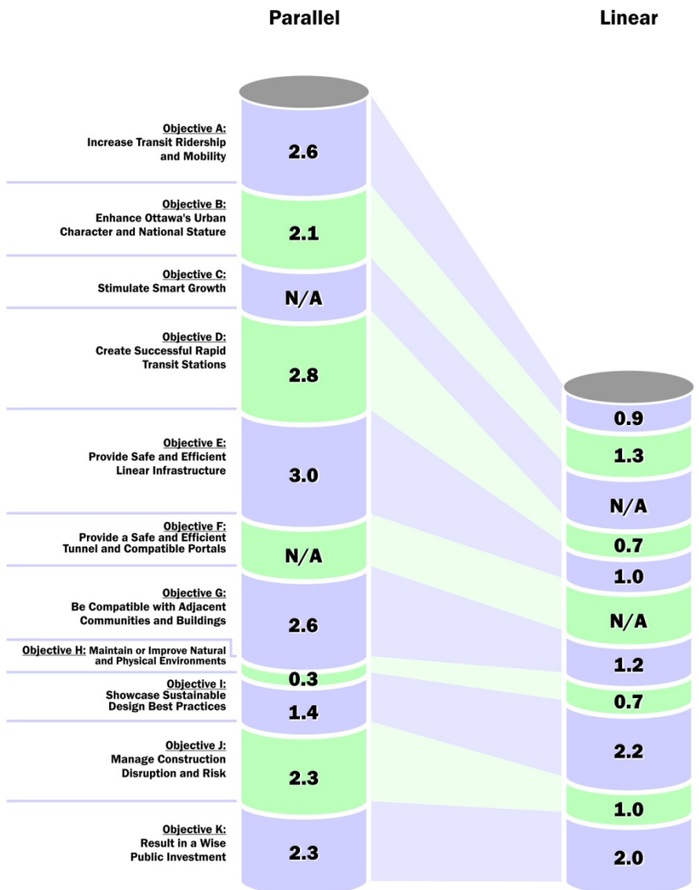
Evaluation and Recommendation

The Parallel Option scored higher in many categories as it can accommodate the required transfers with minimal impact on residential areas by locating bus activity further north and allowing most buses to terminate without using Scott Street; removes conflicts between buses and passengers; contains the majority of the bus activity off of the road network and can be easily reconfigured when the line is extended. The size of the platform and the circulation of buses will need to be resolved in the functional planning stage. Allowing passengers to cross the tracks access to the south platform, rather than crossing the bus driveway, was preferred to minimize potential conflicts and maintain pedestrian safety. The design of the track crossing will require more design work.

The Parallel Configuration ranked highest in the evaluation of alternatives and is recommended because it provides an efficient way to run BRT in and out of the Transitway west of the station and it also provides an adequate lay-by area. This configuration also addresses bus service that will remain on Scott Street to serve local and through service by minimizing bus volumes on this roadway.

The evaluation of the Parallel and Linear design concepts is summarized in Figure 8-4.

Figure 8-4: Evaluation of Tunney's Pasture Options



8.3.2 Bayview

Overview

This segment includes Bayview Station that currently serves as a transfer station for the O-Train and as a staging/waiting area for buses serving the downtown. The segment follows the existing Transitway corridor from Parkdale Avenue to Preston Street.

The new LRT station will provide a connection with the North-South corridor and protect for a potential future connection to Gatineau via the Prince of Wales Bridge. Reuse of existing infrastructure, including two bridge structures built for the Transitway and roads will help contain costs for the LRT lines intersecting at this location. The alignment and station design seeks to maximize the development potential for lands adjacent to the station that are in both public and private ownership. A concept plan for the City's Bayview site and the Bayview-Carling Community Development Plan were considered in the preparation of the alignment options.

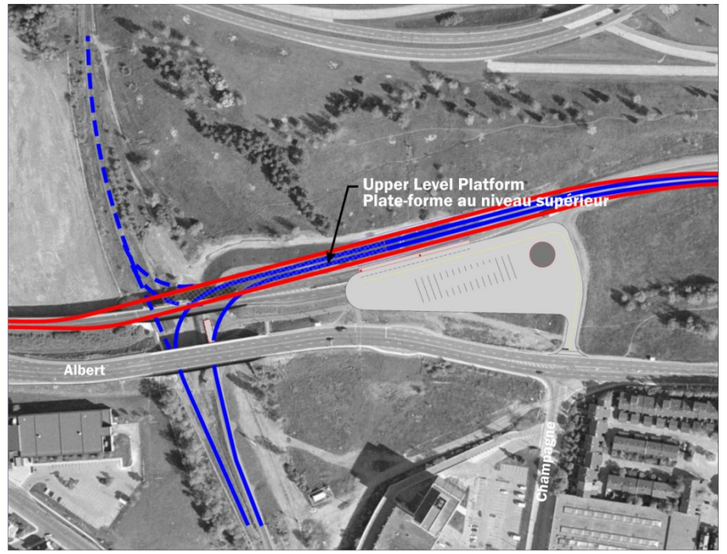
Two station design concepts were developed and evaluated:

- Direct to Downtown Option
- Transfer "T" Option

Direct to Downtown Option

In this concept, a continuous connection from the North-South LRT line to the core area is provided, without having passengers transfer. This alignment uses more track and takes up more area than the Transfer "T" alignment, thereby adding costs to the project and potentially affecting the development potential of surrounding properties.

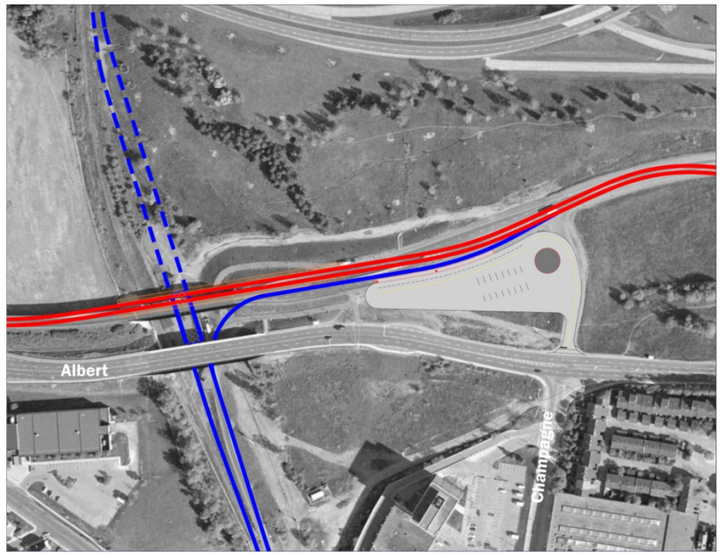
Figure 8-5: Bayview "Direct to Downtown" Option



Transfer "T" Option

In this concept, passengers from the south would be required to transfer to the new LRT line and in essence Bayview Station becomes the terminus of the future North-South LRT line, until such time as decisions are made regarding the disposition of an interprovincial transit strategy. This station option would provide for a service and tail track for moving trains between the lines in the future as well as ensuring that short ending trains is possible to provide better service during peak hours and for special events such as Canada Day celebrations and festivals.

Figure 8-6: Bayview Transfer "T" Option

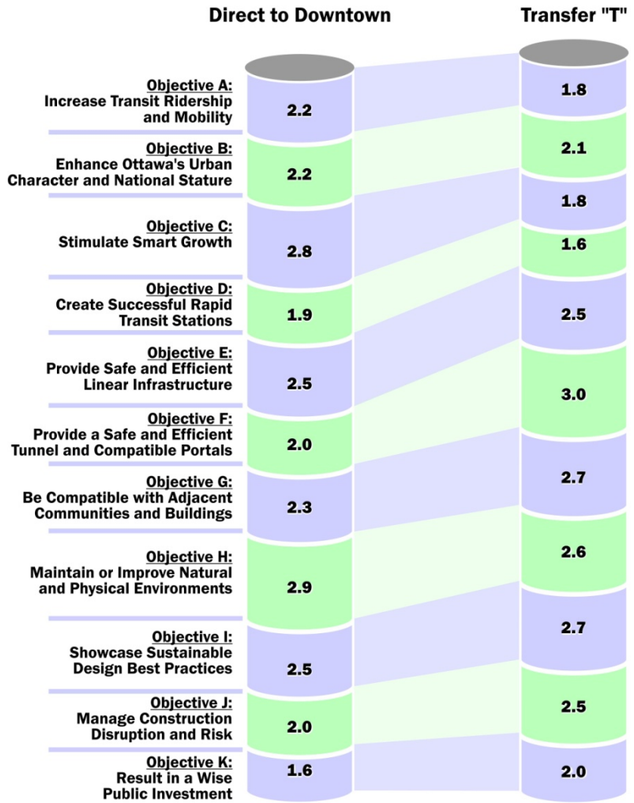


Evaluation and Recommendation

The major difference between the options is the degree to which they protect for a range of potential futures. The Direct to Downtown Option is configured to allow for interlining of trains into the downtown from the south, and potentially the north, but could be easily reconfigured to permit platform to platform transfers if the south and north legs were to be connected in the future. During the next design stage, the focus will be on determining if the track geometry can be accommodated and how the structural system for the elevated station can be configured to minimize cost yet protect for a range of futures.

Although the Transfer "T" Option scores marginally higher when ranked against the evaluation criteria, discussions with stakeholders indicated a strong desire for a direct link between downtown and important destinations to the south. Therefore, the Direct to Downtown Option was selected as the preferred design alternative for this segment. Although it will be marginally more expensive than the other option, it does preserve a direct connection to the core from the Ottawa Macdonald-Cartier International Airport and between Carleton University and the University of Ottawa.

Figure 8-7: Evaluation of Bayview Station Options



8.3.3 LeBreton

Overview

This segment runs from Preston Street to the escarpment and generally follows the existing Transitway corridor route to Booth Street and then continues easterly toward the escarpment. The LeBreton alignment and station will complement redevelopment of the LeBreton Flats and also continue to serve as a transfer point to Gatineau via Booth Street and the Chaudière Bridge crossing. This is an important transfer point to employees headed to Place de Portage, Terraces de la Chaudière and for transit riders entering the city from Gatineau.

The corridor is in an open trench west of Booth Street and continues below grade towards Brickhill Street where the trench is deep enough to launch the tunnel-boring machine into the limestone bedrock. The tunnel portal will be situated near this location. The proposed grade and gradient of the alignment effectively takes advantage of the existing topography and minimizes impact on nearby features such as the aqueduct, tailrace and existing roads. This configuration is consistent with development plans for the area and provides for the potential for joint development on the City's escarpment lands. The corridor will be designed to allow development to proceed over top of the alignment.

Three design concepts were developed and evaluated for LeBreton:

- Bus/Booth At-Grade Crossing Option
- Transit Under Booth Street Option
- Buses on Booth/Albert Option

In all three options, the LRT alignment would be located slightly to the south of the existing Transitway alignment in an open trench starting to the west of Booth Street. This would permit a reconstructed Booth Street to cross over the LRT corridor via a new bridge structure. A centre platform configuration for the LRT station would be provided. The primary difference between the three options developed concerns how bus transit is accommodated at this location.

Bus/Booth At-Grade Crossing Option

The Bus/Booth At-Grade Crossing configuration accommodates short-to medium-term bus operations with a temporary bus facility south of the new LRT alignment. This bus roadway would cross Booth Street at grade, much the way it does today.

