

TO:	CHAIR AND MEMBERS STRATEGIC PRIORITIES AND POLICY COMMITTEE MEETING ON MAY 15, 2017
FROM:	KELLY SCHERR, P.ENG., MBA, FEC MANAGING DIRECTOR, ENVIRONMENTAL & ENGINEERING SERVICES AND CITY ENGINEER
SUBJECT:	RAPID TRANSIT CORRIDORS

RECOMMENDATION

That, on the recommendation of the Managing Director, Environmental and Engineering Services and City Engineer, with the concurrence of the City Manager, the following actions **BE TAKEN** with respect to the rapid transit initiative:

- a) that the King Street/Queens Avenue couplet system **BE APPROVED** as the preferred downtown east-west corridors;
- b) that the Richmond Street corridor **BE APPROVED** as the preferred northern corridor through the downtown;
- c) that an at-grade level crossing at the CP Railway with dedicated bus lanes **BE APPROVED** as the preferred cross section on the Richmond Street corridor at this time;
- d) that alternative methods to separate both automobile and transit vehicles from the railway in the downtown (for example, a tunnel or grade separation, etc.) **BE EVALUATED** for long term implementation, noting that this evaluation would be subject to a separate assessment and future business case for implementation;
- e) that the Bus Rapid Transit Network, with the above noted modifications **BE APPROVED** as the preferred alternative for the completion of the Rapid Transit Master Plan, as the basis for the updated Business Case and the undertaking of a Transit Project Assessment Process (as per Regulation 231/08); and
- f) that subject to the approval of c), the implementation of the Adelaide Street / CP railway grade separation **BE CONSIDERED** a necessary element of the rapid transit system and a request for funding under the Public Transit Infrastructure Fund Phase II program be advanced.

PREVIOUS REPORTS PERTINENT TO THIS MATTER
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- Civic Works Committee - June 19, 2012 - London 2030 Transportation Master Plan
- Civic Works Committee - October 7, 2013 – Bus Rapid Transit Strategy
- Civic Works Committee – July 21, 2014 – Rapid Transit Corridors Environmental Assessment Study Appointment of Consulting Engineer
- Civic Works Committee – June 2, 2015 – Rapid Transit Funding Opportunities
- Civic Works Committee – August 24, 2015 – Shift Rapid Transit Initiative Appointment of Survey Consultants

- Strategic Priorities and Policy Committee – January 28, 2016 – Downtown Infrastructure Planning and Coordination
- Strategic Priorities and Policy Committee – November 9, 2015 - Shift Rapid Transit Update
- Strategic Priorities and Policy Committee – May 5, 2016 - Shift Rapid Transit Business Case
- Strategic Priorities and Policy Committee – September 12, 2016 - Rapid Transit Implementation Working Group
- Strategic Priorities and Policy Committee – May 3, 2017 - Rapid Transit Alternative Corridor Review

COUNCIL'S 2015-2019 STRATEGIC PLAN

Municipal Council has recognized the importance of rapid transit and improved mobility in its 2015-2019 - Strategic Plan for the City of London ([2015 – 2019 Strategic Plan](#)) as follows:

Strengthening Our Community

- Healthy, safe, and accessible city

Building a Sustainable City

- Robust infrastructure
- Convenient and connected mobility choices
- Strong and healthy environment
- Beautiful places and spaces
- Responsible growth

Growing our Economy

- Local, regional, and global innovation
- Strategic, collaborative partnerships

Leading in Public Service

- Collaborative, engaged leadership
- Excellent service delivery

BACKGROUND

On April 4th 2017, Council approved a motion from the Rapid Transit Implementation Working Group (RTIWG) from its meeting held on March 9th 2017. The motion directed Civic Administration to review alternative route options in the downtown including an east-west corridor and a north-south corridor. It also directed Civic Administration to review alternatives to the proposed Richmond Row tunnel.

On April 18th 2017, Council requested additional information on options to mitigate potential impacts during construction, means to maintain access for businesses during construction and opportunities to provide for rapid transit through mixed traffic on King Street.

At the Strategic Priorities and Policy Committee meeting held on May 3rd 2017, a Rapid Transit Alternative Corridor Review report which included a technical memo and drawings of the various conceptual designs was provided in response to the Council direction. The documentation is also available for download at <http://www.shiftlondon.ca/reports>.

This report responds to these directions of Council. The recommendations will define the corridors of the bus rapid transit network, and become the basis for the design and analysis during the Transit Project Assessment Process (TPAP), as well as the updated business case that will be submitted to the provincial and federal funding partners.

Context

Rapid transit is the primary recommendation of the Smart Moves Transportation Master Plan (TMP), is identified in the current Official Plan, and represents a cornerstone of The London Plan and Council's 2015 - 2019 Strategic Plan.

The implementation of a rapid transit system will not only result in significant improvement in London's public transit system, it is a central component of London's land use and transportation policy. It will help shape the city's future pattern of growth, encourage intensification and regeneration, and stimulate economic growth for decades to come. Rapid transit corridors integrated with a strong conventional transit system, supportive land use planning policies and appropriate service coverage and frequency will facilitate more transit trips, reduce traffic volumes and make transit a fast, more reliable, convenient and comfortable transportation option for residents.

In September 2014, Council initiated an Environmental Assessment (EA) process to identify and examine options for rapid transit in London. The EA process examined potential corridors and technology.

In May 2016, Council approved the following recommendations:

- a) *that the Full Bus Rapid Transit Network Alternative **BE APPROVED** as the preferred option, based on the cost benefit analysis and other findings of the Rapid Transit Environmental Assessment and Business Case;*
- b) *that a Rapid Transit conversion to Light Rail Transit technology **BE ENDORSED** as a strategic direction subject to a review of transit technologies undertaken as part of future updates to the Transportation Master Plan and confirmation through a new business case;*
- c) *the Civic Administration **BE DIRECTED** to design the Full Bus Rapid Transit Network Alternative taking into consideration a future transition to a Light Rail Transit technology and utility infrastructure lifecycle renewal requirements;*
- d) *the Civic Administration **BE DIRECTED** to utilize the Full Bus Rapid Transit Network Alternative, as the preferred alternative for the completion of the Rapid Transit Environmental Assessment Master Plan;*

The approved Business Case identified the Full BRT Network option as the recommended alternative because it offered the greatest value for Londoners. This option meets the city's ridership needs, and provides benefits in terms of economic growth, community development and revitalization. It can improve air quality and reduce GHG emission, while modernizing the transit system by making it more attractive, reliable and convenient for residents to move around the city. It was determined to be the best value solution from an affordability and financial return on investment perspective.

The Rapid Transit Environmental Assessment (EA) is being undertaken to create a Rapid Transit Master Plan (RTMP) that adheres to the legislative requirements of the *Environmental Assessment Act*. The Master Plan will provide a strategy for building a Rapid Transit system that will help meet the City's economic development, mobility, environmental and community building objectives while still being operationally feasible and economically viable.

DISCUSSION

The Shift Rapid Transit project is following the provincially regulated Environmental Assessment process. This process is based on a phased approach with the level of detail and analysis increasing for each phase. Phase 1 and Phase 2 of the process include the identification of the problem or opportunity and assessment of alternative solutions. This included the identification and evaluation of alternative corridors.

The results will be documented in a final RTMP. The next steps in the process include final approval of the corridors and completing any additional public consultation required for this phase. The RTMP will then be presented to SPPC on July 24th and Council on July 25th. Following approval, the project will move to a Transit Project Assessment Process (TPAP) which will include detailed analysis of specific designs for each of the preferred corridors and ongoing public consultation including opportunities to mitigate the impacts on businesses, both during construction and afterwards.

The Rapid Transit Master Plan applied a comprehensive evaluation framework based on five categories:

- Economic Development and City Building
- Community Building and Revitalization
- Transportation Capacity and Mobility
- Ease of Implementation and Operational Viability
- Natural Environment and Climate Change

Affordability and Fiscal Responsibility was an overarching consideration and key aspect of the Rapid Transit Business Case.

A key component in determining the preferred network was the alignment with a number of strategic initiatives and projects. The Dundas Place EA, Our Move Forward: London's Downtown Plan, Cycling Master Plan and Back to the River initiative were all key parameters in determining the corridors.

Rapid Transit Network Analysis

Through the course of the Rapid Transit Master Plan, various corridors have been evaluated to determine a preferred network. A long list was initially developed, narrowed down to 13 different corridor segments, and then screened and short-listed to eight corridor segments for further evaluation, ultimately resulting in a preferred rapid transit network.

Included in this evaluation process was a number of sub-analyses focused corridor alternatives including alignments through Western University, the Richmond Street Rail Crossing, south tunnel portal options, downtown routings and Old East Village routings.

The preferred network was presented for public input at Public Information Centre #4 held on February 23rd 2017. The network is shown on **Figure 1**.

