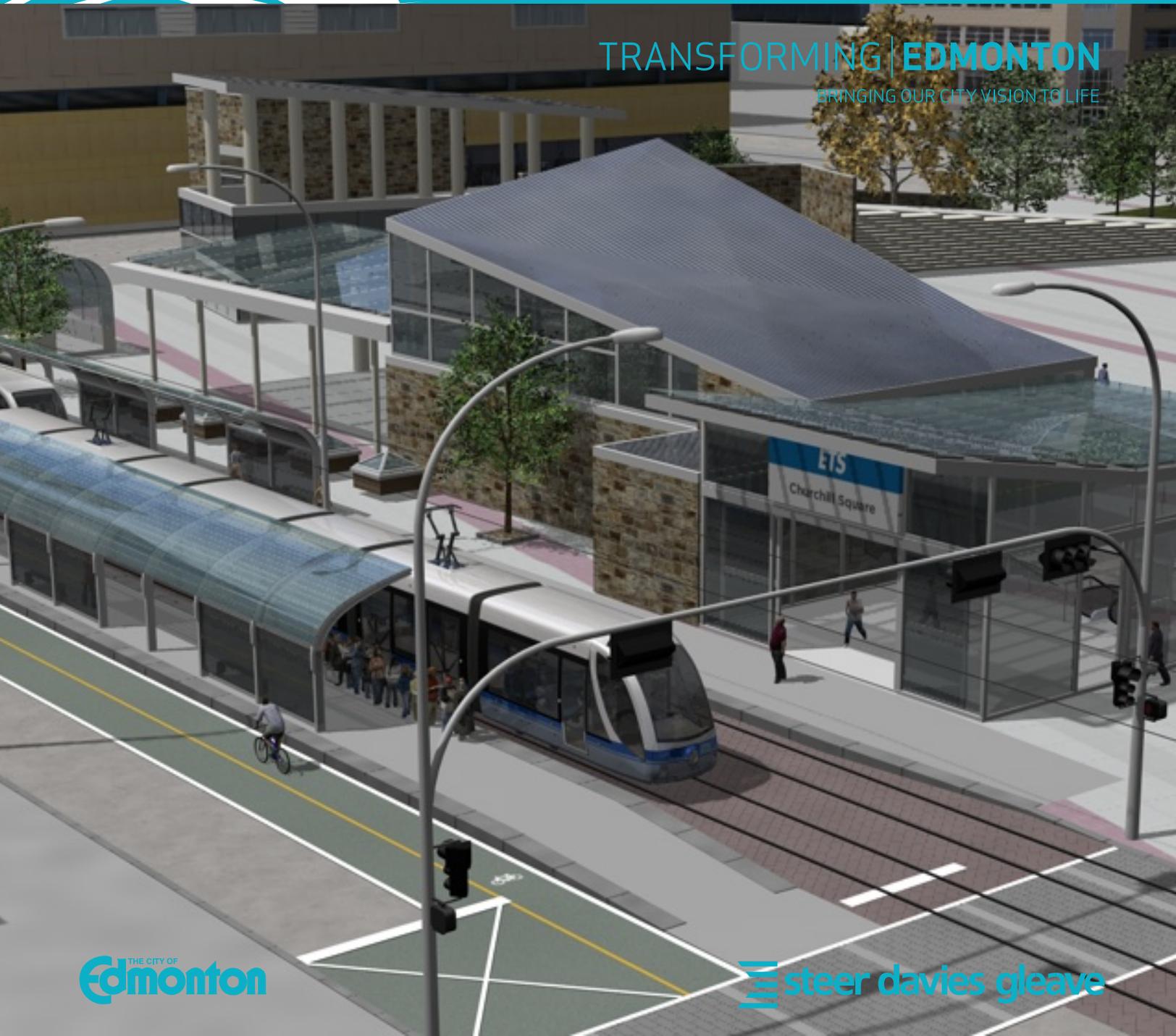


THEWAYWE MOVE

DOWNTOWN LRT CONCEPT PLAN REPORT

October, 2012

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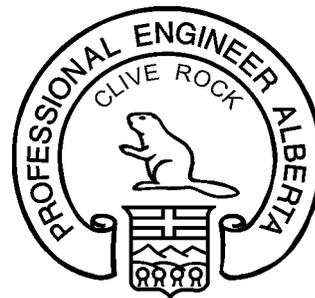
Edmonton LRT Expansion

Downtown LRT Concept Plan

Final Report

October 2012

<p>PERMIT TO PRACTICE STEER DAVIES GLEAVE NORTH AMERICA INC.</p> <p>Signature _____</p> <p>Date _____</p> <p>PERMIT NUMBER: P 11394 The Association of Professional Engineers and Geoscientists of Alberta</p>
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Executive Summary

This executive summary provides an overview of the Downtown Light Rail Transit (LRT) Concept Design development for the 2.1-km LRT, connecting the proposed Southeast to West LRT alignments. The Downtown LRT Concept Plan Workbook is the companion design documents to this report. The Workbook contains all of the detailed engineering designs relevant to the project. Additionally, a simplified drawing of the Downtown LRT Concept Design is included in Appendix J of this document.

The Downtown LRT is the keystone segment of this new, surface level, low floor, urban style LRT system planned to extend from Lewis Estates to Millwoods. The Concept Design built off of the previous planning work to confirm the appropriate “corridor” for the Downtown LRT Connector across Downtown Edmonton. Since the corridor’s By-law approval by City Council in 2010, the Concept Design process has engaged with stakeholders to further refine the design details. This included identifying exact track layouts, stop locations, urban realm improvements, and design concepts within the previously approved corridor. This complete report provides details of the analysis and outreach leading up to the approval of the Concept Design by City Council in January 2012.

Background & Project Purpose

In June 2009, the City Council adopted the long-term LRT Network Plan that defined the future size, scale, and operation of the regional LRT system. The Network Plan makes downtown Edmonton the focal point of the system, with the determination that a surface (street)-level LRT system would be needed in the downtown core to serve future system expansion separate from the existing LRT system in the downtown tunnel.

The City’s LRT Network Plan proposes developing all new LRT corridors (not connecting to the existing LRT system) in a style that differs from the current LRT line. The focus of future LRT expansion will be to provide an urban style - city scale system, an approach that will provide closer stop spacing and improved links to communities, supporting the City’s vision for a more compact, sustainable and liveable city. An urban style - city scale system is defined in the LRT Network Plan as:

- Urban style: A style of system that offers: reduced scale platforms and stops; modern low floor LRT vehicles; frequent stops; transit priority; serving dense urban corridors.
- City scale: Distinctive design that provides: identity; seamless integration; easily accessible; supportive of land use plans, and walkable communities.

The keystone element of the LRT Network Plan included the surface-level LRT connection of the Southeast and West LRT alignments, across the downtown grid.

Downtown LRT Concept Plan

Given the unique complexities of developing LRT in the downtown core, this segment was developed as a separate project, referred to as the Downtown LRT Connector.

On June 21, 2010, after a year of rigorous study, basic design, and public consultation, City Council approved the Downtown LRT Connector “corridor” at a statutory public hearing. Approval of the “corridor” identified the broad alignment (streets and avenues) the Downtown LRT would follow. The approved corridor follows 104 Avenue, 107 Street and 102 Avenue through the downtown. This approval set the stage for the second (current) phase of the project, development of the Concept Design.

The purpose of the Concept Design development was to further refine the details of the corridor, such as exact locations of the track, stop options, and any changes to the surrounding roadways or infrastructure required by the project. Additionally, the Concept Design refined cost estimates and the basic assessment of environmental and socio-economic impacts/benefits. Through the development of the Concept Design, the City of Edmonton Transportation Department presented multiple options for stop locations and track configurations for consideration by public stakeholders and City decision makers. With the technical assessment and stakeholder feedback as a basis, City Council approved the Concept Design in January 2012. Approval came only after multiple iterations of the Concept Design were analyzed. This included significant outreach to public stakeholders related to issues of safety, neighbourhood division, cultural impacts, property acquisitions, stop design (above ground/below ground), and considerations of alternative corridors (beyond the By-law approved corridor).

The approved Downtown LRT Concept Design complements and links the proposed Southeast to West LRT corridor, and supports the City’s Strategic Plan (The Way Ahead), the Municipal Development Plan (The Way We Grow), the Transportation Master Plan (The Way We Move), the LRT Network Plan, and the Capital City Downtown Plan (CCDP). In combination, these initiatives provide a major opportunity for the City of Edmonton to introduce a series of major improvements to the downtown. In particular, the introduction of a new (surface level) LRT route can be a significant “city shaper” providing a focus for new development, and changing the way in which people access and use the downtown and it’s many facilities.

