
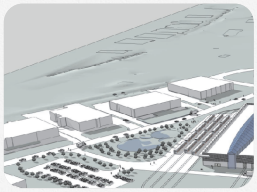
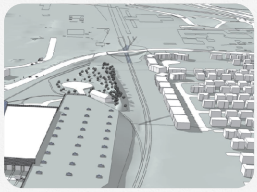


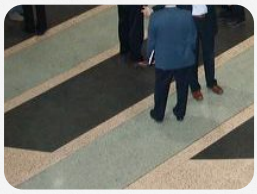
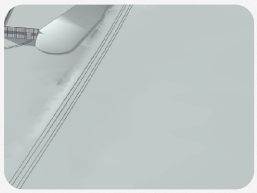

Business Case

Downtown Ottawa Transit Tunnel Project:

Tunney's Pasture to Blair Station via a Downtown LRT Tunnel

Prepared for: City of Ottawa

Prepared by: Metropolitan Knowledge International
in collaboration with Delcan Corporation

26 March 2010

Business Case
Downtown Ottawa Transit Tunnel Project:
Tunney's Pasture to Blair Station via a Downtown LRT Tunnel

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26 March 2010

Foreword/Executive Summary

The Downtown Ottawa Transit Tunnel (DOTT) is the centrepiece of a new investment strategy for public transit in the City of Ottawa. It is the core element of a transportation strategy that can support a more compact form of growth, reduce greenhouse gas emissions, increase mobility for residents and visitors, and dramatically improve the urban environment.

Transit through downtown Ottawa accommodates over 10,000 riders in each direction along the Transitway during peak hours. Currently, transit service is limited to approximately 180 buses an hour along Albert and Slater Streets during peak times to meet travel demand. Effectively, the transit system has reached its capacity in providing Bus Rapid Transit service through the downtown to serve surrounding communities. The system will no longer be able to expand service beyond 2018, and will reach capacity shortly afterwards. With a new, 12.5km grade-separated LRT line operating east-west through a 3.2 km tunnel beneath Downtown Ottawa, the DOTT project will allow transit ridership to grow into the future.

This business case is primarily based on the Planning and Environmental Assessment Study currently underway by the City to develop a detailed plan for the design and implementation of the DOTT project. The study which commenced in fall 2008 and is scheduled for completion in mid-2010 includes extensive public consultation on various aspects of the project, from route alignment to station design to the design and construction of a maintenance facility.

The implementation of the DOTT project is crucial to the viability of Ottawa's downtown as the City's centre of commercial and business activity. Failure to provide efficient and effective public transit could stifle the City's potential for future growth.

Background

The purpose of the Downtown Ottawa Transit Tunnel (DOTT) Planning and Environmental Assessment Study is to develop a plan for a new electrified grade separated rapid Light Rail Transit (LRT) facility that follows Council's decision to implement the City's Transportation Master Plan (TMP). The system must be cost effective, safe, functional, reliable, affordable, durable and sustainable. In May 2009, Ottawa City Council approved the preferred corridor alignment and station designs. The preferred alignment was based on an evaluation using a set of criteria developed for a grade separated LRT system, and forms an important part of the planning phase of the study.

The undertaking for a new grade separated transit facility will see the construction of approximately 12.5 kilometres of new electrified light rail transit between Tunney's Pasture and Blair Stations. Thirteen LRT stations have been identified along the proposed route. The tunnel will span approximately 3.2 kilometres with four below grade stations serving downtown and the University of Ottawa campus. The underground tunnel will start at the western portal, located east of LeBreton Station near Brickhill Street, run through the downtown core area until it turns south-easterly, and reach grade at a portal south of

Campus Station. In addition, the recommended plan includes establishing a maintenance and storage facility, to support LRT operations.

The Recommended Plan was presented to the public in October 2009 and to Transit Committee in December 2009. The plan was approved by City Council in January 2010.

A discussion of the rationale for the recommended plan is provided in the report, as well as supporting documentation and information pertaining to issues arising during consultation with key stakeholders and the public.

Public Consultation / Input

To date, the study has involved over 150 stakeholder groups, including community organizations, property owners and businesses within the study area, institutions, approval agencies and groups with a special interest in the study. In addition several Agency, Business and Public Consultation Group meetings (up to 6 meetings each) and three formal Public Open Houses and presentations were conducted in February, June and October 2009 and were cumulatively attended by more than 300 people. Individual meetings were also arranged with groups such as the Downtown Coalition, Viking Rideau Corporation, the University of Ottawa, CEAA, PWGSC and the NCC. A project website (www.ottawa.ca/tunnel) was established along with a dedicated e-mail address (dott@ottawa.ca) to allow the public to contact the study team directly. Finally, a number of DOTT updates were presented to special interest and community groups at the request of local industry representatives, Ward Councillors and educational institutions such as the University of Ottawa.

As part of the formal provincial environmental assessment process a fourth Public Open House was held in February 2010, and was attended by more than 140 people. The Environmental Project Report will be posted for public review in late spring 2010.

Costs

The cost of the DOTT project, estimated during functional design, is $2.1 billion. A detailed costing of the fully scoped project has been carried out as part of the functional design phase of this study. Costing information includes an estimate for property acquisition, design, project management, construction, and vehicles. These details are outlined in Section 3 of this report. The capital costs of the project are being submitted for Federal and Provincial funding support. Operating costs for the DOTT will be borne by the City of Ottawa.

Benefits

The new DOTT project will result in substantial benefits, including increased ridership, reduced air pollutants and greenhouse gas emissions, improved mobility, substantial job

creation and economic development. In addition to the tangible benefits there will be substantial improvements in the reliability, comfort and convenience of the system.

The project was designed to respond to the growth of the City, and provide increased transit capacity into the city core. The need for the project is based on the Transportation Master Plan analysis that indicates that over the planning period:

- Population will increase 30%
- Employment will increase by 35%
- Mode split will increase from 23% to 30%, and
- Transit ridership will increase by 78%, or 93 million to 166 million annual trips.

By providing greater transportation choice, and adding more capacity, riders will see:

- Reduced travel times,
- Reduced congestion downtown,
- More efficient transit operations, and
- Improved levels of comfort and convenience.

The DOTT project will also allow for redevelopment and transit-integrated development in the downtown. This will help the City achieve its targets for increased reurbanization and intensification and the protection of agricultural and sensitive environmental areas against urban population and expansion pressure.

Increased Transit Ridership

The DOTT project will provide a substantial increase in carrying capacity through the core and will contribute to significant ridership increases. Ridership estimates from the Transportation Master Plan indicate that:

- Total system ridership is expected to increase from 93 million to 166 million trips per annum;
- Ridership on the DOTT line is estimated at 51 million trips in 2021, and 76 million trips in 2031;
- The TMP model indicates that there will be a ridership uplift of 9% through the introduction of LRT. This translates to:
    - 4.6 million new trips in the opening year,
    - 34 million new trips per year in 2031, and
    - Cumulative 161.4 million new trips between an opening in 2019 and 2031.

More than 40% of all transit trips taken in the City will use the DOTT project for all or part of their journey, with the downtown stations predicted to handle more than 50 million annual trips in 2031.

Reduced Emissions of Air Pollutants and Greenhouse Gases

The project is forecast to reduce carbon dioxide emissions by approximately 38,000 tonnes in 2031. It will also reduce criteria air contaminant emissions by approximately 1750 tonnes in the same year. The Net Present Value of these reductions is approximately $69 million.

Improved Mobility

The DOTT project will allow for improved travel from many parts of the City, speeding journey times into and out of the core. The number of stations in the core will provide a similar level of service as the existing transitway, with improved connections to the Byward Market, north Elgin Street, LeBreton Flats and services to Gatineau. The reductions in bus service through the core will also allow for local routes to better accommodate demand and connect to all points in the core. Pressure along Wellington can also be relieved providing improved operational opportunities for STO services.

Economic Development

The DOTT project will contribute to the regeneration of the economy of the Central Area and the creation of new jobs or increased employment. The total amount of direct, indirect, and imputed employment generated associated with the investment is just over 20,000 person-years, and total output of some $3.2 billion.

Transportation User Benefits

The Multiple Account Evaluation (MAE) indicates that there are several substantial benefits in this area, including annual time savings of more than 16 million minutes per year in 2031, and NPV benefits of:

- $276 million in time savings,
- $600 million in vehicle operating cost savings, and
- $217 million in accident avoidance savings.

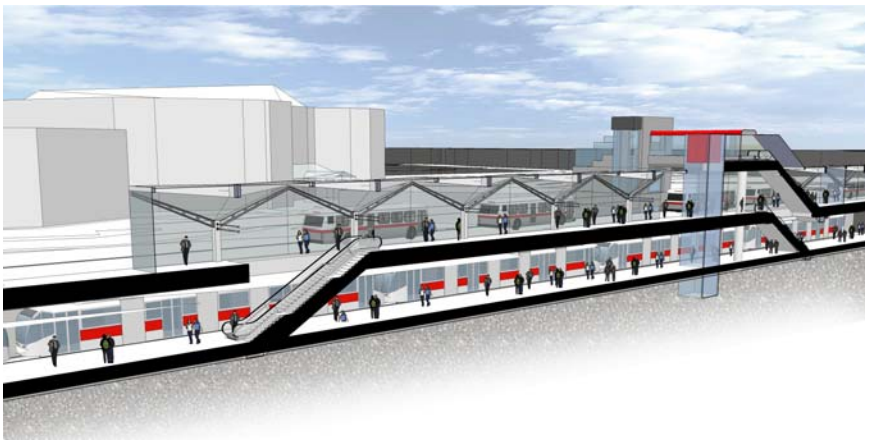
The results are a total user benefit of close to $1.1 billion in present value over the 30-year analysis period (from opening in 2019 through 2039).

Summary

Moving around Ottawa has become more challenging as the downtown core transit system is rapidly approaching capacity and demands from all communities continue to grow. Within the very near future, the transit system will have reached its capacity in the downtown area. The City is proposing a citywide integrated transit solution to address the congestion problem in the downtown core which includes the conversion of the Transitway to light rail and the construction of a downtown tunnel. A do-nothing scenario will put at risk the economic prosperity, environmental integrity and quality of life of Canada's national

capital. Ottawa residents, visitors and business communities who experienced the transit strike in late 2008 to early 2009 understand the importance of public transit for the City. Not addressing the capacity constraints downtown will contribute to extreme congestion, poor air quality, reduced economic opportunities and a decline in social mobility.

The DOTT will increase transit ridership, and improve transportation services throughout the region, and in particular, the downtown core area, as well as provide a key piece of transportation infrastructure needed to support the City's projected population and employment levels for the year 2031. It is a bold project that has the potential to transform the downtown and parliamentary precinct of our nation's capital city.



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1 Introduction, Context, and Basic Eligibility

Transit capacity in downtown Ottawa has been a topic of discussion for many years. In the mid-1970s, the former Region of Ottawa-Carleton first suggested the eventual need for a grade separated rapid transit facility through the downtown. In June 1986, Regional Council directed that a study be undertaken to examine the feasibility of grade separating the Transitway through the Central Area linking the existing East/Southeast and West/Southwest Transitways. The study examining both above and below-ground alternatives as well as alternative alignments and station configurations in the Central Area was completed in 1988 with the conclusion that a tunnel was the most appropriate grade separated alternative. Regional Council decided to continue with further extension of the bus Transitway outside of the downtown leaving the expensive grade separation of the downtown section until it was required.

In October 2001, the City began operating a pilot LRT service using diesel-powered Bombardier 'Talent' vehicles within the former CPR Ellwood North-South railway corridor. Known as the O-Train, the service runs between Greenboro and Bayview Stations, while also serving Carleton University and the Federal Government office complexes at Confederation Heights and Carling Avenue. This service has proven to be very successful, with current ridership of 10,200 per weekday (average 2009), well in excess of original projections of 5,800 to 7,300 per day.

In May 2003, the City adopted a new Official Plan (OP) that set out a growth management strategy emphasizing urban intensification and increased mixed-use development centred about key rapid transit corridors as a means to address travel demand and to discourage single occupancy vehicle use as the preferred mode of peak period travel. To support this strategy, the City also approved a Transportation Master Plan (TMP), with an expanded rapid transit network as a key component to achieving this objective.

In 2007, the City initiated the five-year review of the TMP to update the rapid transit network and plan for 2031. The process developed a revised rapid transit network and set out a set of implementation priorities. The TMP update reported that transit through downtown accommodates over 10,000 riders, per direction, during peak hours. Currently, transit service has been kept at or below 180 buses an hour along Albert and Slater Streets during peak times in order to maintain service reliability. Effectively, the transit system has approached its capacity in providing Bus Rapid Transit service through the downtown to serve surrounding communities. The system will no longer be able to expand service to accommodate future growth if surface operations continue.

The TMP aims to implement a series of initiatives whereby electrified light rail will:

- Increase transit ridership and improve transportation services throughout the region, and in particular, the downtown core area;

- Provide the transportation infrastructure needed to support the City's projected population and employment levels for the year 2031.

The most significant initiative, and the subject of the DOTT study, is to:

- Construct a tunnel across downtown Ottawa; and
- Convert the existing Transitway between Tunney's Pasture and Blair Station from bus to rail technology.

As approved by Council, light rail transit will follow the established Transitway route between Tunney's Pasture Station and Blair Station via a tunnel through the downtown to replace the existing on-street downtown transit. The need for LRT has been established through the TMP exercise and Council approved the choice of LRT technology in November 2009.

The following sections describe how the Downtown Ottawa Transit Tunnel (DOTT) project fits within the broader context.

Ottawa 20/20: Growth Management Strategy

Ottawa is Canada's fourth-largest city and Ontario's second-largest city, with a population of over 900,000 (metropolitan area is over 1.2 million) and an area of 2,596 square kilometres. In 2003, the City released Ottawa 20/20 as its growth management strategy "for managing growth over the next 20 years in ways that will reinforce the qualities most valued by the city's residents: the availability of high-quality services; its reputation for innovative economic development and exciting job opportunities; liveable communities; diverse artistic and cultural life; varied housing forms; green and open spaces; and the heritage landmarks and landforms that distinguish Ottawa from all other cities."

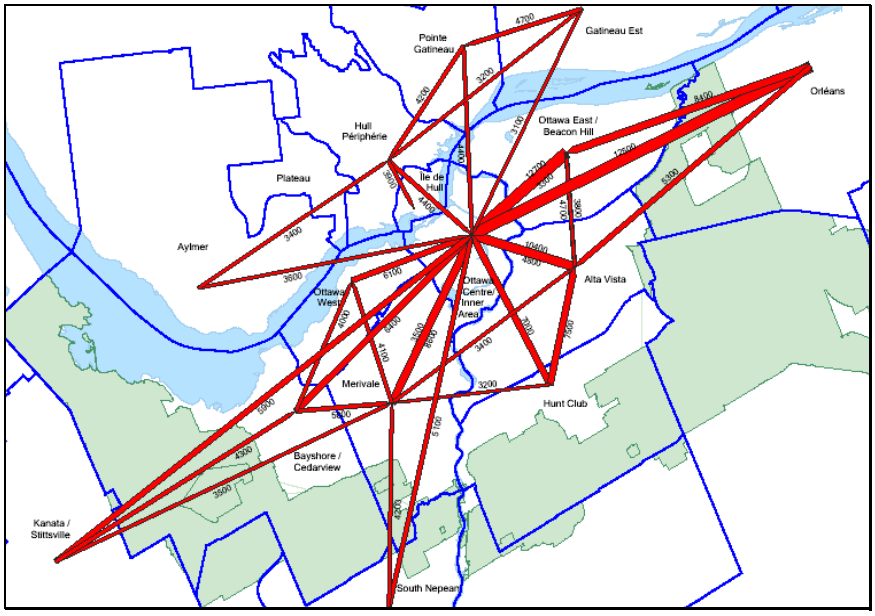
Based on the following guiding principles, the Ottawa 20/20 vision became the foundation of a series of growth management plans to guide the City's growth in physical development (Official Plan), economic development (Economic Strategy), people development (Human Services Plan), cultural development (Arts and Heritage Plan), and ecological development (Environmental Strategy):

- A Caring and Inclusive City
- A Creative City Rich in Heritage, Unique in Identity
- A Green and Environmentally-Sensitive City
- A City of Distinct, Liveable Communities
- An Innovative City Where Prosperity is Shared Among All
- A Responsible and Responsive City
- A Healthy and Active City

Specific to the "city of distinct, liveable communities" principle, further development of the rapid transit system would encourage growth at higher densities. New housing and other land uses will also be encouraged to locate

along rapid transit corridors and in areas that can be serviced with quality transit, creating a built-in ridership for transit and reducing the need for car travel.

To support this growth management strategy, the City approved a Transportation Master Plan (TMP) that set a 30% transit modal split target for the year 2031. The TMP identifies an expanded rapid transit network as a key component to achieving this target. The major travel flows between districts in the National Capital Region for weekday mornings in 2005 are shown in the exhibit below. The exhibit clearly shows that downtown Ottawa is a dominant destination (23% of trips shown), and that a significantly greater number of residents crossed the Greenbelt from Orléans than from Kanata-Stittsville. It also shows that 57% of trips to central Ottawa from other districts came from east of the Rideau River, versus 43% from areas to the west.



Official Plan

The update to Ottawa's OP was approved by Council in June 2009, setting out the plan for the City to 2031. With the updated OP, Ottawa's population is expected to exceed 1.1 million by 2031, a level of growth that will open new opportunities for the City and its residents. The OP is intended to help manage this growth in ways that reinforce the qualities of the city most valued by its residents: its distinctly liveable communities, its green and open character, and its unique characteristics that distinguish Ottawa from all other places.

Employment growth is expected to be robust over the coming years, driven by expansion in the information technology and federal government sectors. The projections assume that over the next 20 years, job creation occurs at a steady rate and the city's job base is expected to grow from 530,000 jobs in 2006 to

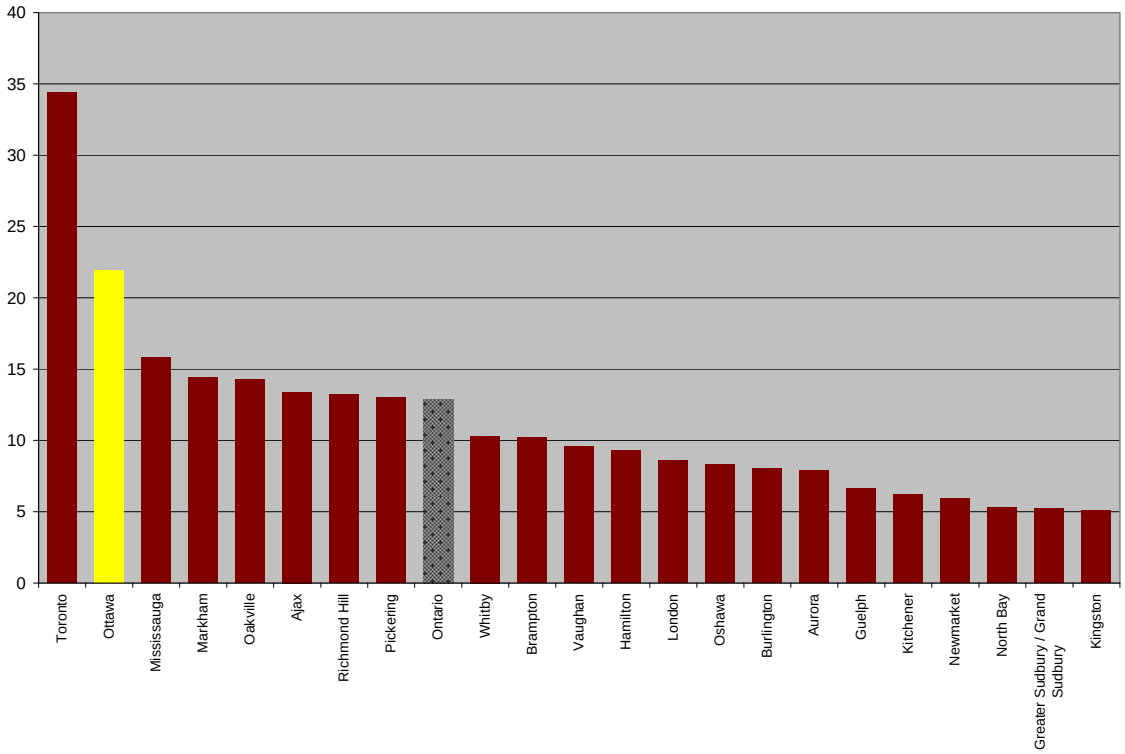
703,000 by 2031, with urban job growth slightly higher outside the Greenbelt than inside it, and some additional employment occurring in the rural areas.

Within the urban area, the Plan directs growth to locations with significant development potential, specifically those designated as Central Area, Mixed-Use Centre, Town Centre, Employment Area, and Mainstreets. These areas include key locations centred on the rapid transit network. The Central Area is the economic and cultural heart of the City and the symbolic heart of the nation. Parliament Hill and a host of national institutions such as the National Gallery and the Canadian War Museum draw thousands of visitors to the core of Ottawa every year. Over time, its distinctive qualities will be enhanced by providing for a greater range of uses, paying particular attention to the quality of community design and ensuring that residential uses are strengthened. In the Central Area, population is projected to more than double and employment to increase by 23% during the 2006-31 period.

Land use and infrastructure issues are strongly inter-related and together form a cornerstone of the City's growth management program. Of key importance in this respect is the link between land-use patterns and transportation facilities. The provision of transportation infrastructure deeply affects land-use patterns because it brings a new range of destinations "closer" and encourages travel to them. This influences residents' decisions about where to live and work, and may change where businesses choose to locate within the City. Land-use patterns affect the performance of transportation systems and the travel options realistically available to residents.

A clear objective of the OP is a substantial increase in the use of public transit and reduced dependence upon automobile use during peak hours. Increasing the percentage of trips by transit from today's level of 23 per cent of total passenger trips using motorized modes (transit or automobile) to about 30 per cent by 2031 is crucial to meet growing travel needs. As shown by the Census 2006 data, Ottawa ranked second in the percentage of those using public transit to travel to work in Ontario. The rapid transit system will be expanded to directly serve much more of the urban area. Complementary measures will also be needed to enhance the relative attractiveness of transit over private automobile use.