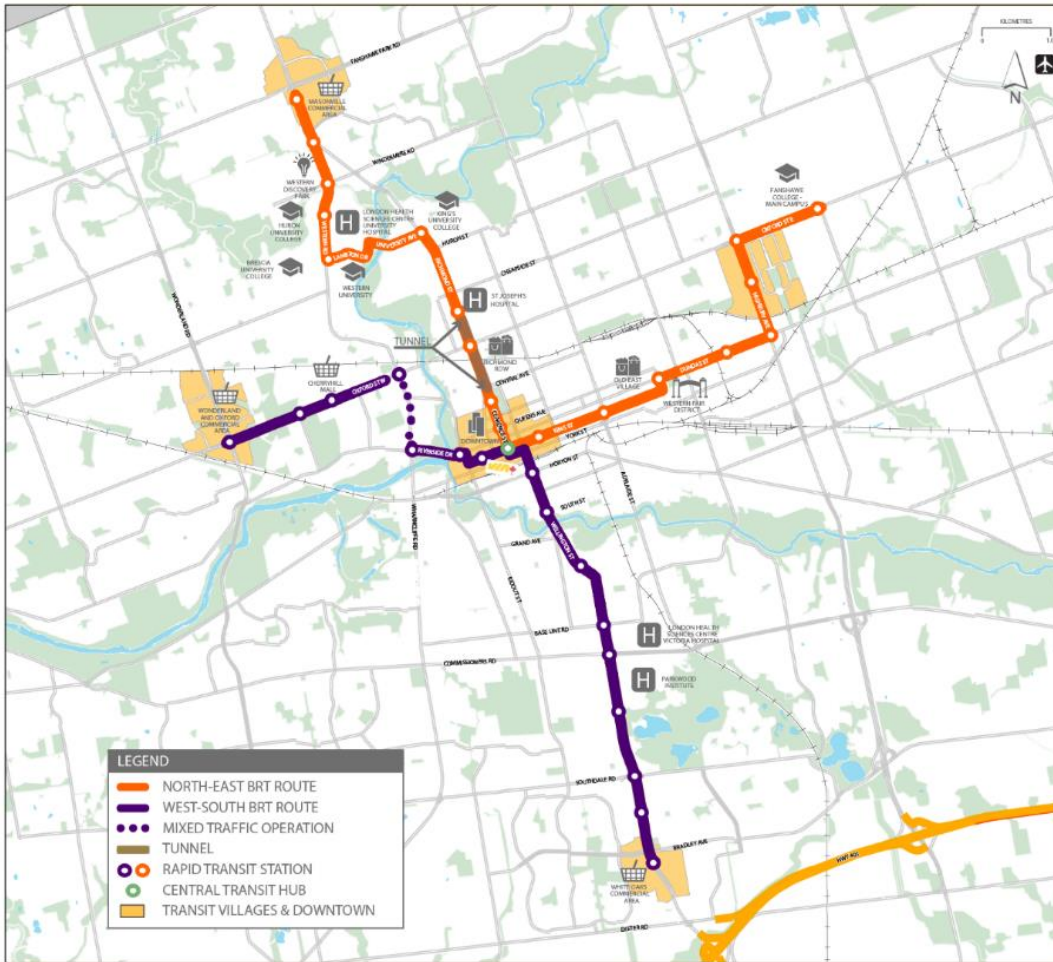


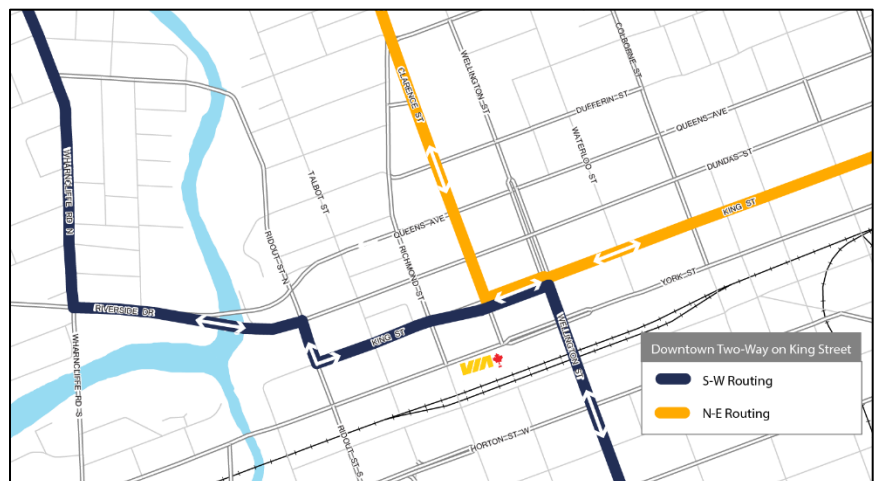
Figure 1 – Rapid Transit Network (Feb 2017)

In response to the Council direction from April 2017, Civic Administration reviewed alternative route options in the downtown, including an east-west corridor and a north-south corridor, as well as alternatives to the proposed Richmond Row tunnel. The following provides an overview of the options considered and documented in the Rapid Transit Alternative Corridor Review report, that was received for information at the SPPC meeting on May 3rd, 2017.

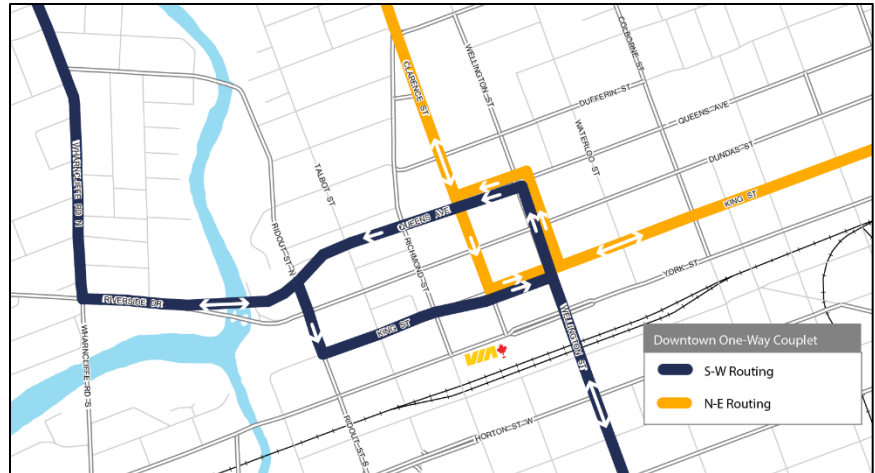
Corridor Assessment

Downtown East-West Alternatives

King Street Corridor - This alternative utilizes King Street for both eastbound and westbound rapid transit movements in dedicated lanes and one general purpose vehicle lane in the eastbound direction.



King Street /Queens Avenue Couplet – This alternative is comprised of an eastbound transit lane on King Street and a westbound transit lane on Queens Avenue. King Street and Queen Avenue would have two general purpose vehicle lanes. The couplet alternative requires the use of the



Queens Avenue Bridge for two way rapid transit plus two westbound general vehicle lanes and the Kensington Bridge for two eastbound general vehicle lanes. This alternative precludes a Queen Street cycle track.

Both options use a proposed curb-running rapid transit cross section along the east-west corridors. An overview of the benefits and impacts of curb-running versus centre-running rapid transit is provided in the Rapid Transit Alternative Corridor Review report presented to SPPC on May 3rd 2017.

It should be noted that, in both alternatives, intersection turning lane requirements, station locations, platform lengths, parking, access implications and cross sectional elements will be refined and finalized through the TPAP process.

Evaluation of Downtown East West Alternatives

While the master plan reviews a number of broader criteria, the alternatives were assessed utilizing a number of key criteria. **Table 1** summarizes the evaluation of the Downtown East-West Corridor alternatives. A detailed technical memo is provided in Appendix A.

Table 1 – Downtown East-West Corridor Summary Evaluation

Criteria	King Street Two-Way	King/Queens Couplet	King Street Mixed Traffic
Construction impacts (Impacts to Businesses during Construction)	◐	◑	◐
Effects on adjacent commercial uses (post-implementation)	◐	◑	◐
Public space and amenities	◐	◑	●
Consistent with other City policies and plans	●	◐	◐
Network capacity and Impact to existing transportation network	◑	●	◐
Transit service	●	◑	◐
Cyclist mobility	●	◑	●
Ability to stage implementation	◐	◑	◐

Criteria	King Street Two-Way	King/Queens Couplet	King Street Mixed Traffic
Overall Technical Summary			
Project Team Assessment of Public Feedback			

LEGEND

Not Preferred

Most Preferred



As a result of the technical evaluation and consideration of public and stakeholder input, the King/Queens couplet has emerged as the preferred alternative. While King Street two-way also scored very well, the main advantages of the King/Queens couplet are that it:

- Reduces construction duration on King Street, reducing potential impacts to businesses;
- Balances traffic capacities, providing two traffic lanes on both Queen Street and King Street;
- Allows on-street parking and loading on the north side of King Street;
- Reduces conflicts with operations, access and loading for Covent Garden Market and Budweiser Gardens; and
- Allows local buses to share dedicated transit lanes on King Street eastbound, Wellington Street northbound, and Queens Avenue westbound with local stops and bus bays sharing infrastructure with rapid transit where possible.

It should be noted that the recommendation of the King/Queens Couplet as the preferred alternative will have the following impacts:

- Cycling - An alternative route through the downtown will need to be determined to accommodate east west cycling movements. A potential option is to use the Dundas Street corridor from the Thames River to Old East Village to accommodate cyclists in shared use lanes and potentially dedicated lanes outside of Dundas Place. This will be reviewed through the detailed design of Dundas Place.
- The funds in Phase 1 of the Public Transit Infrastructure Funding program identified for the Queens Avenue cycle track (\$1.075 million) may go unspent given the change in scope and project delivery timelines. The City will explore options to reallocate those funds with the Federal government.
- Our Move Forward, London's Downtown Plan and the Back to the River concept identified a vision to enable a more pedestrian-oriented public space along Dundas Street from Ridout to the Thames River and to reduce traffic on the Kensington Bridge. It should be noted these concepts were to be subject to a review of feasibility and implementability based on an assessment of transportation impacts and environmental assessments. The King/Queen couplet option requires the use of the Kensington Bridge for two general purpose eastbound vehicle traffic lanes in the current configuration. Through the One River Environmental Assessment, enhancements to Dundas Street at the Forks

of the River will be reviewed to integrate more pedestrian and cyclist facilities in conjunction with the roadway. Should the couplet be approved, work will be undertaken to provide a safe, pedestrian-friendly space for Back to the River, but it will not be car-free as originally envisioned and some important planning objectives will be more difficult to achieve should the couplet be approved.

Northern Corridor Alternatives

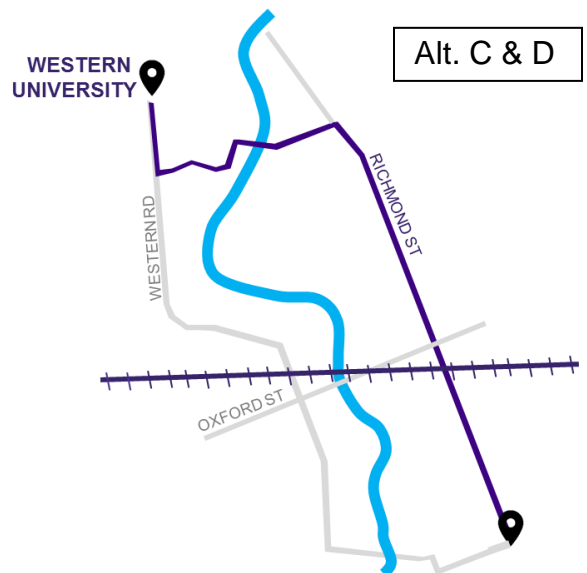
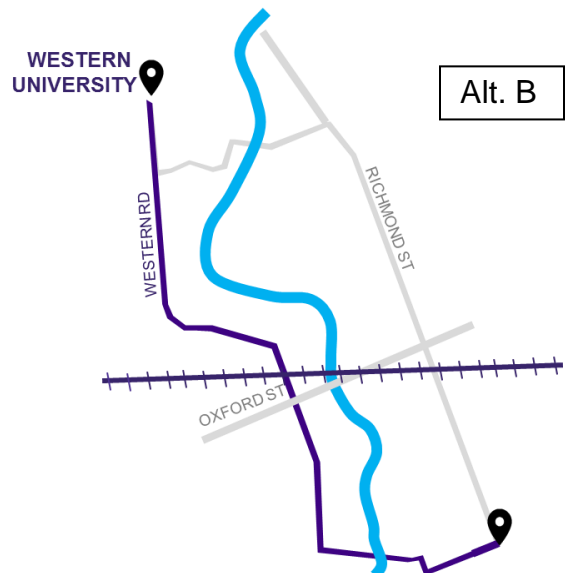
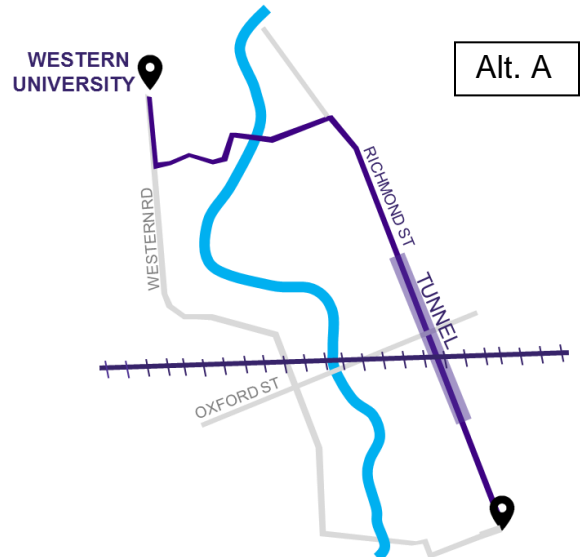
An analysis and high level assessment was undertaken based on the conceptual designs for the following four alternatives:

- A – Richmond Street Corridor with Transit Tunnel at CPR Alternative
- B - Wharncliffe Road/Western Road Alternative
- C - Richmond Street Corridor with At-grade crossing of CP Rail Alternative
- D - Richmond Street Corridor with Underpass Alternative

All four options that were evaluated utilized a proposed centre running rapid transit cross section along the north-south corridors. Placing Rapid Transit in the centre or median of roadways provides a very high quality level of service for transit.

A detailed analysis of the benefits and impacts of centre running rapid transit lanes versus curb side running rapid transit will be reviewed for the preferred corridor during the TPAP process. It should be noted that in all alternatives, intersection turning lane requirements, station locations, platform lengths, parking, access implications and cross sectional elements will also be refined and finalized through the TPAP process.

The Master Plan reviews a number of broader criteria and a summary of the criteria was provided in the Rapid Transit Alternative Corridor Review report presented to SPPC on May 3rd 2017. A summary of the key criteria is provided below.



Growth Management Objectives

The Council-approved and Ministry-approved London Plan establishes our City's plan for growth and development in London.

The Richmond Street corridor is well aligned with Place Types that have been applied to permit highly urban land uses – primarily the Downtown and Rapid Transit Corridor Place Types. These two Place Types allow for a broad range and mix of commercial, residential and office uses. Within significant stretches along this corridor, substantial heights and densities are permitted. In fact, the London Plan applies minimum heights to certain segments of this corridor, to ensure an urban form and intensity of development is achieved through new development. Transit-oriented forms of development are encouraged, to support high quality pedestrian environments and densities that support rapid transit ridership and Downtown/Core Area revitalization.

More specifically, there is significant development potential along this corridor for high rise residential and office towers along this corridor within the Downtown Area (Clarence Street from Kent Street to King Street) and the Rapid Transit Corridor Place Type (particularly along the Richmond Row Main Street segment from Oxford Street to Kent Street). Furthermore, this alignment captures Victoria Park – the City's premier gathering place for large events – shown in the London Plan as a large green space adjacent to Richmond Street at Central Ave.

This north-south option connects the large institutional uses shown in the Rapid Transit Corridor at Grosvenor Street – St. Joseph's Hospital and the Lawson Health Research Institute which cumulatively represent employment of more than 6,000 people. It also connects King's University College to both the Downtown and, north, to the Transit Village at Masonville. Finally, the Rapid Transit Corridor applied to Richmond Street, north of Huron Street, could support intensification where it can be demonstrated that the proposed height and intensity of development is appropriate. Substantial opportunity within this segment likely exists at the Western Gates.

In comparison, the Western Road/Wharnccliffe Road corridor has significantly less opportunity for growth and development as set out in the London Plan. While the Rapid Transit Corridor Place Type has been applied to the portion of this corridor along Wharnccliffe Road, this segment is entirely within the Thames River Floodplain and intensification is not permitted in accordance with the Provincial Policy Statement. These lands are correspondingly within the Upper Thames River Conservation Area permit limit – permits are not supported by the UTRCA for intensification within this area. These lands are also within the Blackfriars-Petersville Heritage Conservation District.

This corridor runs through the BIGS (Beaufort, Irwin, Gunn Streets) Secondary Plan area, where there is some potential for intensification. Much of this area has already been intensified, but there is opportunity for some amount of low-to-mid-rise development. Further north, most of the lands are designated for an Institutional Place Type in the London Plan. It is expected that these lands will be primarily developed for institutional purposes – and not mixed use non-institutional development. Much of this Institutional land east of Western Road, south of Platt's Lane, is undevelopable due to the Thames River Floodplain. North of Platt's Lane the Western/Wharnccliffe option converges with the Richmond Street option that traverses Western's campus and connects with Western Road northward.

Overall, the Richmond Street corridor provides both the ridership opportunities by way of connecting significant employment and activity generators and the capacity to intensify the corridor and support the transit infrastructure investment. The Western/Wharnccliffe option provides limited value from this perspective and does not viably connect major employment nodes such as St. Joseph's hospital and King's University College, major urban main streets such as Richmond Row, city-wide event spaces such as Victoria Park and significant development opportunities such as those in the Downtown and Rapid Transit Place Types. It also does very little to encourage Downtown revitalization as it results in a rapid transit system that substantively skirts the northern part of the Downtown and the Richmond Row area.

Transit Ridership

The primary objective of this rapid transit initiative is to improve the overall transit system in the City of London. The implementation of Rapid Transit corridors, together with a strong base transit system with appropriate service coverage and levels of service, will improve travel time performance, increase the passenger capacity of the transit network and improve the quality of service for transit passengers. All Londoners will benefit from reduced auto demands across the city.

For the Richmond Street with a tunnel alternative, peak hour ridership in the north corridor (all routes) is estimated at 1,800-1,900 passengers per hour in 2034. For the Wharnccliffe-Western alternative, total peak point transit ridership in the corridor is forecast to drop by at least 5%. In addition, the distribution of ridership between rapid transit and local routes would be affected with ridership on the RT corridor being lower for the Wharnccliffe-Western alternative (note that at the time of this report a review of the optimal local service structures for the Wharnccliffe-Western alternative had not been completed).

The Wharnccliffe-Western alternative would primarily support post-secondary students although it does not directly access the campus. It would bypass major destinations including Richmond Row, northwest areas of Downtown, St. Joseph's Hospital and King's University College. Because the Richmond Street corridor includes a greater mix of uses, it has a higher potential for ridership throughout the day and evenings and is less impacted by the seasonal variations due to Western University.

Heritage Impacts

The City of London places a strong emphasis on protecting cultural heritage resources. The assessment impacts of rapid transit on cultural heritage resources, and potential mitigation measures, is an iterative process with the level of assessment increasing as designs are developed. Overall, the goal is to avoid potential impacts.

At the Master Plan stage, there are a number of key comparators to evaluate corridor options including presence of Heritage Conservation Districts and individual listed and designated heritage properties. Within the corridors being evaluated in this report, there are four Heritage Conservation Districts:

- Bishop Hellmuth Heritage Conservation District
- Blackfriars/Petersville Heritage Conservation District
- Downtown Heritage Conservation District
- West Woodfield Heritage Conservation District

Two additional Heritage Conservation Districts, Great Talbot and Gibbons Park, have been endorsed by Council but have not been designated under Part V of the *Ontario Heritage Act* at present.

One consideration in comparing the alternatives is the number of listed and designated heritage properties, including those within a Heritage Conservation District, along the corridor options. For the Wharncliffe-Western alternative, there would be significant greater potential for impacts to heritage designated properties in the Blackfriars /Petersville Heritage Conservation District. Because Wharncliffe would need to be widened considerably to accommodate dedicated bus lanes (recognizing that bus traffic on this corridor would triple compared with the Richmond Street option and would no longer be feasible/functional within mixed traffic).

If the Richmond Street corridor is utilized, the south-west corridor rapid transit would also utilize Wharncliffe Road North, but the potential impacts on heritage designated properties would be less given the rapid transit would be in mixed traffic given the reduced headways and number of transit vehicles. A concern for the Richmond Street alternatives is the proximity to Victoria Park and the archeological significance of this site. The Victoria Park site was home to the British Military Garrison from 1839 to 1869. This site represents a very significant historic and archaeological resource and the unexcavated portions of the Victoria Park site have immense cultural heritage value. Excavations for the tunnel portal at Clarence Street and Angel Street have a high potential for impacts. This requires archaeological assessment to determine the impact and what, if any mitigation measures can be applied.

Property Impacts

The construction of rapid transit lanes and stations will require road widening in some areas. **Table 2** below summarizes the number of sites where additional property may be required along each corridor and the number of designated heritage properties that would be impacted. For this comparison, only the portions of the corridors that are different are included (i.e. Western Road north of Lambton is not included). It is also noted that the Wharncliffe-Western alternative includes additional widening south of Oxford to accommodate both rapid transit routings.

These impacts should be considered indicative as they are based on preliminary concept designs. More detailed design alternatives for the preferred corridor will be developed as part of the Transit Project Assessment Process.

Table 2 - Impacts on Property

	Richmond Street Corridor with Transit Tunnel at CPR	Wharncliffe Road / Western Road	Richmond Street Corridor with At-grade Rapid Transit	Richmond Street Combined Grade Separation
Number of properties where PARTIAL property may be required	22	147	26	22
Number of properties where FULL property may be required	4	48 (*24)	8 (*1)	17-24 (*1)

**Designated heritage properties. All figures indicative subject to development of design alternatives and mitigation measures*

Of the three alternatives, the Wharncliffe-Western alternative is likely to have the most significant requirements for additional property. As noted above, the Richmond Street combined underpass alternative will have very significant property impacts for Richmond Row and would require the acquisition of some 16-18 major commercial properties depending which side of the road is widened.

Impacts to Business during Construction

The impact of construction on businesses will depend on the level of disruption as well as the nature of businesses affected by construction. The level of disruption would depend on factors such as duration of construction, the extent of road closures and restrictions on access. Since a detailed construction phasing plan is not part of the EA, the construction duration that is assumed in this study should be considered preliminary and approximate.

Certain types of businesses will also be more affected by construction than others. The assessment was undertaken based on the businesses tolerance towards interruptions related to the removal of street parking, road closures, noise and vibrations, sidewalks closure and visibility issues.