Process

In July 2010, the City of Edmonton Transportation Department initiated the second phase of the Downtown LRT Connector, development of the Concept Design. Development of the Concept Design included clearly defined process steps to:

- Develop track location, infrastructure improvements, and stop location options within the approved Downtown LRT Connector corridor.
- Present and test options through stakeholder involvement activities.
- Conduct qualitative assessment of the recommended Concept Design.
- Identify and present the recommended Concept Design for stakeholder feedback.
- Continue design and refine the recommended Downtown LRT corridor (based on stakeholder feedback).

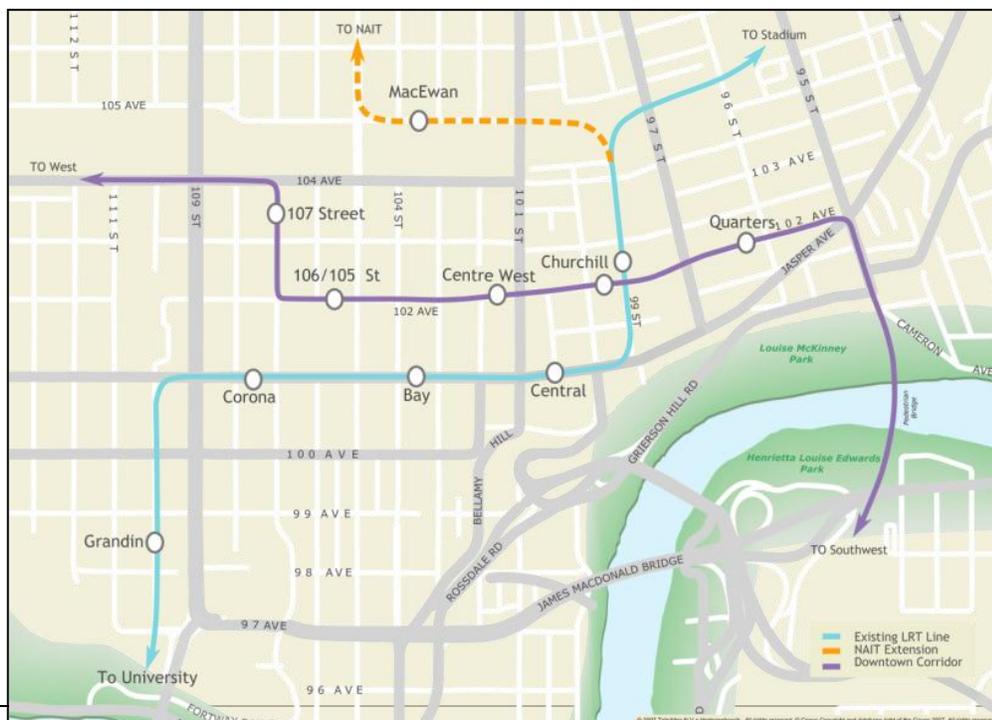
- Present recommended Concept Design for City Council consideration.

Stakeholder sentiment and feedback served as a critical input to the process. Outreach to stakeholders included two primary components. The first component included focused discussions with key stakeholder organizations such as major downtown employers, the Downtown, Boyle Street and Riverdale Community Leagues, Chinese community representatives and major civic attractions. The second component included broad outreach to public stakeholders. To provide clear and concise information on the project, process, and options, a workbook of the concept plan options was produced and used to support the stakeholder consultation sessions held in September/November 2010, March/April 2011, and October 2011. The team consulted with more than 250 stakeholders through public open houses and individual meetings.

Options & Analysis

During the development and assessment of the Concept Design, a number of potential stop locations, track locations, and traffic configurations were identified. The platforms for each stop will be approximately 30 to 35 centimetres high and 80 metres long, effectively the length of the block. Access for passengers is via shallow ramps from the intersections at each end of a block. The identified stops locations would provide a stop spacing of approximately 500 metres along the 2.1 kilometre route. Stops were located to maximize the 400 metre catchment for users. The Downtown LRT corridor and stops is shown in Figure E.1. The stop locations allow for close walking accessibility and catchment along the proposed corridor. Details of the multiple options examined by the project team and presented to stakeholders are detailed below.

FIGURE E.1 APPROVED CORRIDOR & STOP LOCATIONS



Downtown LRT Concept Plan

The sections below details the various stop locations and options that were analyzed throughout the Concept Design process. The final stop locations reflected in the City Council approved Concept Design are noted at the end of this section.

107 Street

The objective of this stop location in this area is to provide a direct and convenient transit service to MacEwan University, NorQuest College, the Warehouse Campus neighbourhood, and 108 Street. The NorQuest options noted below were added following additional stakeholder feedback.

- Option 1: Stop on the north side of 104 Avenue.
- Option 2: Stop located on a diagonal alignment between 108 to 107 Streets.
- Option 3: Stop on the east side of 107 Street between 103 and 102 Avenues.
- Option 4: Stop on 107 Street between 104 and 103 Avenues.
- NorQuest Option 1: Stop on the west side of 107 Street between 103 and 102 Avenues.
- NorQuest Option 2: Stop on the west side of 107 Street between 103 and 102 Avenues.
- NorQuest Option 3: Stop on the west side of 107 Street between 103 and 102 Avenues.

105/106 Street

The objective for this stop location is to provide a stop as far west as possible on 102 Avenue to provide walking links through to Jasper Avenue and Corona Station prior to the potential future wider downtown LRT circulator.

- Option 1: Stop between 105 and 106 Street, retains two traffic lanes.
- Option 2: Stop between 105 and 106 Street, retains single eastbound traffic lane.
- Option 3: Stop between 105 and 106 Street, closes a section of 102 Avenue to all traffic.

Centre West

The objective for this stop location is to provide connectivity to the commercial core within the downtown, walking links through to Jasper Avenue, interchange with transit on 101 Street and future connectivity to the potential arena development.

- Option 1 is located along 102 Avenue between 102 and 101 Street, with the street right-of-way narrowed to two shared auto/bicycle lanes.
- Option 2 is in the same location with no auto access and includes two-way bicycle lanes.

- New Option 2a is in the same location as Option 1 but with one (likely eastbound) auto lane and, if right-of-way allows, adjacent bicycle lanes.
- Option 3 moves the platform farther west (between 103 and 102 Streets) with no auto access and two-way bicycle lanes.
- New Option 3a is in the same location as Option 3 but includes one (likely westbound) auto lane along with adjacent bicycle lanes if right-of-way allows. Churchill Square

The objective for this stop location is to provide connectivity to the arts and entertainment district within the downtown, interchange with the existing LRT line, walking links through to Jasper Avenue and the river valley, interchange with transit on 100 Street, and connectivity to the municipal government.

- Option 1: Stop between 100 and 99 Streets, retains two traffic lanes.
- Option 2: Stop between 100 and 99 Streets, with single eastbound lane.
- Option 3 : Stop between 100 and 99 Streets, closes section of 102 Avenue to all traffic.

Quarters

The objective of this stop location is to serve the Quarters area and provide an easternmost stop in the Downtown.

- Option 1: Stop between 97 and 96 Streets on 102 Ave, with single eastbound access lane . Westbound traffic between 95 and 96 Street.
- Option 2: Stop Between 97 and 96 Street on 102 Ave, with single eastbound access lane. East and Westbound traffic between 95 and 96 Street.
- Option 3: Stop between 97 and 96 Street on 102 Ave, with single westbound access lane 95 Street to 97 Street.
- Option 4: Stop underground, 102 Avenue.
- Option 5: Stop between 97 and 96 Street on 102A Ave, with single westbound access lane 95 Street to 97 Street.
- Option 6: Stop underground, 102A Avenue.

The options were evaluated against the City's LRT assessment criteria taking note that within the downtown, the primary role of the LRT is somewhat different from the radial LRT corridors which feed it, as the route will provide access to major destinations within the downtown, serve the increasing residential catchment area within the downtown, and provide a link to the existing transit network. The evaluation of the downtown route has taken account of the LRT route being one of the nine catalyst projects included within the CCDP.

Final Stop Options

Based upon the technical evaluation and stakeholder consultation the recommended concept alignment was identified as best meeting the assessment/evaluation criteria

Downtown LRT Concept Plan

and the objectives of the city's plans, particularly the CCDP. Table E.1 below details the recommended stop designs and provides key information regarding the selection of each.