Figure 8-8: LeBreton Bus/Booth At Grade Crossing Option

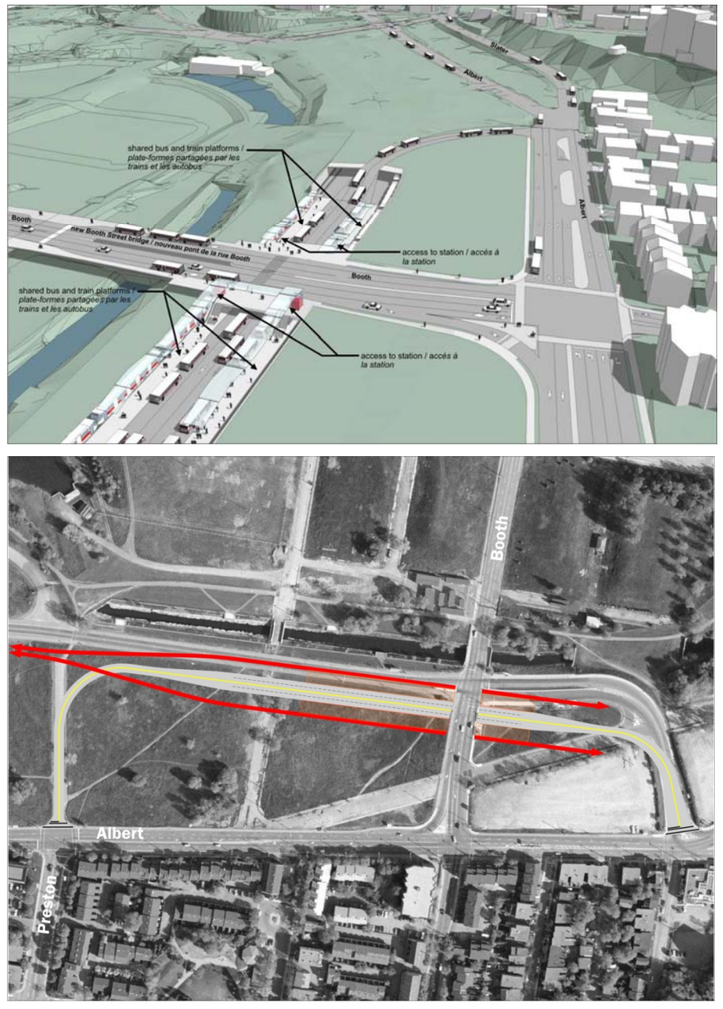
This configuration would permit 'bus-to-bus' transfers at grade with connections to the LRT corridor below Booth Street provided from the new Booth Street bridge spanning the LRT station. This option serves the Gatineau/Ottawa transportation connection and the LRT component and is consistent with plans to serve the future development of the LeBreton area; however, the temporary bus lanes would delay future development south of the aqueduct, and there are some throw-away costs associated with the temporary bus facilities.

Transit under Booth Street Option

This concept accommodates short-to-medium-term bus operations with a temporary bus facility located within the LRT corridor, at the same level as the LRT platforms and extending under the new Booth Street bridge.

This configuration would permit most 'bus to rail' transfers from a common platform. In the long-term, area occupied by the bus roadway could be converted to public space. This option serves the Gatineau/Ottawa transportation connection and the LRT component but is not consistent with plans to serve the future development of the LeBreton area due to additional land requirements. There are significant costs associated with the temporary bus facilities.

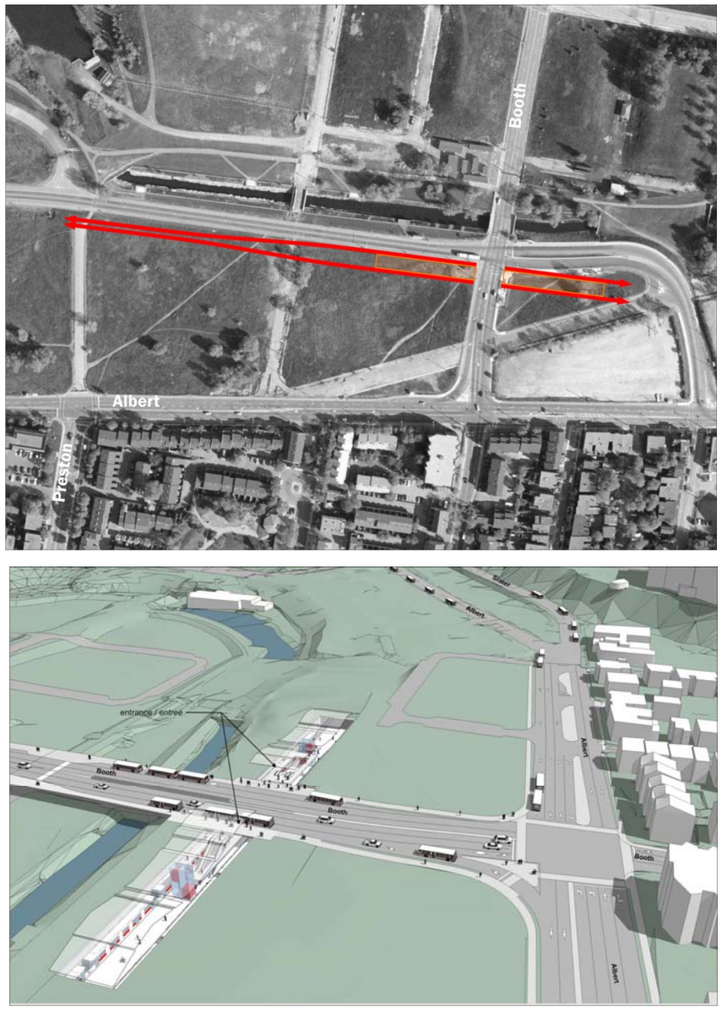
Figure 8-9: LeBreton Transit Under Booth Street Option

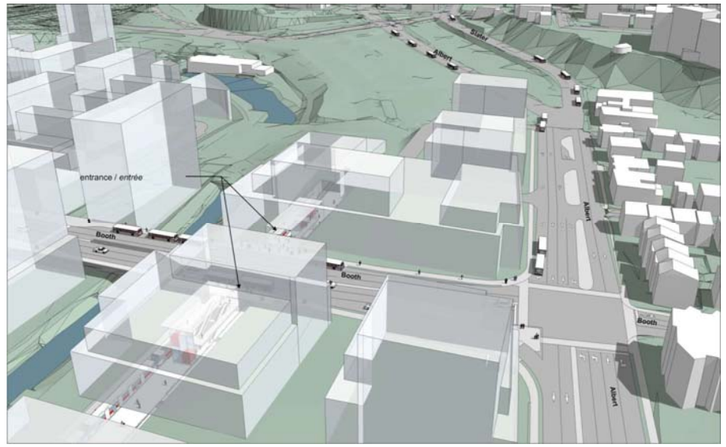


Buses on Booth/Albert Option

This concept would accommodate bus operations on the new Booth Street bridge over the LRT Corridor, which would be wide enough to accommodate bus lanes and waiting areas for passengers. Transit users transferring at this location would be well served from either direction with minimal travel time between stations and platforms.

Figure 8-10: LeBreton Bus on Booth/Albert Option



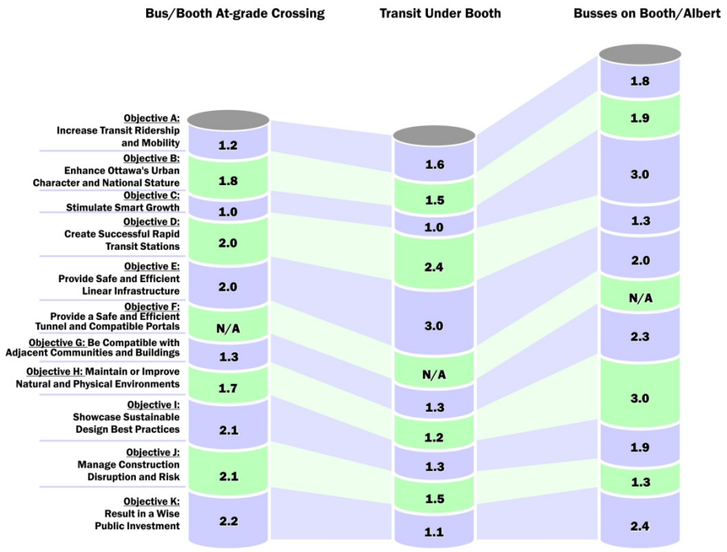


Evaluation and Recommendation

The Buses on Booth/Albert Option is recommended as it is consistent with the NCC's development plans, the Booth Street bridge design and provides an efficient transfer between the LRT and buses serving the Chaudière Crossing into Gatineau. This option would also allow residential development south of the aqueduct to proceed more quickly as no land would be required for temporary bus infrastructure. The recommended option provides for flexibility in the implementation of decisions that will arise from the Interprovincial Transit Strategy.

The decision to limit bus activity east of the station also favours the Buses on Booth/Albert option. The number of traffic lanes and the number of auxiliary lanes at the Booth/Albert intersection will need to be investigated during preliminary design.

Figure 8-11: Evaluation of LeBreton Station Options



8.3.4 Downtown LRT Tunnel

Overview

The Downtown Transit Tunnel segment includes the area through the downtown core from the escarpment to King Edward Avenue. A number of alignment configurations were explored to construct a tunnel across the downtown core, grouped into three families of similar configurations. These included:

- Single Tunnels Under Parallel Streets (3 alternatives)
- Single or Twin Tunnels Under One Street (4 alternatives)
- Single or Twin Tunnels Under Downtown (1 alternative)

All major east-west roads within the study area were considered for possible tunnel alignments, with the exceptions of Wellington Street and Laurier Avenue, which were not considered because of proximity to sensitive federal lands in the parliamentary precinct and poor geotechnical conditions, respectively. In addition, these road corridors are located toward the edge of the developed areas, rather than being centrally located in the core for convenience of accessibility.

8.3.4.1 Single Tunnels Under Parallel Streets (Alternatives 1-3)

This family of alignment alternatives uses twin, single tunnels, under parallel streets (westbound under one street and eastbound under the other, similar to the existing surface Transitway). H-shaped stations would connect westbound and eastbound platforms, with north-south streets used for a central station access. These alignments minimize encroachment under adjacent lands by using public right-of-ways for the tunnel alignment.

Three alternatives were developed for this configuration:

Albert and Slater Streets (Alternative 1)

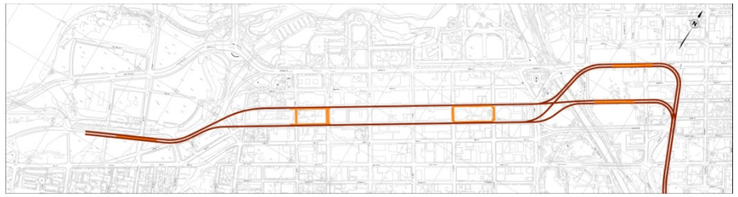
- Westbound tunnel under Albert, eastbound under Slater (under existing Transitway)
- Station east of the canal under Mackenzie-King Bridge

Figure 8-12: Albert/Slater Alternative Alignment

Albert and Queen Streets (Alternative 2)

- Westbound tunnel under Queen, eastbound under Albert
- Station east of the canal under Mackenzie-King Bridge or Daly

Figure 8-13: Albert/Queen Alternative Alignment



Queen and Sparks Streets (Alternative 3)

- Westbound tunnel under Sparks, eastbound under Queen
- Station east of the canal located under Rideau or Daly

Figure 8-14: Queen/Sparks Alternative Alignment

All three of these alternatives work well west of Elgin Street, but require relatively sharp curves to transition to the Waller/Nicholas alignment east of the Rideau Centre, although the northernmost alternatives could more easily accommodate the curves.