Census Year 2006: Travel to Work - % Using Public Transit
Select Ontario Municipalities



Transportation Master Plan

As part of the Ottawa 20/20 initiative to manage growth, the City updated its Transportation Master Plan (TMP) in November 2008. It is the vision of the TMP to establish the new transit network that will create the conditions needed to support mobility and a reduced reliance on individual cars as a means of transportation while contributing to broader goals of sustainable development, a strong economy and improved quality of life. The TMP aims to increase the proportion of motorized person-trips carried by transit in the morning peak hour from 23% in 2005 to 30% (a level similar to many European cities) in 2031. Part of its multi-pronged transit strategy is outlined below:

- Supporting measures. The City will work to make transit more competitive relative to automobile use, and to make it the first choice for as many people as possible. To do so, it will improve the form of development, reduce the supply of abundant free parking at key destinations, improve public awareness and support, level the financial playing field between transit and driving, better integrate transit with other modes, and set priorities for new infrastructure that improve transit's service advantage wherever possible.

- Ease of mobility. The City will improve the mobility it offers to individuals through a variety of initiatives related to route network structure and service standards, rapid transit and transit priority networks, fleet expansion and maintenance, and safety and security by expanding the network of bus rapid transit and electrified light rail corridors to encourage intensification of land uses around many rapid transit stations and by implementing a network of transit priority corridors to reduce travel times and improve the reliability of transit service in mixed traffic conditions (where necessary capital investments will be made for grade-separated rapid transit facilities).

Travelling to downtown Ottawa has become more challenging as the downtown core transit system is rapidly approaching capacity, the road system is already at capacity and demands from all communities continue to grow. By 2018, the transit system will have reached its capacity in the downtown area. The City is proposing a citywide integrated transit solution to address the congestion problem in the downtown core which includes the conversion of the Transitway to light rail and the construction of a downtown tunnel. A do-nothing scenario will put at risk the economic prosperity, environmental integrity and quality of life of Canada's national capital. Ottawa residents, visitors and business communities who experienced the transit strike in late 2008 to early 2009 understand the importance of public transit for the City. Not addressing the capacity constraints downtown will contribute to extreme congestion, poor air quality, reduced economic opportunities and a decline in social mobility.

Other City Initiatives Supportive Of The Downtown Ottawa Transit Tunnel Project

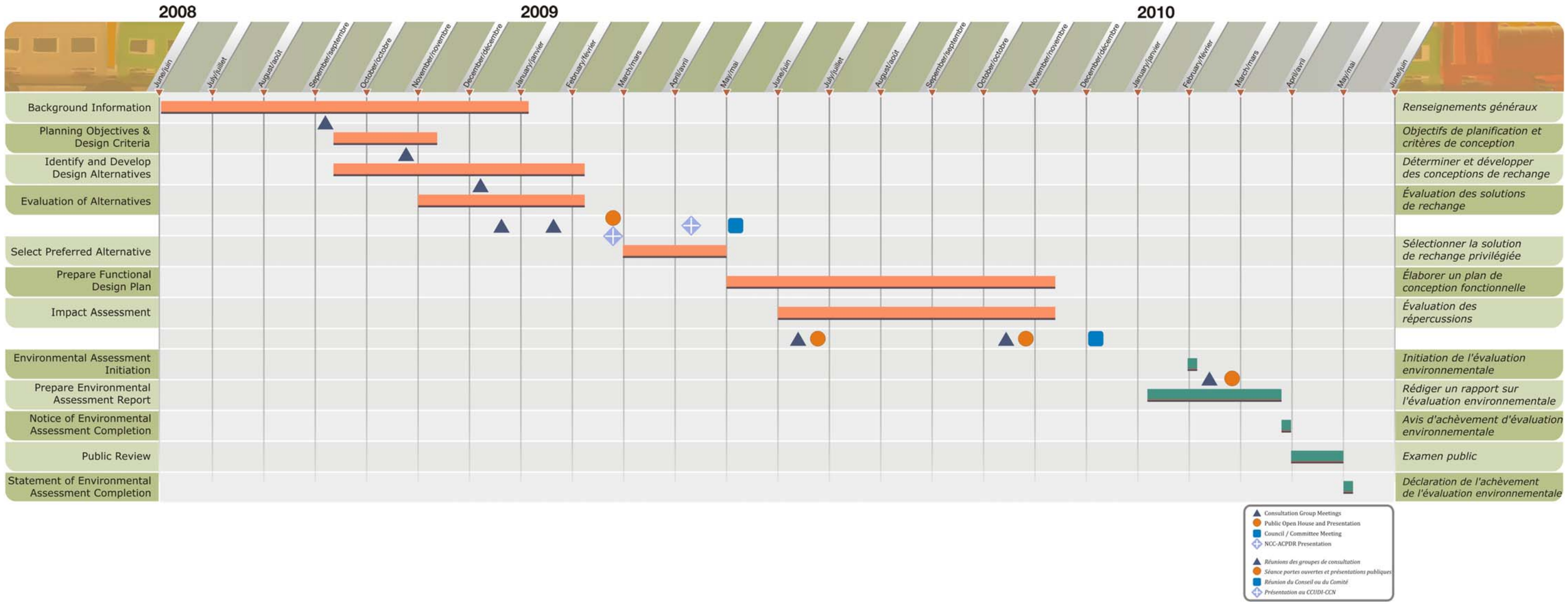
Besides those already mentioned, the City of Ottawa has set in place a number of other policies and programs that have been developed to support the proposed Downtown Ottawa Transit Tunnel project. The Transportation Master Plan sets out a phased set of projects, which will be implemented by 2031. The first phase transit projects include:

- Expansion of current Transitway - The Transitway is to be expanded by adding a 15-km BRT (bus rapid transit) system in east, west and south Ottawa, including;
    - Southwest Transitway – from Baseline station to Norice Street and from Fallowfield Road to Barrhaven Town Centre,
    - West Transitway – from Bayshore to Moodie Drive, and
    - Cumberland Transitway – from Blair Station to Innes Road and from Innes Road (at Blair) to Navan Road (at the hydro corridor).
- Strandherd-Armstrong Bridge, Approaches and Associated Work - The six-lane bridge crossing the Rideau River with two lanes dedicated for public transit to link Prince of Wales Drive and Earl Armstrong Road.

- Transit Priority on Strandherd Drive – from Rideau River to Woodroffe Park and Ride, including bus lanes on Strandherd/Armstrong bridge, and on Woodroffe Avenue – from Woodroffe Park & Ride (at Strandherd Road) to Fallowfield Park and Ride
- Baseline Rd. to Norice St. Rapid Transit - New BRT/LRT major transfer station to integrate the Algonquin College expansion and the Centrepointe Town Centre future developments.

Project Specific Studies

On November 28, 2008, as part of the TMP Update approval, City Council approved a transit tunnel through downtown Ottawa as a key feature of the new rapid transit network. As such, a series of technical studies have been initiated. The Downtown Ottawa Transit Tunnel Planning and Environmental Assessment (EA) study has been initiated and is scheduled to be completed by June 2010. The study has the objective to determine how to build LRT between Tunney's Pasture Station and Blair Transit Station on the existing Transitway and to identify the routing of the tunnel section through the downtown core. In addition, the study includes recommendations for station locations, transit riders' access to the tunnel from the street, the look of the stations from an urban design perspective and finally how the stations will be integrated with existing buildings.


2008
2009
2010
June/juin
July/juillet
August/août
September/septembre
October/octobre
November/novembre
December/décembre
January/janvier
February/février
March/mars
April/avril
May/mai
June/juin
July/juillet
August/août
September/septembre
October/octobre
November/novembre
December/décembre
January/janvier
February/février
March/mars
April/avril
May/mai
June/juin
Background Information
Planning Objectives & Design Criteria
Identify and Develop Design Alternatives
Evaluation of Alternatives
Select Preferred Alternative
Prepare Functional Design Plan
Impact Assessment
Environmental Assessment Initiation
Prepare Environmental Assessment Report
Notice of Environmental Assessment Completion
Public Review
Statement of Environmental Assessment Completion
Renseignements généraux
Objectifs de planification et critères de conception
Déterminer et développer des conceptions de rechange
Évaluation des solutions de rechange
Sélectionner la solution de rechange privilégiée
Élaborer un plan de conception fonctionnelle
Évaluation des répercussions
Initiation de l'évaluation environnementale
Rédiger un rapport sur l'évaluation environnementale
Avis d'achèvement d'évaluation environnementale
Examen public
Déclaration de l'achèvement de l'évaluation environnementale
Consultation Group Meetings
Public Open House and Presentation
Council / Committee Meeting
NCC-ACPDR Presentation
Réunions des groupes de consultation
Séance portes ouvertes et présentations publiques
Réunion du Conseil ou du Comité
Présentation au CCUDI-CCN

The study is completed in two separate phases: (1) Project Planning and Functional Design Phase; and (2) Environmental Assessment (EA) Phase.

During the first phase, the City considered the alignment of the transit tunnel and LRT alignment from Tunney's Pasture to Blair Station, the location and spacing of stations, their design, and how the DOTT project will link into other rapid transit expansion projects – including the possibility of connecting with future rapid transit links to Gatineau. The objectives of this first phase are:

- Increase transit ridership and mobility
- Enhance Ottawa's urban character and national stature
- Stimulate smart growth
- Create successful rapid transit stations
- Provide safe and efficient linear infrastructure
- Provide a safe and efficient tunnel and compatible portals
- Be compatible with adjacent communities
- Maintain or improve natural and physical environments
- Showcase sustainable design best practices
- Manage construction disruption and risk
- Result in a wise public investment

The first Open House for this phase took place on February 26, 2009. An interim report that advances a technically preferred alignment and station design was presented at the Transit Committee meeting on May 6, 2009.

On June 24, 2009, the second open house was held to solicit public feedback regarding the maintenance and storage facility. The maintenance and storage facility will accommodate activities needed to support the operation and maintenance of the light rail system, including:

- Heavy maintenance (major repairs);
- Light maintenance (minor repairs);
- Cleaning (inside and out);
- Storage of rail vehicles; and
- Signalling and communications control.

The facility will be sized to accommodate the ultimate number of vehicles required, though only a portion of the facility may be constructed initially.

The third open house was held on October 26, 2009 to gather public input on the planning and the functional design of the DOTT.

The Rail System Selection Report was tabled at the City's Transit Committee on October 21, 2009 and considered by the Council on November 18, 2009. Essentially the decision by Council for light rail will ensure that this and future light rail projects:

- Has less impact on the urban fabric and allows the ability to integrate both non-segregated and segregated systems,
- Provides the necessary capacity for the ridership predictions in the main core,
- Can efficiently accommodate low passenger capacity in the extensions outside of the main core,
- Has lower total system capital costs than light metro, and
- Can accommodate Ottawa weather conditions.

The Recommended Plan, consolidating the planning and vehicle technology selection was approved by Council on 13 January 2010. This completed the first phase of the project.

The functional design contained in the Recommended Plan is the basis for the EA phase of the study, which was initiated with a formal Notice of Commencement on 12 February 2010. This process consists of a coordinated EA that meets the requirements of the new Transit Project Assessment Process (Ontario Regulation 231/08) under the Ontario Environmental Assessment Act (OEAA) and the requirements of the Canadian Environmental Assessment Act (CEAA). This EA process allows for the final consultation on the project and the completion of the documentations. It will document the potential effects of the project on the environment, including any mitigation strategies necessary to offset negative impacts. This second phase is expected to finish in June 2010.

The City of Ottawa Council approved DOTT to expand and improve its rapid transit network. This project has been submitted for funding to the Government of Canada under the Building Canada Fund (BCF), and to the Government of Ontario.

1.1 Eligible transit project subcategory

As a light rail system, the Downtown Ottawa Transit Tunnel project is eligible under subcategories "a" and "e", under the Major Infrastructure Component (MIC) of the Building Canada Fund.

1.2 Funding Recipient eligibility

As a municipal government under provincial statute, The City of Ottawa is eligible to receive BCF funding.

1.3 Detailed Project Overview

The Recommended Plan for the DOTT is comprised of the construction, operation and maintenance of the electrified LRT project. A detailed description of the

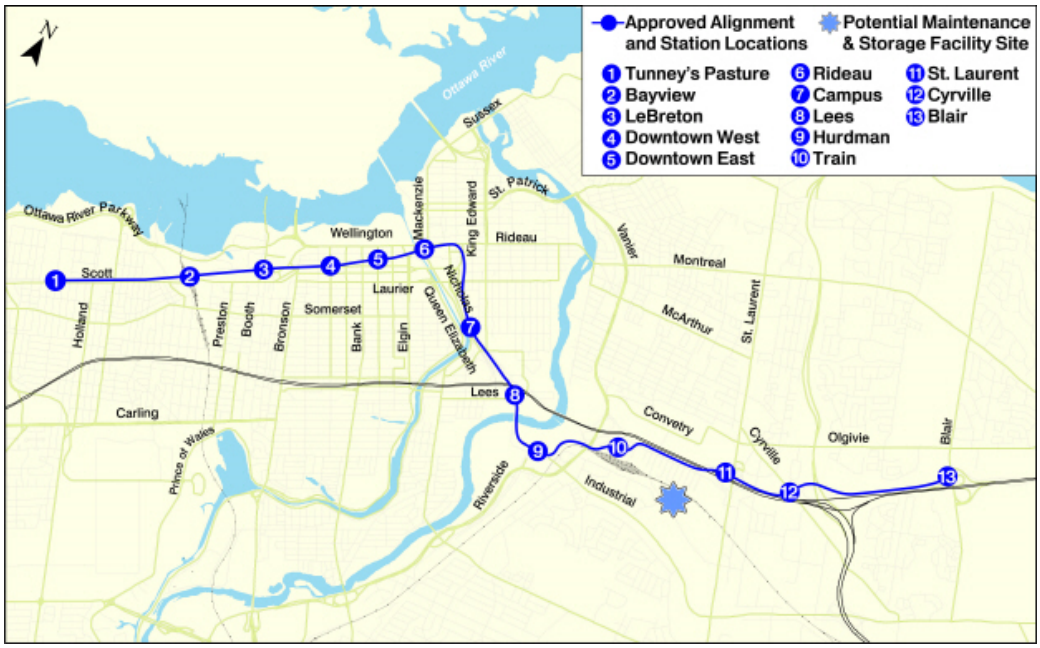
Recommended Plan is contained in the Functional Design Report. The following section outlines the proposed route, technology, and work to be carried out as part of the City of Ottawa's DOTT project.

Route Overview

The DOTT project consists of the following three segments:

- An at-grade alignment from the western terminus at Tunney's Pasture to east of Booth Street,
- A 3.2 km tunnel through the downtown core from Booth Street to south of the University of Ottawa (at Mann Ave.), and
- An at-grade route from south of the University of Ottawa to Blair Station.

Overall, thirteen stations as shown in the exhibits below are proposed along the 12.5-km route. Four of the stations will be underground and the remaining nine will be conversions of the existing Transitway stations to LRT stations. The route will connect into the existing Transitway east and west of the study area, into the Southeast Transitway at Hurdman Station, and to the O-Train at Bayview Station.



Design Assumptions

Project planning objectives and associated design criteria have been identified to guide the development and evaluation of alternative alignments and designs for the DOTT project. These objectives and criteria:

- Enable a shared understanding by the City, the design team, and all stakeholders of the project and its expectations;
- Implement planning and design directions of the Plan for Canada's Capital, Ontario's Provincial Policy Statement, and the City of Ottawa's Official Plan and Transportation Master Plan Update;
- Form the fundamental planning objectives and basic design assumptions;
- Provide guidance for designers and others to use when trade-offs need to be addressed;
- Provide a basis for the selection of criteria to be used in the evaluation and assessment of alternative designs; and
- Form the basis for determining detailed design criteria and specifications.

These objectives and criteria are not intended to replace existing federal, provincial and municipal policies and standards which apply to the study area and which the design of the DOTT will be required to meet. Rather they compliment and enhance those provisions and provide additional design direction that is focused specifically on this project in this context.

The DOTT project will be planned and designed in accordance with the following eleven (11) project planning objectives. The project will:

A. Increase Transit Ridership and Mobility

B. Enhance Ottawa's Urban Character and National Stature

C. Stimulate Smart Growth

D. Create Successful Rapid Transit Stations

E. Provide Safe and Efficient Linear Infrastructure

F. Provide a Safe and Efficient Tunnel and Compatible Portals

G. Be Compatible With Adjacent Communities

H. Maintain or Improve Natural and Physical Environments

I. Showcase Sustainable Design Best Practices

J. Manage Construction Disruption and Risk

K. Result in a Wise Public Investment

Geometric Constraints and Utilities

The DOTT project's linear infrastructure, including running structures, track, power supply, bridges and structures will provide for the safe, efficient, durable, expedient and reliable movement of transit vehicles as well as the routing of services and utilities.

Related design criteria comprise:

- Route Length: Use shortest routes to reduce trip times and cost of construction.
- Transitway Co-alignment: Reuse existing roadbed and drainage wherever possible, including the possibility of using existing transitway corridors.
- Transitway Conversion: Provide for potential interface with existing bus rapid transit station facilities wherever possible.
- Mainline Track Curvature: Design and build mainline track to minimize noise and vibration and to maximize ride comfort by assuming 425 m as the desirable minimum for horizontal curves at 80 km/hr vehicle speed, with 150 m being the minimum for basic ride comfort, and with 75 m absolute minimum (to be used only where physical constraints dictate).
- Balanced and Unbalanced Superelevation: design for a maximum superelevation of outer rail of circular curves of 100 mm, and minimize unbalanced superelevation. Consider a functional planning maximum unbalanced superelevation of 25 mm (with a lateral acceleration of 0.018g), and an absolute maximum unbalanced superelevation of 75 mm (with lateral acceleration of 0.1g).
- Clearance Envelope Calculation: Develop and apply a vehicle clearance envelope that accounts for the design vehicle dynamic envelope, superelevation effect, curvature effect and trackwork construction and maintenance tolerances.
- Track Centres: Assume a minimum track separation with a centre OCS pole is 4.5 m on tangent track, with minimum track separation on curves is increased by 3.5 times the superelevation.
- Track Gauge: Assume the track gauge shall be "standard" gauge of 1435 mm (4'-8½"), measured 16 mm below top of rail.
- Track Structure: A durable and long-life track support system will be developed to respond to the various corridor segments. Embedded track will be used where emergency vehicles require access, double-tie and vibration isolation systems will be used where sensitive land uses exist and the track will be directly fixed to the tunnel or bridge structures as required for long term stability.
- Vertical Curves: For functional design purposes crest vertical curves should have a minimum 250 m radius and sag vertical curves should have a minimum 350 m radius.
- Track Grades: Track grades should be less than the desired maximum of 3.5%. Where necessary, short stretches of track with a 5.0% grade will be acceptable as the absolute maximum.
- Station Grades: Stations should be planned with a constant 0.3% grade for drainage, but can have grades up to 1.5% maximum. If a station has to be

on a crest curve, the maximum grade would be 0.5% down in each direction from station centreline. Stations cannot be planned with sag curves.

- Special Trackwork and Storage Tracks: To provide for operational flexibility and to recover from disrupted operations, special track work and storage tracks will be designed into the system. Special trackwork shall be placed on a constant grade, preferably less than 0.5%, on tangent track with no horizontal or vertical curves. These elements shall be placed to provide good flexibility but are more easily accommodated outside the tunnel area.
- Electrical Power Substations: Electrical power substations should be integrated into stations or adjacent buildings. If possible the substations will not be located in the downtown core area.
- Municipal Services & Utilities: The construction or realignment of municipal services and utilities should cross the alignment at a right angle where possible rather than running parallel or directly above.
- Emergency Vehicle Access: Provide potential for emergency vehicle access along and across the corridor, where appropriate.
- Underground Structures: Assume a design life for underground structures of 100-120 years.
- Bridge Structures: Design bridges to the Canadian Highway Bridge Design Code CAN/CSA-S6-06 (or latest revision).
- Seismic Rating: Assume an importance category of "Emergency-route" in regards to the seismic rating of bridges and structures.
- Aesthetic: Design structures that compliment their community context.

Functional Design Overview

West Transitway Conversion

Beginning at Tunney's Pasture Station in the west, the proposed LRT alignment follows the existing BRT alignment in a below-grade trench east towards Bayview Station. East of Carruthers Avenue, the trench ends, with the existing Transitway rising onto an elevated fill structure and an overpass at Bayview Road. East of Bayview Road, the LRT alignment shifts slightly north of the existing Transitway alignment and enters Bayview Station, which will be a three level station accommodating the DOTT tracks on the upper level, an intermediate mezzanine to connect the station to the local street network and to adjacent development opportunities, and a lower level accommodating platforms for a future North-South LRT alignment and potentially an interprovincial transit connection via the Prince of Wales Bridge. To the east of Bayview Station the LRT alignment slopes downwards to cross under a new extension of Preston Street and reconstructed Booth Street bridge. The alignment through this area is situated within a corridor defined as part of a previous agreement between the National Capital Commission

（NCC） and City of Ottawa to accommodate LRT through the NCC's LeBreton Flats development lands. East of Booth Street, the LRT alignment curves north and then east and enters into the downtown transit tunnel.

Downtown Transit Tunnel

Horizontal Alignment

The proposed downtown transit tunnel spans roughly 3.2 km from east of Booth Street to south of Mann Avenue with four underground stations. The tunnel route follows a "cross-country" alignment that enters the downtown under Albert Street, with the Downtown West station in the Lyon/Bay block. The alignment then turns slightly to the north at Bank Street to cross under Queen Street at O'Connor, with the Downtown East Station centred between Bank Street and O'Connor. The alignment then continues cross-country toward Rideau Street, passing under the Confederation Square area, with a Rideau Station spanning under the Rideau Canal to the area of the Rideau Centre. A curve to the south takes the alignment under Rideau and Waller Streets where the existing Transitway corridor is reached at the east end of the Mackenzie-King Bridge. Following under the existing Transitway corridor to a point south of Laurier Avenue, the alignment crosses under Nicholas Street and follows Colonel By Drive, with Campus Station located in the vicinity of the Corktown Footbridge. South of Campus Station, the alignment curves back under Nicholas Street to rejoin the existing Transitway alignment at the south end of the university campus. The east tunnel portal would be located south of this location, between Mann Avenue and Lees Station.

Vertical Alignment

The vertical alignment of the tunnel must be deep enough to permit the safe construction of the tunnel and stations by avoiding impacts to building foundations, utilities and the Rideau Canal. Given existing available data on rock characteristics at tunnel depths, and the fact that the horizontal alignment of the tunnel passes under some significant existing buildings downtown, conservative estimates of the structural clearances required to construct underground tunnels and station caverns have been applied, resulting in a deep alignment. Additional investigation during the preliminary engineering phase will provide more data on subsurface conditions including detailed information on rock and soil characteristics, faults and ground water movement along the route of the tunnel. Any changes to the vertical alignment or, construction methods proposed will be based on the results of this investigation. After entering the tunnel through the west portal, the LRT alignment descends to a depth of 38 m below grade before reaching the Downtown West Station. The tunnel continues to descend, reaching a low point of 44 m below grade, before rising to the Downtown East Station.