TABLE E.1 FINAL DOWNTOWN LRT CONCEPT DESIGN STOPS

107 Street	105/106 Street	Centre West	Churchill Square	Quarters
<p>Option 2: Diagonal alignment with stop between 108 to 107 Street</p> <p>Option 4 On 107 Street between 103 and 104 Ave</p>	<p>Option 2: Stop between 105 & 106 street with a single eastbound traffic lane</p>	<p>Option 2 (amended): Stop between 102 and 101 Street, with a single eastbound traffic lane</p>	<p>Option 2: Stop between 100 and 99 Streets, with single eastbound lane.</p>	<p>Option 3: Stop between 97 and 96 Street on 102 Ave, with single westbound access lane.</p>
<p>Rated highest due to its high pedestrian and bicycle access, linkages to nearby activity centers including the two campuses, urban design integration, TOD potential and consistency with the CCDP, and operational flexibility.</p> <p>*While Option 2 was the preferred option recommended to City Council. Council also maintained Option 4: 107 Street. This is the alternate option if funding is not secured for the joint development associated with the Diagonal stop in Option 2.</p>	<p>Provides the optimum LRT and cycle arrangement while retaining local traffic access eastbound. The arrangement provides the highest level of local walking and cycle accessibility.</p> <p>The arrangement is supportive of the CCDP policies related to Sustainable, Vibrant, Well Designed, and Accessibility.</p>	<p>Rated higher than the other options due its proximity to transit connections on 101 Street and its connectivity within the heart of the downtown core (shopping, offices and leisure).</p> <p>The option reduces the traffic impacts on vehicle egress from 102 Street by providing an eastbound traffic lane through to 101 Street and a westbound traffic lane and dedicated right turn lane through to 103 Street.</p> <p>The option would be supportive of the CCDP policies to create a Sustainable, vibrant, Well-Designed and Accessible Downtown.</p>	<p>Provides a quality arrangement for the LRT at what is the heart of the City. The arrangement would provide greater platform space and the highest level of accessibility and integration with Churchill Square and the associated precinct. Stop platforms would be integrated with the sidewalks providing an opportunity to reinforce the sense of place, to enhance and complement the square and support all year round street vibrancy. This approach would support the CCDP.</p>	<p>This stop provides the best connectivity to the existing and future development within the area. The location was developed in conjunction with the Quarters planning process and best represents the ultimate development goals of the Quarters plan. Multiple adjustments to the original design were completed to provide parking, address safety concerns, provide urban realm improvements, and avoid property impacts.</p>

Next Steps

The recommended Downtown LRT Concept Design was approved by City Council on January 31, 2012. This approval advances the design of the Downtown LRT to Preliminary Engineering (PE). Through PE, the Downtown LRT will be combined as part of the Southeast to West LRT project. Alternative design and funding scenarios are currently being examined by the City to advance these projects.

1 Introduction

Study Purpose

- 1.1 The purpose of the Downtown LRT Concept Design study is the development and evaluation of LRT alignment and integrated street design options along the Council approved Corridor to identify and agree a preferred concept design. The approved corridor utilizes 104 Avenue, 107 Street and 102 Avenue to provide the 2.1-km, low floor LRT connection through the downtown for the proposed Southeast to West LRT. A surface, urban style LRT alignment is proposed solution through downtown Edmonton.
- 1.2 The Downtown LRT Concept Plan Workbook is the companion design document to this report. The Workbook contains all of the detailed engineering designs relevant to the project. Additionally, a simplified drawing of the Downtown LRT Concept Design is included in Appendix J of this document.

Background

- 1.3 In June 2009, the City Council adopted the long-term LRT Network Plan that defined the future size, scale, and operation of the regional LRT system. The Network Plan makes downtown Edmonton the focal point of the system, with the determination that in addition to the existing high floor system and its associated downtown tunnel, a street-level low floor LRT system would be needed in the downtown core to serve future system expansion.
- 1.4 This report builds upon the earlier work undertaken to identify the LRT corridor through the downtown which was approved on June 21, 2010 at a statutory public hearing of the City Council. This report further refines the approved corridor, identifying the specific track layouts, design concepts, urban realm improvements, stop locations, and traffic arrangements. The document describes the process used in the development of the Downtown LRT Concept Design. It outlines the design analysis, development, and options considered.
- 1.5 The Downtown LRT Concept Design complements, and links the proposed Southeast to West LRT corridor and has been developed to be supportive of the development objectives set out within the CCDP. In combination, these initiatives provide a major opportunity for the City of Edmonton to introduce a series of major improvements to the downtown. In particular, the introduction of a new (surface level) LRT route can be a significant “city shaper” providing a focus for new development, and changing the way in which people access and use the downtown and it’s many facilities.
- 1.6 The report consists of the following seven sections:
 1. Introduction.
 2. Project Context.
 3. Concept Development Process.
 4. Stakeholder Involvement.

Downtown LRT Concept Plan

5. Recommended Concept Design.
6. LRT Engineering.
7. Next Steps.

Urban Style - City Scale

The City of Edmonton has adopted a new long-term LRT network plan and style of system that differs from the current more suburban style high floor LRT line. The focus of future LRT expansion will be to provide an Urban Style - City Scale system, an approach that will provide closer stop spacing and improved links to communities, supporting the City's vision for a more compact, sustainable and liveable city. An Urban Style - City Scale system is defined in the LRT Network Plan as:

- Urban style: - A style of System that offers: reduced scale platforms and stops; modern low floor LRT vehicles; frequent stops; transit priority; serving dense urban corridors.
- City scale: - Distinctive design that provides: identity; seamless integration; easily accessible; supportive of land use plans, and walkable communities.

- 1.7 Figure 1.1 provides examples of Urban Style - City Scale LRT in Dublin and Amsterdam, showing related transit oriented development (TOD) and the integration of LRT into existing city streetscapes.

FIGURE 1.1 EXAMPLES OF URBAN STYLE - CITY SCALE LRT

Alignment - Amsterdam, Netherlands



LRT/Stop - Dublin, Ireland



Study Boundary

- 1.8 The development of the Concept Design for the Downtown LRT builds upon the earlier work undertaken to identify the LRT corridor through the downtown, as approved by City Council.
- 1.9 The route runs from a connection to the West LRT line on 104 Avenue, running south on 107 Street before turning east on 102 Avenue through the Warehouse Campus District and through Churchill Square, connecting to the Southeast line in the Quarters. Figure 1.2 provides an illustration of the approved Downtown LRT corridor.

2 Project Context

City Plans

2.1 The development and assessment of the Concept Design through the downtown has been influenced by The City of Edmonton’s strategic vision, which aims for a more compact, livable and sustainable city, where people have the opportunity to choose and use alternative transportation modes. In turn, this approach is also set out in the following City Plans:

- “The Way Ahead”, the Strategic Plan.
- “The Way We Grow”, the Municipal Development Plan (MDP).
- “The Way We Move”, the Transportation Master Plan (TMP).
- The LRT Network Plan.
- The CCDP.

The Way Ahead

2.2 The City of Edmonton’s Strategic Plan provides a framework to establish priorities and make informed decisions for the future. This plan sets a vision for Edmonton 30 years in the future. Created with input from citizens, the vision sets direction for the City by establishing a descriptive target of a vibrant, sustainable city that builds on Edmonton’s cherished assets. Recognizing the critical role that public transportation plays in the viability and success of Edmonton, the Plan serves to guide City Council’s decision making with strategic goals and progress checkpoints.

The Way We Grow

2.3 The MDP represents the City’s strategic growth and development plan. Clear direction on municipal and regional planning is critical given the anticipated population growth of over 1 million residents by 2040. The realization of many goals and objectives of the MDP will shape the city’s urban form and direct the development in conjunction with key transit node and corridor locations including LRT. This approach serves to manage growth and ultimately create a sustainable, healthy, and compact City.

The Way We Move

2.4 The TMP re-prioritized the transportation network towards transit and goods movement, providing private automobile trips with a lower priority. At the same time, the City has followed through with its policy direction to coordinate land use and transportation planning by directly linking the TMP to the MDP and vice versa. The new TMP also promotes a more compact urban form, the creation of transit-oriented development and a significant investment in public transportation.

2.5 The TMP establishes a number of strategic goals for the City’s transportation network and planning. These cover areas including:

- Transportation & land use integration.
 - Access & mobility.
 - Sustainability.
 - Health & safety.
 - Transportation mode shift.
 - Well maintained infrastructure.
 - Economic vitality.
- 2.6 The new TMP sets out how a larger, more integrated LRT network could be used to meet the City's wider objectives.

The LRT Network Plan

- 2.7 Expansion of the LRT network has a significant role to play in helping to shape future city development and supporting the City's strategic objectives.
- 2.8 New LRT stops, developed in conjunction with surrounding land use plans encouraging appropriate density, provide the catalysts for the development of more compact urban communities. The new LRT lines also provide the opportunity to incorporate urban realm improvements, integrating the routes and stop with the communities they serve. The use of surface routes and stops offer improved accessibility, help to promote greater use of transit, and increase mode share. The stops also help to generate increased local vibrancy through the pedestrian movement to and from the stops.
- 2.9 Recognising the importance of transit's role in helping to meet the City's strategic goals and the role that the existing and future development of LRT can play in this effort, the City has developed an LRT Network Plan to guide the long term expansion of the network.
- 2.10 The Plan is based on an assessment of long term population and employment growth, capacity requirements, and an evaluation of potential LRT catchments and corridors. The plan proposes a six line LRT system extending from the Downtown to the Northwest, Northeast, East, Southeast, South and West, as illustrated in Figure 2.1.