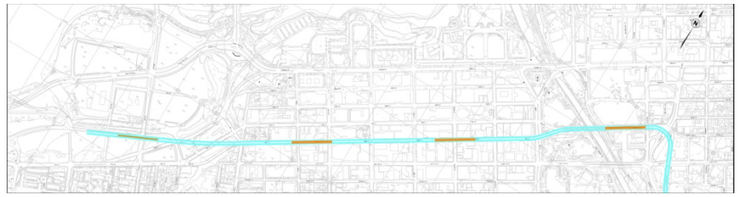
8.3.4.2 Single or Twin Tunnels Under One Street (Alternatives 4-7)

This family of alignment alternatives uses a single larger tunnel or two smaller twin tunnels under one street. Centre, side or stacked platform configurations are possible for the stations. Some encroachment under adjacent lands would be required at station locations due to the narrow public rights-of-way within the downtown area. Four alternatives were developed for this configuration:

Slater Street (Alternative 4)

- Station east of the canal under Mackenzie-King Bridge
- Catchment area includes stable residential area south of Laurier, which could increase pressure for redevelopment

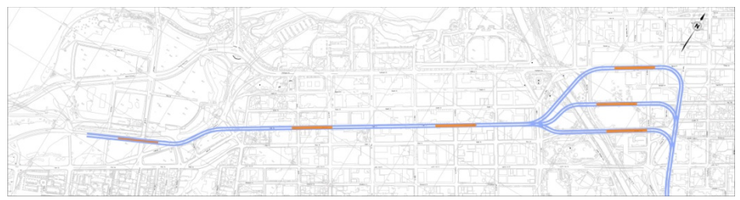
Figure 8-15: Slater Alternative Alignment



Albert Street (Alternative 5)

- Station east of the canal under Mackenzie-King Bridge, Daly or Rideau
- Catchment centered on downtown
- Most flexibility for route east of the Rideau Canal

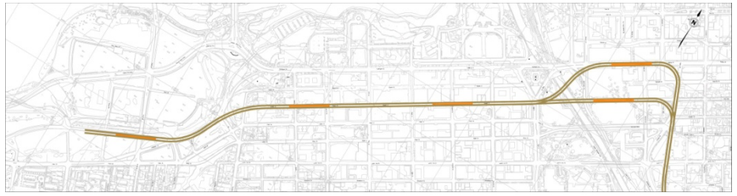
Figure 8-16: Albert Alternative Alignment



Queen Street (Alternative 6)

- Station east of the canal under Daly or Rideau
- Catchment area beginning to extend too far north
- Cannot serve a station at the MacKenzie King Bridge

Figure 8-17: Queen Alternative Alignment



Sparks Street (Alternative 7)

- Station east of the canal under Daly or Rideau
- Catchment area extends too far north, reducing the ability to attract riders

Figure 8-18: Sparks Alternative Alignment

All four of these alternatives work well west of Elgin Street, but require relatively sharp curves to transition to the Waller/Nicholas alignment east of the Rideau Centre, although the two northernmost alternatives could more easily accommodate the curves.

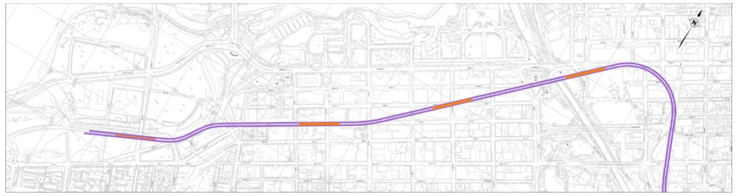
8.3.4.3 Single or Twin Tunnels Under Downtown (Alternative 8)

This alignment configuration uses a single large tunnel or twin single tunnels under the downtown. The alignment would not follow a single street, and would require significant encroachment under adjacent lands to construct. Centre, side or stacked station configurations possible. A single alternative was developed for this configuration:

Cross Country (Alternative 8)

- Diagonal alignment from Albert Street in the west to Rideau Street in the east
- Station east of the canal under Rideau Street, with connections to east and west sides

Figure 8-19: Cross Country Alternative Alignment



Evaluation and Recommendation

The evaluation determined that the further north the alignment runs, the further north the catchment area of the stations shifted. This resulted in more of the station catchment area covering Parliament Hill and the Ottawa River which generate comparatively fewer trips. Businesses along Laurier Avenue and residential areas to the south of downtown would have reduced access to rapid transit.

Conversely, the further south the alignment runs, the further south the catchment area of the stations shifted. While more of the catchment area covers the developed areas of the downtown, the closer Laurier Avenue and the residential areas to the south are to the rapid transit stations, the higher the pressure will be to redevelop these stable neighbourhood areas.

Based on the above, the recommended alignment and station configuration is the cross-country route. This alignment is the most direct and cost efficient route (based on high-level, per metre cost estimates) for the tunnel. The alignment can be constructed easily, and will have low on-going maintenance costs as the track curvature is minimized. It services a large percentage of the existing and potential development in the

downtown, and is technically the most feasible given geotechnical conditions and construction considerations.

Figure 8-20: Evaluation of Downtown Tunnel Alignments

8.3.4.4 Downtown Station Locations

Overview

The number and placement of stations in the downtown was based on existing and future population and employment densities. Local transit routes, major trip producers, existing building inter-connections and adequate coverage of the core were also considered. Using a 300-metre circle as a proxy for a five-minute walk, and a 500-metre circle for a 7.5-minute walk, the spacing of the stations was optimized. The analysis indicated that two stations are required between Bronson Avenue and Elgin Street and another needed near the Rideau Centre. As each of the stations would have a minimum of two separate public entries from the platform to surface level, good coverage across the downtown would be provided.

Combining the station layout and spacing analysis results in a preferred arrangement with the downtown tunnel featuring three underground centre platform stations located at Bay/Lyon (Downtown West), at Bank/O'Connor (Downtown East), and at the Rideau Centre. Although considered outside of the downtown core, the Campus Station would be designed in a similar fashion because it is within the tunnel system.

The recommended tunnel alignment at Rideau Station serves multiple purposes, including facilitating local transit connections with direct and indirect access to the By-Ward Market, Rideau Centre and retail on Rideau Street, the Ottawa Convention Centre and the National Arts Centre and Confederation Square.

This station location best suits the LRT alignment from a functional and operational perspective. Local and regional transit would be well served by the station as it would act as a hub for riders destined to this area of the downtown. The number of above-grade transfers and reduced travel time because of a more direct transition between local and regional traffic as well as the opportunity to transfer to local routes at other stations along the LRT network would make this a very active station.

8.3.4.5 Downtown Station Platform Configurations

Planning objectives and design criteria developed for evaluation of alternative LRT alignments and station design concepts were adapted to evaluate the platform configuration options. Six objectives were developed.

- Create Successful Rapid Transit Stations
- Security and Life Safety
- Enhance Ottawa's Urban Character and National Stature
- Showcase Sustainable Design Best Practices
- Manage Construction Disruption and Risk
- Result in a Wise Public Investment

The station configuration and platform designs considered during the study include four types:

- Centre platform
- Side platforms
- Stacked platforms
- H-shaped platforms

Figure 8-21: Centre Platform Configuration Option

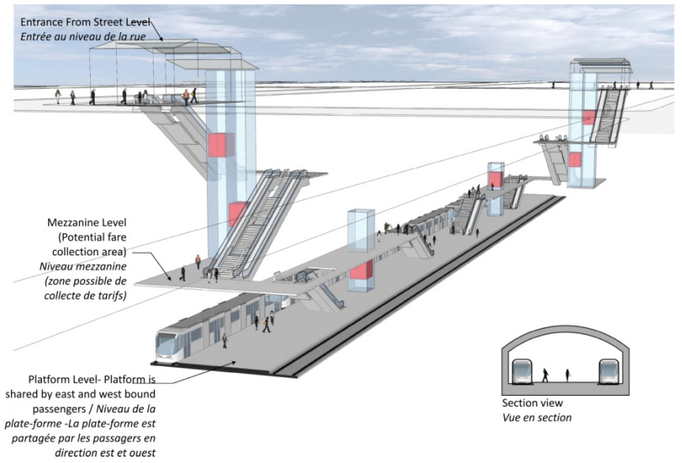


Figure8-22: Side Platform Configuration

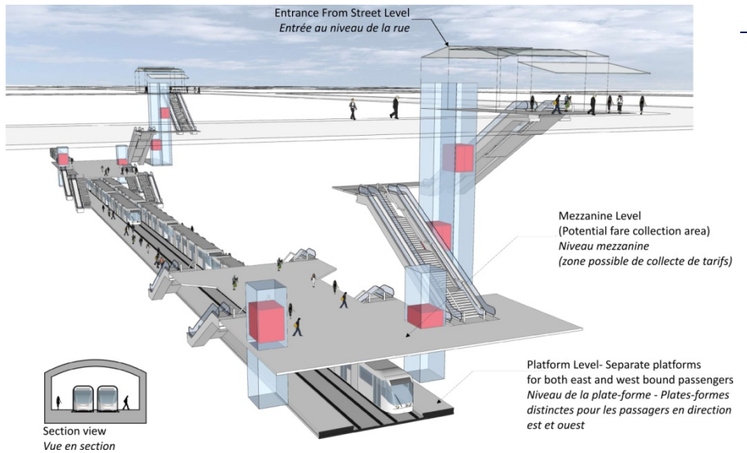


Figure 8-23: Stacked Platform Configuration

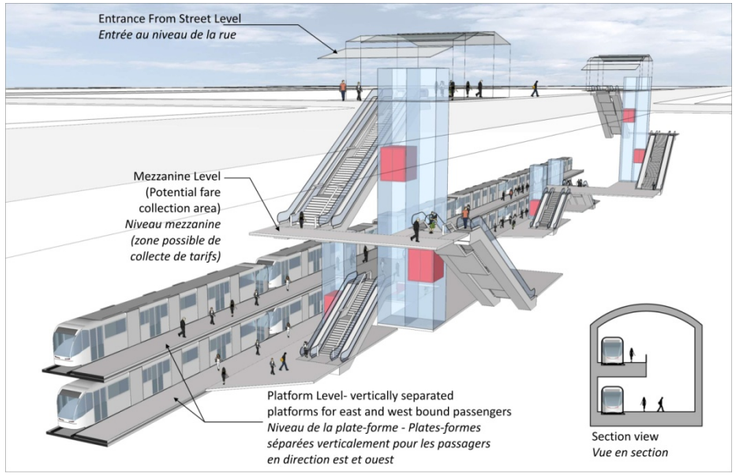
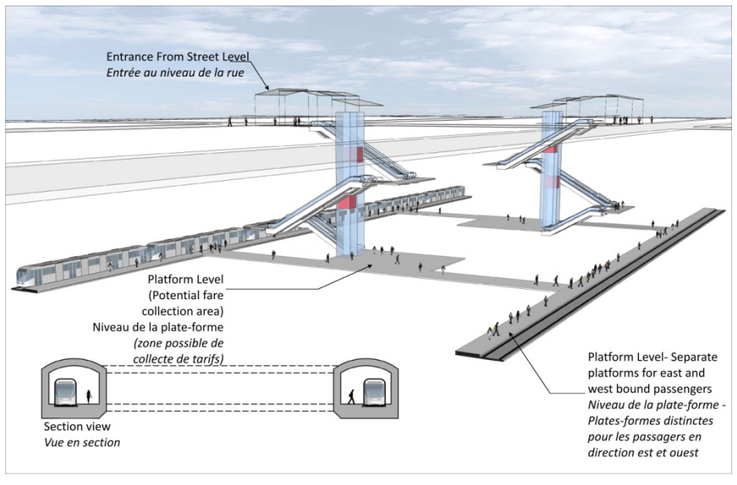


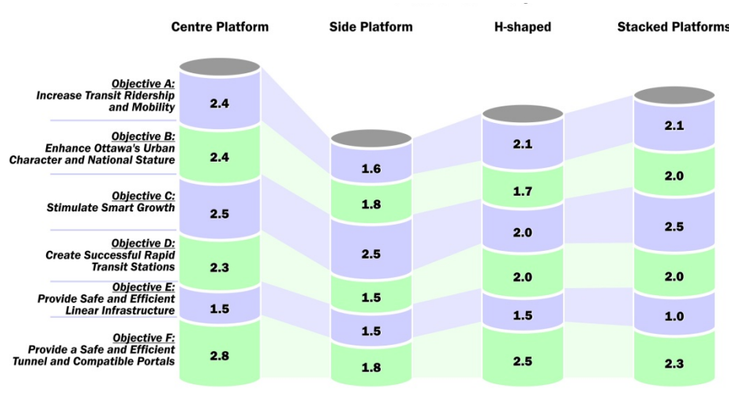
Figure 8-24: H-Shaped Platform Configuration



Evaluation and Recommendation

The most efficient station design is the centre platform configuration. The centre platform, with an east and west bound LRT track on either side can be effectively and economically constructed as the tunnel boring machine (TBM) works its way through the limestone bedrock under the downtown area. The centre platform avoids duplication of stairways, escalators and elevators, thereby saving costs. This configuration also minimizes entrance and way-finding requirements associated with other platform types. Supporting infrastructure and equipment needs are minimized and the platform creates a safer environment since there is a higher likelihood of multiple passengers at any given time and it is easier to secure the area in case of an emergency.

Figure 8-25: Evaluation of Platform Configuration Alternatives



8.3.5 Laurier-Lees (East Portal)

Overview

This segment encompasses stations at Campus (serving the University of Ottawa) and Lees, which is located within the existing Transitway corridor slightly north of the existing platform. Known site contamination in the vicinity of Lees Station limits expansion at this location, therefore keeping the station within the existing corridor will avoid further remediation costs. This alignment uses the existing Rideau River Bridge to Hurdman Station.