Generally, food service, entertainment and retail businesses are more sensitive to the impacts of construction on retail activities than large, stable office uses. Based on the inventory, there are approximately 145 businesses located along Richmond Street between Central Avenue and Oxford Street. A relatively high portion (28%) of these businesses are considered to have low tolerance for construction disruption, with another 39% considered to have moderate tolerance for construction disruption. The remainder of the businesses are considered to have medium-high or higher tolerance for construction disruption.

Of the three alternatives evaluated, the Richmond Street corridor with the tunnel would have the longest duration of construction. The Richmond Street at-grade alternative would require a shorter construction period, but there would still be impacts. As there are fewer businesses along Wharncliffe Road, this alternative would have the least short term construction impacts on businesses.

Corridor Capital Costs

High level capital costs were developed for the new alternatives using the same unit cost assumptions as the current preferred alternative. Costs include preliminary order of magnitude estimates for property. It should be noted that the analysis of property compensation cost estimates are based on a preliminary analysis of the corridors, extraordinary assumptions, and will require further detailed and independent consultation and analysis once the preferred corridor is selected.

A breakdown of the high level costs by alternative is shown in the **Table 3**. These costs include an allocation of the total project contingencies as a percentage of the segment costs. Costs for vehicles, maintenance facilities and the potential Quick Start project are excluded.

There is a high level of uncertainty for this cost until design options are developed and preliminary and detailed engineering work is completed. This includes assessing mitigation measures for major underground utilities, fire, life, safety requirements and soil conditions.

Table 3 – Relative High Level Capital Cost (\$ millions)

Segment	Richmond Street Corridor with Transit Tunnel at CPR	Wharncliffe Road / Western Road	Richmond Street Corridor with At-grade Rapid Transit	Richmond Street Combined Grade Separation
Wharncliffe Road (Riverside to Oxford)*	-	\$25-35	-	-
Wharncliffe/Western (Oxford to Lambton)	-	\$55-75	-	-
Western Road (Lambton to Fanshawe Park)	\$56	\$56	\$56	\$56
Clarence/Richmond (King to Central)	\$10	-	\$10	\$10
Richmond/University (Central to Western Road)	\$192	-	\$45-55	\$160-180
Total corridor cost	\$258	\$136-166	\$111-121	\$226-246

* Note: Costs for new segments and alternatives are shown as ranges. All costs do not include contingency amounts.

** Incremental cost over south-west corridor cost due to additional widening to accommodate both south-west and north-east routes

Capital costs for the combined Richmond Street underpass reflects the shorter length of excavation compared to the tunnel option, but significant property costs. In order to construct the underpass, an additional 12 m would be required at the narrowest point along Richmond Street just north of the CPR. The additional right-of-way is needed to maintain access to the adjacent properties for fire and municipal services. This alternative would require some 16 to 18 commercial properties between John Street and Oxford Street. This additional 12 m requirement would result in an entire side of Richmond Row to be demolished from Pall Mall to Oxford Street resulting in significant acquisition costs of \$60 M-\$70 M and run contrary to the project's goal of City Building. Similarly, the Richmond Street at-grade alternative would require some properties in order to accommodate left turn lanes and a station on Richmond Street at Oxford

Street.

The most significant differences between the alternatives relate to the grade separation at the CP Rail tracks. The Richmond Street tunnel represents a major cost component and higher risk of cost escalation due to the uncertainties associated with tunneling. Initial costing for the RTMP and Business Case was based on conceptual level designs for the tunnel and estimated the cost of the tunnel at \$90-100 million, excluding contingencies.

Updated Richmond Street Tunnel Costs

The project costing to date has been undertaken at the Master Planning level based on preliminary assumptions. At the Master Plan level, it is typical to apply a higher contingency to project costs to account for uncertainties and risks, as has been done to date. Given the high level of uncertainty and risks associated with the tunnel, a more detailed costing was developed than would normally be completed during the Master Plan. The intent of advancing this work was to provide actual estimates for costs that were assumed to be covered in the contingencies in the previous high-level estimate.

This analysis involved more advanced engineering work, including analyses of underground utility re-routing, fire, life, safety requirements, ventilation plans, maintenance of rail traffic during construction, temporary shoring and design requirements for the station at Oxford Street. Updated costing also takes into account the recent impact of the implementation of infrastructure funding programs and the number of major construction projects in the Greater Toronto Area that have had the impact of increasing material and labour prices, especially related to major civil works such as tunnels.

The tunnel was estimated by the project consultants in the preliminary planning stage as costing \$90 million, with the expectation that a 50% contingency would be required, resulting in a potential cost of approximately \$135 million. The more recent cost assessment estimates the cost of the tunnel at approximately \$170 million, excluding contingencies. As greater design information is available to support the new estimate, a reduced contingency allocation of 30% is appropriate, resulting in a potential cost of approximately \$220 million.

While a change in capital cost estimates is not usually included in the allocation of project contingency in the project planning phase, the team has evaluated if the revised tunnel costs can be accommodated in the original budget and still leave adequate contingency for the delivery of the rest of the project. While every effort would be made to effectively manage the contingency associated with both the tunnel and with the remainder of the project, the remaining \$39 million in general contingency represents only a 12.6% contingency on remaining costs. In order to maintain an appropriate contingency for the other sections, an additional \$85 million would be required to accommodate the change in the tunnel costs.

Business Case Implications

Concurrent with the development of the Rapid Transit Master Plan, a Business Case was prepared to evaluate broad network and technology options. The Business Case served as the basis for the recommended city-wide rapid transit alternative comprised of Bus Rapid Transit.

The Business Case model has been re-run to provide a high level indication of the potential implications of new alternatives for the north corridor. Note that a range is shown for the new alternatives as, given the condensed timeframe for assessment, less detail went into the development of costs and benefits than for the Richmond Tunnel alternative.

Based on preliminary analysis, **Table 4** provides a summary of the benefit cost ratios. The new alternatives would have a benefit cost ratio in the same range as the current preferred alternative. For the Richmond At-Grade alternative, the lower capital costs would be off-set somewhat by reduced travel time savings for transit users and higher operating costs for transit. It is also important to note that the potential for land use uplift, which is not included in the base benefit-cost ratios, would be less for the Wharncliffe-Western corridor.

Table 4 – Business Case Comparison

	Richmond Street Corridor with Transit Tunnel at CPR	Wharncliffe Road / Western Road	Richmond Street Corridor with At-grade Rapid Transit	Richmond Street Combined Grade Separation
Benefit Cost Ratio *	1.13	1.05-1.15	1.1-1.20	1.05-1.15

* Excludes wider economic benefits

The above table assumes that the additional costs related to the tunnel can be delivered within the \$560 million budget. As discussed in the previous section, an additional \$85 million would be required and the benefit-cost ratio for the tunnel option would be reduced.

Richmond CP Railway Crossing Delays

In order to update and review the information related to the impact of the CP Railway, the City undertook a railway crossing delay study at the Richmond Street crossing in late February/early March (**Table 5**). The average number of trains over the course of a 24 hour day crossing this location was 11. The average delay is approximately 5 minutes, but can be up to 12 minutes on a typical day. It should be noted that one delay when the train was stopped was over 95 minutes.

Table 5 – CP Railway Interruptions

Day (2017)	Period of Recording (hrs)	Number/Day	Average Time of Delay	Max Time of Delay
February 21	11	4	5m 40sec	8m 30sec
February 22	24	10	4m 10sec	8m 55sec
February 23	24	10	5m 20sec	12m 30sec
February 24	20	9	4m 5sec	8m 55sec
March 3	9	4	5m 25sec	10m 30sec
March 4	24	12	5m 50sec	8m 45sec
March 5	24	13	4m 45sec	95 min
March 6	18	10	4m 25sec	8m 35sec









Based on an assessment of the train interruptions on Richmond Street, the average travel time delay of approximately 5 minutes does result in potential queuing of transit vehicles on the north corridor given the 5 minute headway that is proposed along this route. During the am and pm peak hour, an average of one interruption per day was observed. Operational modifications would be required for Richmond At-Grade alternative. This would require additional fleet and additional operating hours in order to maintain longer end-of-run times to accommodate the increased variability in run times. These costs would be recurring as long as the risk of interruption by trains remains.

Recommendation for the Northern Corridor

The environmental assessment process is an iterative planning and decision-making process takes into account the natural, social, cultural, built and economic environments as well as the ability of alternatives to provide sustainable and fiscally responsible solutions. **Table 6** summarizes the evaluation of the northern corridor alternatives. A detailed technical memo is provided in **Appendix A**.

Table 6 – North Corridor Summary Evaluation

Criteria	Richmond Street with Tunnel	Wharncliffe / Western Road	Richmond Street at-grade	Richmond Street with Underpass
Capital Costs				
Operating Costs				
Construction impacts (Impacts to Businesses during Construction)				
Effects on adjacent commercial uses (post-implementation)				
Cultural heritage impacts				
Supports growth management objectives				
Consistent with other City policies and plans				
Network capacity and impact to existing transportation network				
Transit service				
Transit ridership relative to capacity				
Travel time of transit				
Ability to stage implementation				
Ease of construction				
Property impacts				

Criteria	Richmond Street with Tunnel	Wharncliffe / Western Road	Richmond Street at-grade	Richmond Street with Underpass
Overall Technical Summary				
Project Team Assessment of Public Feedback				

LEGEND

Not Preferred

Most Preferred



Based on these criteria, Richmond Street remains the preferred northern route for BRT. The main advantages of the Richmond Street corridor include:

- Provides direct high-quality transit service with stations at major transit trip generators, including Richmond Row (Oxford Street), Victoria Park, St. Joseph’s Hospital, King’s University College, Western University campus centre, and University Hospital;
- Provides approximately 6 to 7 minutes in travel time savings (from downtown to Fanshawe Park Road) versus transit in mixed traffic;
- Best serves transit ridership in the north part of London and northwest parts of Downtown;
- Minimizes cultural heritage impacts to the Blackfriars/Petersville Heritage Conservation District;
- Avoids traffic congestion at Wharncliffe Road and Oxford Street West;
- Avoids the floodplain and the restrictions on future development that are associated with it; and,
- Serves the most transit trip generators and most existing and future population and employment.

If rapid transit is to remain on Richmond Street as recommended, a decision is also needed regarding how to address the CPR crossing. As the construction of an underpass scored the poorest of three railway crossing options, the subsequent discussion will focus on the tunnel and at-grade alternatives.