FIGURE 2.1 EDMONTON'S PROPOSED FUTURE LRT NETWORK



2.11 Key elements of this plan include:

- Serving communities only where future land use and demand warrants it.
- Street level operation of new LRT lines.
- An urban style, city scale approach to guide any future LRT development.
- Low floor LRT technology for new lines that do not connect to the existing system.

Capital City Downtown Plan

2.12 In the development of the Concept Design a critical influence has been the CCDP, which sets out the proposals for the ongoing development of the downtown area. Within this plan, the Downtown LRT is identified as one of the nine catalyst projects, as it will provide opportunities to improve access through the downtown, with the LRT stops providing opportunities to focus development and support new activity centres and existing and new communities.

2.13 The CCDP was prepared in parallel with the Downtown LRT corridor study, which provided the ideal opportunity to integrate the two studies. In turn, this ensures the LRT network is integrated into the CCDP to maximise the proposals for land use, urban realm and street use (which include pedestrian, cycling, transit and general traffic).

2.14 The CCDP also sets four key policies which help guide the development of the downtown LRT alignment, Under these policies, the development of the LRT will help support and facilitate all the objectives under the four policies:

I Sustainable:

- Healthy natural environment.
- Reduced energy and emissions and improved air quality.
- Stewardship of natural and material resources.
- Healthy communities.
- A sense of place.

I Vibrant:

- Additional downtown housing.
- Commercial, retail and educational activities.
- Diverse arts, culture and entertainment.

I Well designed:

- Well designed built and urban forms.
- Defined street framework.
- Additional connected parks and open spaces.
- Historic preservation.

I Accessibility:

- Efficient roadway system.
- Enhanced pedestrian circulation.
- Improved cycling.
- Superior transit.

3 Concept Development

Concept Design Process Overview

- 3.1 The City Transportation Department and the project team, in conjunction with stakeholders, have used a multi-stage process to review, develop, assess and identify the preferred Concept Design.
- 3.2 The approved Downtown LRT corridor formed the starting point for the study team. The development of the preferred alignment of the Concept Design was then approached in two stages. The first stage included the development of “Initial Options” for design features, such as stop location options and the location of track within the alignment. The second stage identified the most promising components of each option to form the final “Concept”. A detailed concept was developed to further identify impacts, benefits, and methods of mitigation. Each step is described in detail below.

Initial Options Development

- 3.3 Using the approved LRT corridor, the associated LRT stop locations were reviewed to ensure that they best served the City and fit with the objective set out in the “Project Context”. At each of the stop locations a number of objectives were identified to support the development of options that would meet each locations objectives.
- 3.4 The options were drawn up in conceptual form and used to produce a consultation booklet (“Concept Plan for the Downtown LRT Connector - Design Options”). The booklet was used in meetings with stakeholders in September 2010 to highlight the issues and opportunities with the differing options and to help facilitate stakeholder involvement and feedback.
- 3.5 The feedback from the stakeholder events was used in combination with the objective set out in the “Project Context” to evaluate the options against the City’s LRT assessment criteria. The top level criteria are:
 - Feasibility/constructability.
 - Land use/promoting compact urban form.
 - Movement of people and goods.
 - Natural environment (not applicable to corridor).
 - Parks, river valley, and ravine system.
 - Social environment.
- 3.6 This approach resulting in a preferred stop arrangement for each of the identified locations.

Concept Design

- 3.7 The preferred options were further refined. An additional public consultation booklet was produced focused on the single concept (“Downtown LRT Connector - Draft Concept Plan”). This document was used for the public open house session undertaken in early November 2010 to help facilitate public involvement and feedback.
- 3.8 Following the feedback received in the September and November stakeholder sessions, further adjustments were made to the design to reflect the feedback. An additional stakeholder public open house was held in April 2011 in anticipation of City Council review.
- 3.9 Following the April 2011 public review of the concept design, concerns were expressed regarding the diagonal 107 Street stop on the western edge of the downtown; and the project alignment and proposed portal through the eastern segment of the project. Council directed administration to further consult with Grant MacEwan, Norquest College, the Chinese community and communities surrounding the Quarters.
- 3.10 The project team engaged with MacEwan University and NorQuest College to reach resolution on the diagonal 107 Street stop (with associated joint development potential). Additionally, City Council directed the team to further engage with the community in the Boyle Street/China Town area in order to attempt to resolve issues around the alignment location, China Town Gate, safety, and the portal location. The team developed and implemented a series of workshops to engage with the local community; draw out their ideas on issues and opportunities; obtain assistance with appropriate designs to address their concerns. Various options and designs were examined (multiple alignments; surface and below ground). The modified designs were taken forward to the public in open house sessions in October 2011.
- 3.11 The project team ultimately recommended a modified design to address many of the concerns. Additional parking and traffic lanes were provided. The alignment was shifted to avoid property acquisition. Architectural features were incorporated to reflect the unique cultural aspects of the area. The pedestrian environment was expanded to provide appropriate mid-block crossing points. City Council again reviewed and ultimately approved the proposed concept designs, including the surface segment along 102 Avenue through the Boyle Street/China Town area and the inclusion of both the 107 Street and diagonal 107 Street stop options for continued development. Additional details on the outreach methods conducted for these design refinements are included in Section 4.
- 3.12 In parallel to the development of the public consultation booklet and materials, the development of the draft concept design continued, examining:
- Pedestrian and cycle integration.
 - Traffic assessment and identification of complimentary measures.
 - Utilities and drainage.
 - Geotechnical issues.

Downtown LRT Concept Plan

I Environmental issues including:

- Landscape.
- Historic resources.
- Noise and vibration.

I Cost estimates

- 3.13 The public consultation and the further development of the Concept Design has been used to refine the alignment design.

Stop Option Development

- 3.14 During the development of the Concept Design, a number of potential stop locations were examined for their merits. This included the 107 Street, 105/106 Street, Centre West, Churchill Square, and the Quarters.

- 3.15 The platforms for each stop will be approximately 30 to 35 centimetres high and 80 metres long, effectively the length of the block. Access for passengers is via shallow ramps from the intersections at each end of a block.

107 Street

- 3.16 The objective of this stop location in this area is to provide a direct and convenient transit service to MacEwan University, NorQuest College, the Warehouse Campus neighbourhood, and 108 Street. The stop locations that would meet these objectives are potentially more widely spaced than other stop locations being considered along the alignment, as opportunities exist at a greater number of locations on this section of the route.
- 3.17 A single stop location is proposed to serve both MacEwan University and NorQuest College. A number of stop locations have been identified and evaluated between 102 Avenue/107 Street and 104 Avenue and 109 Street. The stop location would also serve part of the Warehouse Campus district.
- 3.18 The stop options developed and evaluated were:

I 107 Street options:

- Option 1: Stop on the north side of 104 Avenue.
- Option 2: Stop located on a diagonal alignment between 108 and 107 Streets.

Following discussions with stakeholders a number of further options were developed and evaluated. “NorQuest” options were developed in consultation with NorQuest College and their consultants.

- Option 3: Stop on the east side of 107 Street between 103 and 102 Avenues.
- Option 4: Stop on 107 Street between 104 and 103 Avenues.
- NorQuest Option 1: stop on the west side of 107 Street between 103 and 102 Avenues (impacts access on west Side).

- NorQuest Option 2: stop on the west side of 107 Street between 103 and 102 Avenues (mitigated impact on access).
- NorQuest Option 3: stop on the west side of 107 Street between 103 and 102 Avenues (102 Avenue alignment on south side of street).

105/106 Street

3.19 The objective for this stop location is to provide a stop as far west as possible on 102 Avenue to provide walking links through to Jasper Avenue and Corona Station prior to the potential future wider downtown LRT circulator. The stop would also provide local walk links within the Warehouse Campus District and walking links to the Provincial Government building to the southwest.

3.20 The stop options developed and evaluated were:

I 105/106 Street options:

- Option 1: Stop between 105 and 106 Street retains two traffic lanes.
- Option 2: Stop between 105 and 106 Street retains single eastbound traffic lane.
- Option 3: Stop between 105 and 106 Street closes a section of 102 Avenue to all traffic.

Centre West

3.21 The objective for this stop location is to provide connectivity to the commercial core within the downtown, walking links through to Jasper Avenue, interchange with transit on 101 Street and future connectivity to the potential arena development.

3.22 The stop location is proposed between 101 and 103 Streets on 102 Avenue. The location will provide connectivity and accessibility to the core business district, Downtown shopping and amenities, Pedway and potential future arena.

3.23 The stop options developed and evaluated were:

I Centre West options:

- Option 1: Stop between 102 and 101 Street, retains two traffic lanes.
- Option 2: Stop between 102 and 101 Street, closes a section of 102 Avenue to all traffic.
- Option 2a: Stop between 102 and 101 Street, single traffic lane.
- Option 3: Stop between 103 and 102 Streets, closes a section of 102 Avenue to all traffic.
- Option 3a: Stop between 103 and 102 Streets, single traffic lane.