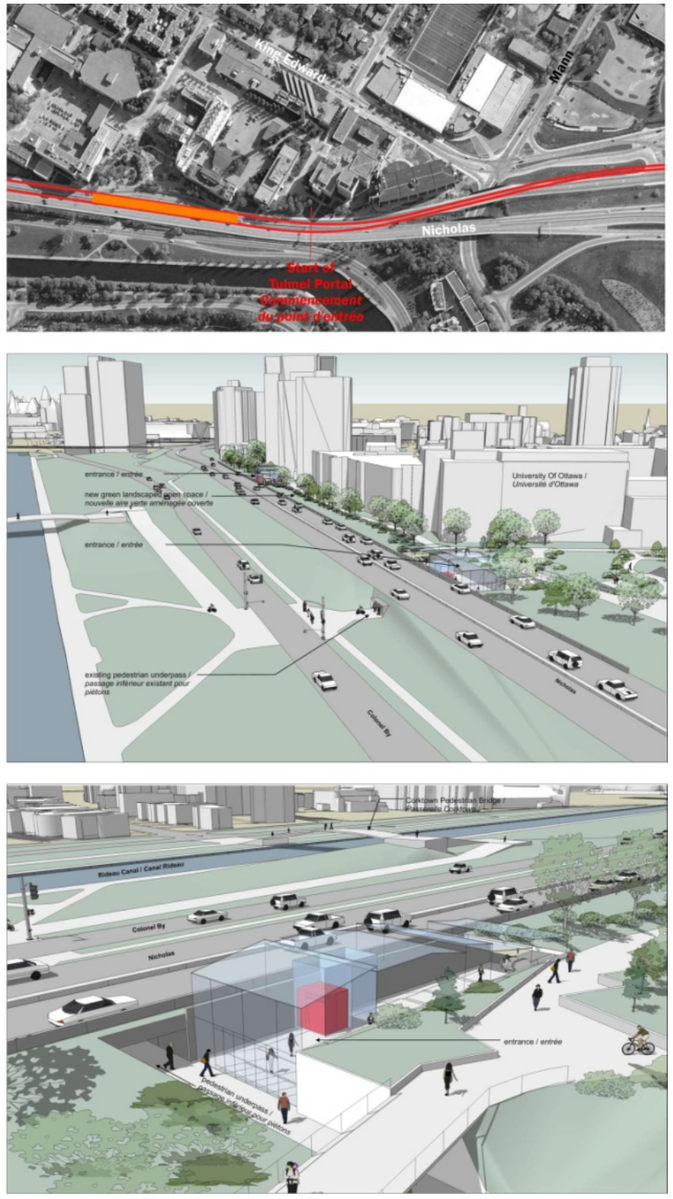
The eastern portal of the tunnel is also located in this segment. The location of the portal was determined based on a number of factors: minimizing impact on the University and Nicholas Street; allowing for temporary bus operations around the construction zone; minimizing disruption to infrastructure in the area; and maximizing the use of the tunnel boring machine. Three design alternatives were considered and evaluated for this segment:

- Portal North of Mann Option
- Portal South of Mann Option
- Portal South of Laurier Option

Portal North of Mann Avenue (Campus Station Underground) Option

In this alternative, the alignment would begin to rise to Campus Station, which would be underground approximately where the Campus Station is today. South of that the alignment would rise, with a portal south of the station and north of Mann Avenue, and pass over the existing Transitway bridge over Mann Ave. The alignment would then follow the existing Transitway through Lees Station and over the Rideau River.

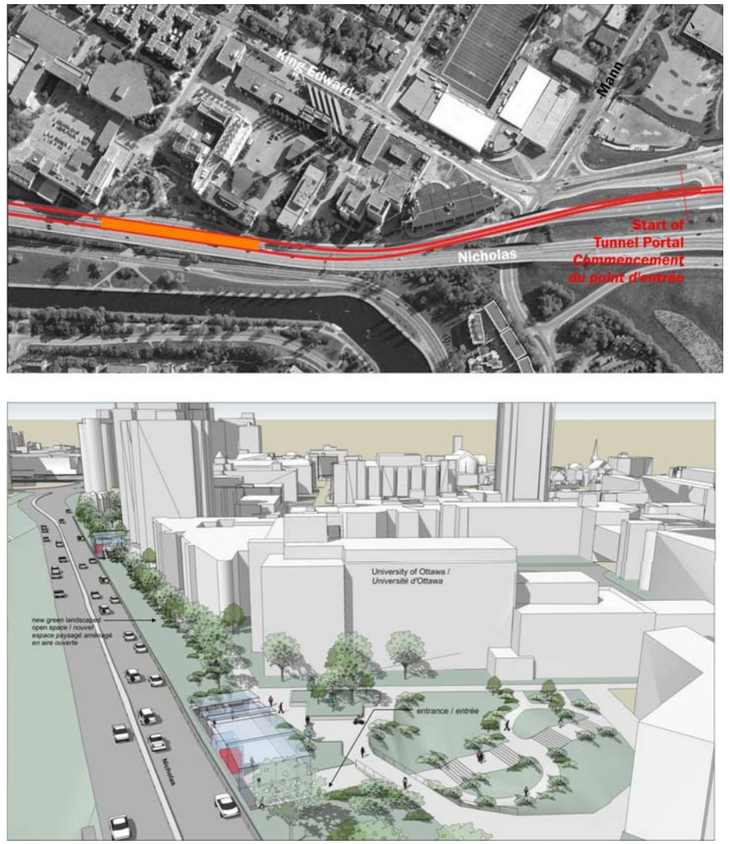
Figure 8-26: Portal North of Mann Option



Portal South of Mann Avenue (Campus Station Underground) Option

In this alternative, the alignment would begin to rise to Campus Station, which would be underground approximately where the Campus Station is today. South of Campus Station the alignment would drop slightly to pass underneath Mann Ave. before rising to a portal south of Mann Avenue. The alignment would then follow the existing Transitway through Lees Station and over the Rideau River.

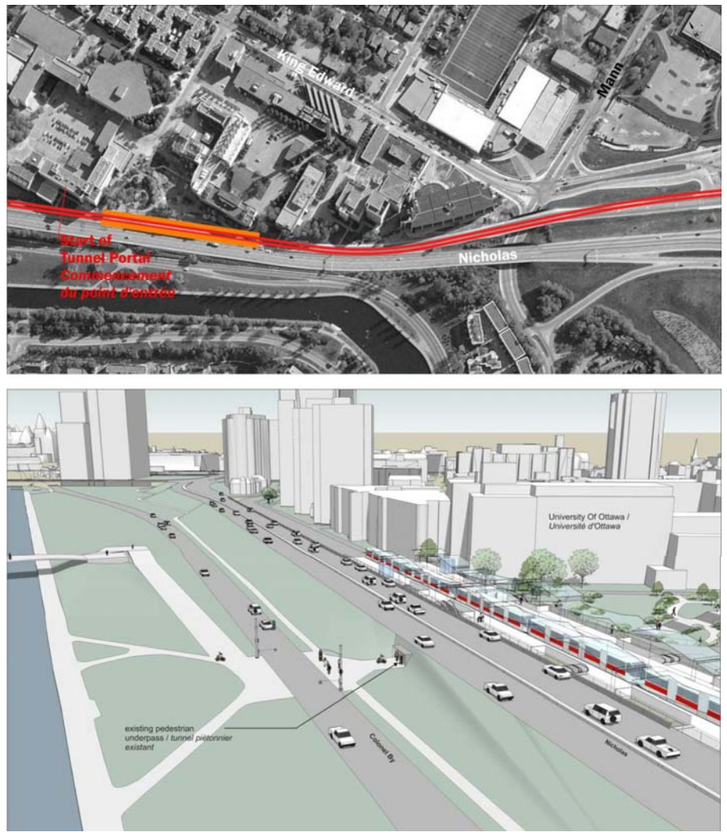
Figure 8-27: Portal South of Mann Option



Portal South of Laurier Avenue (Campus Station on Surface) Option

In this alternative, the alignment would begin to rise under Laurier Avenue, with a portal between Laurier Avenue and Campus Station. South of Campus Station the alignment would then follow the existing Transitway south, over Mann Avenue, and through Lees Station and over the Rideau River.

Figure 8-28: Portal South of Laurier Option



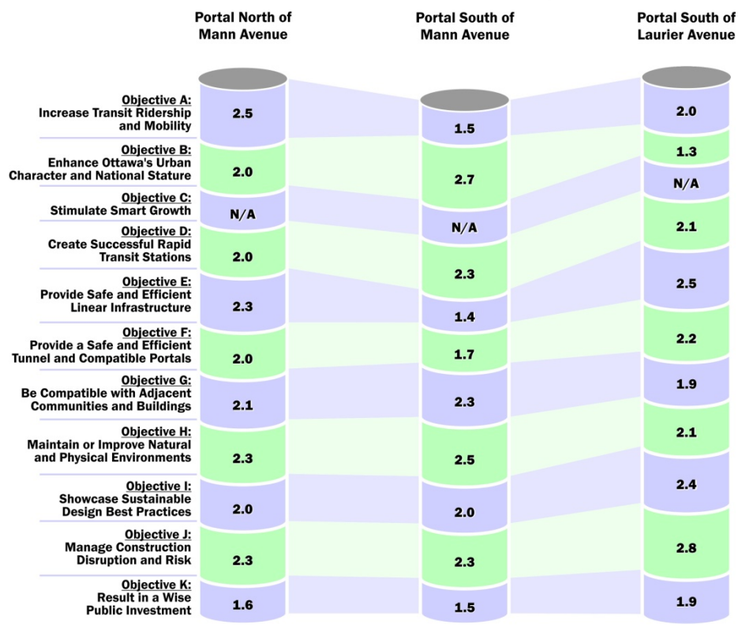
Evaluation and Recommendation

The three options are very similar, although one of the three would place Campus Station at grade. The major factors are the cost of the longer tunnel and the advantage of having the portal as far south as possible to allow the existing Transitway corridor between Nicholas Street and the University to be upgraded to improve the National Capital Arrival Route along Nicholas and provide a green buffer along the western edge of the University campus.

Based on geotechnical conditions, the portal located south of Mann Avenue was recommended. An opportunity to provide a below grade station that would be integrated with existing and future buildings and pedestrian systems ranks high in desirability and cost efficiencies. With the portal located further south, the TBM can be extracted at a construction staging area and the portal entrance would be completed with typical cut and cover technology since the tunnel is out of the limestone bedrock condition and into the glacial till characteristic of Sandy Hill. The portal at this location also lends itself well to eliminating a portion of the existing Transitway corridor adjacent to the University, thereby providing opportunities for landscaping along the university/canal corridor, enhancing the Capital Entry along Nicholas and providing good separation between Nicholas and the University campus.

It should be observed that during the functional design process further refinement to the preferred station design concept at Campus was undertaken. The station has been moved to the west side of Nicholas to improve constructability and reduce the impact that construction will have on local traffic and Transitway bus service. There is a minor change to the LRT tunnel alignment in this location to accommodate this refinement.

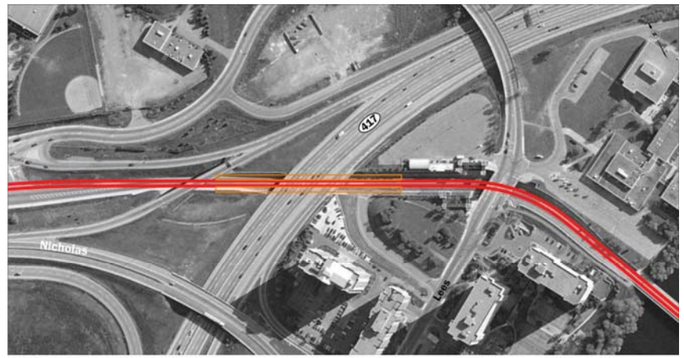
Figure 8-29: Evaluation of Laurier-Lees Alignment and Campus Station Concepts

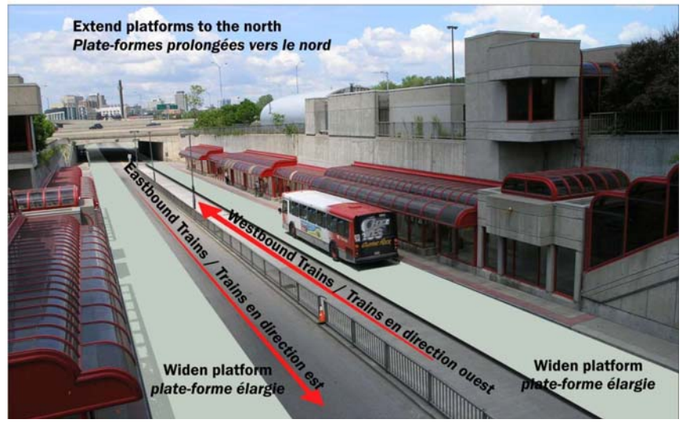


Lees Station

As mentioned previously, only one station design concept (re-use existing) was developed for Lees Station due to the desire to make use of existing Transitway infrastructure and the constraints imposed by existing environmental contamination in this area. In order to accommodate proper LRT track geometry across the existing Rideau River Bridge to the south, the platforms at Lees Station would be shifted slightly north but remain within the existing open cut area.