The tunnel then maintains a relatively flat grade between Downtown East and Rideau Station, located approximately 30 m below grade. The tunnel then begins

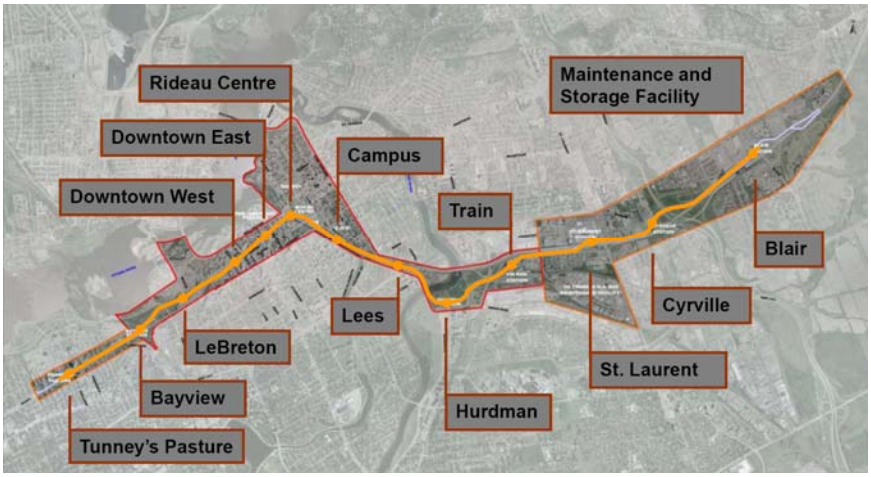
to climb back towards grade, reaching a level of 16 m below grade at Campus Station. A slight dip south of Campus will be required to avoid utilities and tunnel under Mann Avenue, before the West Portal is reached between Mann Avenue and Lees Station.

East Transitway Conversion

After exiting the tunnel, the LRT alignment again follows the existing Transitway corridor, through Lees Station and over the existing Rideau River Bridge to Hurdman Station. The LRT alignment through Hurdman Station is located to the north of the existing BRT platforms, and once again rejoins the existing Transitway alignment east of Hurdman Station to cross over Riverside Drive on the existing Transitway overpass. Through Train Station, the existing Transitway corridor is followed, with the alignment straightened to the north of the existing BRT platforms. East of Train Station, the LRT alignment once again follows the existing Transitway alignment, with the two connections to the Maintenance and Storage Facility connecting in near Belfast Rd., through St. Laurent and Cyrville Stations to its terminus at Blair Station, 12.5 km to the east of Tunney's Pasture.

Stations

Thirteen stations are proposed along the DOTT line. Of these, four will be located underground within the downtown transit tunnel. The other nine stations will be conversions of existing Transitway stations. Tunney's Pasture, Lees, St. Laurent and Cyrville will be straightforward conversions of existing BRT platforms to accommodate LRT technology, while other stations will require more complex reconstruction to accommodate connections to future LRT lines (Bayview), integrate into NCC development lands (LeBreton), accommodate major bus-rail passenger transfers (Hurdman, Blair) or provide an improved alignment for rail operations (Train).



The platform of the stations is 180-m long to accommodate 6-car trains in the future. The configuration of each individual station is designed to fit within the environment within which the station is located. For the underground stations, the platform will be constructed under a combination of private buildings and downtown streets. The underground stations will accommodate the multiple levels of parking under existing buildings as well as the fare collection level as shown in the exhibit below. All of the stations will be fully accessible.

The DOTT project's rapid transit stations will be safe, accessible, attractive, functional, and designed as a connected system of important public amenities. Associated design criteria comprise:

- Catchment Area: Capture the maximum number of riders by locating rapid transit stations that are within relatively short walking distance of medium and high density land uses.
- Building Integration: Select station sites that provide for the best opportunity to integrate the station with existing or planned buildings, tourist destinations, and below-grade retail businesses.
- Personal Services: Encourage accessory retail and service uses to be co-located at all rapid transit stations.
- Spacing: Space rapid transit stations at a frequency that balances the need to capture riders with the need for rapid service.
- Capacity: Vary the scale and capacity of rapid transit stations to match the civic context and expected ridership for the year 2031 and beyond, including the possible need to service special events at certain stations.
- Passenger Circulation in Stations: Design internal circulation to account for stairs and escalators, elevators, run-off areas, queue spaces and corridor flows.
- Transfer Stations: Avoid conflicts between vehicles and between users at transfer stations (including Bayview and Hurdman Stations), and provide capacity for safe and efficient movements and ticket transactions.
- Platform Length: Accommodate the future by planning stations for 6-car LRT trains.
- Platform Access: Maintain at least two access points from all platforms.
- Building Code: Require that all structures adhere to the Ontario Building Code and other associated codes as applicable.
- Barrier Free Design: Ensure that rapid transit stations and associated pedestrian routes are 100% barrier free for persons with a range of abilities.
- Elevating Devices: Provide elevator and redundant escalator connections between all levels, in both directions.

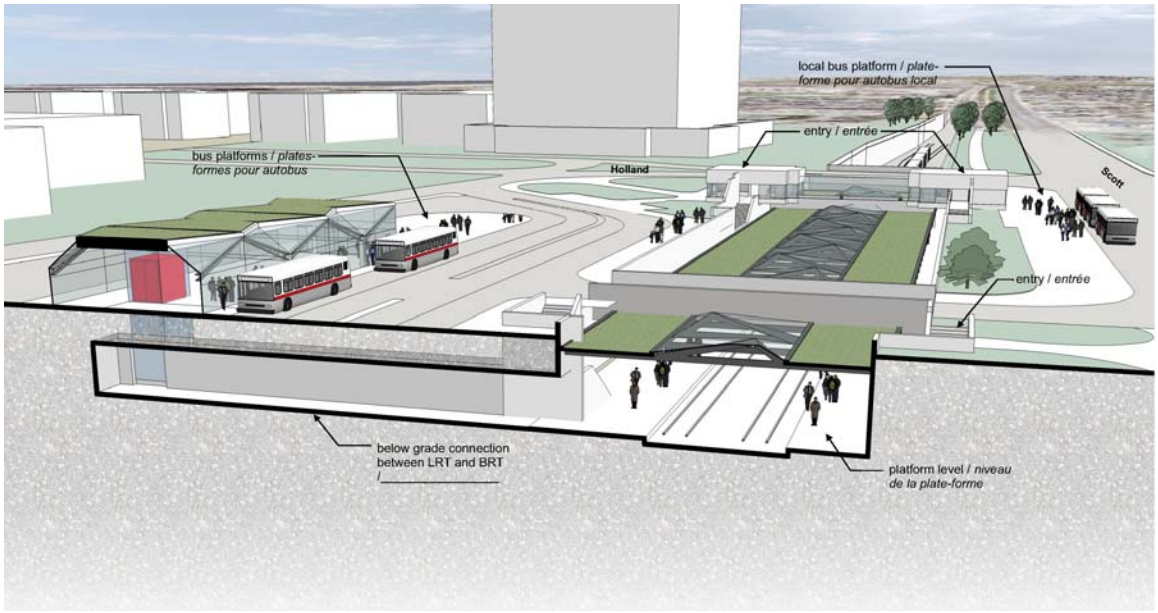
- Wayfinding: Provide legible communications and signage systems that enable user wayfinding and ease of orientation, for all users including persons with a range of abilities, visitors and infrequent users.
- Branding: Develop a common branding scheme that assists in identifying station locations and creating a memorable user experience.
- Durability & Maintenance: Use materials and finishes that are timeless, durable, easily maintained, vandalism resistant, and appropriate for Ottawa's four-season climate and harsh urban conditions.
- Noise and Vibration Management: Use building materials, systems and station designs that minimize noise and vibration transmission.
- Ventilation: Provide adequate ventilation for operating requirements and emergency events, while minimizing the need for mechanical systems through the use of natural ventilation and the piston effect of trains.
- Ventilation Exhaust: Locate ventilation exhaust ports in unobtrusive locations and avoid proximity to fresh air intakes from adjacent buildings.
- Fare Collection: Allow space for a variety of fare collection systems potentially including collector booths, sales of tickets, and smartcard readers.
- Signals and Communication: Provide high quality train control and passenger communications systems for persons with a range of abilities, including intelligent passenger and tourist information solutions.
- Climate Control: Provide weather protection at surface stations, local transit connections, and pick-up/drop-off facilities.
- Personal Safety: Ensure that all public spaces adhere to the principles of crime prevention through environmental design, including the provision of: publicly visible spaces for passive surveillance, easily located entrances, and appropriate use of lighting and landscaping.
- System Security: Provide for surveillance and security systems to maintain a safe and secure system.

The following sections provide further detail on each of the stations.

Tunney's Pasture Station

Tunney's Pasture Station will serve as the western terminus for the DOTT and accommodate transfers from BRT service from the west and southwest until such time that the LRT system is expanded further to Baseline Station in accordance with the TMP (subject to a future Planning and Environmental Assessment Study). The Station will accommodate bus and rail transfers for approximately 9,000 passengers per hour during peak operating times. Until the line is extended further west, 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

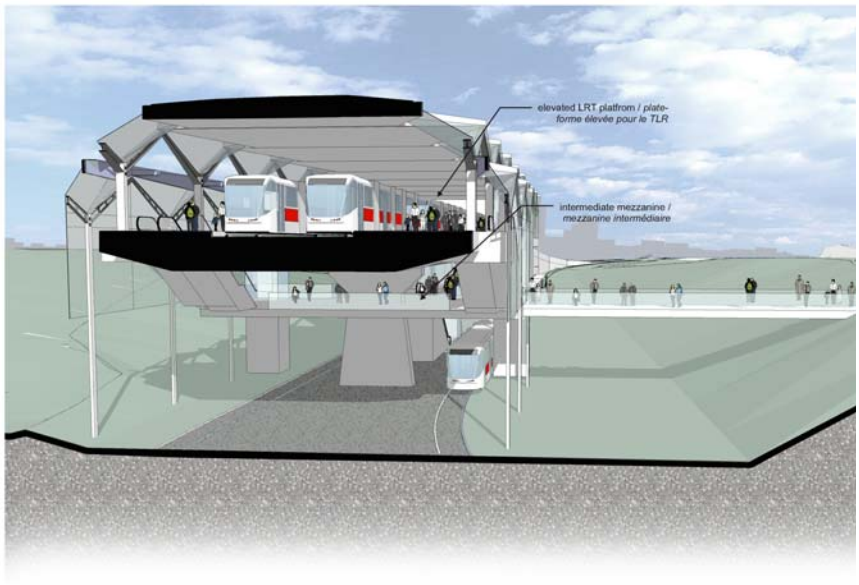
proceed with its development initiatives. Integration of the station with future PWGSC development plans for the Tunney's Pasture employment node can be accommodated. Once LRT is extended to Baseline Station and the BRT transfer facilities are no longer required, these lands can be re-purposed for development.



Bayview Station

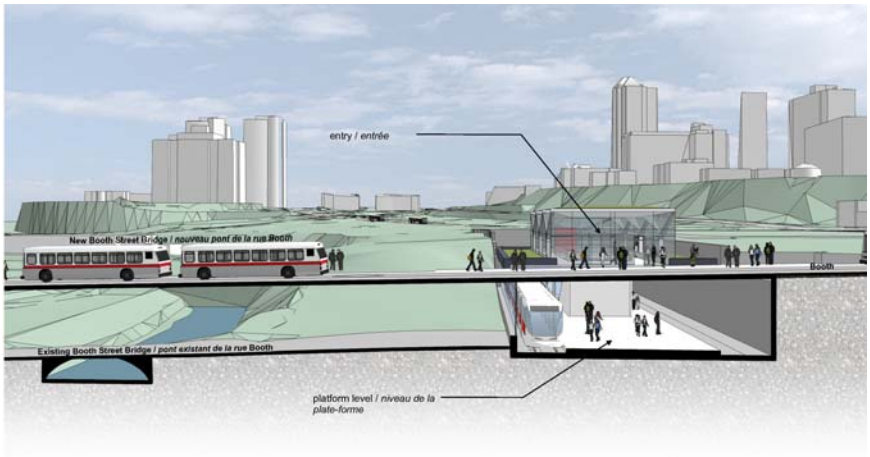
Bayview Station will be a transfer point between the DOTT and the existing O-Train / future North-South LRT. Additionally, the design must consider the potential for interprovincial transit service via the Prince of Wales Bridge. The recommended configuration provides for eventual through movements to/from the North-South LRT line to the core area without having passengers transfer and addresses a direct connection to the core from the Airport and between Carleton University and the University of Ottawa, when the North-South line is converted to electrified light rail as identified in Increment 2 of the TMP.

As the station site is located adjacent to the Bayview and Somerset Area redevelopment lands, potential integration of the station design into future development is of importance. The recommended alignment and new LRT station design therefore seeks to maximize the development potential for lands adjacent to the station that are in both public and private ownership. Cycling and pedestrian pathway opportunities along the alignment, but particularly through the Bayview Station area, will be provided. Options to provide the pathways will be considered in the preliminary engineering stage. Subsequent design phases can also assess the potential for development of the land between the station and Scott Street.



LeBreton Station

LeBreton Station will support future redevelopment of adjacent lands and provide for transfers to OC Transpo bus service to and from Gatineau using Booth Street. The station will be located underneath a new Booth Street bridge, which will span over the LRT corridor and the adjacent aqueduct located north of the station. The station can be directly integrated into future development on NCC land and will also support development on the City's adjacent Escarpment Area development lands.



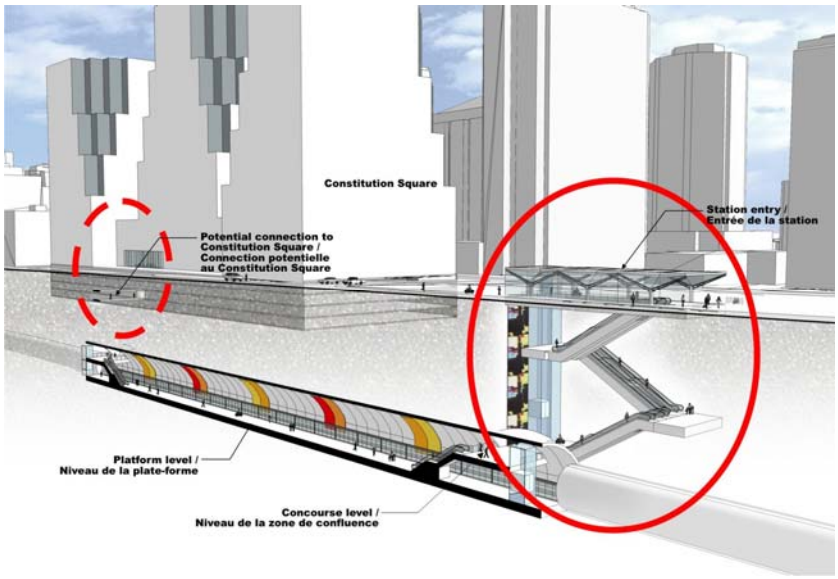
Stations in Downtown Transit Tunnel

The number and placement of stations in the downtown is based on existing and future population and employment densities. Local transit routes, major trip producers, existing internal building connections and adequate coverage of the

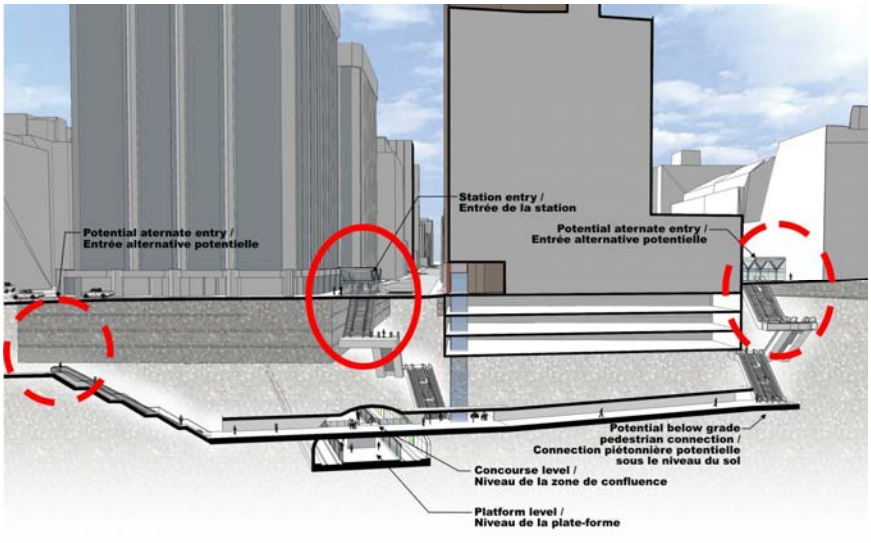
core were also considered. Using a 300-metre circle as a proxy for a five-minute walk, and a 500-metre circle for a 7.5-minute walk, the spacing of the stations was optimized. Two stations are located between Bronson Avenue and Elgin Street and another at Rideau Station. Each of the stations will have a minimum of two public entries, providing good coverage across the downtown.

The four underground stations are:

- **Downtown West Station** is located under Albert Street, east of Bay Street, allowing integration with future Central Public Library building and serve existing development in the west end of downtown. An entrance into Place de Ville or Constitution Square is also proposed if appropriate funding from the private sector becomes available.

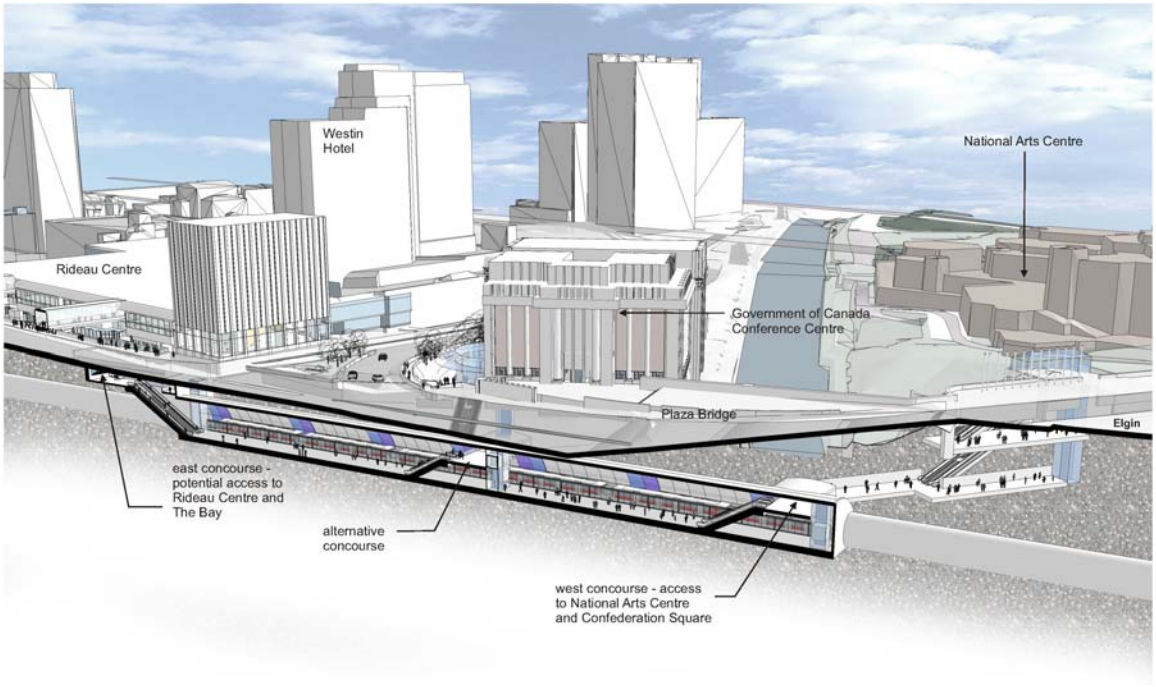


- **Downtown East Station** is located north of Albert Street, between Bank Street and O'Connor Street, to provide connections to local bus services on Bank Street and to serve existing development in central and east parts of downtown.

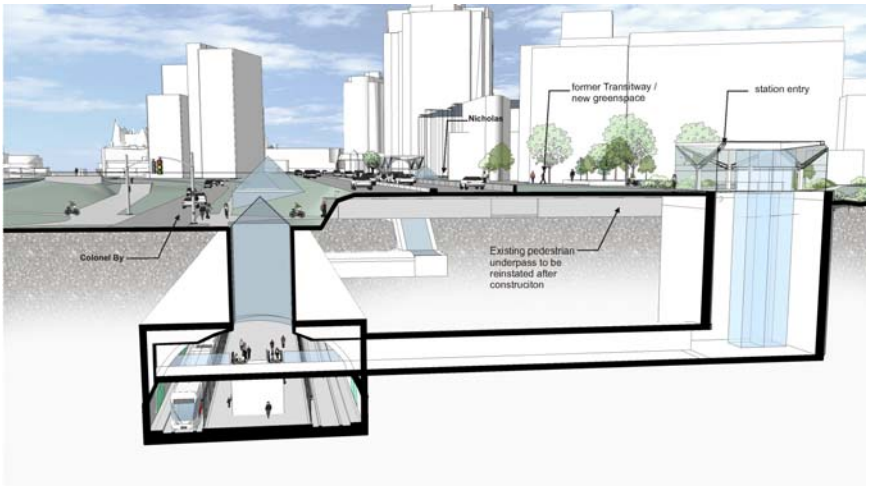


- **Rideau Station** is located south of Wellington Street, between Confederation Square and Sussex Drive, to provide connections to both the west and east sides of Rideau Canal. Passengers exiting via the west station entrance will come to the surface on the east side of Elgin Street, at Confederation Square, with views to the National War Memorial, Parliament Hill, Chateau Laurier, and Government Conference Centre providing for an iconic arrival experience from this station entrance. The location of this station entrance would provide direct access to the LRT station for people attending events at Confederation Square and along the Rideau Canal.

  The design of this station entrance requires further discussion with NCC and Parks Canada during subsequent design phases to ensure that any visual impact to established view corridors and the Rideau Canal zone are minimized. There is an opportunity to integrate with NCC plans for a barrier free connection between the canal level and Confederation Square. If appropriate funding arrangements can be made there is an opportunity to provide a direct underground connection into the National Arts Centre (P1 level), allowing weather-protected connections between the NAC and the LRT station.



- **Campus Station** is located in the vicinity of the existing Campus Transitway Station, but shifted to the west side of Nicholas Street to improve constructability, minimize impacts to transit operations during construction, and avoid closure of Nicholas Street. Station entrances and vent shafts would be located on the east side of Nicholas Street to minimize impacts to NCC lands and the Rideau Canal zone. The station will provide connections to the University of Ottawa, Sandy Hill and Golden Triangle (via the Corktown Footbridge).