Churchill Square

3.24 The objective for this stop location is to provide connectivity to the arts and entertainment district within the downtown, interchange with the existing LRT line, walking links through to Jasper Avenue and the river valley, interchange with transit on 100 Street, and connectivity to the municipal government.

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3.25 The stop location is proposed to be between 99 and 100 Street on 102 Avenue. The stop will provide connectivity to both the west and east side of Churchill Square, and provides the opportunity to integrate the stop platform with the existing sidewalks and surfacing. The location will provide the connectivity between the existing LRT system and the new lines. A new dedicated accessible entrance at the southeast corner of Churchill Square would provide a direct connection between the two LRT systems, and a further connection to the existing Pedway.

3.26 The stop options developed and evaluated were:

■ Churchill Square options:

- Option 1: Stop between 100 and 99 Streets, retains two traffic lanes.
- Option 2: Stop between 100 and 99 Streets, with single eastbound lane.
- Option 3: Stop between 100 and 99 Streets, closes a section of 102 Avenue to all traffic.

Quarters

3.27 The objective of this stop location is to serve the Quarters area and provide an easternmost stop in the downtown before the LRT descends into a short tunnel to turn south to connect to the Southeast LRT line.

3.28 The proposed stop location is just west of 96 Street on 102 Avenue. The stop would be sited on a long block, with one end of the stop adjacent to 96 Street, which will become the focal street through the Quarters area. The identified location provides a stop as far east as practicable and will best serve the heart of the Quarters area. The location also provides walking connectivity to the river valley.

3.29 The stop options developed and evaluated were:

■ The Quarters options:

- Option 1: Stop between 97 and 96 Streets on 102 Ave, with single eastbound access lane. Westbound traffic between 95 and 96 Street.
- Option 2: Stop Between 97 and 96 Street on 102 Ave, with single eastbound access lane . East and Westbound traffic between 95 and 96 Street.

3.30 Following further consultation with the Chinese community and surrounding communities the following additional options were developed:

- Option 3: Stop between 97 and 96 Street on 102 Ave, with single westbound access lane 95 Street to 97 Street.
- Option 4: Stop underground, 102 Avenue.
- Option 5: Stop between 97 and 96 Street on 102A Ave, with single westbound access lane 95 Street to 97 Street.
- Option 6: Stop underground, 102A Avenue.

Evaluation

- 3.31 The options were evaluated against the City’s LRT assessment criteria taking note that within the downtown, the primary role of the LRT is somewhat different from the radial LRT corridors which feed it. The Downtown LRT will provide access to major destinations within the downtown, serve the increasing residential catchment area, and provide a link to the existing transit network. The evaluation of the Concept Design has taken account of the LRT route being one of the nine catalyst projects included within the CCDP. Development of the Downtown LRT supports the associated policies under the CCDP’s four key themes (Sustainable, Vibrant, Well Designed and Accessible).
- 3.32 In addition, the development of the Downtown LRT is based on the design vision and associated design criteria set out in the LRT System Design Report (Steer Davies Gleave, May 2010). That report described the urban style - city scale LRT system being developed in Edmonton, with recommendations and examples related to stop design, alignment design, and operational principles, all aimed at improving user accessibility and convenience.
- 3.33 The evaluation of the options therefore focused on the following assessment criteria:
 - Feasibility / Constructability
 - LRT Alignment
 - Landuse / Promoting Compact Urban Form
 - Catchment
 - Land Use Integration
 - Urban Design
 - Movement of Goods and People
 - Transportation Network Integration
 - Natural Environment
 - Not Applicable along the Corridor
 - Parks, River Valley and Ravine System
 - Urban Design
 - Social Environment
 - Property impacts.
 - Urban form.

Final Stop Options

- 3.34 Based upon the technical evaluation and stakeholder consultation the recommended concept alignment was identified as best meeting the assessment/evaluation criteria and the objectives of the city’s plans, particularly the CCDP. Table 3.1 below details

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the recommended stop designs and provides key information regarding the selection of each.

TABLE 3.1 FINAL STOP OPTIONS

107 Street	105/106 Street	Centre West	Churchill Square	Quarters
<p>Option 2: Diagonal alignment with stop between 108 to 107 Street</p> <p>Option 4 on 107 Street between 104 and 103 Avenues</p>	<p>Option 2: Stop between 105 & 106 street with a single eastbound traffic lane</p>	<p>Option 2 (amended): Stop between 102 and 101 Street, with a single eastbound traffic lane</p>	<p>Option 2: Stop between 100 and 99 Streets, with single eastbound lane.</p>	<p>Option 3: Stop between 97 and 96 Street on 102 Ave, with single westbound access lane.</p>
<p>Rated highest due to its high pedestrian and bicycle access, linkages to nearby activity centers including the two campuses, urban design integration, TOD potential and consistency with the CCDP, and operational flexibility.</p> <p>*While Option 2 was the preferred option recommended to City Council. Council also maintained Option 4: 107 Street. This is the alternate option if funding is not secured for the joint development associated with the Diagonal stop in Option 2.</p>	<p>Provides the optimum LRT and cycle arrangement while retaining local traffic access eastbound. The arrangement provides the highest level of local walking and cycle accessibility.</p> <p>The arrangement is supportive of the CCDP policies related to Sustainable, Vibrant, Well Designed, and Accessibility.</p>	<p>Rated higher than the other options due its proximity to transit connections on 101 Street and its connectivity within the heart of the downtown core (shopping, offices and leisure).</p> <p>The option reduces the traffic impacts on vehicle egress from 102 Street by providing an eastbound traffic lane through to 101 Street and a westbound traffic lane and dedicated right turn lane through to 103 Street.</p> <p>The option would be supportive of the CCDP policies to create a Sustainable, vibrant, Well-Designed and Accessible Downtown.</p>	<p>Provides a quality arrangement for the LRT at what is the heart of the City. The arrangement would provide greater platform space and the highest level of accessibility and integration with Churchill Square and the associated precinct. Stop platforms would be integrated with the sidewalks providing an opportunity to reinforce the sense of place, to enhance and complement the square and support all year round street vibrancy. This approach would support the CCDP.</p>	<p>This stop provides the best connectivity to the existing and future development within the area. The location was developed in conjunction with the Quarters planning process and best represents the ultimate development goals of the Quarters plan. Multiple adjustments to the original design were completed to provide parking, address safety concerns, provide urban realm improvements, and avoid property impacts.</p>

3.35 Additional details of the stop analysis is provided in Appendix I.

4 Stakeholder Involvement

Stakeholder Involvement

- 4.1 Integral to the Concept Design was stakeholder involvement. From the beginning of the concept design process, the team implemented a stakeholder strategy to both educate and engage public stakeholders at key milestones where they could influence the design process. The team began with the development of a City of Edmonton Public Involvement Plan (PIP). The PIP document set out the formal strategy for engagement and the specific involvement techniques to be used. To develop and finalize the PIP, the team reached out to various stakeholder groups to review the PIP and provide concurrence and feedback through profiling interviews. This included direct interviews to review the PIP document with the Downtown Building Owners and Managers Association, the Citadel Theatre, the Downtown Community League, MacEwan University, and several other groups representing multiple stakeholders. The critical goals of the stakeholder involvement process focused on:
- Educating stakeholders regarding the concept design phase and the vision for urban-style LRT through downtown Edmonton.
 - Identifying specific issues and opportunities of the local stakeholders.
 - Working to address stakeholder issues through design (where possible).
- 4.2 Outreach to stakeholders included two primary components. The first component included focused discussions with key stakeholder organizations such as major downtown employers, the Downtown Community League, and major civic attractions. The second component included broad outreach to public stakeholders. To provide clear and concise information on the project, process, and options, a workbook of the concept plan options was produced and used to support the stakeholder consultation sessions. The general timeline for major outreach activities are detailed in Table 4.1.

TABLE 4.1 OUTREACH TIMELINE

Timeline	Activity
September 2010	Questionnaires, interviews, & scoping of issues/opportunities.
November 2010	Public open house & input.
December 2010	Public review by Transportation & Infrastructure Committee.
March 2011	Additional scoping of issues/opportunities regarding draft concept.
May 2011	Public review by Transportation & Infrastructure Committee.
April 2011	Public open house & input on draft concept.
May 2011	Public review by Transportation & Infrastructure Committee.

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June 2011	Public review by City Council.
July/August 2011	Community workshops focused on Boyle Street/Chinese communities.
October 2011	Public open house & input on revised concept design.
November/January 2011	Public review by Transportation Infrastructure Committee.
January 2012	Public review & concept design approval by City Council.

4.3 Multiple opportunities for public outreach and input were provided throughout the project. Public open house served as a critical opportunity for stakeholders to learn about the project, the schedule, and areas for direct input. Over the course of the project public open houses were held in November 2010, April 2011, and October 2011. The input received in each session continued to shape the Concept Designs as they were revised and re-released for consultation. Individual stakeholder sessions were also conducted based on requests.