Figure 8-30: Lees Avenue Station Design Concept





8.3.6 Hurdman Station

Overview

The Hurdman Station segment begins at the Rideau River, through Hurdman Station and extends to Riverside Drive. The preferred alignment generally follows the existing Transitway corridor and is adjacent to National Capital Commission (NCC) vacant lands (part of a former landfill). The NCC intends to develop lands to the north of Hurdman Station and therefore an appropriate access to the site is required. This would be achieved by extending an elevated LRT alignment to go over an extended Industrial Avenue, which would serve the development parcel. This elevated alignment would continue to use the existing Transitway bridge over Riverside Drive as it approaches the VIA Rail Station.

The alignment must also maintain access to the Southeast Transitway, improve access for pedestrians and passenger drop-off at Hurdman Station and minimize impacts on the adjacent residential high-rise development.

Four primary design concepts were developed and evaluated for this station. For all options, the LRT would be raised above-grade, and the existing bus layover facility would be re-located to the west on the south side of the existing bus platform area.

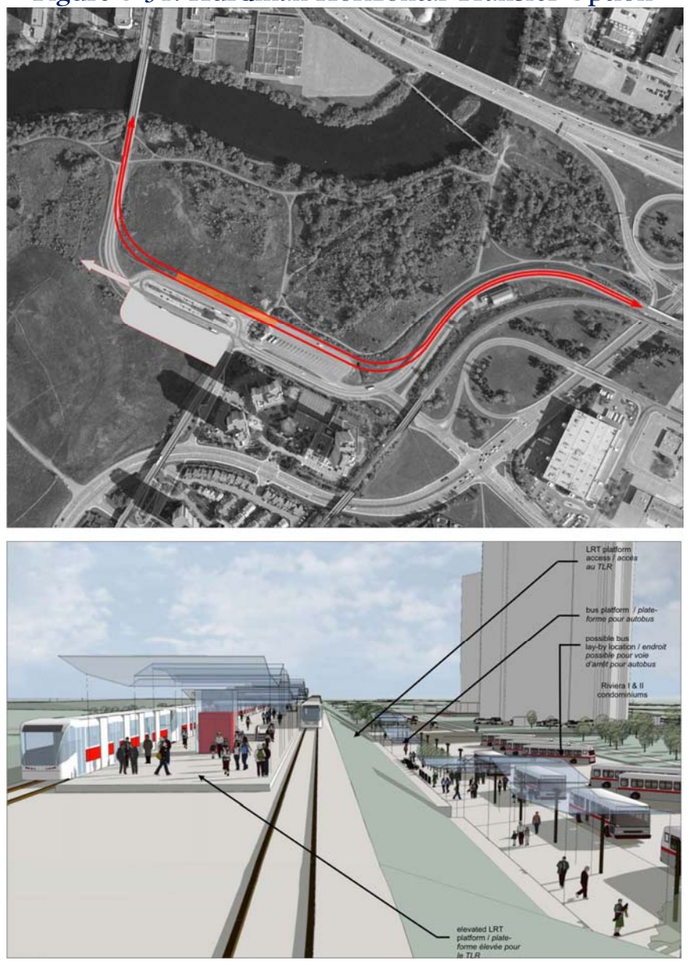
The four station design concepts developed and evaluated, for Hurdman were:

- Horizontal Transfer Option
- Horizontal Transfer Further North Option
- LRT Over Existing Option
- Protect for Connection to Southeast Transitway Option

Horizontal Transfer

This configuration places the LRT platforms to the north of the existing bus platform, and reconfigures the bus loop as a one-sided platform parallel to the LRT, in and arrangement similar to Billings Bridge Station.

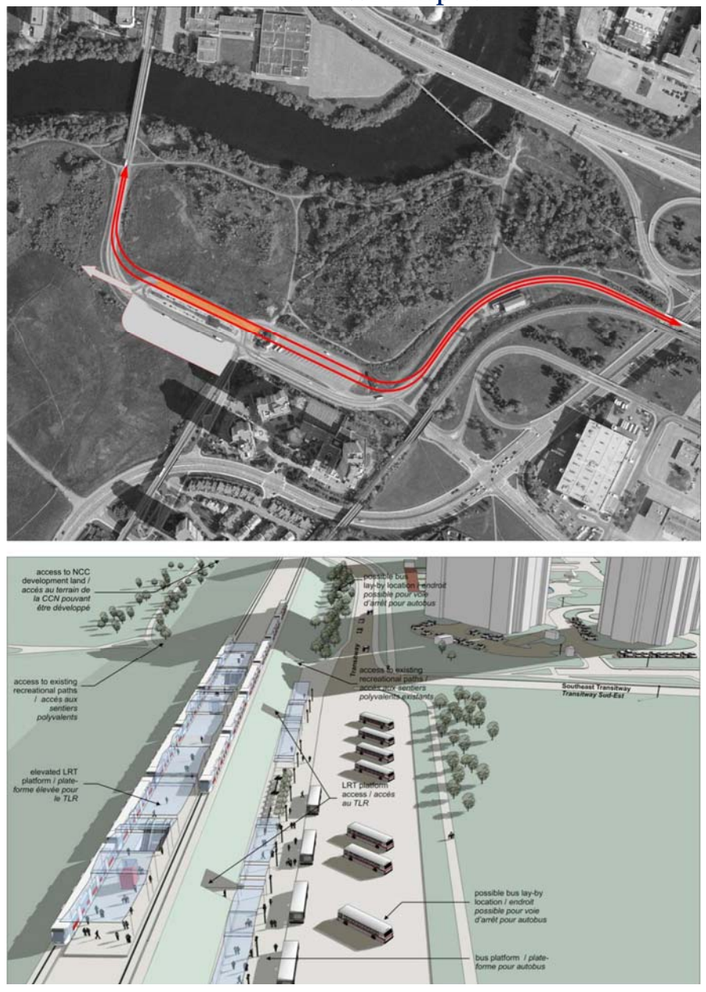
Figure 8-31: Hurdman Horizontal Transfer Option



Horizontal Transfer – Further North Option

The Horizontal Transfer-Further North Option would allow the exiting bus platforms to stay open during construction and would create a larger development parcel on the site of the existing bus lay-up facility, however, additional lands owned by the NCC would be required to construction this option.

Figure 8-32: Hurdman Horizontal Transfer Further North Option

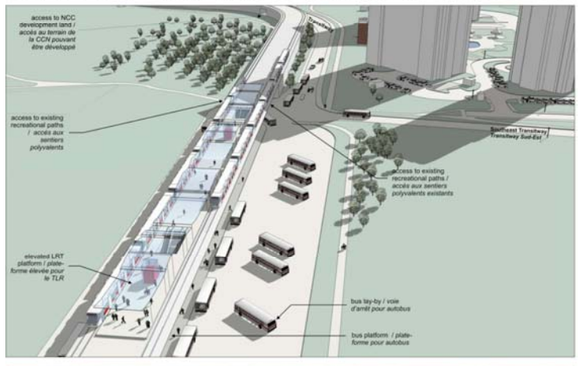


LRT Over Existing Option

This design concept would place the LRT platform directly over top of the existing Hurdman bus platform. While this would minimize transfer distances, it would be the most disruptive to bus service at this station during construction. Ground conditions in the vicinity of the station (environmental

contamination from former landfill site) would also make it difficult to construct any significant structures to support an elevated LRT track and station facilities.

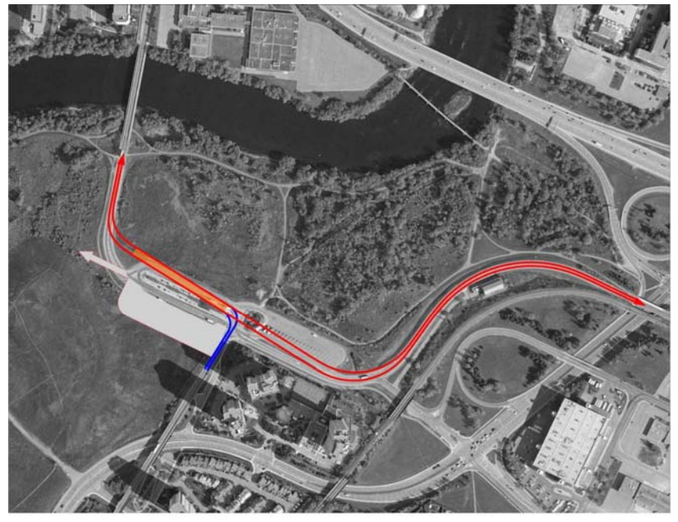
Figure 8-33: Hurdman LRT Over Existing Option



Protect for Connection to Southeast Transitway Option

This design concept rotated the LRT station slightly to allow for a future rail connection to the Southeast Transitway. The resulting configuration would require an at-grade rail junction between the two corridors, with a very sharp curve radius for the connecting tracks. Developing a design which allowed for a grade-separated junction and more generous curves reduced the attractiveness of this option in that it required more land from the NCC reducing the development potential of their property.

Figure 8-34: Hurdman Protect for Connection to Southeast Transitway Option



Evaluation and Recommendation

Although the "LRT over Existing" option scored higher when ranked against the Evaluation Criteria, significant issues with this option were identified with respect to constructability given ground conditions and impacts to existing transit operations during construction. Therefore, the Horizontal Transfer – Further North design concept is recommended as it provides for an efficient transfer layout between the LRT platforms and buses, largely avoids issues associated with the former landfill located under the existing bus platforms and protects access allowing for future development of NCC lands located north of the station. This option also allows Hurdman Station (an important transfer point for buses to/from the Southeast Transitway) to be keep open for the duration of construction.

During the evaluation, efforts were made to determine if a convenient connection to the Southeast Transitway could be protected. The geometric and space constraints were found to be significant, and it was determined that the option is not practical.

Figure 8-35: Evaluation of Hurdman Station Options

8.3.7 Train (VIA Rail) Station

Overview

This segment runs from Riverside Drive to Belfast and follows the existing Transitway, with some deviation from the existing Transitway at the Train Station due to the sharp curves in the existing alignment, which are unsuitable for LRT operations and provide insufficient length to accommodate 180 m platforms. The option to reuse the existing station was initially considered, but rejected because of the geometric constraints.