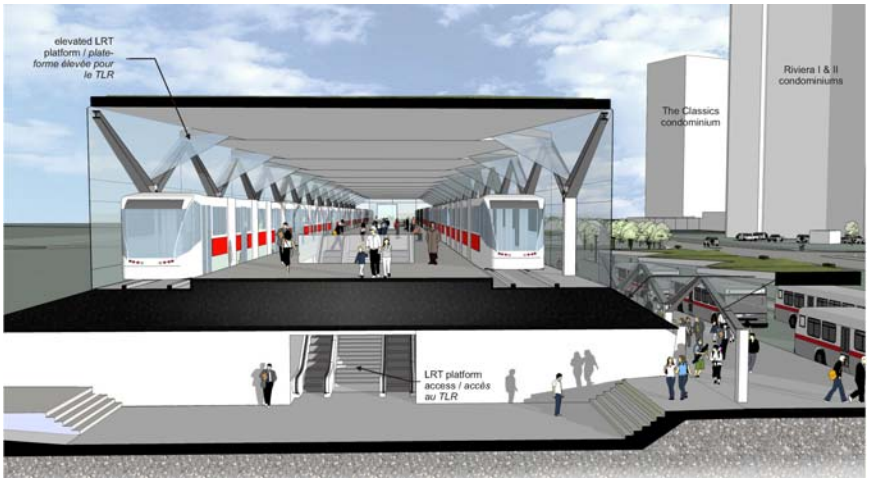


Lees Station

Lees Station serves adjacent residential development to the south and east of the station area, as well as the southern part of the Sandy Hill community. The station will remain in its current location and general configuration, with upgrades to existing station facilities incorporated as part of conversion to LRT. The station has the potential to be integrated into redevelopment of adjacent lands as envisaged in the Nicholas-Mann Gateway Precinct Design Plan, and also future redevelopment of University of Ottawa lands to the south.

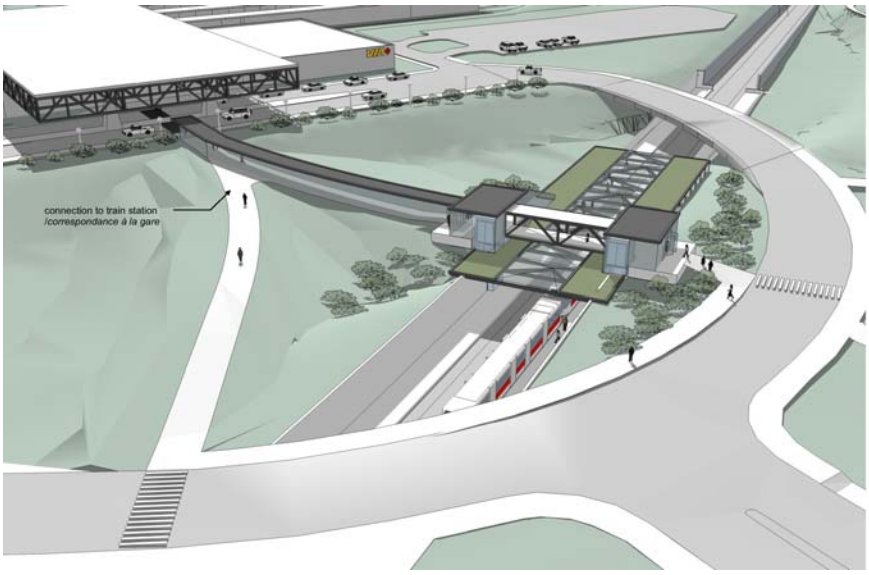
Hurdman Station

Hurdman Station will be a major transfer point between the DOTT and the existing Southeast Transitway as well as local bus services serving communities to the north, east and south of the station. There is a significant opportunity to integrate the station with future NCC development lands located to the north of the station. As mentioned above, direct pedestrian connections will be provided from these lands into the concourse level of the station. The elevated fill structure which supports the LRT platforms and alignment through the station can be built up against in the future, with retaining walls used to reduce the slope of the embankment or reduce the impact on developable lands.



Train Station

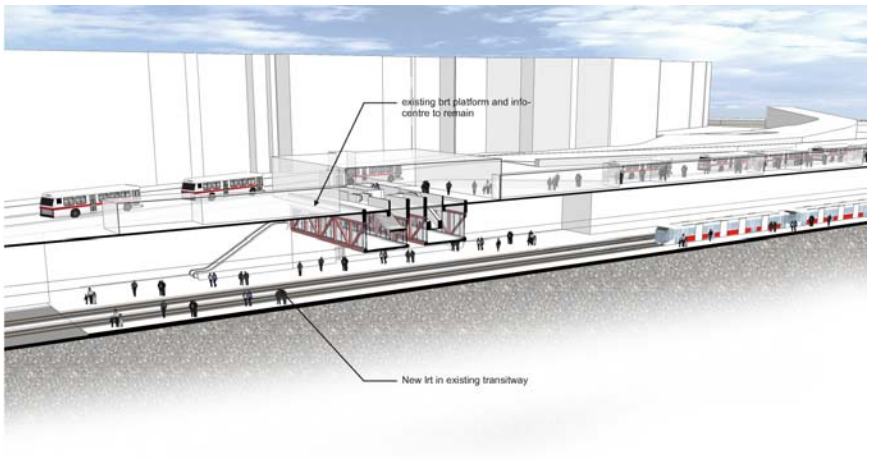
Train Station provides important connections to intercity (VIA) passenger rail service and to potential commuter rail service. A planned pedestrian overpass north of the station area will span over Highway 417, connecting Train Station with development on the north side of the highway, including the Ottawa Baseball Stadium site (formerly known as Lynx Stadium or JetForm Park) and the Overbrook community.



St. Laurent Station

St. Laurent Station serves an established major retail development (St. Laurent Shopping Centre) and provides for transfers to local bus services via an upper level bus terminal. The station will remain in its current location and general

configuration, with upgrades to existing station facilities incorporated as part of conversion to LRT. The shopping centre has submitted plans for a major expansion which will further support transit ridership. Additionally, PWGSC is preparing development plans for a major employment node on lands located near the station site, on the south side of the Queensway. Part of this proposal would involve construction of a direct pedestrian connection from these lands to the upper level of St. Laurent Station.

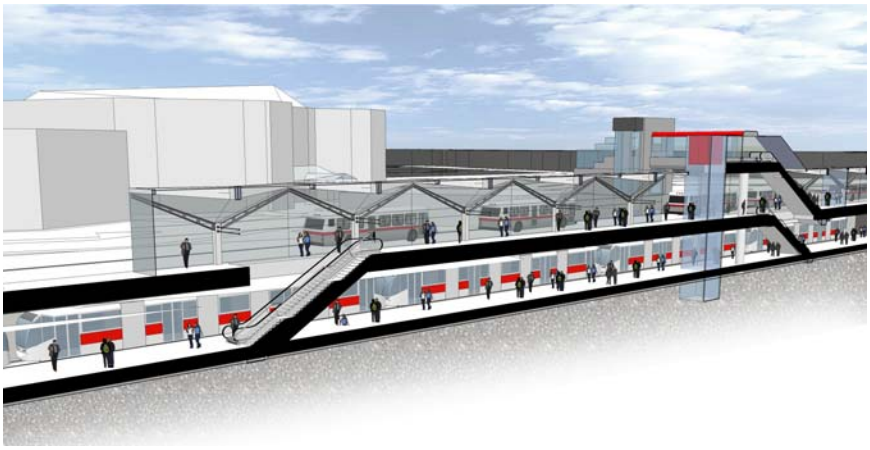


Cyrville Station

Cyrville Station serves adjacent residential development to the north of the station area, as well as employment uses to the west and south. The station will remain in its current location and general configuration, with upgrades to existing station facilities incorporated as part of conversion to LRT. The station design and alignment is also compatible with proposed plans to upgrade the highway interchange as a result of the Interprovincial Bridge Crossing Study (as presented to date). Build-out of planned residential development to the north (Place des Gouveneurs) will support transit ridership at this location, and there is the potential for a direct pedestrian connection from this development to the westbound LRT platform. There is also redevelopment potential within the adjacent office development complex (Queensway Corporate Campus) located to the west of station, which enjoys a direct pedestrian link into the station from the westbound platform.

Blair Station

Blair Station will serve as the eastern terminus of the DOTT and accommodate transfers from BRT service from the east (existing East Transitway and future Cumberland Transitway) and local bus services. The station also serves a major retail development (Gloucester Centre) located immediately adjacent to the station site, as well as office developments to the east and south (linked via a pedestrian bridge over OR 174). The design of the station incorporates an upper level to accommodate expanded bus platforms serving BRT and local services, and a lower level to accommodate new LRT platforms. There is potential for an expansion of the Gloucester Centre shopping mall to integrate into the new station by building over the existing mall access driveway and parking lot that separates the Gloucester Centre from Blair Station.



Connectivity

The DOTT project will provide a fast, convenient, comfortable, reliable, and efficient rapid transit service that will be the cornerstone of Ottawa's rapid transit network, while being fully integrated and connected with other transportation networks. Associated design criteria comprise:

- Modal Split Target: Assist in the City's pursuit of its goal of 30% transit modal split during weekday peak period, by providing the highest possible level of transit service and connectivity with other non-vehicle modes along the corridor.
- Rapid Transit Travel Time: Achieve a rapid travel time along the corridor, based on a combination of station frequency, track geometry, and vehicle technology.
- Reliability: Provide a substantial improvement in service reliability to and from the downtown area, particularly during peak periods by completely separating transit operations from local traffic.
- Travel Comfort and Convenience: Deliver a comfortable and convenient trip experience for riders, based on a combination of track geometry and vehicle technology, station spacing, station connections and transfers.
- Rapid Transit Network Connectivity: Maximize connectivity to and avoid disruptions to Ottawa's existing and planned rapid transit network, including the West Transitway, East Transitway, Southeast Transitway, the O-Train line, and the future Rideau/Montreal LRT Corridor.
- Bus Transit Network Connectivity: Maximize connectivity to Ottawa's existing and planned bus transit network.
- Interprovincial Transit Connectivity: Maximize connectivity to the existing and planned transit network serving the Outaouais, including the potential for interprovincial transit connections at Bayview Station and/or at approaches to existing interprovincial bridge crossings.
- Passenger Rail Connectivity: Maximize connectivity to the Ottawa Train Station and its VIA passenger rail service, considering its potential to become a major intermodal hub providing connections between the LRT and inter-city and potentially regional commuter train service.
- Pedestrian Network Integration: Maximize connectivity to existing and planned pedestrian networks.
- Cycling Network Integration: Maximize connectivity to existing and planned on-road and off-road cycling networks, including the provision of bicycle parking at rapid transit stations.
- Recreational Pathway Integration: Maximize connectivity to existing and planned recreational pathway networks, and provide parallel pathway links where possible.

- Road Network Integration: Maximize connectivity to existing and planned road networks.

Maintenance and Storage Facility

The proposed Maintenance and Storage Facility is an integral part of the project, as it will:

- House and service all of the trains needed to operate the line
- Service vehicles to be used on future LRT lines
- House the operations control centre (signalling, communications) for the line
- Be the primary heavy maintenance facility for the LRT network

Maintenance of the vehicles is crucial to maintain vehicle manufacturer's warranties, minimize long term operating costs and provide for system safety and reliability. 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;
- LRT control centre (signalling, communications, security);
- 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.

Ten potential sites were examined based on the four evaluation factors developed for the facility, namely:

- Site Characteristics (topography, grade, land use compatibility, expansion capability and environmental considerations),
- Facility Operations (turnaround loops, track redundancy, layout efficiency and municipal services)
- System Operations (connectivity to the line, efficiency and access to freight rail), and
- Relative Costs (capital, operating, maintenance and property ownership and acquisition)

The proposed Maintenance and Storage Facility for the DOTT project will be located on lands to the west of the existing OC Transpo headquarters and bus maintenance facility located on the north side of Belfast Road, west of St. Laurent Boulevard and south of the VIA rail corridor.

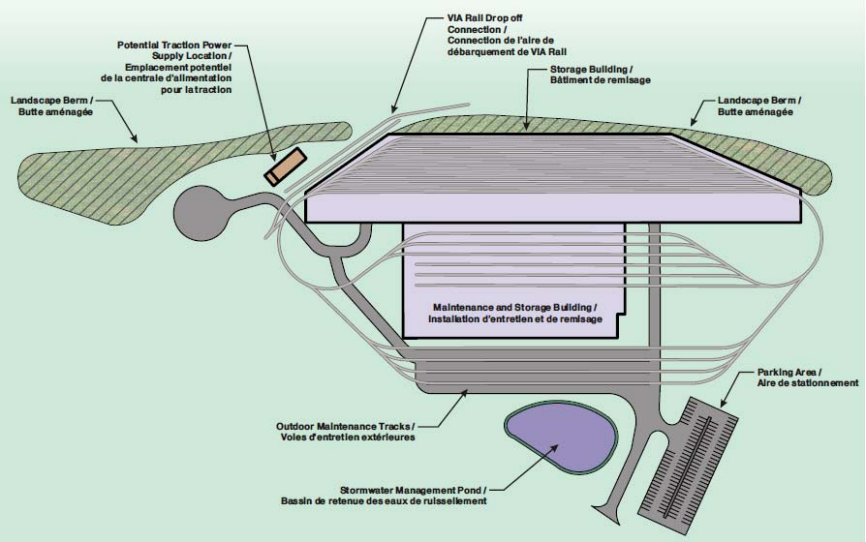
The Maintenance and Storage Facility will be designed based on best practices from LRT maintenance and service facilities around the world, which tend to have the similar characteristics including:

- Facility building – offices, roster areas, meeting rooms and control equipment
- Storage yard - for regular cleaning and minor maintenance
- Repair areas - heavy and light maintenance areas for vehicles
- Workshop – suite of tools and equipment tailored for vehicle types
- Control centre - area of control, security and operational activity
- Cleaning area – for interior cleaning of vehicles
- Train wash – for exterior washing of vehicles
- Traction power substation – local power supply for facility and trains
- Turnaround loops - the ability to work vehicles from either end and equalize wear and tear
- Track redundancy – ability to ensure the vehicles can move under vehicle or system failure conditions

The LRT Maintenance and Storage facility will be sized to accommodate storage of approximately 120 light rail vehicles. An Industry approximation for site size is 0.08 – 0.12 hectares per light rail vehicle, leading to a minimum space requirement of 9.6 hectares to 14.4 hectares. Additional land area beyond 14.4 hectares will allow increased efficiency in the layout of the facility and the ability to accommodate future expansion as the LRT network builds out.

The recommended site is 16 hectares in size and is generally flat. It presents good potential for expansion and has mixed zoning with some industrial. For facility operations, the site already has access to utilities. A heavy rail connection is possible using the VIA Rail tracks to the north of the site.

Although there are some disadvantages of the site associated with systems operations (such as the more challenging connectivity to DOTT alignment and the longer spur track which increases dead heading distance) and costs (related to property acquisition), the site ranks the highest among the ten sites selected as options.



As the facility will require a parcel of land of approximately 12 hectares to accommodate all required functions to operate the LRT, and the site is 16 hectares, there will be some additional land available for expansion. The various sub-options at the St. Laurent site each require property that is not under the ownership and control of the City. Negotiations are proceeding on the preferred sub-option.

Park and Ride Lots

Park and Ride network is intended to support the 30% transit share target for Ottawa and Park & Ride lots are an important adjunct to rapid transit stations. The City policy is to provide new Park & Ride lots to transfer commuters to transit at the rural/urban edge or at the outer edge of the Greenbelt and thereby avoid auto travel across the Greenbelt and onward toward the city centre. Transportation Master Plan envisions several new Park & Ride lots by horizon year 2031. No new Park & Ride lots are planned inside the Greenbelt due to generally high existing transit service levels directly to downtown.

Property

The alignment crosses under, over or through approximately 130 parcels of property, the majority of which are controlled by the City of Ottawa. The property ownership can be broken down into four broad categories:

- Federal lands – 35 ha,
- Provincial other public agencies (including Hydro One and the University of Ottawa) – 11 ha,
- City-owned lands – 78 ha, and
- Private lands – 8 ha.

The necessary property acquisition for right-of-way, stations and other DOTT facilities is planned to commence in 2010 and continue throughout the final stages of the planning and design process between 2010 and 2013 when construction is due to start. As the majority of the alignment follows existing Transitway corridors, or is located underground, the majority of existing households and businesses along the corridor will not be disturbed however a few properties will be impacted and will require relocation because of the DOTT project.

Vehicles

Final vehicle selection has not been made. The current plan is to procure 65 light rail transit vehicles to support the anticipated ridership on the DOTT project. Vehicle specifications will be identified through at the detail design stage of the project.

The following are the criteria for the LRT technology to be selected:

- Accommodate the predicted passenger volumes: Ensuring that operational efficiency and running costs are optimized.
- Provide conditions to easily implement the first increment and subsequent phases of the system.

- Fit into Ottawa's urban environment: Ensuring that the vehicle and system design are a good fit with the city's image and have a reduced environmental impact.
- Minimize capital costs: To ensure that stakeholders and citizens have a good return on investment.
- Minimize the lifetime operating and maintenance costs: To ensure that stakeholders and citizens have a good return on investment, resulting in lower operating costs and encouraging ridership.
- Be able to respond to future land use changes within the City and the demand for travel: Providing flexibility of operations to accommodate future city planning and operational changes.
- Take advantage of the most current technologies: Providing operational efficiencies and subsequent lower operating costs.
- Be proven in service: Minimizing risk of development and increasing operational reliability.
- Be suitable for the climate in Ottawa: Ensuring that the vehicle can withstand the extremes of temperature.

In December, 2009, the Province of Ontario announced funding of $600M toward this project.

Timing of Design Work and Construction

The work on preliminary design will commence in 2010, and be followed by detailed design in equal increments through four years to conclude in 2016. Construction will gradually ramp up starting in 2013 to minimize the disruption to downtown Ottawa and is scheduled for substantial completion in 2018.

1.4 Estimated Start and Completion Dates

If funding is committed expeditiously, the rapid transit project would proceed to the preliminary design work in 2010, followed by detailed design and to construction in 2013. A six-year construction period is envisioned, with the system opening in 2018.

The exact sequencing of construction will be determined during detailed design of the project. It is likely that work on the tunnel component will commence first as this is the most lengthy and complex portion of the project. Most of this work can be done without disruption to existing bus operations, although construction of the East Portal (south of Mann Avenue) will likely require closure of the Transitway north of Lees Station. Substantial work at some station locations (Bayview, Hurdman and Blair) can also be accomplished without disruption to bus operations.

As construction proceeds, sections of the Transitway will need to be closed to buses in order to allow conversion to LRT. Conversion will be done in logical segments to maintain bus service on the Transitway as long as possible, however once a section is closed for conversion it will no longer be accessible to buses.

During this time, all buses currently using the Transitway will need to find alternate routes. The anticipated phasing of the major project components is outlined on the tables on the next page.

Construction Staging

While the final construction staging plan for the DOTT project will be the responsibility of the City's Rail Implementation Office and the contractor selected to construct the system, the DOTT functional design process did look at the general objectives of the staging and opportunities to provide logical break points between sections and phases of work. Estimated construction durations were also compiled to allow for schematic planning of the implementation process. At the most general level, the project will be staged to:

- Minimize construction cost
- Minimize traffic and bus service disruption
- Optimize cash flow
- Maximize contractor efficiency

The staging will also follow these general principles:

- The tunnel and underground stations will likely start first, as these elements will take the longest to construct
- The Maintenance and Storage Facility must be completed midway through the construction of the project to allow for delivery of vehicles and vehicle testing
- Major work at Bayview, Hurdman and Blair is off the existing Transitway and can be done with minimal disruption to bus service
- Conversion of the Transitway will be done in logical segments to maintain bus service on the Transitway for as long as possible
- Once construction starts in an area, bus service will be rerouted, and will not return
- After construction is complete there will be a 6-8 month period for station fit-out, testing and commissioning before revenue service starts

In addition to the general principles, the following assumptions were made to determine construction staging opportunities, estimate duration and estimate capital cost for the tunnelled portion of the project. The twin tunnels will be constructed using a Tunnel Boring Machine (TBM), likely an Earth Pressure Balance

machine, which will allow the tunnel work to proceed from end to end through the varying ground conditions that are known to exist. The tunnels will be staged from LeBreton Flats to take advantage of available land. The depth of the tunnel (averages 30-35m, but extends as far as 44 m, below grade) has been planned to avoid impacts to building foundations, utilities and the Rideau Canal. Cut and cover construction will generally be limited to the areas around the west and east tunnel portals. There will be some visible cut and cover construction work at each station to construct the entrances and vent shafts (some locations which are not under the travel lanes, or which can be closed off may be constructed using open excavations, where local conditions permit). Downtown stations will be mined out from within the tunnels, and all of the excavated material will be hauled out to the LeBreton work site. Campus Station will be constructed using the traditional open excavation method.

The bulk of the visible activity will be at the TBM launch site, which will be at the east end of the LeBreton Flats, although there will be substantial activity at Campus Station and the East Portal (south of Mann Ave.). The following assumptions were made to determine construction staging opportunities, estimate duration and estimate capital cost for the conversion of Transitway Stations:

- Platforms will be widened with the tracks being placed in centre by-pass lanes
- Existing canopies and shelters will be removed
- Elevators will be upgraded
- New canopies will be installed over the platforms and track for the full length of the station (except at a few low-use stations)

The stations at Bayview, LeBreton, Hurdman, Train and Blair require extensive modifications to accommodate conversion and must be largely rebuilt to accommodate the new LRT system and the transfer of passengers to bus and Transitway services.