An overarching goal of rapid transit is to provide frequent, reliable, attractive service that connects people and places. Richmond Street with a transit tunnel best achieves that goal and most fully supports the objectives of the London Plan, Our Move Forward: London’s Downtown Plan and the desire to protect for future LRT. In summary, the proposed transit tunnel:

- Best serves the goal of achieving the mobility objectives of rapid transit (i.e. reliable service), avoiding unpredictable delays due to train crossings;
- Reduces transit operating costs and reduces travel time for transit passengers, compared to the existing at-grade crossing;
- Avoids the congested intersection of Oxford Street and Richmond Street;
- Provides added benefits to emergency service vehicles (police, fire, ambulance), which can use the tunnel to by-pass queued traffic; and,
- Supports the potential future conversion to Light Rail Transit.

However, as shown in the summary table below and the detailed table in **Appendix A**, the Richmond Street at-grade option also scored very well. There are two primary disadvantages to remaining at-grade at this time: the reliability of rapid transit when a train is present and the removal of two traffic lanes on Richmond Street. It is noteworthy to consider, however, that:

- Constructing the Richmond Street corridor at-grade from Clarence Street to St. James Street does not preclude future construction of a transit tunnel on Richmond Street to implement Light Rail Transit;
- There is merit in deferring the construction of the tunnel as London establishes the rapid network, re-structures local bus routes to connect with rapid transit, and implements other planned transportation and transit network improvements; and,
- Deferring the tunnel also provides future flexibility as transit vehicle technologies, including automated vehicles, evolve along with London's transit needs.

Given the increased costs, construction risks and potential impacts to property, the ability of rapid transit to tolerate intermittent delays at an at-grade crossing of the CPR corridor need to be considered. Some rapid transit delays can be partly mitigated through an increased transit vehicle fleet and operating modifications and the application of real-time transit information for passengers. As Richmond Street would be reduced to one travel lane in each direction, additional north-south vehicle capacity for downtown is also needed. Improvements on Wharncliffe Road can partly assist in providing an alternate route, but the planned grade separation at the Adelaide Street railway crossing should be advanced as well.

The recommendation, based on the technical evaluation and public input, is to proceed with the at-grade level crossing of the railway on Richmond Street in order to balance the benefits of rapid transit with the costs, impacts and risks. In the next study phase, design alternatives can be developed and evaluated to mitigate potential impacts of an at-grade solution such as property, traffic, and parking, both during construction and after implementation. A review of curb-running versus centre-running rapid transit lanes, intersection turning lane requirements, station locations, platform lengths, parking, access implications and cross-section elements will be refined and finalized through the TPAP process.

The recommendation to approve Richmond Street as the preferred corridor with an at-grade crossing, however, does not preclude the need to consider the impacts the CPR crossing on Richmond Street can have on all road users. As a result, a separate assessment reviewing options to mitigate the long-standing conflict between the road and the railway should be undertaken to provide long-term benefit for all road users. This evaluation would be subject to a separate assessment and future business case for implementation and more information on how it could proceed would be developed for Council's consideration.

Adelaide Street/CP Railway Grade Separation

In 2013, Council confirmed the Adelaide Street crossing of the Canadian Pacific Railway (CPR) to be the highest priority new rail-road grade separation site in London. The trains on the CPR line create road blockages and traffic congestion in the downtown. This is particularly problematic at the Adelaide Street crossing where train shunting spill-over from the adjacent rail yard creates more frequent and longer road

delays. A new road-rail grade separation on Adelaide Street at the CPR tracks will improve travel by managing congestion, increasing road safety and providing route reliability for emergency services and local transit.

The project was introduced into the 2014 Development Charges Background Study with a 2031 implementation date. An environmental assessment (EA) for the undertaking commenced in February 2016. Formal public meetings for the EA were held in June and December 2016. An additional public meeting is planned and completion of the EA is anticipated in late 2017. The preliminary preferred solution is to lower the road beneath the rail line. The construction of the project is a complex undertaking due to geotechnical and groundwater conditions, stormwater management, proximity to the CPR rail yard, property impacts and utilities.

The need for the implementation of this grade separation, however, is intrinsically linked to the implementation of rapid transit should Council elect to approve the at-grade Richmond alternative. Previously, the tunnel permitted four lanes of traffic to remain on Richmond Street from Grosvenor Street to Central Avenue. Under the at-grade alternative, there Richmond Street would be reduced to two traffic lanes and the improvements at Adelaide Street are required provide vital parallel roadway network improvements to for traffic. Alleviating the delays on the Adelaide Street corridor will provide an alternative reliable corridor that conventional transit can use more effectively as well, supporting the route changes that will occur in parallel to the implementation of rapid transit.

A key recommendation of this report is to move the implementation of the grade separation, subject to the approval of the environmental assessment, to a five year window prior to the implementation of the northern corridor. As it is considered a necessary element for the implementation of the rapid transit system, a request for funding under the Public Transit Infrastructure Fund Phase II program would be put forward for consideration.

Other Considerations

In May of 2015, Council approved the recommendation of Bus Rapid Transit as the technology for the project. The corridors that are being designed can accommodate emerging technologies like electric buses and driverless vehicles. Building dedicated corridors for public transit will allow the City to prioritize the movement of transit, and accommodate and optimize the benefits of future modes, such as driverless technology.

As part of the environmental assessment process for rapid transit, as well as other project such as the Wharncliffe Road grade separation and Adelaide Street grade separation, the City has reviewed the potential to relocate the CP railway. The relocation has been the subject of studies in the past. Re-routing and combining CN and CP rail lines were discussed with the railway companies. A meeting was held with City officials, CP and CN on August 23, 2016.

CP's mainline track runs through London and is a key component of their network, connecting Windsor/Detroit to Montreal. CP has indicated they have no plans to reduce their existing infrastructure in London, as the mainline track and associated yards are required for CP to serve their customers, and by extension the needs of the broader Canadian economy that depends on railways to move goods and commodities to international markets.

Relocating rail corridors, including combining CN and CP or re-routing trains around the city, would be a significant, complex and costly undertaking, including: property acquisition, the cost to construct rail lines, yards, spurs, and new grade separations of roads and rivers. Re-routing the rail lines would also require approval from surrounding municipalities and the provincial and federal governments.

Relocating rail corridors would have to satisfy many criteria, including: preserving rail capacity, preserving service to customers in London and surrounding area, maintaining safety of rail operations, and a business case justifying the investment.

Financial Implications

The total system cost (including vehicles, contingencies and the quick start project) for the revised BRT network described in this report is estimated at \$440 million including a 50 percent contingency. The City's contribution remains unchanged at \$130 million. The City will continue to work with the federal and provincial governments to secure funding for the project.

CONCLUSION

This report provides Committee and Council with an evaluation of the analysis related to the rapid transit alternatives that were requested by Council. The recommendations in this report define the corridors which will form the basis for the bus rapid transit network, and become that basis for the design and analysis during the Transit Project Assessment Process, as well as the updated business case that will be submitted to the provincial and federal funding partners.

The recommendations in this report envision that London's transit system would grow as the City continues to grow. The objective is to embrace the right option, at the right time. The effectiveness of the transit system will be monitored through the Transportation Master Plan, to ensure both current and anticipated future needs are being met by rapid transit and local transit system.

The basis of the recommendations are the technical evaluation and public input while taking into account a balance of the benefits of the alternatives versus project objectives, costs, impacts and risks. The key recommendations include the refinement of the Bus Rapid Transit Network to include the King/Queens Couplet in the downtown and the modification of the Richmond Street corridor to an at-grade crossing of the CP Railway with dedicated bus lanes. Options will also be pursued to address the conflict between road and rail in the downtown more holistically and to the benefit of both transit and all road users.

The renewed consultation process has provided Londoners with additional opportunities to be engaged in the project and the key to the successful implementation of rapid transit will be the continued involvement of residents and business.

Subsequent to Council's approval of the preferred Rapid Transit network, the final Rapid Transit Master Plan and Business Case would be presented to SPCC on July 24th and Council on July 25th.

Acknowledgements

This report was prepared with input from the Rapid Transit Steering Committee.

SUBMITTED BY:	RECOMMENDED BY:
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REVIEWED & CONCURRED BY:	
MARTIN HAYWARD MANAGING DIRECTOR, CORPORATE SERVICES AND CITY TREASURER, CHIEF FINANCIAL OFFICER AND CITY MANAGER	

Attach: Appendix "A" – Technical Memo
cc. London Transit Commission
Rapid Transit

Rapid Transit North Corridor and Downtown Alternatives: Evaluation Tables

The purpose of this Technical Memo is to provide an evaluation of the alternatives. **This Technical Memo should be read in conjunction with the Technical Memo dated April 26, 2017, and associated attachments, which provides the analysis supporting this evaluation.**

Description of Alternatives

Alternative North-South Corridor:

- Richmond Street corridor with tunnel between Central and St. James: from Downtown to Fanshawe Park Road via Clarence Street, Richmond Street, University Drive/Lambton Drive and Western Road (as presented at Public Information Centre #4);
- Downtown to Fanshawe Park Road via Riverside Drive, Wharncliffe Road and Western Road;
- Richmond Street Corridor with at-grade crossing of CP Rail tracks (i.e. no tunnel); and,
- Richmond Street Corridor with combined road and rapid transit underpass between Pall Mall and Oxford.

Alternative East-West Downtown Corridor:

- King Street Two-Way transit comprised of two dedicated transit lanes on King Street: from Riverside Drive on Kensington Bridge, Ridout Street, and King Street to Wellington Street (as presented at Public Information Centre #4);
- King Street / Queens Avenue transit couplet comprised of an eastbound transit lane on King Street and a westbound transit lane on Queens Avenue: from Riverside Drive on Queens Ave Bridge, SB on Ridout Street, EB on King Street and WB on Queens Avenue, with NB transition on Wellington Street; and,
- King Street Two-Way mixed traffic comprised of one lane in each direction shared between transit and general traffic: from Riverside Drive on Kensington Bridge, Ridout Street, and King Street to Wellington Street.

TECHNICAL MEMO – RAPID TRANSIT NORTH CORRIDOR AND DOWNTOWN ALTERNATIVES: EVALUATION TABLES

For the purpose of this evaluation, each general area is examined independently. Depending on the direction of Council, the overall preferred network could consist of a combination of alternatives. For example, the preferred alternative for the North Corridor could be combined with either of the East-West corridor alternatives.

Evaluation Criteria and Alternatives Analysis

The Rapid Transit Master Plan applied a comprehensive evaluation framework based on five categories:

- Economic Development and City Building;
- Community Building and Revitalization;
- Transportation Capacity and Mobility;
- Ease of Implementation and Operational Viability; and,
- Natural Environment and Climate Change.

An overarching consideration and key aspect of the Rapid Transit Business Case was:

- Affordability and Fiscal Responsibility.

These guiding principles were used to develop more specific evaluation criteria to evaluate network alternatives. It should be noted that the evaluation criteria do not have equal value in the overall technical summary.