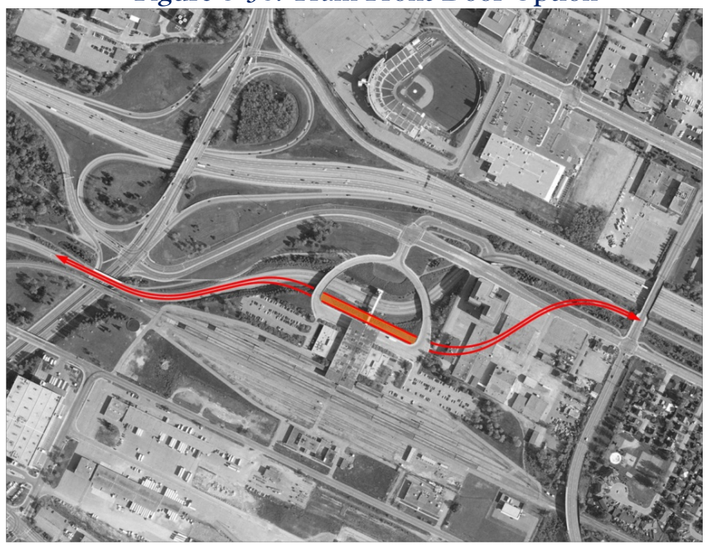
Two station design concepts were developed and evaluated for this design segment:

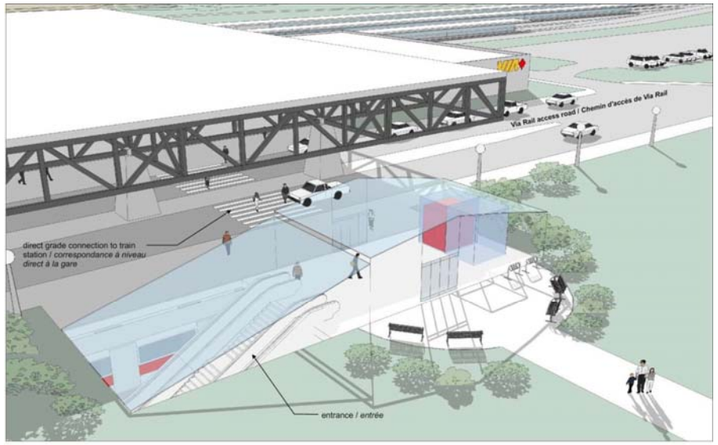
- Front Door Option
- Diagonal Option

Front Door Option

This design concept would line the platform up with the main entrance to the VIA Train Station, but would require an underground connection back to the existing corridor north of Tremblay Road. Additional property would be required and existing buildings would need to be demolished in order to build the underground connection back to the existing corridor. This would increase project costs and construction disruption.

Figure 8-36: Train Front Door Option

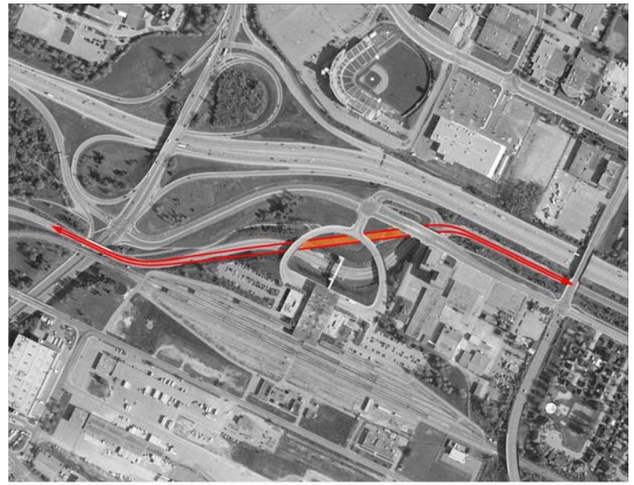


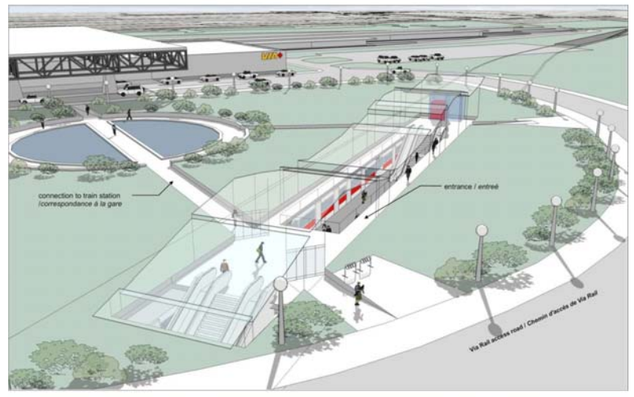


Diagonal Option

This design concept adjusted the track alignment to smooth out the existing tight curves of the Transitway and provided access from the train station and development lands to the east and north. Reconstruction of the Tremblay Road overpass and one of the VIA Rail station access driveways would be required to accommodate this design concept. The full 180-metre long platform can be accommodated.

Figure 8-37: Train Diagonal Option





Evaluation and Recommendation

The Diagonal Option was recommended as it provides a lower cost and less intrusive solution, while maintaining a good connection to the VIA station. The east end of the station can also be easily connected to the development lands to the east and a potential pedestrian bridge over Highway 417 to the Baseball Stadium and Canadian Tire sites.

Figure 8-38: Evaluation of Train Station Options

8.3.8 St. Laurent

Overview

The St. Laurent segment is basically a conversion of the Transitway to LRT service between Belfast Road and Michael Street. Local bus access will continue to be important, as this service will be focused on the station and efficient transfers from local routes. Local bus service will be accommodated at the existing upper level bus platforms with the potential for additional vertical access explored at the eastern end of the new, longer, station platform.

Two design concepts were developed and evaluated for this station:

- Side Platform Option
- Centre Platform Option

Side Platform Option

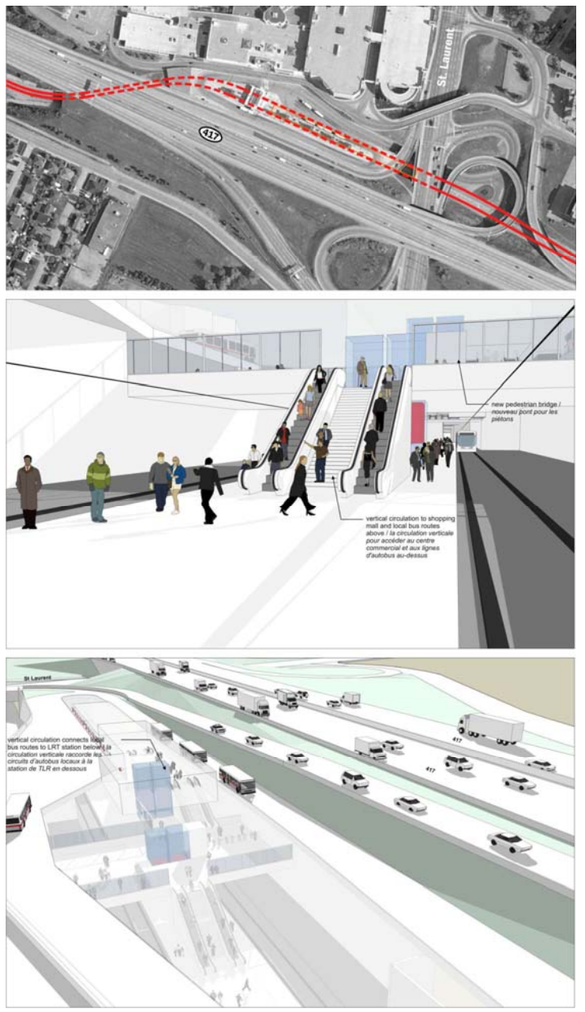
The side platform configuration made use of the existing facility and reduced costs associated with conversion to LRT, based on the assumption that the infrastructure within the existing bus tunnel and station area is compatible with LRT requirements.

Figure 8-39: St. Laurent Side Platform Option

Centre Platform Option

The centre platform configuration was developed to provide a more efficient platform configuration, similar to the underground stations in the downtown area, based on the assumption that the infrastructure within the existing bus tunnel and station area is not compatible with LRT requirements.

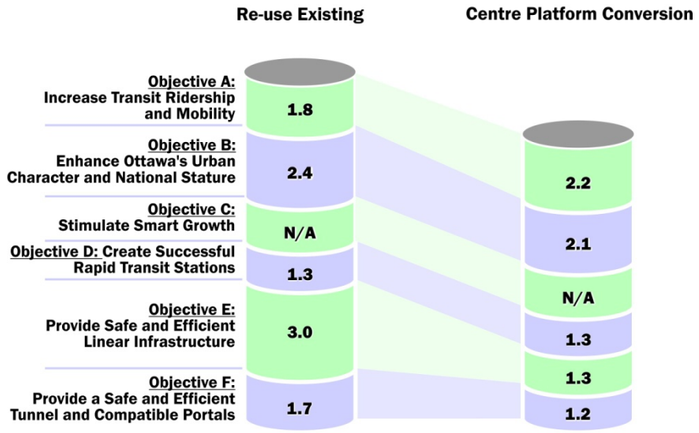
Figure 8-40: St. Laurent Centre Platform Option



Evaluation and Recommendation

The Side Platform Option is recommended as it minimizes additional costs, takes advantage of existing infrastructure and has minimal impact on utilities in the station area.

Figure 8-41: Evaluation of St. Laurent Station Options



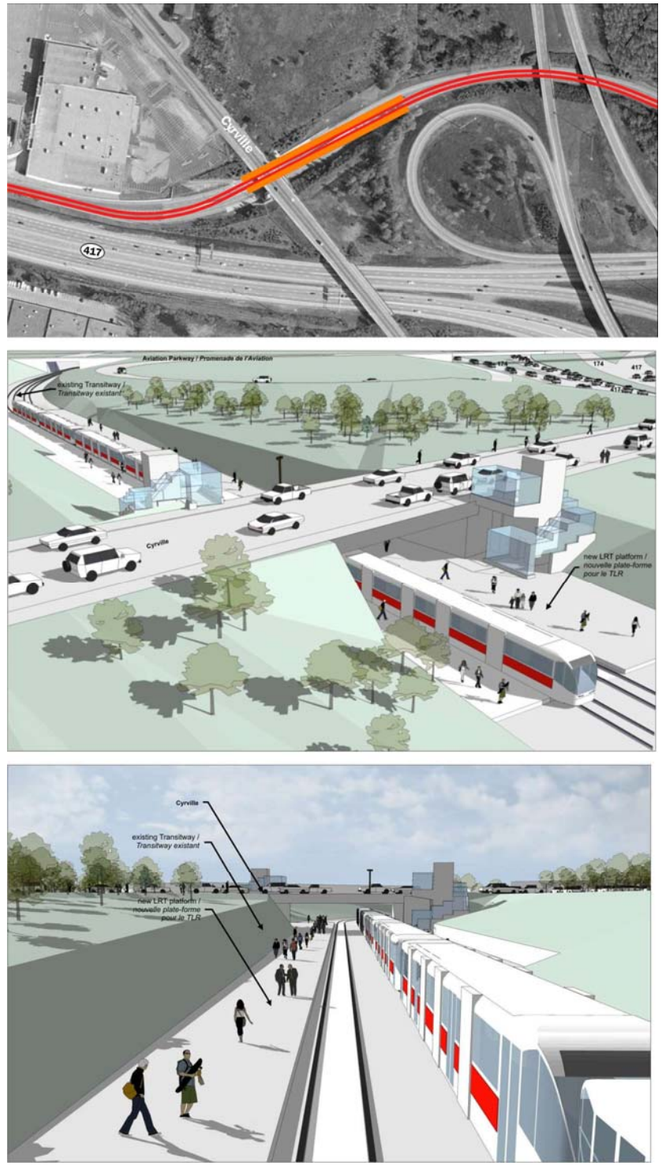
8.3.9 Cyrville

Overview

The LRT alignment through this design segment will follow the existing Transitway from Michael Street to the Aviation Parkway. Therefore, a single station design concept (re-use existing) was developed for this design segment.

Cyrville Station would be upgraded to improve existing access points to the existing side platforms. These improvements would support new high-density development adjacent to the station. The station design and alignment was reviewed for compatibility with proposed plans to upgrade the Highway 417 interchange as a result of the Interprovincial Bridge Crossing Study (as presented to date).