The following assumptions were made to determine construction staging opportunities, estimate duration and estimate capital cost for the conversion of the Transitway running segments (between the stations):

- In open areas, ballast and track will be installed on top of the existing roadway
- Track through the stations will be directly fixed to a concrete slab for ease of maintenance
- Minor changes to drainage will be required
- Some structures will require modifications to increase vertical clearances

DOWNTOWN OTTAWA TRANSIT TUNNEL

Schedule of work in each Calendar Year

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Preliminary Engineering	50%	50%							
Final Design				25%	25%	25%	25%		
Project Management for Design and Construction				10%	20%	25%	25%	10%	10%
Construction Administration & Management				5%	17%	25%	30%	18%	5%
Insurance				100%					
Surveys, Testing, Investigation, Inspection				10%	20%	25%	25%	10%	10%
Start up								30%	70%
Procurement Management	15%	35%	35%	15%					
Tunnel				20%	35%	35%	10%		
Campus Station				20%	20%		15%	45%	
Downtown Stations						20%	35%	35%	10%
Campus-Lees						50%	50%		
LeBreton Station						10%	45%	45%	
Tunney's to LeBreton					30%	35%	25%	10%	
Hurdman to Blair					30%	40%	30%		
M&S Facility					25%	50%	25%		
Property Acquisition (support staffing inclusive)	25%	52%	20%	3%					
Vehicles							40%	50%	10%
Public Art							30%	30%	40%

Operating staging for the line was required to develop the functional plan. The following assumptions were used to develop the physical requirements for rail operations:

- Track, power and systems installation at the Maintenance and Storage Facility will be completed before the vehicles arrive
- Testing in the yard and sections of the line close to the Maintenance and Storage
- Facility will begin operations as soon as possible
- Each section of track that is completed will require a testing and commissioning period
- Crossovers will be provided at the terminus stations and at key points along the line to allow trains to reverse direction
- Pocket tracks will be provided at Hurdman and Blair Stations
- Two storage tracks will be provided at Tunney's Pasture to accommodate out of service or disabled trains
- The connection to the Maintenance and Storage facility will allow trains to enter/leave the line from both directions

Bus Operations during and after Construction were also a major consideration in the development of the functional plan, although the actual bus operating plans will need further review during the detailed planning of the station and the bus network that is put in place after construction will need to reflect the ridership patterns in place at that time. However, there are several assumptions that were made to determine the impact of construction on bus services and to size the bus transfer facilities included in the functional plan. The DOTT project assumed that various segments of the Transitway will be out of service as construction proceeds, during which alternative arrangements will be needed, including:

- Use of the shoulder or outside lane of the Queensway
- Dedication of traffic lanes to transit usage along some streets
- Implementation of traffic signal priority along key routes
- Minor reconfiguration of intersections and interchanges to give buses priority
- Several alternate routes will be required, likely including Innes, Industrial, Ogilvie, Coventry, Tremblay, Riverside and the Queensway in the east, and the Queensway, Carling, Scott/Albert and the Ottawa River Parkway in the west
- Bus routes may be segregated into local and express services and assigned to different routes to minimize local impacts

During the detailed design phase the final detour plans will be closely co-ordinated with construction staging. These plans may include temporary station

facilities to provide good connectivity to local routes and major trip origins and destinations, for instance if buses serving St. Laurent Station are by-passing the existing station, expanded bus bays may be required on St. Laurent to facilitate transfers. As part of this work a detailed traffic management plan will be developed, and will be communicated to the public as part of the broader communications strategy that will be developed for the project.

At the end of the construction period, there will be substantial changes to the existing BRT and local bus routes to provide connections with the new LRT line, reflect the new operating philosophy, respond to ridership growth and changes in ridership patterns and meet the operating budget requirements in place at the time.

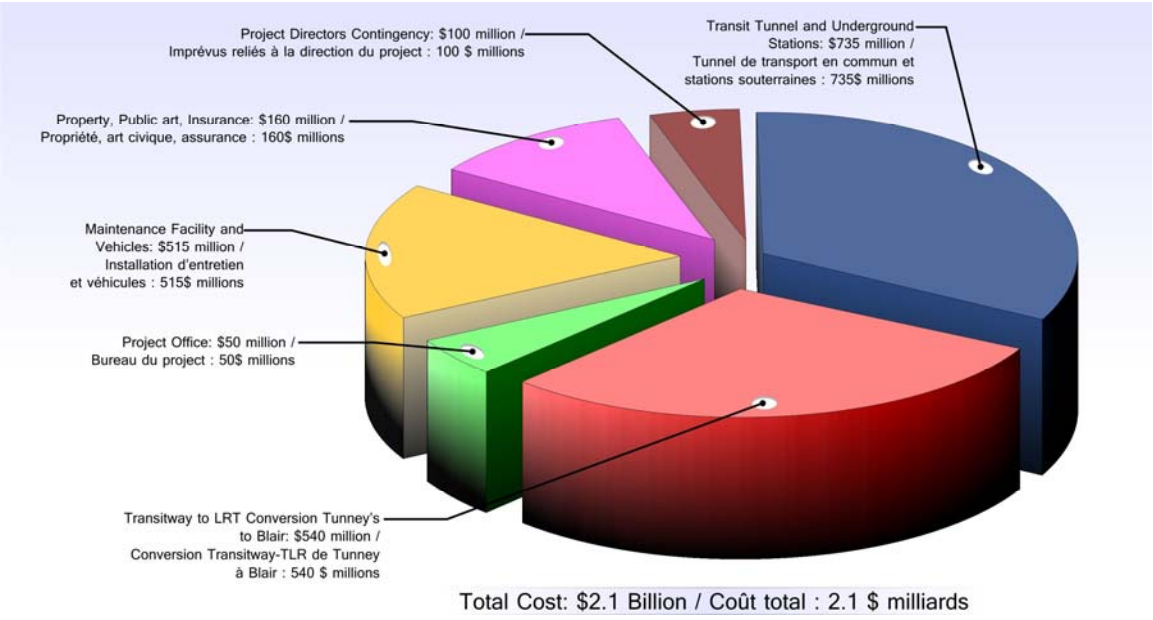
2 Financial and Legal Requirements

This section outlines the project components, their estimated costs, and eligibility under Building Canada Fund. It outlines the status of the cost estimates and reviews the various steps and consultation undertaken as part of the rapid transit EA, initiated in 2008.

2.1 Project Components and Estimated Costs

Cost estimates for the DOTT project were prepared using a rigorous, bottom-up process. Using a Work Breakdown Structure the elements of the project were broken down to simple elements and processes. The quantities for each element and the unit costs were assessed along with the assignment of contingencies based on the degree of uncertainty in each element. Unit costs are based on current construction projects in the Ottawa area, on other transit projects in North America and on construction trends.

The unit costs were developed without contingency, to allow for a transparent review and an objective evaluation of the base costs. As part of the cost estimate development, the City undertook a peer review of the costs and decided that a Director's Contingency of $100 million should be added to the overall project cost to address unforeseen risks and potential cost overruns. The capital costs of the project in 2009 dollars are outlined in the chart below.



2.2 Proposed Funding Sources and the Expenditure Profile Reflecting Total Eligible Costs

The capital costs of the project are proposed to be funded jointly by the City of Ottawa, the Province of Ontario, and the Government of Canada, through the Building Canada Fund. In December, 2009, the Province of Ontario announced funding of $600M toward this project.

The operating costs of the project were developed in coordination with OC Transpo and were built from estimates of revenue service hours and kilometres using current hourly and per-kilometre rates. The total operating costs are forecast to be approximately $981 million over the first thirty years of the project, and will be funded by the City of Ottawa. The estimate looked at the operational efficiencies of LRT, and estimate that the DOTT project will reduce operating costs by approximately $100 million per year in 2031, primarily through the replacement of buses with higher-capacity LRT trains and reorientation of the bus network. The implementation of new sections of Transitway and other transit priority measures to reduce operating costs have also been assumed.

2.3 Proposed Cost Estimates

The proposed cost estimates were developed based on the conceptual design at this time, hence a Class D estimate accurate to +/- 25%. The DOTT project includes a $100 million Directors Contingency, which was added to the total project cost to address unforeseen risks and potential cost overruns.

Contingencies are added to the elements of the cost estimate to reflect the risk associated with the item. These risks can include fluctuations in price in the market, uncertainty related to how the item is delivered and installed or the risks associated with the method of construction. Some elements carry more than one risk, but in general the elements in the cost estimate have been divided into three categories; high risk, medium risk and low risk. Each of these risk levels has been assigned a percentage contingency that is carried in parallel with the extended unit costs and reported in the cost estimate. The use and assignment of contingencies to costs is industry standard practice.

2.4 Capacity to Operate and Maintain the Service

The City of Ottawa has a long history of running rapid transit systems with Transitway and the O-Trains based on funding through a combination of fares, taxation, fees, and other revenues. In the case of public transit, a significant portion of costs are recovered through earned revenue – including the farebox and advertising on vehicles, shelters, and benches. The DOTT project will be operated on a sustainable long-term basis by the City through municipal subsidy.

A detailed operating plan for the DOTT will be developed prior to opening of the line for revenue service and adjusted as ridership patterns develop and establish themselves. Operating plans will address LRT operations under a variety of different scenarios (normal, emergency, special events).

2.5 Federal Legislation, Permits and Authorizations

Through ongoing dialogue with Transport Canada, the City of Ottawa is committed to ensuring all applicable Federal legislation, permits, and authorizations are identified and obtained prior to construction and operation of the system.

2.6 Status of Environmental Assessment and First Nations consultations

On September 12, 2007, City Council directed staff to initiate an environmental assessment (EA) study for the DOTT project. The DOTT project will be carried out under the Provincial Transit Project Assessment Process. As there is a requirement for Federal permits and property, and with the City pursuing Federal funding, the project must also comply with the requirements of the Canadian Environmental Assessment Act (CEAA). Since this project must satisfy both Provincial and Federal act requirements, a co-ordinated process will be undertaken to avoid unnecessary duplication.

The following section outlines the status of work completed to date, and the steps to complete the expedited transit EA process.

Planning Phase

The planning phase concluded with the adoption of the Recommended Plan by council in January 2010. During the planning phase, the City conducted a series of public and stakeholder consultation sessions including the following:

- National Capital Commission's (NCC) Advisory Committee on Planning, Design and Realty (ACPDR) – 3 Meetings (August 2008, February 2009, and May 2009).
- Agency, Business and Public Consultation Groups – Several Meetings (August 2008 to December 2009).
- Briefings for Councillors and the launch of website (December 2008 and January 2010).
- Special Meetings with NCC, Public Works & Government Services Canada (PWGSC), the University of Ottawa, Downtown Coalition (of business and land owners), Viking Rideau Corporation, Downtown Rideau Business Improvement Association (BIA), and Centretown Citizen's Community Association.
- Public Open House #1 (February 26, 2009), which solicited feedback on (1) Project Planning Objectives and Design Criteria; (2) Alternative Transit Alignments and Station Designs; and (3) Preliminary Evaluation of Alternatives.
- Presentation of the information and results of Open House #1 to Committee and Council in May 2009.
- Public Open House #2 (June 24, 2009), which focused the consultation on the Maintenance & Storage Facility.

- Public Open House #3 (October 26, 2009), which presented the Recommended Plan for the project.
- Presentation of the Recommended Plan to Committee (in December 2009) and Council (in January 2010).

EA Stage

The EA Stage is scheduled to take place between February 2010 and June 2010. A fourth open house was held in February 2010 to address environmental issues, as required under the Provincial Regulation, and present the Recommended Arrangement for the Maintenance and Storage Facility.

First Nations Consultation

The Ottawa area is the subject of a Comprehensive Land Claim that is currently under negotiation. Both the provincial and federal governments are parties to the negotiations with the Algonquins of Ontario. A framework for negotiations has been established which outlines the duty to consult has been signed, and the protocols have been followed. Notice of the project has been formally given to the Algonquins and their designated consultant. The consultant was invited to sit on the Agency Consultation Group, and has received regular updates on the project.

The City has exchanged correspondence and the Algonquins have expressed two issues;

- The public art component of the stations and facilities should contain elements that reflect First nations art, and
- Any archaeological work that is undertaken should be shared with the Algonquins, and should include active Algonquin involvement should artefacts be found.

The City has also investigated other duties to consult using information supplied by both Indian and Northern Affairs Canada and the Ontario Ministry of Aboriginal Affairs. Other than the involvement of the Algonquins of Ontario, as part of the comprehensive Land Claim, no other First Nations consultation was required.

2.7 Contract Award Process

The City of Ottawa, through its procurement policies and procedures, practises competitive, fair, and transparent tendering for capital projects. While the contract award process has not yet been established for the DOTT project, competitive tender is anticipated as the procurement procedure. The City does not anticipate any conflicts with the Agreement on Internal Trade.

3 Project Benefits

The DOTT project will result in substantial benefits, including increased ridership, reduced air pollutants and greenhouse gas emissions, improved mobility, substantial job creation and economic development. In addition to the tangible benefits there will be substantial improvements in the reliability, comfort and convenience of the system.

The project was designed to respond to the growth of the City, and provide increased transit capacity into the city core. The need for the project is based on the Transportation Master Plan analysis and subsequent modelling update that indicate that over the planning period (i.e. 2006 to 2031):

- Population will increase 30%, from 870,700 to 1,136,000
- Employment will increase by 35%, from 530,000 to 703,000
- Mode split will increase from 23% to 30%
- Transit ridership will increase by 78%, or from:
    - 44,500 to 80,300 trips in the AM peak hour
    - 93 million to 166 million annual trips.

Detailed analysis of the DOTT ridership is provided in the LRT Corridor Ridership Forecast report, attached as Appendix B.

Various planning and transportation studies conclude that travel access into downtown Ottawa is approaching capacity and cannot handle any further growth. Since road expansions are not feasible, the transit tunnel provides the much needed additional capacity and a sustainable solution for the City to move people in and out of downtown while encouraging higher density growth.

Consequently, the purpose of the DOTT project is to add transportation system capacity in the most heavily used transit corridor and to stimulate reurbanization particularly in the Central Area, while providing greater transportation choice to the City's residents, businesses and institutions for moving within and among the City's major urban areas.

The objectives of the DOTT project are as follows:

- Increase Transit Ridership and Mobility,
- Enhance Ottawa's Urban Character and National Stature,
- Stimulate Smart Growth,
- Create Successful Rapid Transit Stations,
- Provide Safe and Efficient Linear Infrastructure,
- Provide a Safe and Efficient Tunnel and Compatible Portals,
- Be Compatible With Adjacent Communities,

- Maintain or Improve Natural and Physical Environments,
- Showcase Sustainable Design Best Practices,
- Manage Construction Disruption and Risk, and
- Result in a Wise Public Investment.

3.1 Demonstration of Project Benefits

The City of Ottawa's DOTT project will result in all of the objective outcomes identified by the Government of Canada in the Building Canada Fund template, including:

- *Improve mobility, reduce travel times and increase safety and efficiency*,
- *Expand public access and ridership*,
- *Reduce the growth of GHG and other emissions, and*
- *Contribute to sustainable municipal development and land-use planning.*

Building and widening roads alone, especially in downtown Ottawa, is not a practical or affordable solution to meet the anticipated demands and to support the projected growth on the City's transportation system. By providing greater transportation choice, attracting more riders and adding more capacity to the overall transportation network, the DOTT project will help address existing congestion and aid in preventing even higher levels of congestion in the future. The growth of downtown employment will continue through the ability to increase capacity on transit service in the downtown, primarily on the DOTT LRT line. Riders will see:

- Reduced transit travel times. The average speed of the LRT system will be higher than the current BRT system primarily because of the downtown tunnel, which will remove the mixed operation through 14 traffic signals along Albert and Slater, reducing conflicts with surface traffic, service vehicles, and pedestrian crossings. Geometric improvements will also contribute.
- Reduced congestion downtown. The majority of Transitway buses will be removed from the downtown streets allowing for a reallocation of street space through the core to improve pedestrian and cycling environment. Local bus routes will be adjusted to provide good coverage and to take advantage of the additional road space.
- More efficient transit operations. Passengers will use off-board fare payment, allowing for more efficient train boarding (as all doors to all trains can be used). Simplified routing through the downtown will eliminate current confusion and also reduce wait times.
- Improved levels of comfort and convenience. Passengers will have a weather-protected environment, with access to more amenities than exist at current Transitway stations. Real-time train information, improved lighting,

public address and dynamic information displays will all be used to assist passengers.

The DOTT project will also allow for redevelopment and transit-integrated development in the downtown. This will help the City achieve its targets for increased intensification and the protection of agricultural and sensitive environmental areas against urban expansion pressure.

Increased Transit Ridership

The current Transitway serving the downtown is approaching capacity, and is expected to start to limit travel into the downtown by 2018. The DOTT project will provide a substantial increase in carrying capacity through the core and will contribute to significant ridership increases. Ridership estimates indicate that:

- Total system ridership is expected to increase from 93 million to 166 million trips per annum,
- Current ridership on the Tunney's Pasture to Blair portion of the Transitway totals 39 million. This ridership on the DOTT corridor is expected to grow in the future to:
    - 51 million trips in 2021, and
    - 76 million trips in 2031
- The TMP model indicates that there will be a ridership uplift of 9% through the introduction of LRT. This translates into 4.6 million new trips in the opening year
- Estimates from the *OC Transpo Rapid Transit Network Operation Review* indicate that the current network, including the existing Transitways can carry a maximum of 132 million annual trips. The growth in system ridership beyond 132 million annual trips is the result of the infrastructure investment in the DOTT project. This translate into 34 million new trips per year in 2031 (as a result of the additional capacity to be provided by the DOTT as well as due to the attractiveness of LRT system over BRT)
- Cumulative 161.4 million new trips between an opening in 2019 and 2031
- More than 40% of all transit trips taken in the city will use the DOTT project for all or part of their journey.

The downtown stations currently handle the largest number of annual trips, and represent the most congested section of the existing Transitway. Annual ridership through the four underground stations is expected to increase from 25 million to 50 million annual trips by 2031, representing 65% of the ridership on the line. These riders will see the largest benefits from the DOTT project due to travel time saving and improvements in reliability, comfort and convenience.

Reduced Emissions of Air Pollutants and Greenhouse Gases

Greenhouse gas emissions are reduced by transit projects in several ways. First, by replacing diesel fuelled bus trips with electrified LRT, emissions from transit vehicles themselves are reduced. Secondly and more significantly in terms of the total amount of emissions reduced, trips made by private car are replaced by transit trips, resulting in a substantial reduction in greenhouse gas emissions per kilometer.

Preliminary forecasts indicate that the DOTT project will generate considerable greenhouse gas emission savings compared to the base case scenario, where ridership growth will be constrained by capacity. The project is forecast to reduce carbon dioxide emissions by approximately 38,000 tonnes in 2031. It will also reduce criteria air contaminant emissions by approximately 1750 tonnes in the same year.

Improved Mobility

The DOTT project will be complemented by a number of other projects that are part of the TMP. New sections of Transitway and transit priority measures will allow service to operate at reduced travel times as compared to operations on city streets.

The DOTT project will allow for improved travel from many parts of the City, speeding journey times into and out of the core. The number of stations in the core will provide a similar level of service as the existing transitway, with improved connections to the Byward Market, north Elgin Street, LeBreton Flats and services to Gatineau. The reductions in bus service through the core will also allow for local routes to better accommodate demand and connect to all points in the core. Pressure along Wellington can also be relived providing improved operational opportunities for STO services.

Planned improvements in accessibility and the potential to link station accesses directly to adjacent buildings will provide increased mobility in poor weather conditions. These types of connections have proven to be beneficial in other cities.

Travel Time Savings

The current Transitway provides a high quality of service, except in the downtown core where on-street operations reduce both speed and reliability. Today buses travel along Albert and Slater and pass through 14 signalized intersections. The removal of this operational constraint is the major improvement in speed, and results in substantial time savings for the transit traveller.

The majority of the 51 million trips in 2021 and 76 million trips in 2031 will see total time savings of 55 million minutes as a result of the operational improvements. Passengers who travel across the core will see the largest time savings.

As important as travel time savings is the improvement in reliability. Service is currently scheduled at 17 minutes to cross the downtown, but regularly exceeds that by 5-10 minutes. The lack of reliability requires many passengers to add time to their journeys to prepare for potential delays. More regular service will allow them to plan for shorter journeys.

The improved journey time will offset the additional time required to transfer from the platforms to the street level. This time is estimated at 60-120 seconds depending on the station and the use of either elevators or escalators.

In addition to the actual in-vehicle time there are other potential time savings from off-board fare collection, accessing trains from all doors and taking the first train for their trip (rather than waiting for specific bus routes).

Economic Development

The DOTT project will contribute to the regeneration of the economy of the Central Area and the creation of new jobs or increased employment in the following ways:

- Jobs associated with constructing, operating and maintaining the LRT system;
- Jobs arising as a result of the improved travel conditions in the downtown and at stations along the line;
- Increased employment in the downtown core, where offices can be more effectively serviced.

Using standard economic impact modelling (input-output modelling), the multiple account evaluation estimated the employment that will be generated by the construction of the project. The total amount of direct, indirect, and imputed employment generated associated with the investment is just over 20,000 person-years.

From an employer's perspective, what matters is the accessibility of a given location, and how the DOTT project makes that location more or less attractive for the expansion of an existing business or the establishment of a new one. These factors include:

- Access to a suitable workforce living within acceptable travel times and costs
- Access to or by customers
- Access to or by suppliers

For these reasons, the improved access to station areas will promote intensification and the clustering of higher density employment uses. Consistent with the City's growth management objectives, the increased access to employment should also allow more of the City's residents to travel to work by transit.

3.2 Calculation of Economic Benefits

The assessment of the economic benefits of the project has been undertaken using a Multiple Account Evaluation approach. MAE provides decision-makers with a broader representation of the project's benefits by allowing the consideration of factors that could not be considered in a traditional cost-benefit analysis. The structuring of metrics into a series of separate accounts allows for a relative assessment of the project's impacts on different aspects of the economy and society.

The MAE is prepared by comparing a project case against a base case over an analysis period, on a present value basis. In the project case, the DOTT is constructed and the light rail service begins operation in 2019. The base case assumes the existing Transitway service continues, and capacity limitations begin to restrict ridership growth within the forecast period. The analysis period for the MAE is thirty years (to 2039). The discount rate is 5%. The detailed report is attached as Appendix C.

The conduct of the economic analysis is based on assembling existing data as inputs. The inputs and assumptions used are drawn from various sources, and have not been independently audited or verified prior to their use in the MAE.

The estimates of travel time savings as reported in the MAE findings below may be considered to be conservative as they under-represent potential time saving for travellers who move from auto to transit. The estimated travel time savings is derived from transit risers having a faster average trip than the current system provides. Further, we note that all findings are based on ridership data provided by the City's TRANS model.

Transportation User Benefits

This account summarizes economic benefits accruing to users of the transportation system in terms of travel time savings, vehicle operating cost savings and accident avoidance savings.

Ridership forecasts for the LRT indicate 51 million riders in 2021, rising to 76 million riders by 2031. The new riders, i.e., riders that will be induced from auto to transit, was derived as a residual of the projected riders on the OC Transpo system with the project in place and the total capacity of the OC Transpo system without the project in place, which would reach a fixed capacity of 132 million riders within the next approximately 10 years.

Travel Time Savings

Transit projects typically produce travel time savings in two ways; first, by increasing the speed of travel for transit passengers; secondly, by shifting some travel from cars to transit, which in turn relieves road congestion in the transit corridor. To be conservative, it was assumed that there are no travel time savings except for the existing riders (i.e. no travel time savings for those diverted from auto). The travel time for transit was estimated from the average trip length of 5.38 km. Travel time savings for existing riders accrue due to the

improved speed with the project in place, allowing average transit speeds in the corridor to increase from existing 27 kph to 35 kph.