To reflect the public feedback received at public meetings held with various stakeholders in April, and the Public Participation Meeting held May 3, 2017, an additional category was added to this evaluation:

- Project Team Assessment of Public Feedback.

North Corridor Alternatives Evaluation Summary

As a result of Council's direction, the technical evaluation, and consideration of public and stakeholder input, Richmond Street remains the preferred North corridor. The main advantages of the Richmond Street corridor include:

- Providing direct high-quality transit service with stations at major transit trip generators, including Richmond Row (Oxford Street), Victoria Park, St. Joseph's Hospital, King's University College, Western University campus centre, and University Hospital;
- Provides approximately 6 to 7 minutes in travel time savings (from Downtown to Fanshawe Park Road) versus transit in mixed traffic;
- Best serves transit ridership in the north part of London;

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- Minimizes cultural heritage impacts to the Blackfriars/Petersville Heritage Conservation District;
- Avoids traffic congestion at Wharncliffe Road and Oxford Street West;
- Serves the most transit trip generators and most existing and future population and employment.

The benefits of the proposed Transit Tunnel have been previously documented; in summary, the proposed transit tunnel:

- Best meets the mobility objectives of rapid transit (i.e. reliable service), avoiding unpredictable delays due to train crossings;
- Reduces transit operating costs and reduced travel time for transit passengers, compared to the existing at-grade crossing;
- Avoids the congested intersection of Oxford Street and Richmond Street;
- Provides added benefits to emergency service vehicles (police, fire, ambulance), which can use the tunnel to by-pass queued traffic; and,
- Supports the potential future conversion to Light Rail Transit.

However, as shown in the summary table below, and the detailed table at the end of this document, the Richmond Street at-grade option also scored very well:

- Constructing the Richmond Street corridor at-grade from Clarence Street to St. James Street does not preclude future construction of a transit tunnel on Richmond Street to implement Light Rail Transit.
- There is merit in deferring the construction of the tunnel as London establishes a Rapid Transit network, re-structures local bus routes to connect with Rapid Transit, and implements other planned transportation and transit network improvements
- Avoid on-going operating, maintenance and rehabilitation costs associated with tunnel
- Less impactful to construct

The overarching goal of rapid transit is to provide frequent, reliable, attractive service that connects people and places.

While Richmond Street with a Transit Tunnel best achieves that goal, an at-grade crossing of the CP Rail corridor can be mitigated through increased vehicle fleet and increasing operating hours to ensure redundancy, and the application of real-time vehicle arrival information for passengers. In the next study phase, design alternatives can be developed and evaluated to mitigate potential impacts of an at-grade solution such as property, traffic, and parking, both during construction and after implementation.

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Criteria	Richmond Street with Tunnel	Wharncliffe / Western Road	Richmond Street at-grade	Richmond Street with Underpass
Capital Costs				
Operating Costs				
Construction impacts (Impacts to Businesses during Construction)				
Effects on adjacent commercial uses (post-implementation)				
Cultural heritage impacts				
Supports growth management objectives				
Consistent with other City policies and plans				
Network capacity and impact to existing transportation network				
Transit service				
Transit ridership relative to capacity				
Travel time of transit				
Ability to stage implementation				
Ease of construction				
Property impacts				
Overall Technical Summary				
Project Team Assessment of Public Feedback				

LEGEND

Not Preferred

Most Preferred



TECHNICAL MEMO – RAPID TRANSIT NORTH CORRIDOR AND DOWNTOWN ALTERNATIVES: EVALUATION TABLES

Downtown East-West Corridor Alternatives Evaluation Summary

The table below summarizes the evaluation of the Downtown East-West Corridor alternatives. A detailed table is provided at the end of this document.

As a result of Council's direction to review Queens Avenue, the technical evaluation, and consideration of public and stakeholder input, the King/Queens couplet has emerged as the preferred alternative. While King Street two-way also scored very well, the main advantages of the King/Queens couplet are that it:

- Reduces construction duration on King Street;
- Allows some on-street parking / loading on the north side of King Street;
- Reduces conflicts with operations, access and loading for Covent Garden Market and Budweiser Gardens;
- Allows local buses to use dedicated transit lanes on King Street, Wellington Street, and Queens Avenue with bus bays where possible;
- Provides an additional lane for general traffic, at the expense of dedicating east-west cycling facilities on Queens Ave;
- More flexible construction phasing due to changes only on the south side of King Street and the north side of Queens Avenue; and,
- Avoids impact to Mitchell A. Baran Park (west of Thames River).

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Criteria	King Street Two-Way	King/Queens Couplet	King Street Mixed Traffic
Construction impacts (Impacts to Businesses during Construction)			
Effects on adjacent commercial uses (post-implementation)			
Public space and amenities			
Consistent with other City policies and plans			
Network capacity and Impact to existing transportation network			
Transit service			
Cyclist mobility			
Ability to stage implementation			
Overall Technical Summary			
Project Team Assessment of Public Feedback			

LEGEND

Not Preferred









Most Preferred







**TECHNICAL MEMO – RAPID TRANSIT NORTH
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North Corridor Alternatives Evaluation Details





The table below details the evaluation of the North Corridor alternatives, based on the analysis provided in the April 26, 2017 Technical Memo and associated attachments (<http://www.shiftlondon.ca/reports>).

Criteria	Richmond Street corridor with Tunnel between Central and St. James: from Downtown to Fanshawe Park Road via Clarence Street, Richmond Street, University Drive/Lambton Drive and Western Road	Downtown to Fanshawe Park Road via Riverside Drive, Wharncliffe Road and Western Road	Richmond Street Corridor with at-grade crossing of CP Rail tracks (i.e. no tunnel)	Richmond Street Corridor with combined road and rapid transit underpass from Pall Mall to Oxford
Economic Development and City Building				
Capital Costs	\$258 million (in 2016\$) total corridor cost	\$136-166 million (in 2016\$) total corridor cost	\$111-121 million (in 2016\$) total corridor cost	\$226-246 million (in 2016\$) total corridor cost
				
Operating Costs	Additional on-going operating, maintenance and lifecycle costs for tunnel, but reduced costs due to train delays and reduced fleet requirements	Relatively small difference between options in operating costs as a percentage of overall project costs.	Additional operating costs to mitigate delays due to rail crossing, including labour cost and vehicle fleet.	Relatively small difference between options in operating costs as a percentage of overall project costs.
				





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Criteria	Richmond Street corridor with Tunnel between Central and St. James: from Downtown to Fanshawe Park Road via Clarence Street, Richmond Street, University Drive/Lambton Drive and Western Road	Downtown to Fanshawe Park Road via Riverside Drive, Wharncliffe Road and Western Road	Richmond Street Corridor with at-grade crossing of CP Rail tracks (i.e. no tunnel)	Richmond Street Corridor with combined road and rapid transit underpass from Pall Mall to Oxford
Construction impacts (Impacts to Businesses during Construction)	<p>Longest construction duration to implement 900m tunnel and associated underground station.</p> <p>Construction on Richmond impacts approximately 145 businesses, including approximately 40 that have low tolerance for construction disruption.</p>	<p>Shorter construction duration compared to tunnel and underpass.</p> <p>Avoids construction for transit on Richmond.</p> <p>Impacts to businesses around Wharncliffe/Oxford and Wharncliffe/Riverside.</p>	<p>Shorter construction duration compared to tunnel and underpass.</p> <p>Construction on Richmond impacts approximately 145 businesses, including approximately 40 that have low tolerance for construction disruption.</p>	<p>Medium construction duration compared to other options.</p> <p>Construction on Richmond impacts approximately 145 businesses, including approximately 40 that have low tolerance for construction disruption.</p>
				

















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Criteria	Richmond Street corridor with Tunnel between Central and St. James: from Downtown to Fanshawe Park Road via Clarence Street, Richmond Street, University Drive/Lambton Drive and Western Road	Downtown to Fanshawe Park Road via Riverside Drive, Wharncliffe Road and Western Road	Richmond Street Corridor with at-grade crossing of CP Rail tracks (i.e. no tunnel)	Richmond Street Corridor with combined road and rapid transit underpass from Pall Mall to Oxford
Effects on adjacent commercial uses (post-implementation)	<p>Maintains existing on-street parking and access on Richmond Row. No impact to commercial buildings. Restricts unsignalized intersections and driveways on Richmond to right-in/right-out, assuming median transit lanes, from St. James to University, and on Western/Richmond from Lambton to Fanshawe Park Road. Does not increase visibility of Richmond Row businesses to transit riders with rapid transit underground.</p>	<p>Maintains existing on-street parking and loading access on Richmond Row. Restricts unsignalized intersections and driveways on Wharncliffe/Western to right-in/right-out, assuming median transit lanes, from Riverside to Fanshawe Park Road (and Richmond St). Impact to 12 commercial properties around Wharncliffe/Oxford. Does not increase visibility of Richmond Row businesses to transit riders with rapid transit on Wharncliffe/Western.</p>	<p>Reduction of 16 on-street parking spaces on Richmond Row. Restricts unsignalized intersections and driveways on Richmond to right-in/right-out, assuming median transit lanes, from Central to University, and on Western/Richmond from Lambton to Fanshawe Park Road. Impact to 6 commercial buildings on Richmond. Increases visibility of Richmond Row businesses to transit riders with rapid transit at-grade.</p>	<p>Removal of all on-street parking on Richmond Row along the underpass. Restricts unsignalized intersections and driveways on Richmond to right-in/right-out, using service road, from Pall Mall to Oxford. Restricts unsignalized intersections and driveways on Richmond to right-in/right-out, assuming median transit lanes, from St. James to University, and on Western/Richmond from Lambton to Fanshawe Park Road. Impact to all properties on either the east or west side of Richmond (approximately 16-18). Some increase to visibility of Richmond Row businesses to transit riders with rapid transit at-grade until underpass; but reduces visibility from transit and general traffic in underpass.</p>
				

**TECHNICAL MEMO – RAPID TRANSIT NORTH
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Criteria	Richmond Street corridor with Tunnel between Central and St. James: from Downtown to Fanshawe Park Road via Clarence Street, Richmond Street, University Drive/Lambton Drive and Western Road	Downtown to Fanshawe Park Road via Riverside Drive, Wharncliffe Road and Western Road	Richmond Street Corridor with at-grade crossing of CP Rail tracks (i.e. no tunnel)	Richmond Street Corridor with combined road and rapid transit underpass from Pall Mall to Oxford
Effects on adjacent residential uses	Impacts to residential frontages north of Oxford. Access changes as listed in row above.	Impacts to residential properties and frontages on Wharncliffe/Western from Riverside Drive to Sarnia Road. Access changes as listed in row above.	Impacts to residential frontages north of Oxford. Access changes as listed in row above.	Impacts to residential frontages north of Oxford. Access changes as listed in row above.
				