Figure 8-42: Cyrville Station Design Concept



8.3.10 Blair

Overview

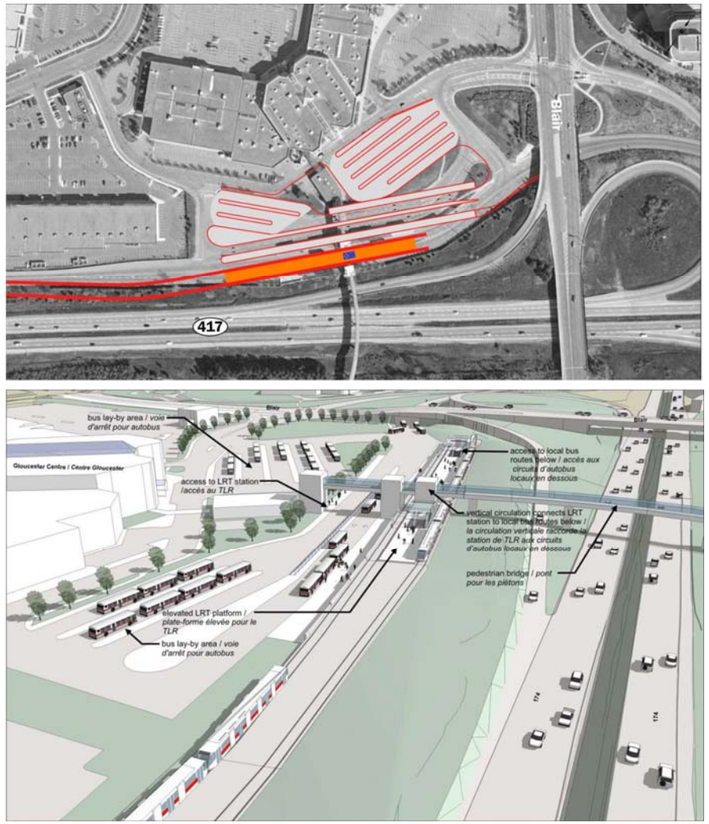
The Blair segment is the most easterly section of the new LRT corridor and will extend from the Aviation Parkway to Blair Road. It will operate as a terminal station and major transfer point over the longer term, serving transit users in the eastern part of the city via the East Transitway, future Cumberland Transitway and local bus services. A centre platform configuration was therefore assumed as a requirement for this station as it most effectively accommodates transfers from BRT service to LRT as well as terminating trains. Three design concepts were developed and evaluated for this station:

- LRT on Upper Level
- LRT on Lower Level
- LRT Shifted East

LRT on Upper Level

The LRT on Upper Level configuration would place the LRT on the existing Transitway level, with the local bus area to the north being reconfigured to serve all local and BRT bus services. This option had geometric constraints for extending the line to the east. Moreover, the existing local bus area does not provide adequate capacity for the volumes of transfers anticipated.

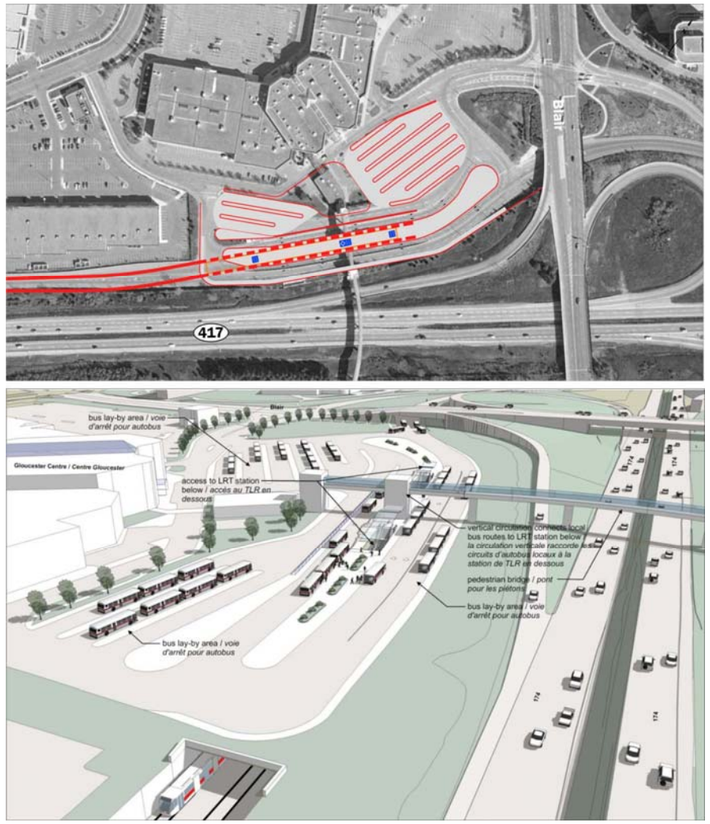
Figure 8-43: Blair LRT on Upper Level Option



LRT on Lower Level

The LRT on Lower Level configuration would require reconstruction of the Transitway Level into a larger bus terminal sitting over top of the LRT, constructed just below the lower local bus area. This configuration provided adequate space for bus transfers and optimized the use of the area.

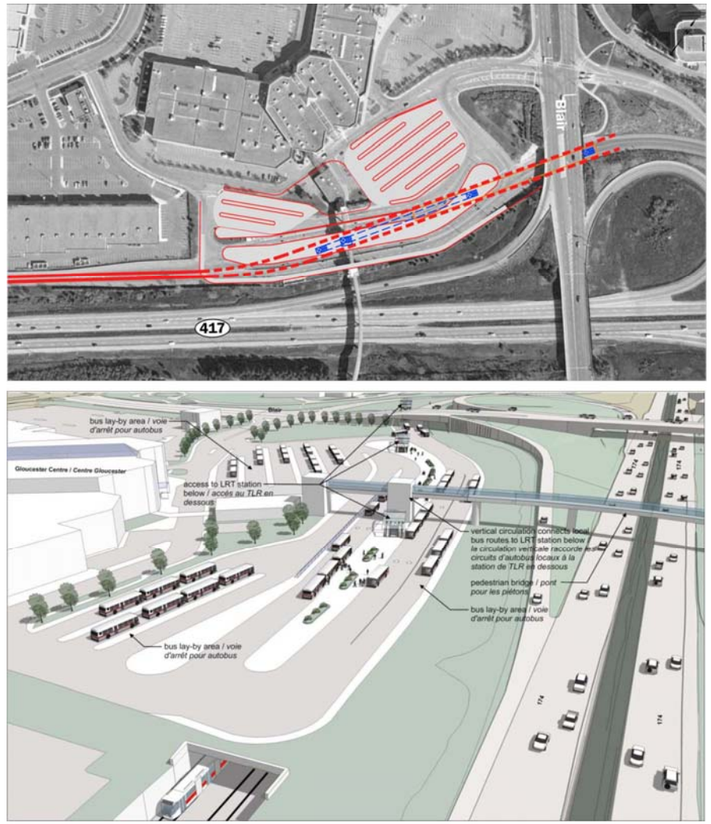
Figure 8-44: Blair LRT on Lower Level Option



LRT Shifted East

The LRT Shifted East configuration positioned the LRT platform far enough east to allow for an access point on the east side of Blair Road. This is more challenging to construct, but would allow for a more direct connection for local passengers east of Blair Road.

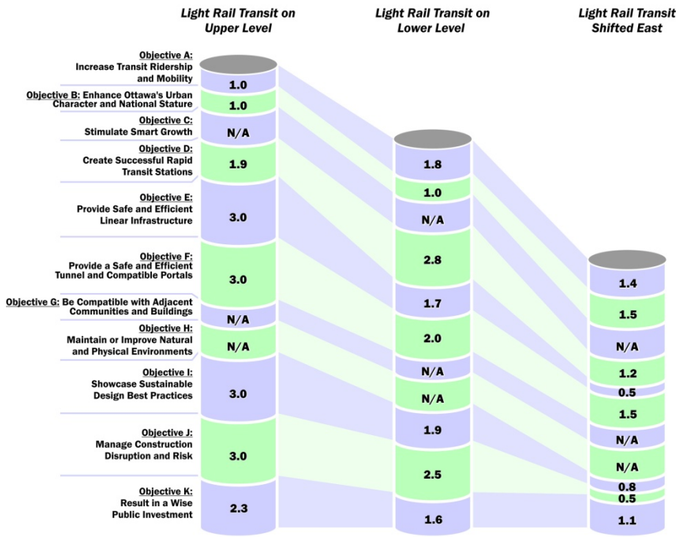
Figure 8-45: Blair LRT Shifted East Option



Evaluation and Recommendation

Although the "LRT on Upper Level" option scored higher when ranked against the evaluation criteria, the inability to provide sufficient space to accommodate anticipated bus volumes and passenger transfers was a significant constraint which could not be addressed. Therefore, the LRT on Lower Level station design concept was recommended as it provides adequate space to accommodate future bus and passenger transfer volumes. This option will also allow for reduced disruption to transit operations through the station area during construction.

Figure 8-46: Evaluation of Blair Station Options



8.4 *Alternative Maintenance and Storage Facility Candidate Sites*

A Maintenance and Storage Facility Site selection exercise was conducted to determine the recommended site for this facility. The full report for this study is contained in Appendix H (Maintenance and Storage Facility Site Selection Report) and summarized below.

A typical feature of any electric light rail transit system is a large site which allows the construction of a Maintenance and Storage Facility. The Maintenance and Storage Facility is an integral part of a light rail transit system, as it provides the ability to:

- House and service all of the trains needed to operate the line,
- Service light rail vehicles to be used on this or any future LRT lines,
- House the operations control centre for the line, and
- Be the primary heavy maintenance facility for the LRT network.

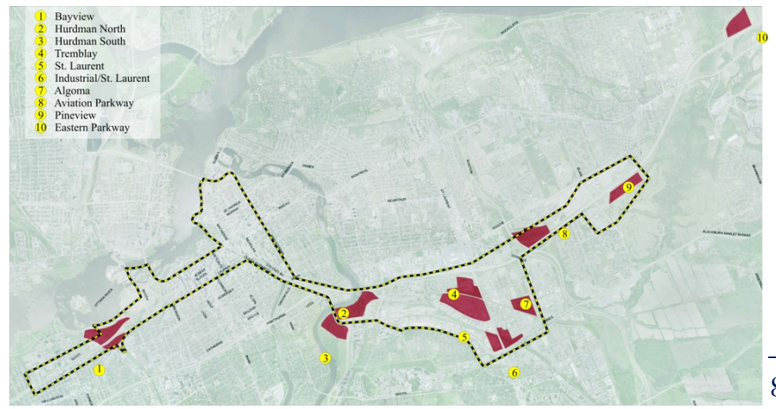
The regular maintenance of the light rail vehicles (LRV's) is crucial to maintain vehicle manufacturer's warranties, minimize long term operating costs and maximize system safety and reliability. To maximize operational efficiencies and minimize operational costs, the Maintenance and Storage Facility will accommodate the following elements on-site:

- Main facility building housing offices, roster areas, meeting rooms and control equipment,
- Storage yard for regular cleaning and minor maintenance,
- Repair areas for heavy and light maintenance areas for vehicles,
- Workshop area with a suite of tools and equipment tailored for vehicle types,
- Control centre (signaling, security, communications and ticketing),
- Cleaning area for interior cleaning of vehicles,
- Train wash for exterior washing of vehicles,
- Electrical substation to local power supply for facility and trains, and
- Turnaround loops providing the ability to work vehicles from either end and equalize wear and tear.

The facility requires a parcel of approximately 12 hectares to accommodate all required functions to operate the LRT. The following candidate sites, illustrated in Figure 8-47, were investigated for suitability as a Maintenance and Storage Facility.

- Site 1: Bayview (North and South)
- Site 2: Hurdman (North)
- Site 3: Hurdman (South)
- Site 4: Tremblay
- Site 5: St. Laurent Bus Depot
- Site 6: Industrial/St. Laurent - Innes/St. Laurent
- Site 7: Algoma
- Site 8: Aviation Parkway
- Site 9: Pineview
- Site 10: Eastern Parkway

Figure 8-47: Maintenance and Storage Facility Candidate Sites



8.4.1 Bayview (North and South)

This 21.5 hectare site is composed of a 16.5 hectare north parcel and a 5 hectare south parcel. Bayview North is zoned 'Open Space and Leisure' and 'Industrial', and has commercial properties to the west, open space to the north and east, and the Transitway to the south. Bayview South is a smaller parcel of land and can only be suitably used in association with Bayview North, and is zoned 'Open Space and Leisure' and 'Mixed-Use/Commercial'. Use of the site may require the demolition of the Tom Brown Arena. Parts of the site are owned by the City, and other parts by the NCC.

Figure 8-48: Site 1 – Bayview (North and South)

8.4.2 Hurdman (North)

The 20.3 hectare site is zoned 'Open Space and Leisure', with a portion of the site along the river also zoned in the 'Flood-plain' overlay zone. Use of this site would require extensive development into this zone and as a consequence would require re-zoning. The proximity of the site to the Rideau River is considered a prime and highly visible location.

Figure 8-49: Site 2 – Hurdman (North)

8.4.3 Hurdman (South)

This site is approximately 13.4 hectares, depending on the final alignment of the Alta Vista Transportation Corridor, and is zoned 'Environmental Protection' and 'Open Space and Leisure' zones, with a portion of the site along the river also zoned in the 'Flood Plain' overlay zone. The site is considered highly visible and a prime location.