Vehicle Operating Cost Savings

This metric is a calculation of the operating costs avoided for car owners who travel by transit instead. The calculation is the product of vehicle kilometres travelled (VKT), and the costs per kilometre of operating a standard four-door sedan. The metric is reported as the monetary value of these savings.

Accident Avoidance Savings

This metric represents the savings to society resulting from the road accidents avoided through modal shift to transit. The calculation is performed using incident factors for accidents per vehicle kilometre, typical costs of fatal, injury, and property accidents, and the number of vehicle kilometres avoided. The metric is reported as the net present value of the monetary value of these savings for the full 30-year analysis period.

Results

Travel time savings have been reported in two ways: annual minutes saved, and the monetary value of these savings. Travel time savings for the DOTT project indicates that a total of over 55 million minutes are saved by the transit users in comparison to the time they may have taken when travelling by the existing transit service. Once monetized over 30 years, these savings are equivalent to an estimated benefit of $276 million for the Ottawa and area economy.

Vehicle Operating Cost savings are a function of the number of riders on transit, which in turn affects the number of vehicle kilometres travelled (VKT) on the network. The vehicle operating cost savings are estimated to be $600 million over 30 years. Accident avoidance savings are also a result of reduced vehicle kilometres travelled (VKT) due to trips being taken by transit instead, this accounts for an additional savings of $217 million. The results are a total user benefit of close to $1.1 billion in present value over the 30-year analysis period.

Transportation User Benefits Account		
Travel Time Savings	AM Peak Minutes, 2031	15,938,472
Travel Time Savings	$ (NPV)	$276,265,200
Vehicle Operating Cost Savings	$ (NPV)	$599,934,133
Accident Avoidance Savings	Fatal/Injury/Property, $ (NPV)	$216,681,187
Summary Metric: NPV of Annual Benefits		**$1,092,880,521**

Environmental Benefits

Greenhouse Gas Reductions

Studies have shown that the transportation sector is a significant contributor of GHG emissions. Within this sector, automobiles are a significant source of emissions. GHG emissions are reduced by the DOTT project by shifting travel from cars to rapid transit. In this analysis, the reduction in vehicle kilometres travelled formed the basis for the reduction in emissions. Greenhouse gas emissions were estimated from the Urban Transport Emissions Calculator

(UTEC). The volume of GHG emission savings is reported in tonnes per year for a typical year (2031). The monetary value of the GHG emission savings are calculated using a per-tonne value of $37 per tonne, calculated by Transport Canada as reported in *Estimating the Costs of Greenhouse Gas Emissions from Transportation (Transport Canada, 2007).*

Criteria Air Contaminants

Criteria Air Contaminants (CAC's) are pollutants with a variety of impacts on the natural environmental and human health. These are associated with vehicle emissions and as such, are also a function of vehicle kilometres travelled, as forecast by the transportation model. The CAC emissions calculated by the model are carbon monoxide (CO), volatile organic compounds (VOC), nitrous oxides (NOx), sulphur oxides (SOx), and particulate matter (PM).

Results

The greenhouse gas emission reductions and their monetary value (NPV), and the CAC reductions and their monetary values in (NPV), are reported in the table below.

Environmental Account		
GhG Emissions Savings	Tonnes/Year, 2031	37,968
Vaue of GhG Emissions Savings	$ (NPV)	$17,034,126
Critical Air Contaminents (CAC) Emissions Savings	Tonnes/Year,2031	1,758
Critical Air Contaminents (CAC) Emissions Savings	$ (NPV)	$51,709,130
Summary Metric: NPV of Annual Benefits	**$ NPV**	**$68,743,256**

Economic Development Account

Investment in downtown transit tunnel and its ancillary projects can create spinoff impacts for Ottawa's economy. The effect of spending money on public transportation creates immediate jobs and income by supporting manufacturing, construction and public transportation operation activities.

For this analysis, input – output multipliers obtained from Statistics Canada were used to obtain the direct and indirect job impacts of the DOTT investment. The output produced by the investment has also been estimated with the use of these multipliers.

The economic impact of the investment is outlined on the table below. The analysis indicates that this investment results in creation of over 20,000 person-years of employment, and total output of some $3.2bn.

Economic Development Account		
Output Generated	$	$3,243,392,964
Employment Generated (Incremental)	Direct, Indirect, Induced jobs	20,116
Taxes Generated (Incremental)	$	$144,438,756

4 Risk Mitigation

In planning and executing a complex undertaking such as the City of Ottawa's DOTT project, it is crucial to take into account the risk exposure to the City as well as its stakeholders throughout the process in order to maximize the project's chance for success and minimize potential negative impact. This section examines the key risks inherent in this project and how they may be addressed or mitigated through the use of different business / delivery models.

4.1 Identification of Risk

As part of the Transportation Master Plan work a risk assessment was undertaken to identify the major risks of the plan and its implementation. The analysis considered a wide range of risks that might arise for each element of the plan. This work was revisited at the start of the planning work on the DOTT project. It involved isolating the risks that were identified for the project, updating the description of the risks and re-evaluating the impact that these risks might have on the project. The appropriate allocation of risk to the party best able to manage it was also part of the process. The results were used in the planning of the DOTT project.

Risk Assessment

Risks are considered throughout the planning process and included in the planning objectives. The DOTT project will be implemented in a manner that minimizes the potential for negative effects on businesses, communities, transportation systems, and other infrastructure during the construction period. Associated design criteria comprise:

- Construction Mitigation Strategy: Actively involve adjacent businesses and landowners, and the overall community, in the City's preparation of a construction mitigation strategy for the project, including a shared understanding that while construction period disruption is inevitable, best efforts will be made to minimize and mitigate that disruption and the hardship or inconvenience that may result.
- Communications: Prepare a communications plan that establishes methods for the City and its contractor to communicate with project stakeholders in order to share information on project activities and its schedule.
- Community Organization: Encourage the community, in particular the adjacent businesses and landowners, to become organized to work with the City in the implementation of the construction mitigation strategy and communications plan, and to develop means for effective lines of communication with construction managers during the construction period, possibly including "block captains", business improvement association, representatives, newsletters, and web site updates.

- Traffic Management: Prepare a traffic management plan that minimizes disruption to the existing pedestrian, cycling, transit, road, and truck networks during construction.
- Project Streamlining: Establish, as an overall goal, that the duration of construction be compressed and streamlined as much as practical to reduce potential negative effects on adjacent businesses and landowners and on the surrounding community and its environment.
- Business Access: Make best efforts to maintain access to existing businesses during construction.
- Project Work Sites: Identify potential sites during the planning process for contractor site offices and materials storage areas, and require plans to be approved by the City that include temporary visual screening and buffering from adjacent communities.
- Contaminated Sites: Require Environmental Site Assessments to be completed prior to site alteration, to determine the potential for project excavation activities that may encounter contaminated soil or ground water.
- Hazardous Materials, Spills and Accidents: Require a hazardous materials, spills and accidents contingency plan to be provided by the contractor and approved by the City and applicable agencies.
- Monitoring: Monitor environmental conditions, including matters such as noise, vibration, and air quality, as warranted.

The DOTT project will be a wise financial investment, considering all components of its life cycle as well as the "triple bottom line" of economic, social and environmental facets. Key risk mitigation measures include:

- Capital Cost: Reduce construction costs by reducing the amount and complexity of infrastructure components and by employing value engineering principles.
- Maintenance and Operating Cost: Reduce operating costs by using durable, easily maintained, and low energy consuming materials and equipment.
- Replacement Cost: Reduce replacement costs by reducing the initial amount and complexity of infrastructure components and requiring good maintenance and operating procedures to extend life spans.
- Total Life Cycle Cost: Evaluate project value by determining the total cost of constructing, maintaining, operating, and replacing the infrastructure components over their intended life spans.
- Social and Environmental Benefits: Consider the economic benefits to the City in regards to social and environmental matters such as improved air quality, health, reduced cost of congestion, reduced travel times, improved goods movement, and increased worker productivity.

- Private Landowner Benefits: Evaluate benefits to property values and development potential associated with "uplift" from the public sector investment in rapid transit.
- Public Fiscal Benefits: Evaluate the economic spin-off effects associated with potential increased revenue from municipal property taxes, development charges, and other taxes and fees.

In evaluating the risks to the DOTT project, the City has set out to clearly articulate, from the City's perspective, an appropriate measure of success and the value brought by the project to its stakeholders. The most serious risks in this context are those that would potentially jeopardize the delivery of a successful project and the expected value to the community. These risks vary from stage to stage during the development of the project.

The approach to risk assessment employed for the purpose of the City of Ottawa's DOTT project involves an analysis of the likelihood of a risk occurring and the severity of the consequence when the risk does occur. For example, a highly likely risk with negligible consequence such as construction cost increases could be managed through transferring the risk to a third party who is in a better position than the City to reduce the risk likelihood. On the other hand, an unlikely risk with serious consequence such as failing to secure capital funding for the project is perhaps best handled by the City instead of any other entity.

Planning Phase

During the planning phase the most significant risks are those that could potentially prevent the project from proceeding to the next phase of implementation. These could include insurmountable design, environmental, or planning problems. No such impacts have been identified or are foreseen at this time.

While the City has committed to going forward with the project, approval and financial support from the Province and the Federal Government is the next priority. The consequence of the project not being approved and supported by the Province and/or the Federal Government would result in the project not proceeding, given the scale of the capital costs involved.

Implementation Phase

The implementation phase involves work along the alignment of the rapid transit project, including design, construction and testing of guideway, stations, and vehicles. At this stage, the most serious financial risk is the impact of insufficient funding which could result in termination of the project or an indefinite delay; the less serious, and generally the more manageable risks are those that result in budget and/or schedule overruns.

In order to examine the implementation phase of the rapid transit project, risk was considered in the context of the following major physical components: the alignment (primarily on existing rail rights of way), the vehicles (technologies

and designs), the stations (planned for major commercial, institutional, employment, and residential nodes) and the facilities (maintenance, repair and inspection yards). These same components are also relevant in the Operations Phase; for example, the selection of vehicles will have an impact on operating reliability, lifecycle costs and operating expenses. Risks related to the operations of the rapid transit projects are discussed in the next section. This section focuses on the capital portion of the project.

Alignment

The proposed alignment of the DOTT project contemplates the use of a combination Transitway conversion and newly constructed guideway (through the tunnel). This will require some property acquisition through expropriation, which exposes the City to a financial risk in the event that property acquisition costs are higher than planned for or there are unforeseen legal entanglements. Financial contingencies have been included to account for this property acquisition risk.

Extensive due diligence through sequential processes of further refinements of the design will ensure mitigation of design-related risks for the guideway and structures. Signal systems being contemplated are based on reliable and tested technology that will comply with all Canadian standards and legislation. No major environmental impact is expected to cause any significant negative consequence on the rapid transit project as a result of the contemplated alignment.

Stations

The locations of the stations have already been determined at this stage of the planning process for the DOTT project. Since these locations were based on community consultation at various open houses and received the City Council approval, the locations are unlikely to generate any issue for the rapid transit project. The design of the stations also forms an important part of the DOTT project's brand. Design and construction risk will be addressed in the design & construction contracts and are anticipated to pose no additional or extraordinary undue risk.

Maintenance & Storage Facility

The Maintenance & Storage Facility as well as the maintenance procedures are important in ensuring the safety of the tracks, vehicles and stations as they commence to deliver service to the City of Ottawa. At the same time, the functioning of the Maintenance & Storage Facility as determined by the design and the construction needs to place safety as a high priority.

Maintenance work is often complex and involves multiple disciplines; therefore, significant emphasis in the planning phase is placed on ensuring that appropriate protocols, designs and structures are put in place to mitigate the impacts of associated risk. Furthermore, it is likely that through the P3 arrangements that a private operator will manage this component of the work with the result that risks will be allocated to the party best positioned to manage the inherent risks of being "in the business" of maintenance.

No new or untested maintenance facilities and equipment designs are contemplated and the performance criteria for the planned facilities and maintenance equipment will follow conventional safety and efficiency standards. No major facilities risks have been identified that could be expected to result in a material negative consequence on the rapid transit project.

Funding and Financing

Financial risks as related to capital budgeting, procurement and scheduling could have a potentially serious impact on the rapid transit project. The two major factors that could impact this initiative are the Federal and Provincial funding agreements, and the availability of financing for private sector partners in a P3 arrangement.

Federal and Provincial funding are essential to the success of the initiative and are considered necessary to the successful implementation of a P3 arrangement. While it is unlikely to have financial risks that would permanently bring the project to a halt if funding is committed, financial risks have the potential to seriously jeopardize the City's ability to deliver what it has promised to deliver to its stakeholders. All budgeting by definition is based on estimates, which are by their very nature imprecise.

The business model being contemplated by the City is selected based on optimal risk allocation. For example, a fixed price contract is reasonable for construction provided that the City is able to specify what it requires for the rapid transit project and still give the contractor a level of flexibility to be innovative to save costs. At this time, the assessment of cost implications is still high level and further analysis is required to determine the risk tolerance level of the City before selecting a business model to work with the private sector in implementing the DOTT project.

Ownership of the DOTT project may affect the ownership of some of the risks (e.g., from total private ownership in the case of Highway 407 to transit operations outsourcing in the case of York Region Transit). While the ownership arrangement has not yet fully determined, it is unlikely that the DOTT project being part of the City's transit network and a public service with public funding will be seen as something completely separate from the City. Even in the case where the City transfers the majority of the responsibility associated with the DOTT project to the private sector, the City fully understands that the risk of managing the private sector to deliver satisfactory rapid transit service to the community remains with the City. As such, the City is prepared to maintain an oversight role to ensure the delivery of value to stakeholders throughout the DOTT project.

A significant external risk is inflationary cost increases, either due to general inflationary conditions in the broader economy, or specific cost increases in construction materials, transportation equipment, or related sectors. These are not controllable by the City, however, we note that most measures of inflation in the broader Canadian economy are currently at historically low levels, although the risk exists of more inflationary conditions in coming years associated with recent monetary stimulus measures and the anticipated economic recovery.

Operations Phase

Once the DOTT project is built and ready for ongoing operations, the project enters into the operations phase and encounters a new set of risks. Again, safety related risks are of the utmost importance. The planning for this phase of the initiative will ensure that appropriate performance specifications are in place such that the safety and security requirements of the system are met. Regardless of whether the City directly operates the DOTT project or outsources the operations to the private sector, the safety standards will be established by the performance specifications and will be in conformity with Canadian safety and security protocols and legislation.

The risks during the operations phase can be categorized into those related to performance (e.g., reliability, punctuality, comfort, customer service) and financial (e.g., revenue, ridership, operating costs, maintenance costs). While the consequences of the performance related risks would probably not lead to much more than inconvenience, the credibility and reputation of the rapid transit project is dependent on its performance. Much of the value expected by the stakeholders is related to performance. Therefore, the City needs to ensure that performance standards are strictly adhered to with an appropriate reward/penalty system for enforcement.

The financial risks during the operations phase could potentially seriously impede the delivery of the project to the stakeholders. The likelihood of the financial risks is also relatively high because of the uncertainty associated with the current economy. It is critical for the City to ensure that the DOTT project remains financially feasible throughout the operations phase.

Many of the financial risks are related to ridership – the higher the ridership, the higher the revenue, the less pressure on the overall financial situation for the rapid transit project. However, revenue is also dependent on the fare policy, which in most cases has an inverse relationship with ridership – i.e., the higher the fare, the lower the ridership. The fare policy needs to be grounded in affordability for the community and for attracting new riders while balancing the need to recover as much as of costs as possible. Further scenario and sensitivity analysis of the financial pro-forma for the rapid transit project is necessary to determine the potential likelihood and impact of the financial risks to the City.

5 Federal Requirements for Funding

5.1 Accessibility

The DOTT project envisions at least 70% low-floor LRT vehicle technology that is fully accessible. All of the stations will be fully accessible, and meet the requirements of the Canadian Standards Association Technical Standard Accessible Design for the Built Environment (CAN/CSA B651-04) for new construction.

5.2 Energy Efficiency

The project planning and design criteria for the DOTT project include eleven planning objectives. One of them is "showcase sustainable design best practices." Specifically, the project will exemplify best practices in energy and environmental design, including "green infrastructure" choices. Associated design criteria comprise the following:

- Reduced Energy Demand: Select rapid transit technologies and building designs that are energy efficient to build and operate.
- Energy Conservation: Develop energy conservation plans that seek to reduce energy consumption during project construction and operation.
- Alternative Energy Supply: Provide opportunities for renewable energy sources such as solar or wind power to locate within the corridor, to supplement the energy grid or power infrastructure accessories such as lighting or communications equipment.
- Corridor Greening: Incorporate a range of landscape treatments including trees and grass and shrubs with the objective of creating a green rapid transit corridor that assists in oxygen production and CO2 reduction.
- Naturalized Drainage: Use naturalized drainage techniques such as bio-retention swales to reduce infrastructure materials required and to encourage ground water recharge.
- Green Roofs: Consider the use of green roofs for rapid transit stations or tunnel portals.
- Natural Lighting: Enable natural light to penetrate and illuminate rapid transit stations to the degree possible to reduce energy demands while improving the user experience.
- Infrastructure Reuse: Use existing infrastructure corridors and services whenever possible, to reduce the project footprint and additional materials that need to be consumed.
- Recycled Materials: Use recycled materials where feasible, to reduce the amount of natural resources depleted or total energy consumed.

- Local Materials: Use materials and resources from local suppliers to reduce transport distances and associated energy consumption.
- Waste Management: Reduce the amount of waste accumulated from construction activities, to reduce the amount of material that will be sent to a landfill.
- Toxics Reduction: Use landscaping treatments and surfaces that can be managed naturally and without pesticide use.

5.3 P3 Approach

The City of Ottawa has undertaken an exercise to review potential public private partnership (P3) models for implementation of the DOTT project. The City of Ottawa is working on a procurement strategy to assess the key risks inherent in the project and explore the role private sector may play in assisting the City in managing or mitigating some of the risks through P3 implementation.

Modelling of P3 models and associated risks has now been established and a public sector comparator is being developed to assess potential implementation partnerships. The work is ongoing and will proceed to a decision point pending resolution of the status of senior government funding for the project.

The City has also initiated discussions with Infrastructure Ontario to evaluate the project under their Alternative Finance and Procurement model to determine if there is value for money in pursuing alternative financing and procurement models.

5.4 Emergency Preparedness

Allowances are included in the DOTT project for emergency operation, communications and security systems. These will provide a high degree of flexibility in responding to a wide range of potential emergency conditions and will provide supervision and surveillance within the system. At this stage the costs are only allowances per station as the extent of the systems has not yet been defined.

APPENDIX A – Multiple Account Evaluation

Multiple Account Evaluation

This appendix outlines a summary of data sources and assumptions used to generate values for the inputs required for each account for the purpose of MAE modelling. The inputs include general inputs, which include assumptions about broader economic indicators and relevant rates and indicators, as well as ridership and traffic inputs that are used in calculations in many accounts. Account-related inputs are specific to individual metrics in the MAE modelling.

The inputs can be grouped under the following categories:

- General Assumptions
- Ridership and Traffic Projections
- Direct Project and Transportation Account
- Direct Transportation User Benefits Account
- Environmental Account
- Land Use/Economic Development Account

A discussion of the sources of data and associated assumptions in each category follows below.

General Assumptions

The general assumptions include several variables that impact all calculations in the analysis. A 30 year analysis period was used for the analysis, in conformity with typical infrastructure investment analyses. Based on the current core inflation rates, an inflation rate of 1.5% was used for projecting the various cost inputs into the 30 year analysis. This was held constant across all inputs.

The investment start year is 2010. The opening year is 2019, following the anticipated completion of construction by that year.

A discounted cash flow model was developed to provide comparisons of the base case to the project case on a net present value basis. The base case and project case were evaluated at a 5% real discount rate over a 30-year period (2010-2039). This analysis assumed that the residual values calculated at the end of the evaluation period were zero and salvage value has not been estimated.

Ridership and Traffic Projections

Ridership Projections

Ridership forecasts used for the projects being evaluated are based on estimates generated from the Ridership projections from the Transportation Master Plan, as detailed in section 3.1 of the report.

Traffic Projections

Traffic data is used to determine the impact of transit on the environment as a result of the shift of some trips to transit. For the purposes of MAE analysis, figures for annual traffic estimates were derived from the estimates of total new ridership generated assuming an average auto occupancy of 1.2, and the average trip length on the LRT system of 5.2 kilometers. However, as traffic modelling was not available for the post-transit and pre-transit condition, travel time benefits that may result from the reduction in congestion resulting from the DOTT project were not calculated. This could represent an understatement of the overall travel time benefits.

Direct Project and Transportation Account:

Direct project cost refers to the cost to the infrastructure provider of the project being evaluated. The cost estimates included capital costs and annual operating/maintenance costs.

Capital Costs

Capital cost estimates were provided for the project scenario by Delcan Consultants, at current 2009 prices. For the analysis, these costs were escalated by the inflation rate for the 30 year planning period. To obtain present value estimates these cost streams were discounted at 5% to the current year.

Operating and Maintenance Costs.

Based on OC Transpo estimates, the project will result in annual operating costs savings of 9.6 million, at current 2010 prices. The present values of these estimates were also estimated by discounting the cost stream at 5%.

Operating Revenues

For the purpose of this analysis, fares for each person boarding transit were assumed to be the only source of revenue. An average fare per boarding figure of $2.25 was based on current Ottawa transit fares for 2010. Projected future fare structure was escalated at the rate of inflation for the analysis period.

Direct Transportation User Benefits Account

Travel Time

For this project, the travel time savings that will accrue to transit riders due to improved service speeds have been estimated. It is assumed that the operating speed would increase from 27km per hour currently to 35km per hour in the project case for the average trip length of 5.2 km. This benefit was quantified in monetary terms, based on the value of travel time for Ottawa at $12.73 per hour from a recent Transport Canada study, *Value of Time and Reliability for*

Local Trips in Canada, *March 2008*. These values were escalated to the 2010 level by applying the rate of inflation.

Vehicle Operating Costs

Total vehicle operating costs were estimated by multiplying per kilometre costs for vehicle operating expenses, with the additional vehicle kilometres travelled by automobiles in the absence of the project (ie. without the modal shift that will result from the project).

According to Canadian Automobile Association (CAA) estimates, the average costs to operate a typical four-door sedan driven 18,000 km annually was 49.7 cents per kilometre in 2009. This cost included variable operating costs including fuel and oil as well as fixed ownership costs such as insurance, licence fees, registration fees, taxes, finance costs, and depreciation.

This value was escalated with the rate of inflation for the analysis period.