Effects on economic development	No discernable difference.	No discernable difference.	No discernable difference.	No discernable difference.
Community Building and Revitalization				
Cultural heritage impacts	No anticipated impact to heritage designated properties. Treatment of Richmond Street between University Drive and Grosvenor Street to be determined, with consideration of property and heritage designations, compared to transit and traffic operations. Significant potential for archaeological resources around Victoria Park requires additional assessment for tunnel construction.	Anticipated impact to 24 heritage designated properties in the Blackfriars/Petersville Heritage Conservation District because Wharncliffe must be widened to accommodate dedicated transit lanes to operate both the North and West corridors. Archaeological potential along Western Road around Platt's Lane requires additional assessment.	Anticipated impact to 1 heritage designated property and 1 listed heritage property. Treatment of Richmond Street between University Drive and Grosvenor Street to be determined, with consideration of property and heritage designations, compared to transit and traffic operations. Surface treatment reduces potential for impact to archaeological resources around Victoria Park.	No anticipated impact to heritage designated properties. Treatment of Richmond Street between University Drive and Grosvenor Street to be determined, with consideration of property and heritage designations, compared to transit and traffic operations. Significant potential for archaeological resources around Victoria Park requires additional assessment for underpass construction.

**TECHNICAL MEMO – RAPID TRANSIT NORTH
CORRIDOR AND DOWNTOWN ALTERNATIVES:
EVALUATION TABLES**

Criteria	Richmond Street corridor with Tunnel between Central and St. James: from Downtown to Fanshawe Park Road via Clarence Street, Richmond Street, University Drive/Lambton Drive and Western Road	Downtown to Fanshawe Park Road via Riverside Drive, Wharncliffe Road and Western Road	Richmond Street Corridor with at-grade crossing of CP Rail tracks (i.e. no tunnel)	Richmond Street Corridor with combined road and rapid transit underpass from Pall Mall to Oxford
				
Supports growth management objectives	Serves the greatest existing and future population and employment, serves the most potential trip generators including Richmond Row, Victoria Park, St. Joseph's Hospital, King's College, and Western University.	Significantly less opportunity for growth and development per London Plan; Wharncliffe has limited growth potential due to floodplain and heritage district.	Serves the greatest existing and future population and employment, serves the most potential trip generators including Richmond Row, Victoria Park, St. Joseph's Hospital, King's College, and Western University.	Serves the greatest existing and future population and employment, serves the most potential trip generators including Richmond Row, Victoria Park, St. Joseph's Hospital, King's College, and Western University.
				
Consistent with other City policies and plans	Consistent with London Plan, Smart Moves, London ON Bikes.	Not consistent with London Plan, Smart Moves. Consistent with London ON Bikes.	Consistent with London Plan, Smart Moves, London ON Bikes.	Consistent with London Plan, Smart Moves, London ON Bikes.
				
Supports appropriate intensification	Supports greater density, mixed-use development in strategic locations defined in London Plan. Compatible with incentives for development along rapid transit corridors and at transit villages and stations.	Supports Beaufort, Irwin, Gunn Street Secondary Plan potential intensification. Does not encourage downtown revitalization with no rapid transit in the north part of Downtown and Richmond Row.	Supports greater density, mixed-use development in strategic locations defined in London Plan. Compatible with incentives for development along rapid transit corridors and at transit villages and stations.	Supports greater density, mixed-use development in strategic locations defined in London Plan. Compatible with incentives for development along rapid transit corridors and at transit villages and stations.
				









**TECHNICAL MEMO – RAPID TRANSIT NORTH
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Criteria	Richmond Street corridor with Tunnel between Central and St. James: from Downtown to Fanshawe Park Road via Clarence Street, Richmond Street, University Drive/Lambton Drive and Western Road	Downtown to Fanshawe Park Road via Riverside Drive, Wharncliffe Road and Western Road	Richmond Street Corridor with at-grade crossing of CP Rail tracks (i.e. no tunnel)	Richmond Street Corridor with combined road and rapid transit underpass from Pall Mall to Oxford
Connectivity to neighbourhoods and business areas	No discernable difference	No discernable difference	No discernable difference	No discernable difference
Pedestrian amenities	No discernable difference	No discernable difference	No discernable difference	No discernable difference
Public space and amenities	No discernable difference	No discernable difference	No discernable difference	No discernable difference
Transportation Capacity and Mobility				
Network capacity and Impact to existing transportation network	<p>Reduced general traffic capacity between Grosvenor Street and University Drive (1.2km) compared to existing with reduction of one lane northbound and one lane southbound. CP Grade crossing on Richmond remains.</p> <p>Provides 2 dedicated lanes for Rapid Transit from downtown to Fanshawe Park Road.</p> <p>Provides cycle facilities consistent with London ON Bikes.</p>	<p>Reduced general traffic capacity between Oxford Street and Riverside Drive (1.0 km) compared to existing with reduction of one lane northbound and one lane southbound. CP Grade crossing on Richmond remains.</p> <p>Provides 2 dedicated lanes for Rapid Transit from downtown to Fanshawe Park Road.</p> <p>Provides cycle facilities consistent with London ON Bikes.</p>	<p>Reduced general traffic capacity between Oxford Street and Riverside Drive (1.0km), and between Grosvenor Street and University Drive (1.2km), with reduction of one lane northbound and one lane southbound. CP Grade crossing on Richmond remains.</p> <p>Provides 2 dedicated lanes for Rapid Transit from downtown to Fanshawe Park Road.</p> <p>Provides cycle facilities consistent with London ON Bikes.</p>	<p>Reduced general traffic capacity between Oxford Street and Riverside Drive (1.0km), and between Grosvenor Street and University Drive (1.2km), with reduction of one lane northbound and one lane southbound. CP Grade crossing on Richmond eliminated.</p> <p>Provides 2 dedicated lanes for Rapid Transit from downtown to Fanshawe Park Road.</p> <p>Provides cycle facilities consistent with London ON Bikes.</p>













**TECHNICAL MEMO – RAPID TRANSIT NORTH
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Criteria	Richmond Street corridor with Tunnel between Central and St. James: from Downtown to Fanshawe Park Road via Clarence Street, Richmond Street, University Drive/Lambton Drive and Western Road	Downtown to Fanshawe Park Road via Riverside Drive, Wharncliffe Road and Western Road	Richmond Street Corridor with at-grade crossing of CP Rail tracks (i.e. no tunnel)	Richmond Street Corridor with combined road and rapid transit underpass from Pall Mall to Oxford
Transit service	Reliable transit service through tunnel with simpler transit scheduling and operations.	Reliable transit service on dedicated lanes with simpler transit scheduling and operations.	Less reliable transit service with at-grade rail crossing.	Reliable transit service through underpass with simpler transit scheduling and operations.
Transit ridership relative to capacity	Forecasted peak hour ridership: 1,800-1,900 passengers per hour in 2034. Ridership accommodated primarily on rapid transit means better ridership to capacity. Greater potential for ridership through the day and evenings due to greater mix of uses and trip generators along the corridor.	Forecasted peak point ridership drop by at least 5%. Ridership distribution between rapid and local transit would be affected; requires additional analysis. Low potential for ridership throughout the day and evenings due to limited uses and few trip generators along the corridor.	Forecasted peak hour ridership: 1,800-1,900 passengers per hour in 2034. Ridership accommodated primarily on rapid transit means better ridership to capacity. Greater potential for ridership through the day and evenings due to greater mix of uses and trip generators along the corridor.	Forecasted peak hour ridership: 1,800-1,900 passengers per hour in 2034. Ridership accommodated primarily on rapid transit means better ridership to capacity. Greater potential for ridership through the day and evenings due to greater mix of uses and trip generators along the corridor.
Travel time of transit	Approximate travel time savings of 6 to 7 minutes for Rapid Transit (compared to buses in mixed traffic) from Downtown London to Masonville Mall during peak periods.	Approximate travel time savings of 4 to 5 minutes for Rapid Transit (compared to buses in mixed traffic) from Downtown London to Masonville Mall during peak periods.	Approximate travel time savings of 5 to 6 minutes for Rapid Transit (compared to buses in mixed traffic) from Downtown London to Masonville Mall during peak periods.	Approximate travel time savings of 6 to 7 minutes for Rapid Transit (compared to buses in mixed traffic) from Downtown London to Masonville Mall during peak periods.





**TECHNICAL MEMO – RAPID TRANSIT NORTH
CORRIDOR AND DOWNTOWN ALTERNATIVES:
EVALUATION TABLES**

Criteria	Richmond Street corridor with Tunnel between Central and St. James: from Downtown to Fanshawe Park Road via Clarence Street, Richmond Street, University Drive/Lambton Drive and Western Road	Downtown to Fanshawe Park Road via Riverside Drive, Wharncliffe Road and Western Road	Richmond Street Corridor with at-grade crossing of CP Rail tracks (i.e. no tunnel)	Richmond Street Corridor with combined road and rapid transit underpass from Pall Mall to Oxford
				
Safety of all corridor users	No discernable difference	No discernable difference	No discernable difference	No discernable difference
Support active transportation	No discernable difference	No discernable difference	No discernable difference	No discernable difference
Cyclist mobility	No discernable difference	No discernable difference	No discernable difference	No discernable difference
Pedestrian mobility	No discernable difference	No discernable difference	No discernable difference	No discernable difference
Ease of Implementation and Operational Viability				
Ability to stage implementation	Least flexibility to implement rapid transit due to longest construction duration and most complex underground works.	Slightly less flexible implementation than at-grade option with replacement of CP bridge over Wharncliffe already programmed.	Most flexible implementation with limited works underground.	Less flexible than at-grade and Wharncliffe/Western options due to complex underground works.
				
Ease of construction	Most complex construction including challenges related to archaeology, utilities, adjacent existing structures, traffic management, coordination with CP, and construction on University lands.	Complex construction including challenges related to heritage, property acquisition, utilities, floodplain, and traffic management.	Least complex construction compared to other options.	Complex construction including challenges related to property acquisition, utilities, adjacent existing structures, traffic management, coordination with CP, and construction on University lands.

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Property impacts <i>Subject to development of design alternatives and mitigation measures.</i>	22 partial acquisitions 4 full acquisitions	147 partial acquisitions 48 full acquisitions	26 partial acquisitions 8 full acquisitions	22 partial acquisitions 17-24 full acquisitions
				
Natural Environment and Climate Change				
Natural heritage features and areas	Minimizes natural environment impacts to North Thames River valley by using existing University Drive bridge.	Avoids natural impacts to North Thames River valley by using existing Queens Avenue bridge, also used by the proposed West Rapid Transit corridor.	Minimizes natural environment impacts to North Thames River valley by using existing University Drive bridge.	Minimizes natural environment impacts to North Thames River valley by using existing University Drive bridge.
				