4.4 Table 4.2 below details the formal consultation sessions conducted over the course of the project. Many other informal contacts and meetings were also conducted with individual stakeholders that requested information, clarification, or input.

TABLE 4.2 FORMAL STAKEHOLDER MEETINGS

	Group	Date
1	City Council Meeting (Approves Downtown Corridor)	21 June 2010
2	Downtown Business Association	16 August 2010
3	Downtown LRT Breakfast meeting	02 September 2010
4	Winspear Theatre	02 September 2010
5	Katz Group	02 September 2010
6	Canada Place	02 September 2010
7	Edmonton Public Library	02 September 2010
8	Citadel Theatre	02 September 2010
9	Open House	02 November 2010
10	Manulife Place	03 September 2010
11	Don Wheaton Family YMCA	03 September 2010
12	MacEwan University	03 September 2010
13	NorQuest College	03 September 2010
14	City Centre Mall	03 September 2010

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15	BOMA	23 September 2010
16	NorQuest College	23 September 2010
17	Alberta Health Services	27 September 2010
18	Fire and Rescue	28 September 2010
19	Quarters Project Team	04 October 2010
20	NorQuest College	07 October 2010
21	Downtown Community League	07 October 2010
22	NorQuest college	14 October 2010
23	104 Street Market Board of Directors	25 October 2101
24	Open House	02 November 2010
25	Chinese Benevolent Association	07 December 2010
26	Transportation Infrastructure Committee	08 December 2010
27	Trails Paths and Routes Advisory Committe	21 march 2011
28	Don Wheaton Family YMCA	24 March 2011
29	NorQuest College	23 March 2011
30	MacEwan University	24 March 2011
31	Katz Group	24 March 2011
32	Downtown Business Association	25 March 2011
33	Winspear Theatre	25 March 2011
34	Chinese Community, Boyle Street and Riverdale Communities	04 April 2011
35	Citadel Theatre	08 April 2011
36	Edmonton Public Library	11 April 2011
37	BOMA	19 April 2011
38	Alberta Health	19 April 2011
39	Edmonton Civic Events	21 April 2011
40	Open House	28 April 2011
41	Transportation Infrastructure Committee	25 May 2011
42	City Council	01 June 2011
43	Boyle Street/Chinese Community Workshop	24 July 2011

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44	Boyle Street/Chinese Community Workshop	21 August 2011
45	Open House / Boyle Street/Chinese Community	05 October 2011
46	Transportation Infrastructure Committee	15 November 2011
47	Transportation Infrastructure Committee	18 January 2012
48	City Council	31 January 2012

- 4.5 Over the course of the outreach activities various comments and common themes were identified. Both positive and negative comments were captured. To the extent possible, the team worked with stakeholders to incorporate their comments into the overall concept design. Several of the key themes identified throughout the project process are detailed in Table 4.3.

TABLE 4.3 PRIMARY CONSULTATION THEMES

Consultation Theme	Project Consideration
LRT is a benefit - Downtown should be a focal point.	Design focused on major points of activity and interchange with Downtown Edmonton including Churchill Square, major shopping districts, and areas of future growth (the Quarters, Warehouse District, etc).
Desire for transit and pedestrian focused environment vs. preserving vehicle access.	Design enforces strong pedestrian environment and access to stops. Surface running LRT with visible and easily accessible stops increases potential ridership. The strong grid network in Downtown Edmonton supports alternative traffic routes away from the LRT corridor.
Safety and security - enhance at LRT stops and in adjacent areas.	Security is enhanced by the surface running LRT that is highly visible. Design features are incorporated to provide visual cues to riders and pedestrians of the track and trains. Design of stops includes safe and comfortable spaces for all weather environments.
Concerns with portal location in the Quarters.	Significant design changes were incorporated along the eastern segment of the project in the Quarters area. Parking, traffic lanes, wider sidewalks, and minimization of property impacts were all addressed. Additional information on the specific outreach for this segment of the design alignment is provided in the sections below.
Access & circulation concerns.	Traffic analysis of the entire downtown area was completed. The analysis demonstrated acceptable levels of impact. Traffic impacts and access points were mitigated from the original concept. Additional traffic lanes, parking areas, and access points were maintained along the alignment.
Architectural features.	Throughout the design, consideration was given to the

	<p>architecture of the stops and look/feel of the LRT. The design incorporates simple stop infrastructure to fit within the various urban areas of downtown. Additional architectural features unique to the Boyle Street/China Town area were committed to by City Council. Consultation on these design features for the portal and stops within this unique part of downtown will continue into Preliminary Engineering.</p>
<p>Desire to address public concerns through the design process.</p>	<p>The overall outreach process was aimed at providing ongoing input from stakeholders. Input (on appropriate design features) will continue into the Preliminary Engineering phase of the project.</p>

- 4.6 Following the initial public review of the concept designs, concerns were expressed regarding the diagonal 107 Street stop on the western edge of the downtown; and the project alignment and proposed portal through the eastern segment of the project.
- 4.7 The diagonal 107 Street stop involved two major stakeholders MacEwan University and NorQuest College. Both campuses have extensive growth plans and desired stops that best served their two institutions. However, the stop spacing and ridership analysis demonstrated a single stop appropriately placed to serve both was the best solution. Through a series of individual meetings, the two institutions came together to identify a diagonal stop between the two campuses, where a joint development could potentially be located. The City’s Sustainable Development group ultimately supported this plan, with the understanding that if such a joint development did not advance, the alternative stop concept along 107 Street would be developed. It was noted that any development in the area would need to be developed in such a way to maximize activity along the street; accommodate the significant educational ridership; and provide a safe environment. With this agreement, the diagonal stop was represented in the Concept Design. However, the stop on 107 Street was maintained as an option, should the two institutions fail to identify funding for the diagonal stop development.
- 4.8 Through the Boyle Street/China Town area, the LRT follows 102 Avenue through the China Town Gate (at 97 Street), with a stop on 102 Avenue (between 97 and 98 Streets), before lowering into a portal before 95 Street. Members of the local community expressed their concerns regarding safety (especially for senior residences), impacts to property, loss of parking, impacts to businesses, and pedestrian impacts. A major concern for the community centred around the LRT passing through the China Town Gate and through the local Chinese community. The China Town Gate was a gift from Edmonton’s Sister City, Harbin in north-eastern China. There was concern the LRT would cause structural damage to the gate and divide the overall community. Several local community members expressed their fear that they had not been engaged in the earlier discussions on the corridor planning and proposed the alignment be moved from 102 Avenue to 102A Avenue. It was believed that 102A Avenue would result in fewer impacts to the local area.

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4.9 Given these concerns, City Council directed the project team to engage with the community in the Boyle Street/China Town area in order to attempt to resolve these issues. The team developed and implemented a series of workshops to engage with the local community in the Boyle Street/China Town area. Two interactive workshops were held to learn about the proposed LRT, to express specific issues/opportunities from the local perspective; and to provide input on the design. The first workshop began with a walking tour of the area to allow local residents to identify key landmarks and areas of importance. This workshop also provided a forum for those in attendance to express the following themes:

- Importance of the China Gate’s historic and cultural significance.
- Critical community and cultural identification of 102 Avenue area.
- Importance of 102 Avenue carrying many pedestrians, buses, & traffic.
- Less activity and multiple vacant lots along 102A Avenue.
- Underground LRT option mitigates potential negative impacts.
- Benefits of more development and activity to draw new people.
- Critical importance of emergency access.
- Importance of vehicular access and parking.
- Importance of the pedestrian realm and mid-block crossings (seniors & local businesses).

4.10 The subsequent workshop included an opportunity for participants to understand the benefits, constraints, and impacts of various LRT designs through the area. Individuals worked out specific designs while considering the overall impacts and benefits. These designs include options on 102 Avenue and 102A Avenue, both on the surface and below ground. The group generally supported an underground option on 102A Avenue.

4.11 Additional design work was completed on all the options developed by the stakeholder teams in Workshop #2. The design work further modified the original concept to address many of the concerns. Additional parking and traffic lanes were provided. The alignment was shifted to avoid major property acquisition. Architectural features were incorporated to reflect the unique cultural aspects of the area. The pedestrian environment was expanded to provide appropriate mid-block crossing points. These designs were further analysed based on the City Council approved criteria for corridor selection. However, the analysis continued to support the surface LRT on 102 Avenue as the preferred option.

4.12 The Transportation and Infrastructure Committee, a sub-committee of City Council, reviewed the results and the proposed concept design. They requested that the project team continue to examine an alternative alignment along 103 Avenue. An additional alignment was designed for 103 Avenue and the team further examined the issues and opportunities of moving the alignment north. The 103 Avenue and 102A Avenue alignments were previously examined in the earlier corridor study analysis. However, these designs were refined and examined again to determine if they were feasible, beneficial, and/or less impactful. The project team analysed the refined corridors against the City Council approved criteria for corridor selection and determined the surface 102 Avenue design to be the most beneficial.