Accident Costs

Incident rate for accidents is directly related to the number of vehicle kilometres travelled. In order to estimate the average cost of accidents for each scenario, the incident rate in Ontario was multiplied by the average cost of accidents and the total automobile VKT.

For the purpose of this analysis the incident rate of accidents in Ontario was multiplied by the average cost of accidents and the total automobile vehicle kilometres travelled (VKT).

Accident incidents can be categorised into fatal accidents, injury only, and property damage incidents. The values of average cost of these accidents and average incident rate for accidents are outlined below. The cost data was available for 2004 and was inflated to 2010 values.

Average Cost of Accident by Collision Severity

Fatal Collisions	$ 15,700,000
Injury only	$ 82,000
Property damage only	$ 8,000

Source: Transport Canada Accidents Analysis and Estimation of the Social Cost of Motor Vehicle Collisions in Ontario.
http://www.tc.gc.ca/roadsafety/tp/tp14800/pdf/TP14800E.pdf.

Rate of Incidence Accidents by Collision Severity

Incidence Rates per Billion VKT	
Fatal Collisions	8.9
Injury Only	604
Property Damage Only	3670

Source: Canadian Motor Vehicle Traffic Collision Statistics: 2006.

Environmental Costs

Urban transportation is a major contributor of Green House Gases (GhG) and Criteria Air Contaminants (CAC). Changes in emissions affect ambient air quality and related environmental impacts.

In order to estimate the environmental impacts the underlying assumption is that reduction in GHG and CAC emissions will result primarily from the number of cars taken off the road as a result of increased transit ridership.

For this analysis, data for the emissions in the base case scenario, as well as the project scenarios, was estimated using the Urban Transportation Emission Calculator (UTEC) model from Transport Canada. For estimating the monetary impacts, the average emission costs by pollutant are detailed below.

Green House Gas Emissions

According to a Transport Canada study, unit cost of GhG emissions is estimated at $37.38 per tonne of CO2 equivalent. This value was updated by applying inflation to get current values for the analysis year.

Critical Air Contaminants

The unit cost of air pollution by pollutant emitted has been estimated by Transport Canada in a 2007 study entitled *Total Cost of Air Pollution Due to Transportation in Canada*. These are:

Unit Cost of Air Pollutant Emitted (Ontario)

Pollutant	Unit Cost per tonne
VOC	$877
Nox	$5,940
SO2	$6,520
PM10	$28,600

Source: Transport Canada, Total Cost of Air Pollution Due to Transportation in Canada, 2007

These values were updated by applying the inflation rate to get current values for the analysis period.

Economic Development Account

Employment Generated, Output Generated, Taxation Revenue

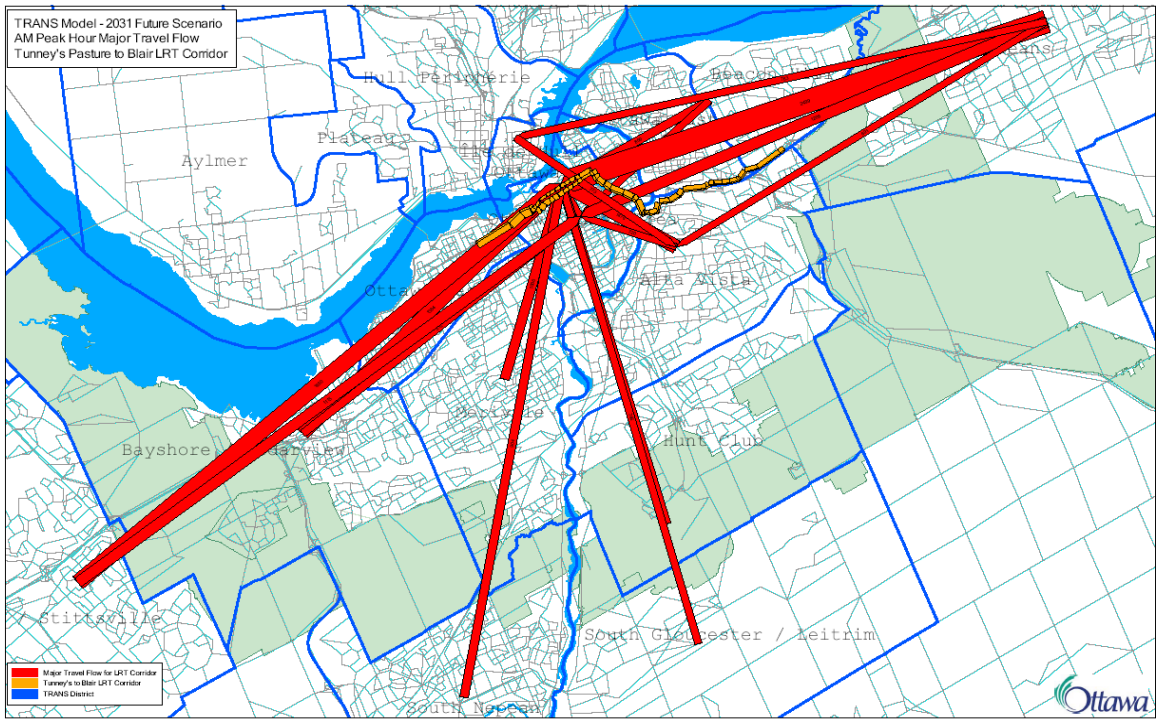
Economic impact analysis was undertaken using Ottawa-based input-output multipliers relating to the transportation sector for the investment proposed for the D.O.T.T project. The output provided estimates of the direct and indirect employment impacts of the capital investment in Ottawa. The input-output analysis also includes economic output generated in dollar terms, and an estimate of taxation revenue generated.

APPENDIX B – LRT Corridor Ridership Forecast Report

LRT Corridor Ridership Forecast

(Tunney's Pasture to Blair Station)

March 2010



Technical Report

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1.0 Using the TRANS Model

The City of Ottawa, in conjunctions with other TRANS agencies (the National Capital Commission (NCC), the Ministère des Transports du Québec (MTQ), Ville de Gatineau, the Société de transport de l'Outaouais (STO) and the Ministry of Transportation of Ontario (MTO)) maintains a Travel Demand Forecasting model called TRANS Model for the National Capital Region (NCR). The TRANS Model was originally developed in 1986 and was recently upgraded (in 2007) to incorporate state-of-the-art modelling techniques and was calibrated using latest travel data from 2005 NCR Origin-Destination Survey.

The travel demand model simulates the person trips made by all motorized modes in the NCR during morning and afternoon peak periods, both for today and in the future. The driving input of the model is the Council-approved population and employment forecasts. The model reflects important factors that determine trip-making patterns such as the changes in the make-up of household (including the reduction in household size and the aging of population) and the availability of cars to household members, the growth in and distribution of employment by type, how individual organize their trips in sequences, the deterrent effect of traffic congestion on use of the car and the relative attractiveness of the Transitway as compared to the automobile, etc.

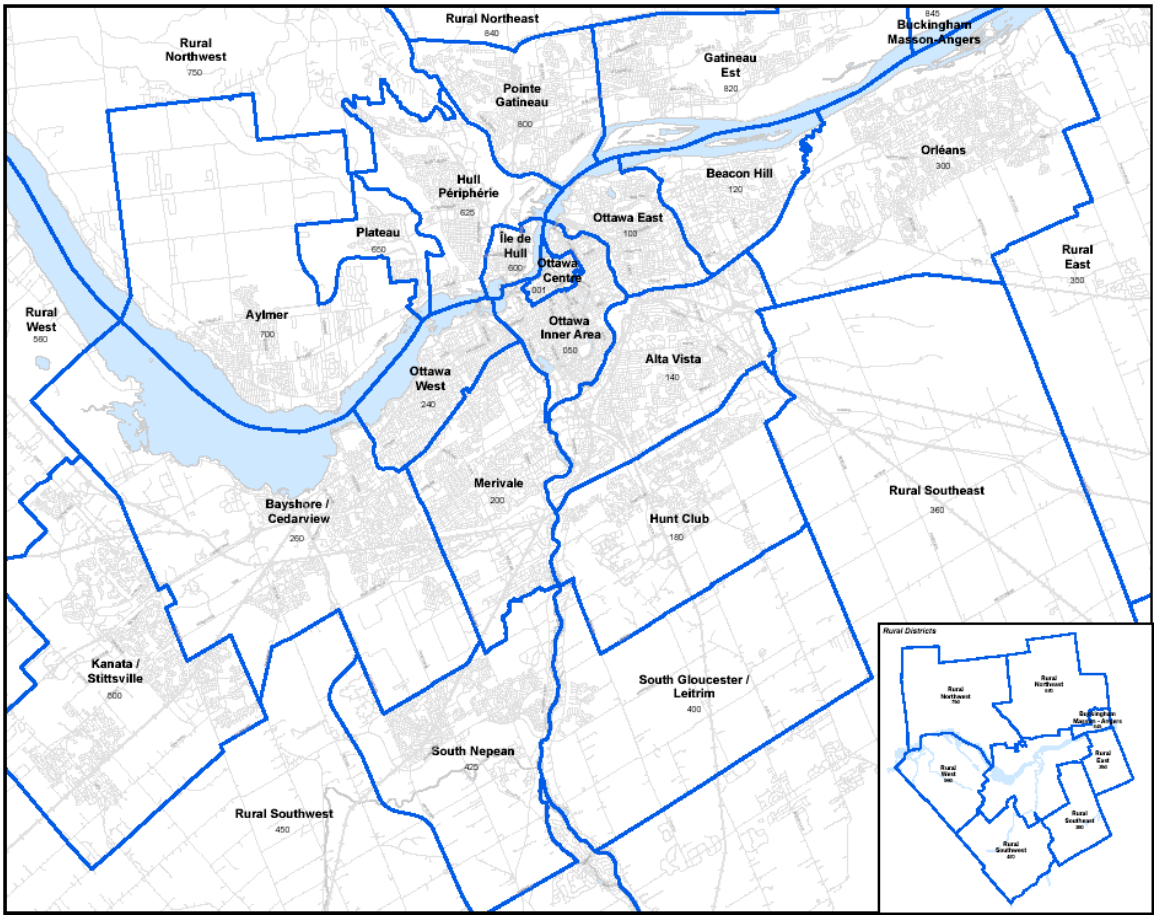
The TRANS model serves to understand the impact of long-term development patterns and growth within Ottawa and Gatineau on future growth in travel demands across the NCR.

The Model was used to develop the road and transit infrastructure required to serve future growth to 2031 and beyond, which were approved in November 2008 as part of the Transportation Master Plan Update. The model has also been / is being used in several transportation planning studies including Interprovincial Crossing, Interprovincial Transit Strategy, the Downtown Ottawa Transit Tunnel (DOTT), and all other major transportation planning studies.

2.0 TRANS Planning Districts

The TRANS Model captures the travel interactions within the entire National Capital Region (NCR) area. For planning purposes, NCR is divided into 26 Districts (Exhibit 1).

Exhibit 1: TRANS Districts



3.0 TRANS Model Assumptions

3.1 Population and Employment Assumptions

The 2031 population and employment levels for major growth areas, and the percentage increase over current population and employment levels, is summarized in Table 1. Table 1 indicates that the City of Ottawa is projected to grow by approximately 30% to reach 1,135,700. Employment is expected to grow by approximately 35% to reach 703,000. This growth in employment is based on the City's economic role in serving the greater Ottawa-Gatineau region and outlying areas. Major highlights of the growth in both population and employment levels across the planning regions are summarized as follows:

- Approximately 52% of the population and 72% of employment will be located in areas inside the Greenbelt.
- The population in the urban communities located outside the Greenbelt will increase by approximately 72 %.
- Employment growth across the City will be split between areas inside the Greenbelt (42%) and urban centres outside the Greenbelt (50%).
- Employment in the Ottawa Inner area will increase by approximately 15%.
- The population growth projected for areas inside the Greenbelt will be relatively evenly split between the inner area (bounded by Ottawa River to the north, Rideau River to the east and CPR rail corridor to the west) and the remaining urban areas inside the Greenbelt.
- For the National Capital Area (i.e. including Gatineau), more than 75% of the population and about 80% of the employment will be located in Ottawa.

Table 1: Growth in Population and Employment for Major Growth Areas

	Population							Employment						
	Base Year	% of Total	2031	% of Total	Growth	% of Total	% of Base Year	Base Year	% of Total	2031	% of Total	Growth	% of Total	% of Base Year
Ottawa Inner Area	95,800	11%	118,500	10%	22,700	9%	24%	153,900	29%	181,000	26%	27,100	15%	18%
Inside Greenbelt*	437,300	50%	467,300	41%	30,000	11%	7%	274,700	53%	324,500	46%	49,800	27%	18%
Inside Greenbelt (Urban) Subtotal	**533,100**	**61%**	**585,800**	**52%**	**52,700**	**20%**	**10%**	**428,600**	**82%**	**505,500**	**72%**	**76,900**	**42%**	**18%**
Orleans	99,000	11%	123,500	11%	24,500	9%	25%	17,900	3%	35,000	5%	17,100	9%	96%
South Nepean	55,500	6%	104,300	9%	48,800	18%	88%	7,000	1%	40,000	6%	33,000	18%	471%
Riverside South / Leitrim	9,000	1%	43,300	4%	34,300	13%	381%	2,800	0.5%	9,300	1%	6,500	4%	232%
Kanata / Stittsville	88,400	10%	162,200	14%	73,800	28%	83%	43,600	8%	77,000	11%	33,400	18%	77%
Outside Greenbelt (Urban) Subtotal	**251,900**	**29%**	**433,300**	**38%**	**181,400**	**68%**	**72%**	**71,300**	**14%**	**161,300**	**23%**	**90,000**	**50%**	**126%**
Ottawa Urban Areas	**785,000**	**90%**	**1,019,100**	**90%**	**234,100**	**88%**	**30%**	**499,900**	**96%**	**666,800**	**95%**	**166,900**	**92%**	**33%**
Rural Areas	**85,700**	**10%**	**116,600**	**10%**	**30,900**	**12%**	**36%**	**21,800**	**4%**	**36,200**	**5%**	**14,400**	**8%**	**66%**
City of Ottawa Total	**870,700**	**100%**	**1,135,700**	**100%**	**265,000**	**100%**	**30%**	**521,700**	**100%**	**703,000**	**100%**	**181,300**	**100%**	**35%**
Ile de Hull	11,500	4%	15,000	4%	3,500	4%	30%	25,100	24%	49,600	30%	24,500	41%	98%
Remainder of Gatineau & MRC[1]	267,700	96%	353,200	96%	85,500	96%	32%	77,500	76%	113,400	70%	35,900	59%	46%
Gatineau & MRC Total	**279,200**	**100%**	**368,200**	**100%**	**89,000**	**100%**	**32%**	**102,600**	**100%**	**163,000**	**100%**	**60,400**	**100%**	**59%**
National Capital Region	**1,149,900**		**1,503,900**		**354,000**		**31%**	**624,300**		**866,000**		**241,700**		**39%**

* *Does not include Ottawa Inner Area*

3.2 Road Network Assumptions

The expansion of the road network by 2031 reflects improvements identified in the 2008 Transportation Master Plan. Assumed road expansion surrounding the Tunney's to Blair Corridor area includes:

- New interprovincial bridge across the Ottawa River in the east;
- Ottawa Road 174 widen from four to six lanes from Blair Road to Jeanne d'Arc Blvd
- New four-lane Alta Vista Transportation Corridor (including 2 general + two bus lanes) from Nicholas Street/Highway 417 interchange to Conroy Road at Walkley Road

3.3 Transit Network Assumptions

For modelling purposes, the following transit infrastructure and operation were assumed by 2031:

- East-West LRT service from Baseline to Blair
- North-South LRT service from Riverside South to Rideau Centre
- OC Transpo regular routes will terminate at LRT stations and passengers will transfer to get to the Downtown.
- STO buses are assumed to be run on Wellington Street. This assumption could be revised depending on the results of the Interprovincial Transit Strategic Study.

4.0 City-Wide Travel Demand

Table 2 summarizes projected motorized travel demand for the City of Ottawa for the morning peak hour. City-wide growth in auto vehicle travel in the morning peak hour is forecast to increase by approximately 23%, which is less than the 30% rate of population growth. Public transit ridership is forecast to accommodate a significant portion of the growth, which will lead to increase in ridership by 78%.

Table 2: Projected Transit and Automobile Travel Demand – City-Wide
(a.m. peak hour)

Mode	Person-Trips		
	2005	2031	Growth
Transit	45,200	80,300	78%
Automobile	146,100	180,000	23%
Total motorized trips	191,300	260,300	36%

4.1 Transit Trip Origin

Table 3 presents 2005 and 2031 morning peak hour city-wide transit trips by origin. Overall morning peak hour transit ridership in 2005 was 45,200. More than half of these trips (58%)started from Inside Greenbelt, followed by 29% from Urban Area Outside Greenbelt and 11% from Gatineau coming to Ottawa.

By 2031, the estimated morning peak hour transit trips will be approximately 78% more than 2005 level, due to increase in population and employment as well as higher level of transit service. While Inside Greenbelt will be the largest transit trips generator, the highest growth will occur in Urban Area Outside Greenbelt and on the Gatineau side. This is mainly due to the intense development outside the Greenbelt and more employment opportunity in the Ottawa Centre.

Table 3: Origin of transit trips – City-Wide (2005 and 2031 a.m. peak hour)

Districts	District Trip Origin 2005		District Trip Origin 2031		% Growth Since 2005
	Transit Trips	% Share	Transit Trips	% Share	
Ottawa Centre[1]	500	1%	900	1%	80%
Ottawa Inner Area[2]	3,900	9%	5,700	7%	46%
Ottawa East/Beacon Hill	4,500	10%	6,800	9%	51%
Alta Vista	4,100	9%	6,400	8%	56%
Hunt Club	2,800	6%	3,500	4%	25%
Merrivale	3,800	8%	5,600	7%	47%
Ottawa West	2,200	5%	3,500	4%	59%
Bayshore	4,100	9%	5,600	7%	37%
Inside Greenbelt	**25,900**	**57%**	**38,000**	**47%**	**47%**
Orleans	6,800	15%	10,200	13%	50%
South Gloucester	300	1%	2,200	3%	633%
South Nepean	2,500	6%	7,000	9%	180%
Kanata/Stittsville	3,500	8%	9,200	11%	163%
Urban Area Outside Greenbelt	**13,100**	**30%**	**28,600**	**36%**	**118%**
Rural	1,100	2%	2,200	3%	100%
Gatineau	5,100	11%	11,500	14%	125%
Total	**45,200**	**100%**	**80,300**	**100%**	**78%**

1- Area bounded by Ottawa River/St. Patrick to the north, King Edward to the east, Gloucester to the south and Bronson to the west

2- Area bounded by Ottawa River to the north, Rideau River to the east and CPR rail to the west. Does not include Ottawa Centre

4.2 Transit Trip Destination

Table 4 presents the 2005 and 2031 morning peak hour city-wide transit trips by destination. In 2005, major destinations of transit trips were Ottawa Centre and Ottawa Inner Area with 34% and 19% respectively.

In 2031, Ottawa Centre and Ottawa Inner Area will remain the major destinations of transit trips. Transit trips to Ottawa Centre will increase to 20,000 from 15,500 in 2005 (29% growth) and Ottawa Inner Area transit trips will increase to 12,400 from 8,400 in 2005 (48% growth). Alta Vista, Gatineau, Merivale, Ottawa East and Kanata/Stittsville will emerge as other important destinations for transit.

Table 4: Destination of transit trips – City-Wide (2005 and 2031 a.m. peak hour)

Districts	District Trip Destination 2005		District Trip Destination 2031		% Growth Since 2005
	Transit Trips	% Share	Transit Trips	% Share	
Ottawa Centre	15,500	34%	20,000	25%	29%
Ottawa Inner Area	8,400	19%	12,400	15%	48%
Ottawa East/Beacon Hill	3,400	8%	5,700	7%	68%
Alta Vista	4,400	10%	8,300	10%	89%
Hunt Club	600	1%	1,300	2%	117%
Merrivale	3,800	8%	6,200	8%	63%
Ottawa West	2,300	5%	3,800	5%	65%
Bayshore	1,900	4%	3,500	4%	84%
Inside Greenbelt	**40,300**	**89%**	**61,200**	**76%**	**52%**
Orleans	1,100	2%	3,400	4%	209%
South Gloucester	-	-	1,000	1%	1000%
South Nepean	500	1%	2,900	4%	480%
Kanata/Stittsville	1,300	3%	5,400	7%	315%
Urban Area Outside Greenbelt	**2,900**	**6%**	**12,700**	**16%**	**338%**
Rural	-	-	-	-	-
Gatineau	2,000	4%	6,300	8%	215%
Total	**45,200**	**100%**	**80,200**	**100%**	**78%**

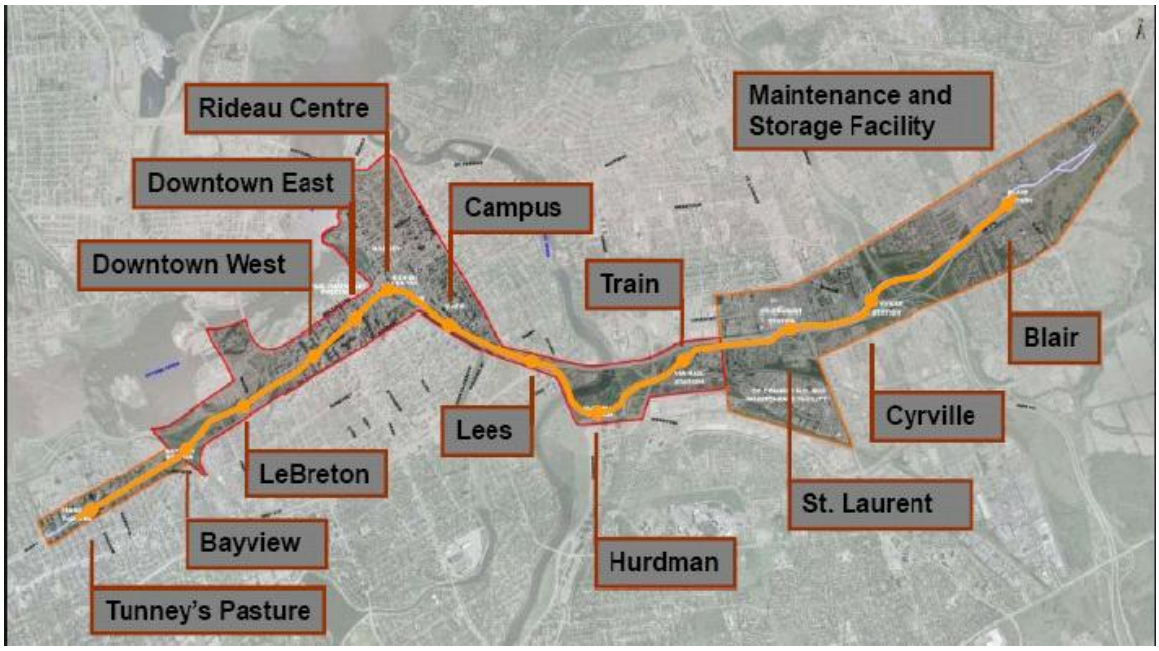
Note: Table 4 indicates higher growth rate for some of the destinations such as South Gloucester, South Nepean due to the very low numbers in 2005.