Figure 8-50: Site 3 – Hurdman (South)

8.4.4 Tremblay

This mainly flat, 12.1 hectare site was recently purchased by PWGSC, and is zoned 'Light Industrial'. The land's prestigious location near the St. Laurent Shopping Centre and its proximity to the Queensway/St. Laurent Interchange would mean that joint use would have to be considered.

Figure 8-51: Site 4 – Tremblay

8.4.5 St. Laurent Bus Depot

The area is zoned 'Industrial' and, due to its already pre-established function, the combination of the M&S facility and the bus depot would have some operational benefits if both the LRT operations and bus operations were run by OC Transpo. The site provides 16 hectares of available area, but would include the partial redevelopment of the existing St. Laurent Depot. Further expansion would require the purchase of more lands to the west.

Figure 8-52: Site 5 – St. Laurent Bus Depot

8.4.6 Industrial/St. Laurent – Innes/St. Laurent

This site is composed of two parcels totalling 16 hectares, but would require the purchase of other privately owned, adjacent lands. The parcels of land are zoned 'Industrial', 'Mixed-Use/ Commercial' and 'Open Space and Leisure' zones and are connected by an abandoned right-of-way and structure under the St. Laurent Boulevard overpass.

The site is at one of the most remote locations and is nearly 2.0km from the proposed alignment, which would increase the non-productive "dead-head" km's that are needed to connect to the mainline. The connection would involve "cut and cover" tunneling and disruption to roads and the VIA Rail track.

Figure 8-53: Site 6 – Industrial/St. Laurent – Innes/St. Laurent

8.4.7 Algoma

The 11 hectare site is owned by the City and is currently used as a municipal snow dump. The land is zoned as 'Industrial'; however, it is in 'Light Industrial Subzone' and may need to be re-zoned to permit the M&S facility to be constructed. The site represents a slightly smaller, 11 hectare, area of land than is currently desirable and, as such, further expansion would require additional facilities to be constructed.

Figure 8-54: Site 7 – Algoma

8.4.8 Aviation Parkway

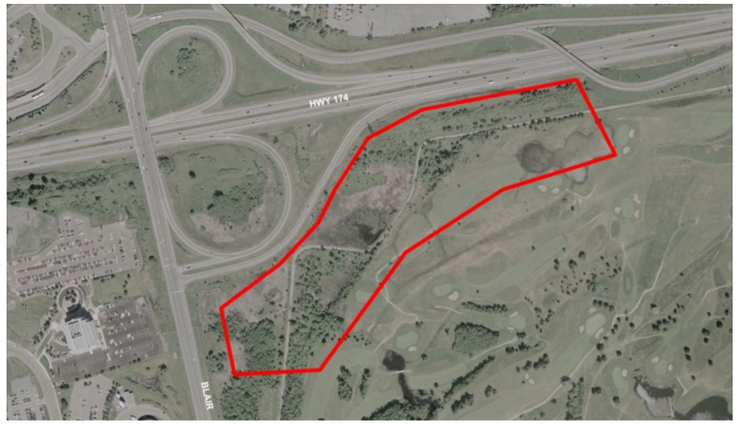
This 18 hectare site within, and adjacent to Highway 174 and Aviation Parkway, is relatively undeveloped and has a number of storm water outlets feeding into a watercourse. The land is zoned as 'Open Space and Leisure' and is owned by the City, MTO and the NCC. The proposed LRT alignment would pass through the site, alleviating the complexity of a connecting track.

Figure 8-55: Site 8 – Aviation Parkway

8.4.9 Pineview

The 12.5 hectare site is relatively flat, and is zoned as 'Open Space and Leisure'. It is owned by the NCC and is within the Greenbelt and, as such, it would likely be an environmentally sensitive choice as it is bordered by natural habitat to the south and east. The site offers limited scope for expansion unless more of the Pineview golf course is acquired at a later stage.

Figure 8-56: Site 9 – Pineview



8.4.10 Eastern Parkway

This 15 hectare site is owned by the NCC, zoned 'Agricultural' and is located within the Greenbelt, adjacent to Highway 174. This site would need to be re-zoned to permit the construction of the Maintenance and Storage Facility.

The site is outside the study zone, and although it is along the likely future route of an easterly expansion of the system to Orléans it is on the opposite side of the highway to the assumed Transitway corridor.

Figure 8-57: Site 10 – Eastern Parkway

8.5 *Evaluation Process for Maintenance and Storage Facility Candidate Sites*

8.5.1 Evaluation Criteria

The ten candidate sites were evaluated based on four key evaluation criteria developed for the facility design, namely:

- Site Characteristics
  - Topography and grade
  - Land Use Compatibility
  - Expansion Capability (to accommodate future LRT network expansion)
  - Environment (human, biological, physical)
- Facility Operations
  - Turnaround loops (to turn light rail vehicles)
  - Municipal services, utilities and power
  - Efficiency (site design)
  - Track redundancy and reversal (to ensure operational flexibility)
- System Operations
  - System connectivity (proximity and access to LRT alignment)
  - Efficiency (to minimize non-revenue movement of vehicles)
  - Heavy rail connectivity (for delivery of new light rail vehicles)
- Costs
  - Capital
  - Operating and maintenance
  - Property ownership and acquisition

8.5.2 Evaluation Methodology

A comparative evaluation of the candidate sites was completed using a 0-3 ranking system (0=fails, 3=performs best) for each evaluation criteria.

Each of the candidate sites was examined in detail and their characteristics compared. Understanding the potential sensitivity of a major development in the city, two methods of assessment were used "Percentage ranking" and "Comparative evaluation" allowing a more sensitive treatment of the facility choice, taking into account public sensitivities and potential environmental effects of the chosen areas.

8.6 *Evaluation of Maintenance and Storage Facility Candidate Sites*

The evaluation of the ten candidate sites resulted in three short-listed candidate sites:

- Site 5: St Laurent Bus Depot
- Site 6: Industrial /St. Laurent – Innes/St. Laurent
- Site 7: Algoma

The following table provides details of their advantages and disadvantages.

Table 8-2: Short Listed Sites

Site	Advantages	Disadvantages
Site 5: St Laurent Bus Depot	• Appropriate use of zoned land. • Centralised facility. • Little or no environmental issues. • Requires purchase of a single additional Site.	• Higher connectivity costs. • Higher O&M costs. • Requires major development of existing Bus Depot site. • Higher construction costs. • May impact bus operations.
Site 6: Industrial / St. Laurent – Innes St / St. Laurent	• Appropriate use of zoned land. • Close to size required. • Good road and rail access. • With other land acquisition, some further expansion possibilities. • City ownership + Private ownership. • Little or no environmental issues.	• Two distinct parcels of land. • Higher O&M costs. • Higher construction costs. • More complex track layout. • Higher connectivity costs.
Site 7: Algoma	• Appropriate use of zoned land. • Close to size required. • Good road access. • Good rail access. • Owned by City. • Little or no environmental issues.	• Tighter space for implementation of yard. • Limited expansion. • Requires parallel running with VIA Rail. • Higher O&M costs. • Higher construction costs. • Higher connectivity costs. • Requires relocation of snow facility.

Although three sites were short-listed, the proximity to the alignment and cost of implementation of Sites 6 and 7 precluded their use as the final site. As such, Site 5 and its surrounding area up to the western side of Belfast Road bridge was further evaluated to determine the optimum site positioning.

Within the area comprising Site 5, three potential Maintenance and Storage Facility positions were evaluated.

Location 1: Easterly Position (Using part of the existing St. Laurent Bus Depot parking lot).

Location 2: Westerly Position (Using the existing OC Transpo storage area and westerly properties).

Location 3: Central Position (Using existing OC Transpo storage area, 767 Belfast Road and Pepsi bottling plant).

8.6.1 Refinement of Preferred Site

An additional evaluation of the Easterly, Westerly and Central Positions within the overall St. Laurent Depot (Site 5) was undertaken, with each alternative ranked in terms of "responsiveness" to the relevant criteria on a scale of 0-3; from least to most responsive, using the indicators identified. The overall most responsive alternative was then identified by summarizing the degree to which each of the criteria and associated indicators were met.

It is important to note that this was a completely separate evaluation, and that the ranking scale was meant to distinguish the three St. Laurent Depot Positions and was not related to the rankings contained in the evaluation of the ten original candidate sites.

The evaluation was carried out as two assessments:

1) In accordance with the existing standard 'comparative evaluation' methodology; this provides an unbiased comparison of the locations and the evaluation criteria (see Table 8-3).

2) A 'percentage ranking' methodology; which weights the site characteristics to provide findings that more realistically portray public opinion, regardless of the outcome of the categories. This method was chosen as the 'comparative evaluation' can favour a location which has issues of complex development, ownership or public sensitivity (see Table 8-4).

Table 8-3: Evaluation of Locations (Comparative Evaluation)

	Location 1: Easterly Position	Location 2: Westerly Position	Location 3: Central Position
Evaluation criteria: Site characteristics	2.7	2.0	2.5
Evaluation criteria: Facility Operations	2.0	2.8	2.5
Evaluation criteria: System Operations	1.7	2.7	2.3
Evaluation criteria: Costs	1.3	3.0	1.7
Total	**7.7**	**10.5**	**9.0**

Table8-4: Evaluation of Locations (Percentage Ranking)

	Location 1: Easterly Position	Location 2: Westerly Position	Location 3: Central Position
Evaluation criteria: Site characteristics	16.0	12.0	15.0
Evaluation criteria: Facility Operations	8.0	11.0	10.0
Evaluation criteria: System Operations	5.0	8.0	7.0
Evaluation criteria: Costs	4.0	9.0	5.0
Total	**33.0**	**40.0**	**37.0**
Percentage Ranking	69%	83%	77%

Under both the 'comparative evaluation' and the 'percentage ranking' methodologies, the Westerly Position emerged as the preferred site for the Maintenance and Storage Facility.

Its principal advantages are that it is the least expensive in terms of capital costs and maintenance and operation costs, and that it is considered to be the least expensive and least complicated in terms of land acquisition.

8.7 Consultation on the Alternative Alignments, Station Design Concepts and Maintenance and Storage Facility Sites

8.7.1 Alternative Alignments and Station Design Concepts

The alternative alignments and station design concepts were initially introduced at the Agency, Business and Public Consultation Group meetings of 29 October 2008, with refinements presented at the following meetings held on 2 December 2008 and 21 January 2009. An additional meeting of the Business Consultation Group and selected Agency Consultation Group members was held on 18 February to discuss alignment alternatives associated with the downtown LRT tunnel. Meetings with individual stakeholders (including the Downtown Coalition, Rideau-Viking Corporation, National Arts Centre, National Capital Commission, Public Works and Government Services Canada and the University of Ottawa) were also undertaken to resolve issues and concerns with specific design segments before the alternative alignments and station design concepts were presented to the public at the first Public Open House and Presentation on 26 February 2009. Additional consultation and feedback was used to develop the recommended alignment and station design concepts which were presented to the City of Ottawa's Transit Committee for discussion on 6 May 2009. City Council approved the recommended alignment and station design concepts on 27 May 2009. See Section 4.0 and Appendices A (Public Consultation Report) and B (Progress Reports to Transit Committee and Council) for more detail on consultation activities regarding the alternative alignments and station design concepts.

8.7.2 Alternative Maintenance and Storage Facility Sites

The alternative Maintenance and Storage Facility Sites were initially introduced at the joint Consultation Group meeting of 22 June 2009 and presented to the public at the second Public Open House on 24 June 2009. Based on feedback from the Consultation Groups and the public, additional evaluation was undertaken, focussing on the land use and development impacts

of the three short-listed sites. The results of this analysis were presented at the Agency, Business and Public Consultation Group meetings of 21 October 2009, and to the public at the third Public Open House and Presentation on 26 October 2009. Additional consultation and feedback was used to develop the recommended Maintenance and Storage Facility site, which was presented to the City of Ottawa's Transit Committee for discussion on 16 December 2009. City Council approved the recommended Maintenance and Storage Facility site on 13 January 2010. See Section 4.0 and Appendices A (Public Consultation Report) and B (Progress Reports to Transit Committee and Council) for more detail on consultation activities regarding the alternative Maintenance and Storage Facility sites.