- 4.13 With this information, City Council again reviewed and ultimately approved the proposed concept designs, including the surface segment along 102 Avenue through the Boyle Street/China Town area. With this approval, the concept design moves into the next project phase, the Preliminary Engineering. A plan for appropriate outreach throughout the Preliminary Engineering phase has been presented.

5 Recommended Concept Design

Overview

5.1 The review, development and assessment of the potential Downtown LRT Corridor design options, and the consultation undertaken with stakeholders identified the recommended Concept Plan detailed below that would best meet both the objectives for the future LRT and be the most supportive of the CCDP, as well as the wider City objectives. The Downtown LRT Concept Plan Workbook is the companion design documents to this report. The Workbook contains all of the concept engineering designs relevant to the project. Additionally, a simplified drawing of the Downtown LRT Concept Design is included in Appendix J of this document.

5.2 In summary the Downtown LRT route's prime functions are:

- To serve the downtown itself and to connect the proposed West and Southeast LRT routes;
- To make provision for a Central Area Circulator LRT (for future assessment) providing LRT links to the University and Strathcona area; and,
- To reflect and advance the wider City and downtown objectives, including support for development, reducing auto dependency and use, and making Edmonton a more liveable city.

LRT Design Parameters

5.3 The concept design is based upon the design parameters contained within the Appendix A.

Recommended Concept Plan

Alignment

5.4 The recommended alignment of the Downtown LRT starts at the connection to the West LRT line in the centre of 104 Avenue at its intersection with 109 Street. For one block to 108 Street, the alignment continues in the centre of 104 Avenue. In this vicinity, two alignment and stop options are to be taken forward to the PE design.

- Option 1 - 107 Street stop (default).
- Option 2 - diagonal 107 Street stop (option to be developed in conjunction with possible educational facility redevelopment).

107 Street Stop

5.5 The alignment would continue in the centre of 104 Avenue east to the 107 Street intersection. The route then turns south to run on the western side of 107 Street.

5.6 The 107 Street stop shown in Figure 5.1, is located midblock, to the south of the 103 Avenue intersection a scissors crossover could be located to aid LRT operability and to allow this stop to act as the terminus for the system.

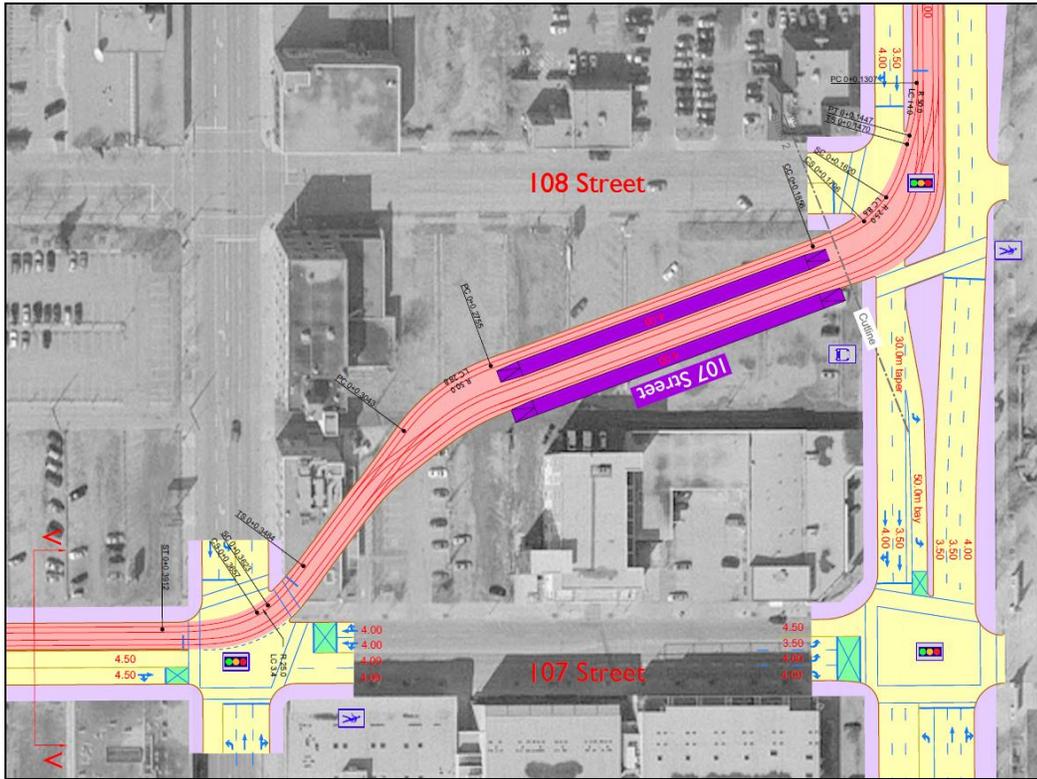
FIGURE 5.1 107 STREET STOP



Diagonal 107 Street Stop

- 5.7 The alignment would turn south crossing into the northeast corner of 108 Street, and the city block to the southeast of the intersection.
- 5.8 The alignment crosses through the whole city block on an angle (NW to SE) through to the intersection of 103 Avenue and 107 Street. The diagonal 107 Street stop shown in Figure 5.2, is sited within the city block, with a three-track arrangement serving two platforms.
- 5.9 The three-track arrangement will provide operational flexibility, allow the service frequency through the downtown to be regulated, providing space for trains to be turned back in the event of any disruption and enabling an extra vehicle to be stored close to the heart of the downtown (to provide extra capacity to cater for events within the downtown). The arrangement would also allow the LRT to be terminated at this location for an initial phase of development.

FIGURE 5.2 DIAGONAL 107 STREET STOP



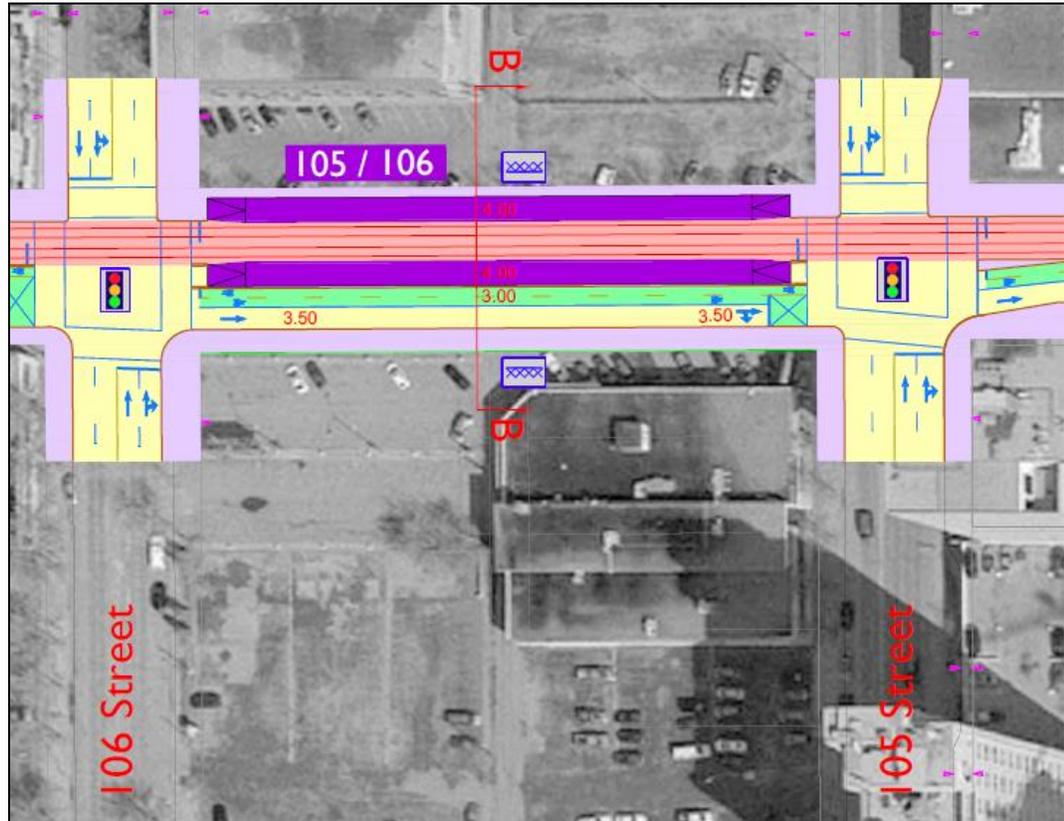
Alignment Continued

- 5.10 The alignment turns from the stop to run on the west side of 107 Street through to the intersection with 102 Avenue. Provision for the Central Area Circulator LRT is provided at this intersection with tail track extending south. The LRT alignment turns east running on the north side of the 102 Avenue. A single traffic lane eastbound is retained through to 106 Street.

105/106 Street Stop

- 5.11 The 105/106 Street stop shown in Figure 5.3, is sited on the north side of 102 Avenue between 106 and 105 Street with side platforms and with the westbound platform integrated with the sidewalk. Dedicated cycle lanes are provided in both directions along with an eastbound traffic lane. Improved sidewalks would be provided on 106 and 105 Streets between 103 Avenue and Jasper to offer enhanced pedestrian routes.