5.0 LRT Corridor Ridership Forecast (Tunney's Pasture to Blair Station)

5.1 LRT Corridor Alignment

Tunney's Pasture to Blair LRT Corridor alignment is presented in Exhibit 2. There are 13 stations along the corridor. The length of the corridor is approximately 12.5 kilometres, with a 3.2 kilometres tunnel in the Downtown and four underground stations.

Exhibit 2: Tunney's Pasture to Blair LRT Corridor Alignment and Stations



5.2 LRT Corridor Ridership

By 2031, the estimated ridership for the Tunney's Pasture to Blair LRT Corridor is approximately 36,800 for morning peak hour and 32,600 for afternoon (p.m.) peak hour. This translates to approximately 76 Million annual ridership on the corridor. Morning peak hour corridor ridership is higher than in the afternoon as the afternoon transit demand is stretched over a longer period. Exhibit 3 graphically illustrates the projected 2031 morning peak hour transit volumes along the corridor and Table 5 lists morning and afternoon ridership by section along the corridor.

Exhibit 3: Tunney's Pasture to Blair LRT Corridor Link Volumes, 2031 a.m. peak hour

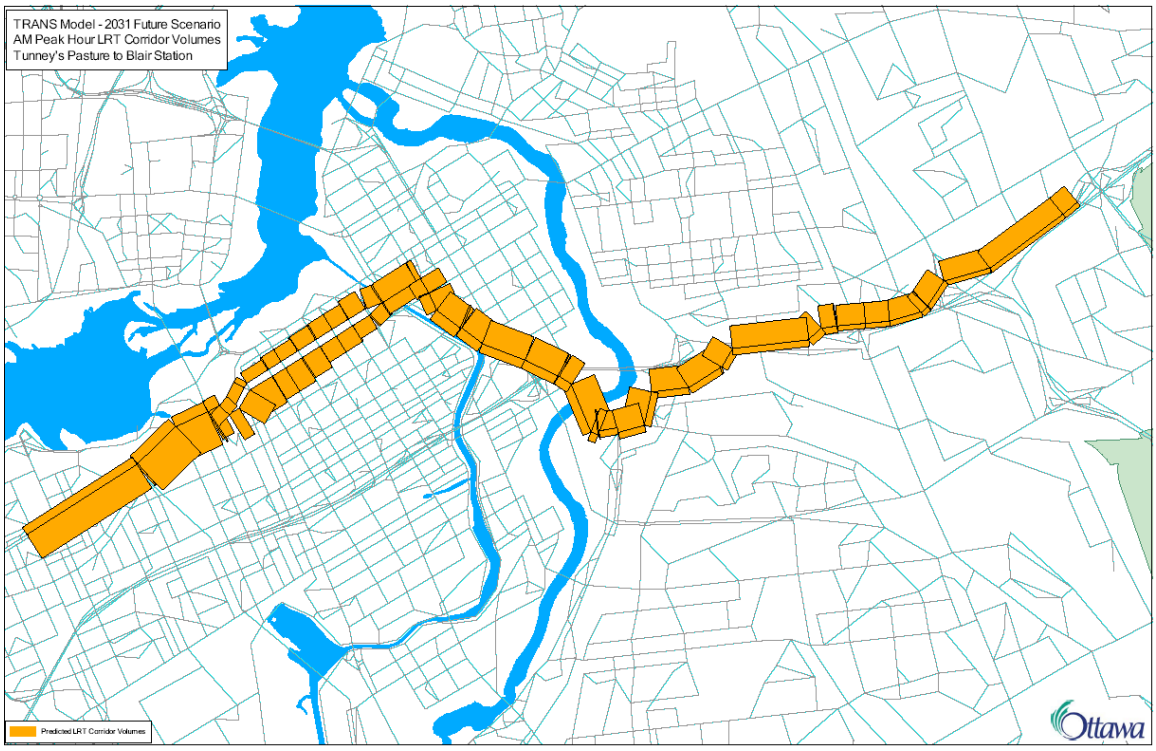


Table 5: Tunney's Pasture to Blair LRT Corridor Ridership
(2031 a.m. and p.m. peak hour)

	a.m. peak hour		**p.m. peak hour**	
Total Ridership	36,800		32,600	
Ridership by Section (Pass/h):	**Eastbound**	**Westbound**	**Eastbound**	**Westbound**
Tunney's – Bayview	11,900	3,700	4,000	11,000
Bayview – LeBreton	15,400	4,600	5,600	13,100
LeBreton – Downtown W	13,300	4,900	4,700	12,600
Downtown W – Downtown E	11,500	7,200	7,400	10,300
Downtown E – Rideau Centre	6,400	8,900	8,800	6,000
Rideau Centre – Campus	4,800	9,800	8,900	5,200
Campus – Lees	3,900	10,600	9,600	4,400
Lees – Hurdman	3,800	10,700	9,500	4,300
Hurdman – Train	2,900	9,700	8,400	3,500
Train – St. Laurent	2,900	9,700	8,200	3,500
St. Laurent – Cyrville	2,200	8,900	7,000	2,700
Cyrville - Blair	2,100	8,800	6,800	2,600
Passenger-Kilometre on LRT Corridor	183,200		163,600	
Avg. Trip length on LRT Corridor (km)	5		5	

5.2.1 LRT Stations Boarding and Alighting

Exhibit 4 graphically presents boarding and alighting activities at LRT Corridor stations during the morning peak hour. Colour of the circle shows type of passenger activities (red being boarding and green being alighting) and size of the circle indicates magnitude of these activities. Downtown Ottawa stations (i.e. Downtown West, Downtown East, Rideau Centre and Campus) show high alighting than boarding due to these being dominant destinations. LeBreton station also shows relatively high alighting activities due to transfers to Gatineau. Hurdman and St. Laurent stations show balance activities between boarding and alighting. Cyrville and Train are relatively low volume stations. Blair station shows high boarding activities due to major transfers from the Transitway system in the east (East Transitway and Cumberland Transitway).

Table 6 provides more detailed examination of the LRT Corridor stations activities for a.m. peak hour.

Ottawa Downtown tunnel stations (Downtown West, Downtown East, Rideau Centre and Campus) together will have an estimated 19,500 alighting, accounting for about 61% of the total alighting in the morning peak hour. The majority of these alighting are downtown destined. LeBreton and Hurdman stations have 3,300 and 2,600 alighting respectively. These alighting are mainly for transfers to final destinations. From LeBreton, riders transfer to local bus service to go to Gatineau. From Hurdman, riders transfer from the LRT to the Southeast Transitway and local bus service.

High boarding activities are estimated at Blair (8,800) and Hurdman (2,700) stations given transfer connections with the rest of the transit system at these locations. Boarding at Tunney's Pasture is relatively low due to assumed extension of the E-W LRT to the Baseline station. West and southwest riders will transfer to the LRT at Baseline, Queensway, Lincoln Field and Tunney's pasture stations.

For the afternoon peak hour, station activities will be in reverse direction.

Exhibit 4: Tunney's Pasture to Blair LRT Corridor Station Activities, 2031 a.m. peak hour

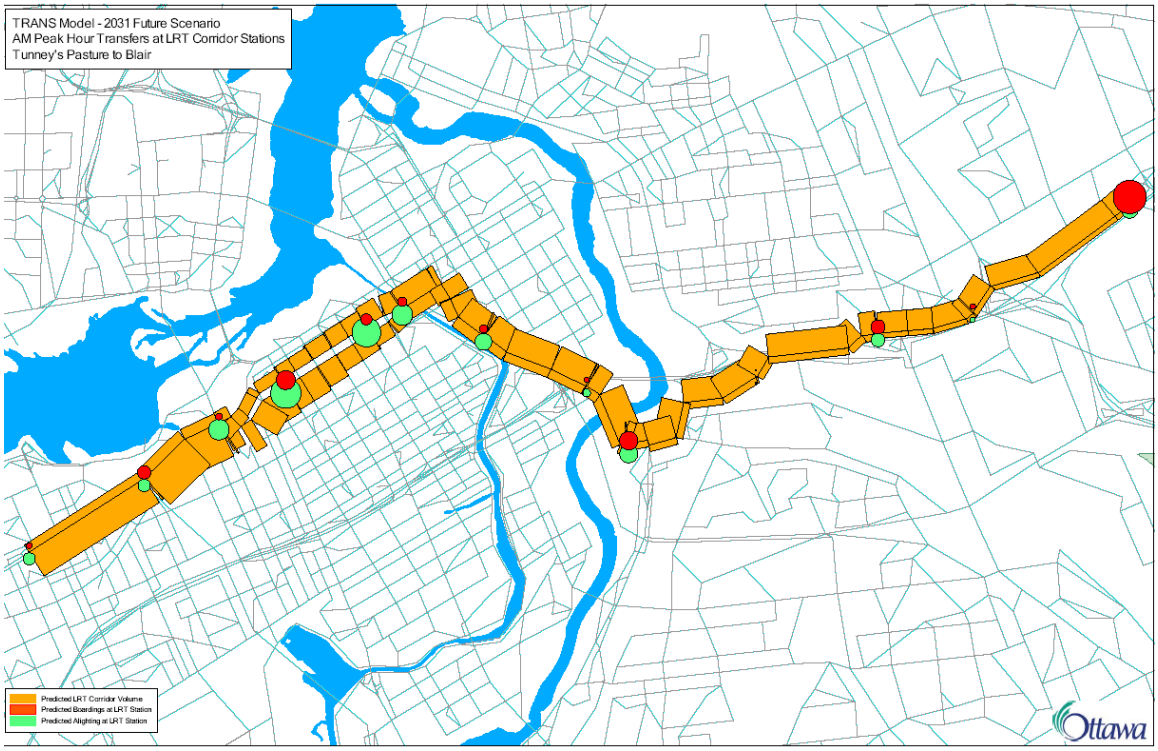


Table 6: Tunney's Pasture to Blair LRT Corridor Stations - Boarding and Alighting
(2031 a.m. peak hour)

LRT Station	Boarding	Alighting
Tunney's Pasture	300	1,200
Bayview	1,400	1,200
LeBreton	400	3,300
Downtown West	2,800	7,300
Downtown East	1,000	6,600
Rideau Centre	700	3,400
Campus	500	2,200
Lees	300	500
Hurdman	2,700	2,600
Train Station	100	100
St. Laurent	1,600	1,400
Cyrville	300	300
Blair	8,800	2,100
Total	**20,900**	**32,200**

5.3 LRT Corridor Trip Origins and Destinations

5.3.1 LRT Corridor Trip Origins

Table 7 presents 2031 a.m. peak hour LRT Corridor ridership by their origin. It is estimated that 19% of the ridership will originate from Orleans, 11% from Kanata/Stittsville and 9% each from Ottawa East/Beacon Hill and Alta Vista. Gatineau residents are estimate to be 9% of the Corridor ridership (transferring to LRT).

Table 7: Tunney's Pasture to Blair LRT Corridor ridership by Origin
(2031 a.m. peak hour)

District	**Ridership**	**% Share**
Ottawa Centre	500	1 %
Ottawa Inner Area	2,580	7 %
Ottawa East/Beacon Hill	3,190	9 %
Alta Vista	3,330	9 %
Hunt Club	1,940	5 %
Merivale	2,030	5.5 %
Ottawa West	1,800	5 %
Bayshore	3,000	8 %
Orleans	7,000	19 %
South Gloucester	1,530	4 %
South Nepean	2,030	5.5 %
Kanata/Stittsville	3,880	11 %
Rural	620	2 %
Gatineau	3,370	9 %
Total	**36,800**	**100 %**

5.3.2 LRT Corridor Trip Destinations

It is estimated that 57% of LRT Corridor rideship will be destined to Ottawa Centre and Inner Area. Gatineau, Alta Vista, and Ottawa East/Beacon Hill will also be among major destinations with 10%, 9%, and 6% share respectively.

Table 8: Tunney's Pasture to Blair LRT Corridor - Major Destinations
(2031 a.m. peak hour)

District	**Ridership**	**% Share**
Ottawa Centre	13,210	36 %
Ottawa Inner Area	7,620	21 %
Ottawa East/Beacon Hill	2,360	6 %
Alta Vista	3,370	9 %
Merivale	1,550	4 %
Ottawa West	1,320	4 %
Orleans	890	2 %
Kanata/Stittsville	870	2 %
Gatineau	3,700	10 %
Rest	1,910	6 %
Total	**36,800**	**100 %**

5.4 Trip Distribution

Exhibit 5 graphically illustrates the major desire line flows on the Tunney's Pasture to Blair LRT Corridor for 2031 in the morning peak hour. Travel desire lines were established with a threshold of 500 district-to-district trips per hour (a.m. peak hour transit trips). The width of the line indicates the magnitude of travel.

Exhibit 5: Tunney's Pasture to Blair LRT Corridor, Major Desire Lines

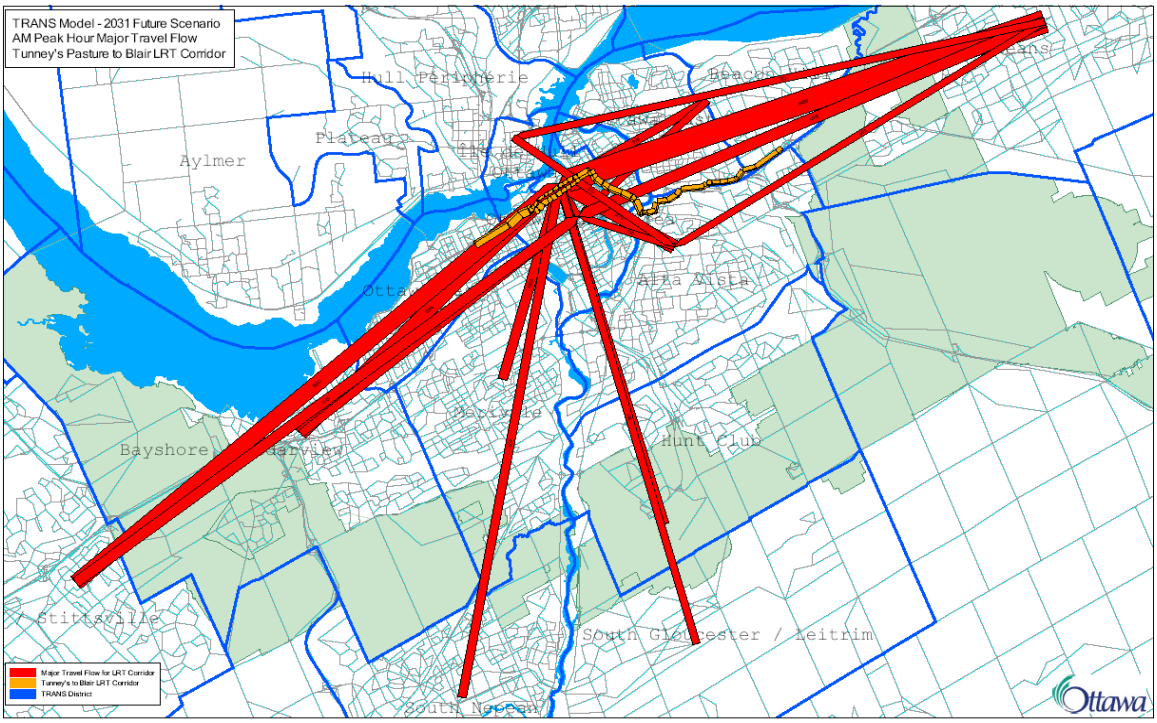
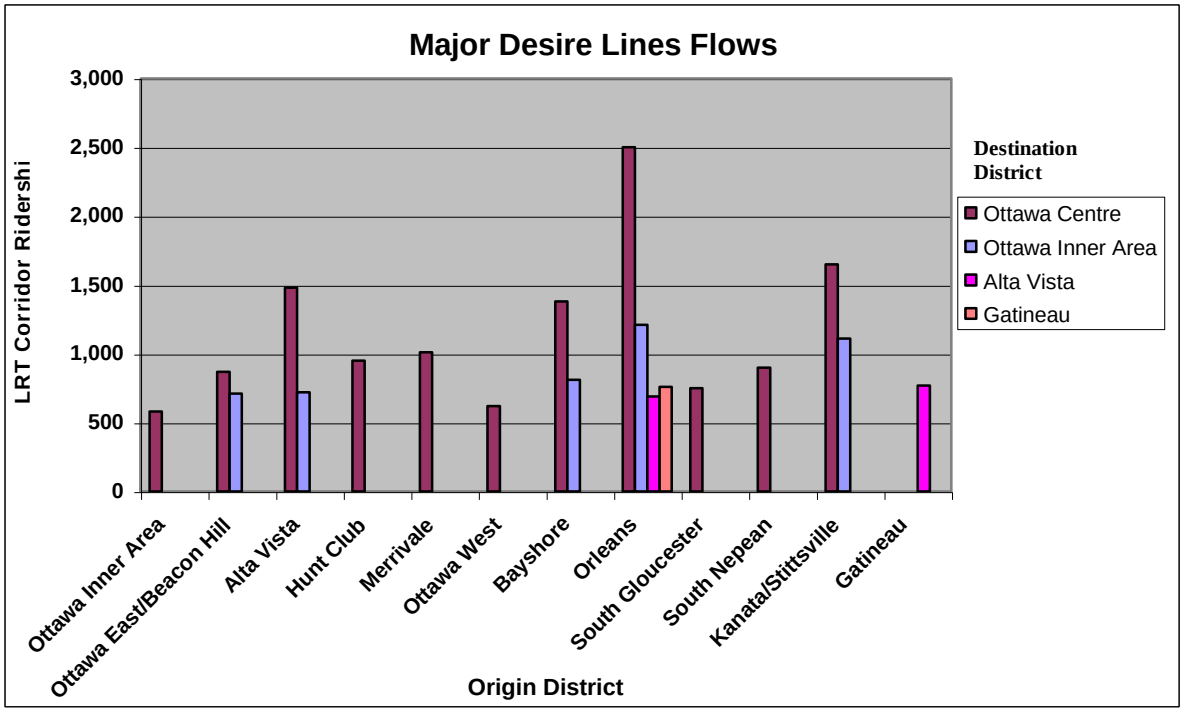


Exhibit 6 illustrates the forecast demand among the different planning districts. Largest flow is forecasted to be from Orleans to Ottawa Centre with 2,500 trips/hour, followed by from Kanata/Stittsville to Ottawa Centre with 1,650 trips/hour. Other major flows are: Alta Vista to Ottawa Centre (1,480 trips), Bayshore to Ottawa Centre (1,380 trips), Orleans to Ottawa Inner Area (1,210 trips) and Kanata/Stittsville to Ottawa Inner Area (1,1110) trips.

Exhibit 6: Tunney's Pasture to Blair LRT Corridor, Major Desire Lines



5.5 Trip Assignment

Exhibit 7 and 8 show the projected transit assignment for the Tunney's Pasture to Blair LRT Corridor and the transit services used by riders to access and egress the LRT Corridor in the morning and afternoon peak hour respectively. The plots indicate that east, southeast, southwest and west transitways are the main corridors used to reach the LRT Corridor. North-South LRT is also heavily used to reach the corridor to get to the downtown from south in the morning and opposite direction in the afternoon.

Exhibit 7: Tunney's Pasture to Blair LRT Corridor Assignment
(2031 a.m. peak hour)

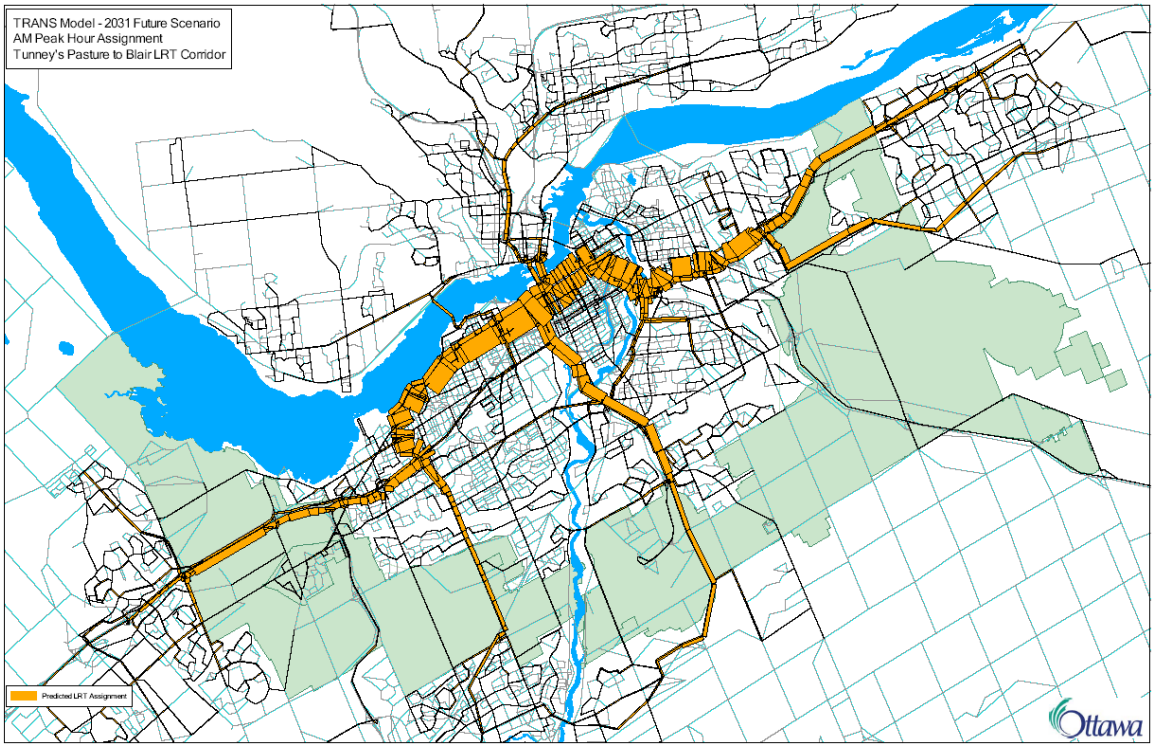


Exhibit 8: Tunney's Pasture to Blair LRT Corridor Assignment
(2031 p.m. peak hour)