Air quality and greenhouse gas emissions	No discernable difference	No discernable difference	No discernable difference	No discernable difference
Climate change adaptation	No discernable difference	No discernable difference	No discernable difference	No discernable difference










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Water quality	No discernable difference	No discernable difference	No discernable difference	No discernable difference
Environmental regulations	No discernable difference	No discernable difference	No discernable difference	No discernable difference
Environmental policies	No discernable difference	No discernable difference	No discernable difference	No discernable difference
Public Feedback				
Project Team Assessment of Public Feedback at Meetings Held April 19, April 25, and May 3, 2017				

**TECHNICAL MEMO – RAPID TRANSIT NORTH
CORRIDOR AND DOWNTOWN ALTERNATIVES:
EVALUATION TABLES**

Downtown East-West Corridor Alternatives Evaluation Summary










The table below details the evaluation of the Downtown East-West Corridor alternatives, based on the analysis provided in the April 26, 2017 Technical Memo and associated attachments (<http://www.shiftlondon.ca/reports>).

Criteria	King Street Two-Way Transit: from Riverside Drive on Kensington Bridge, Ridout Street, and King Street to Wellington Street	King/Queens Couplet: from Riverside Drive on Queens Ave Bridge, SB on Ridout Street, EB on King Street and WB on Queens Avenue, with NB transition on Wellington Street	King Street Two-Way mixed traffic: from Riverside Drive on Kensington Bridge, Ridout Street, and King Street to Wellington Street
Economic Development and City Building			
Capital Costs	Relatively small difference between options in capital costs as a percentage of overall project costs.	Relatively small difference between options in capital costs as a percentage of overall project costs.	Relatively small difference between options in capital costs as a percentage of overall project costs.
			
Operating Costs	Relatively small difference between options in operating costs as a percentage of overall project costs.	Relatively small difference between options in operating costs as a percentage of overall project costs.	Relatively small difference between options in operating costs as a percentage of overall project costs.
			
Construction impacts (Impacts to Businesses during Construction)	Longer duration construction to implement two transit lanes. Construction on two streets (Ridout and King) results in fewer businesses impacted (93), including 56 Low & Low-Medium tolerance businesses.	Shorter duration construction to implement one transit lane. Construction on four streets (Ridout, King, Wellington, Queens) results in more businesses impacted (118), including 62 Low & Low-Medium tolerance businesses.	Longer duration construction to implement two-way traffic on King Street. Construction on two streets (Ridout and King) results in fewer businesses impacted (93), including 56 Low & Low-Medium tolerance businesses.
			




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EVALUATION TABLES**

Criteria	King Street Two-Way Transit: from Riverside Drive on Kensington Bridge, Ridout Street, and King Street to Wellington Street	King/Queens Couplet: from Riverside Drive on Queens Ave Bridge, SB on Ridout Street, EB on King Street and WB on Queens Avenue, with NB transition on Wellington Street	King Street Two-Way mixed traffic: from Riverside Drive on Kensington Bridge, Ridout Street, and King Street to Wellington Street
Effects on adjacent commercial uses (post-implementation)	<p>Reduction of 89 on-street parking spaces on Clarence, King, and Queens. This option allows for the planned Queens Ave cycle-track project, which accounts for 61 of the parking spaces removed.</p> <p>Greater impact to existing on-street loading operations for major downtown uses.</p> <p>Provides more direct connection between business areas, Rapid Transit and inter-regional Bus & Train stations from all Rapid Transit corridors. RT station at Clarence/King is less than 200m from VIA station.</p>	<p>Reduction of 77 on-street parking spaces on Clarence, King, and Queens.</p> <p>Less impact to existing on-street loading operations for major downtown uses.</p> <p>Less direct connection between business areas, Rapid Transit and inter-regional Bus & Train stations from South and East Rapid Transit corridors. RT station at Wellington/King is approx. 300m from VIA station.</p>	<p>Reduction of 89 on-street parking spaces on Clarence, King, and Queens. This option allows for the planned Queens Ave cycle-track project, which accounts for 61 of the parking spaces removed.</p> <p>Greater impact to existing on-street loading operations for major downtown uses.</p> <p>Provides more direct connection between business areas, Rapid Transit and inter-regional Bus & Train stations from all Rapid Transit corridors. RT station at Clarence/King is less than 200m from VIA station.</p>
Effects on adjacent residential uses	No discernable difference	No discernable difference	No discernable difference
Effects on economic development	No discernable difference	No discernable difference	No discernable difference
Community Building and Revitalization			
Public space and amenities	<p>Impacts Mitchell A. Baran Park (west side of Thames River) with new transit-only two-lane road between Riverside Drive and Kensington Bridge.</p> <p>Impact to trees along Ridout Street (east side) and King Street (north and south side).</p>	<p>No impact to Mitchell A. Baran Park (west side of Thames River).</p> <p>Impact to trees along King Street (south side) and Queens Ave (north side). Removal of trees in the median on Wellington Street between King and Queens.</p>	<p>No impact to Mitchell A. Baran Park (west side of Thames River).</p> <p>Impact to trees along Ridout Street (east side) and King Street (north and south side).</p>










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Cultural heritage impacts	Design anticipated to fit within existing rights-of-ways with minimal impact to built cultural heritage features and archaeological resources.	Design anticipated to fit within existing rights-of-ways with minimal impact to built cultural heritage features and archaeological resources.	Design anticipated to fit within existing rights-of-ways with minimal impact to built cultural heritage features and archaeological resources.
			
Consistent with other City policies and plans	Compatible with the London Plan, Smart Moves, Dundas Place Flex Street, London On Bikes and Back to the River initiative.	Compatible with the London Plan, Smart Moves, and Dundas Place Flex Street between Wellington and Ridout. Requires vehicle traffic on Kensington Bridge, potentially changing the dynamic of the space for the My Dundas Place project and Back to the River initiative. Change would be addressed during detailed design process for these two projects. Eliminated cycle track on Queens Ave proposed in London On Bikes.	Compatible with the London Plan, Smart Moves, London On Bikes and Dundas Place Flex Street between Wellington and Ridout. Requires vehicle traffic on Kensington Bridge, potentially changing the dynamic of the space for the My Dundas Place project and Back to the River initiative. Change would be addressed during detailed design process for these two projects.
			
Supports growth management objectives	No discernable difference	No discernable difference	No discernable difference
Supports appropriate intensification	No discernable difference	No discernable difference	No discernable difference




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Connectivity to neighbourhoods and business areas	No discernable difference	No discernable difference	No discernable difference
Pedestrian amenities	No discernable difference	No discernable difference	No discernable difference
Transportation Capacity and Mobility			
Network capacity and Impact to existing transportation network	Provides 5 lanes for general traffic, 2 dedicated lanes for Rapid Transit, and 2 dedicated cycle tracks on Queens. Overall transportation network capacity is similar to the couplet.	Provides 6 lanes for general traffic, 2 dedicated lanes for Rapid Transit combined with local transit, and no dedicated cycle facilities. Overall transportation network capacity is similar to King Street two-way.	Provides 7 lanes for general traffic, with Rapid Transit and local transit mixed with general traffic on King Street, and 2 dedicated cycle tracks on Queens. Overall transportation network capacity is reduced with transit operating entirely in mixed traffic.
			
Transit service	Intuitive two-way transit corridor and stations, with Central Transit Hub at King & Clarence. Simple connections and transfers. Simpler transit scheduling and operations. Westbound rapid transit lane on King Street offers greater reliability due to counter-flow design. Local buses will share dedicated transit lane on King Street EB with no local stops on King Street, and use Queens Avenue WB in mixed traffic with local stops.	Less intuitive couplet transit corridor, with split station at Talbot. No central transit hub, with transfers between corridors at Queens & Clarence; and King & Wellington. More complex connections and transfers. Slight difference in corridor length (EB vs WB) requires more complex scheduling and operations. Greater interaction with general traffic due to with-flow design. Local buses will share dedicated transit lanes on King Street EB, Wellington Street NB, and Queens Avenue WB with local stops and bus bays where possible.	Intuitive two-way transit corridor and stations, with Central Transit Hub at King & Clarence. Simple connections and transfers. Mixed traffic operations requires more complex scheduling to compensate for traffic congestion. Most interaction with general traffic due to mixed-flow design. Local buses with share general purpose lanes on King Street and/or Queens Ave.

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Cyclist mobility	On-street bike lanes on King Street removed. Accommodates two-way cycle track on Queens Avenue. Accommodates cycle facility on Riverside Drive between Wharncliffe Road and Kensington Bridge.	On-street bike lane on King Street removed. No accommodation of cycle track on Queens Avenue. No accommodation of cycle facility on Riverside Drive between Wharncliffe Road and Kensington Bridge.	On-street bike lanes on King Street removed. Accommodates two-way cycle track on Queens Avenue. Accommodates cycle facility on Riverside Drive between Wharncliffe Road and Kensington Bridge.
			
Safety of all corridor users	Less intuitive operation of King Street and Ridout Street with two-way transit and one-way general traffic. Less conflict points between Rapid Transit and general traffic with shorter corridors.	Intuitive one-way operation on King Street and Queens Avenue. More conflict points between Rapid Transit and general traffic with additional length of corridors, additional intersections and driveways.	Intuitive two-way operation on King Street. More conflict points between Rapid transit and general traffic with mixed operations.
			
Transit ridership relative to capacity	No discernable difference	No discernable difference	No discernable difference
Travel time of transit	No discernable difference	No discernable difference	No discernable difference
Support active transportation	No discernable difference	No discernable difference	No discernable difference

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Pedestrian mobility	No discernable difference	No discernable difference	No discernable difference
Ease of Implementation and Operational Viability			
Ability to stage implementation	Less flexible to implement rapid transit due to the reallocation of right-of-way along King Street.	More flexible to implement rapid transit due to change to only one-side of King Street and one-side of Queens Avenue.	Less flexible to implement rapid transit due to the reallocation of right-of-way along King Street.
			
Ease of construction	No discernable difference	No discernable difference	No discernable difference
Property impacts	No discernable difference	No discernable difference	No discernable difference
Natural Environment and Climate Change			
Air quality and greenhouse gas emissions	No discernable difference	No discernable difference	No discernable difference
Climate change adaptation	No discernable difference	No discernable difference	No discernable difference
Water quality	No discernable difference	No discernable difference	No discernable difference
Natural heritage features and areas	No discernable difference	No discernable difference	No discernable difference
Environmental regulations	No discernable difference	No discernable difference	No discernable difference

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Environmental policies	No discernable difference	No discernable difference	No discernable difference
Public Feedback			
Project Team Assessment of Public Feedback at Meetings Held April 19, April 25, and May 3, 2017	