FIGURE 5.3 105/106 STREET STOP



Alignment Continued

- 5.12 The LRT alignment continues on the north side of 102 Avenue with a single traffic lane provided eastbound through to 102 Street. The design includes urban realm improvements such as sidewalks and dedicated two-way cycle lanes.

Centre West Stop

- 5.13 The Centre West stop Shown in Figure 5.4, is sited on the north side of 102 Avenue between 102 and 101 Street with side platforms, with the westbound platform integrated with the sidewalk. Dedicated cycle lanes are provided in both directions along with an eastbound traffic lane, to help facilitate vehicle egress from 102 Street.

FIGURE 5.4 CENTRE WEST STOP



Alignment Continued

- 5.14 The LRT alignment continues on the north side of 102 Avenue with a single traffic lane provided in both directions between 101 and 100 Street. The design includes urban realm improvements such as sidewalks and dedicated two-way cycle lanes.

Churchill Square Stop

- 5.15 The Churchill stop shown in Figure 5.5, would be integrated with the north side of Churchill Square. A dedicated cycle lane would be provided in each direction. A new connection to the existing LRT would be or provided at the southeast corner of Churchill Square to ensure that there is a high quality, direct connection between the two LRT systems.

FIGURE 5.5 CHURCHILL SQUARE STOP



Alignment Continued

- 5.16 The LRT alignment then continues on the north side of 102 Avenue with a single traffic lane provided in an eastbound direction. The two-way dedicated cycle lanes turns north onto 99 Street to then turn east onto 102A Avenue (as previously planned by the CCDP).
- 5.17 The alignment continues across 97 Street crossing from the north side of 102 Avenue to the south side before it continues under the China Town Gate through to the Quarters stop, a single westbound access lane would be provided with on-street parking.

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Quarters Stop

- 5.18 The Quarters stop shown in Figure 5.6, would be sited to the west of 96 Street with side platforms, the eastbound platform integrated with the sidewalk.

FIGURE 5.6 QUARTERS STOP



Alignment Continued

- 5.19 The route crosses 96 Street before descending into a tunnel portal to connect to the southeast LRT. Prior to the portal crossing, mid-block pedestrian crossings have been included to accommodate regular walking patterns in the neighbourhood. Additionally, the subsequent PE phase of design will include input from stakeholders regarding the unique design elements (focused on the area's Chinese heritage) for the stops, aesthetic elements, and portal design.

End of Downtown LRT Alignment

- 5.20 The Downtown LRT Concept Design ends at the portal entrance. The previously approved Southeast LRT Concept Design addressed the tunnel and alignment design continuing south.

6 LRT Engineering

6.1 This section provides technical information on the evaluation work undertaken in support of the proposed concept design; the individual design elements; the impacts; cost estimates; and the design assumptions used. The Downtown LRT Concept Plan Workbook is the companion design document to this report. The Workbook contains all of the concept engineering designs relevant to the project. Additionally, a simplified drawing of the Downtown LRT Concept Design is included in Appendix J of this document. Many of the topics discussed in this section are supported by additional technical memorandums. References to relevant technical documents are provided throughout this section with associated appendix numbers.

LRT Operations

Overview

6.2 The low floor LRT vehicles will be driver operated using line of sight operation. Where ever possible a segregated alignment within existing road right-of-way (ROW) has been provided. The style of driver operation being similar to that of bus operation with the driver, the driver operating the vehicle defensively based on the road conditions ahead. The vehicles will operate at grade crossing through intersections using revised intersection signalling with dedicated LRT signals. An automatic vehicle location system will be used to support the control/operation of the system and to provide real time passenger information at stops.

Operating Principles

6.3 The principle for the operation of the proposed low floor urban style LRT routes are:

- Maximise the proportion of segregated alignment.
- Use of line of sight operation on street.
- Provide fully segregated track within the road ROW.
- Use of dedicated LRT signalling aspects at intersections.
- In enclosed alignments (tunnels, cuttings) where the horizontal or vertical curvature limits sighting distances, speed restrictions are used to ensure safe line of sight operation would be indicated or a form of local LRT signalling installed to indicate the route is clear.
- Bi-directional running over other than a short clearly visible section will be controlled by the use of an LRT signalling system to indicate the route is clear and to detect and visually indicate two vehicles on a single line section.
- Speed limits:
 - The maximum speed of a LRT vehicle within a roadway is limited to the road speed limit.

- The maximum speed on a segregated alignment is limited by the clear sighting distance and the normal braking limits for the LRT vehicle.
- The maximum speed is 80 kph.

Vehicle Operation

- 6.4 The vehicles (either single or coupled vehicles) will be driver operated using line of sight operation. Operating rules and training will be developed to ensure the vehicles are driven in a confident but defensive manner, ensuring drivers are aware of pedestrians and other road users. When approaching pedestrian crossing or signalled intersections reducing speed to ensure the vehicle can stop if it is not given priority over the other movements.
- 6.5 The operation will be supported by a central control and vehicle timetabling system using an automatic vehicle location system. The system monitors vehicle positions (usually based upon GPS) and the vehicles odometer reporting this to the central system via a data radio channel. The system responds in real time to the source vehicle and adjacent services to show if vehicle are ahead of, or behind schedule. The schedule status is then used to prioritise each vehicles demand at road intersections. Vehicle running on time or behind schedule being afforded the highest level of priority and the vehicles running ahead of schedule less priority.

Intersection Priority

- 6.6 The signalling through Intersection for low floor LRT vehicle would be controlled by the local traffic signal intersection controller with the light rail system or vehicles placing a demand for the signalled movement as required. The highest level of priority should be afforded to the LRT wherever this is achievable. The priority being adjusted depending on each vehicles performance to timetable, road conditions and time of day.
- 6.7 All the conflicting traffic movements will be controlled and set to 'red'.
- 6.8 Operationally the low floor LRT vehicles would approach the junction at caution being prepared to stop if the proceed signal is not given. The LRT vehicle speed limit approaching the intersection would be related to the road speeds of the roads and the level of visibility that the driver has of the intersection and the associated road traffic stop lines.
- 6.9 The LRT vehicle operator should ensure the traffic has stopped at the intersection stop lines or if this cannot be seen, cross the junction at an appropriate speed. On the front of the vehicle clearing the junction (including footways or crosswalks) the vehicle should accelerate to the following sections line speed to ensure the vehicle clears the intersection as quickly as possible.

Transportation Network

Overview

- 6.10 The City of Edmonton has a well-developed roadway network, largely contained within the urban core of the City. As with all developing cities ongoing development of the

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roadway network to support continual growth in general traffic and in particular the private car is becoming more difficult as roadway improvements would significantly impact on the existing urban environment and the surrounding communities.

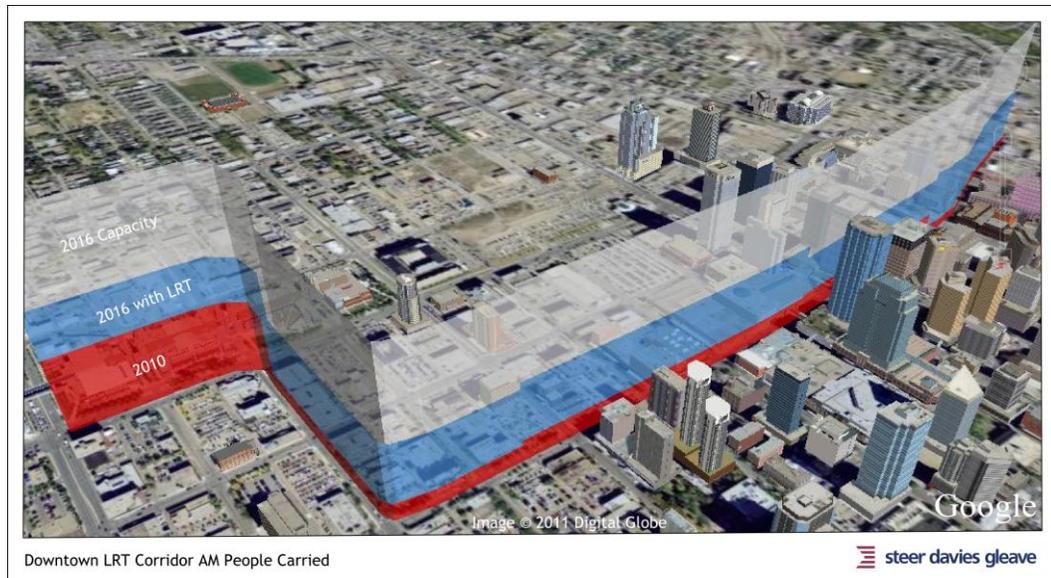
- 6.11 To ensure the City is able to continue to develop and prosper, maximising the use of the transportation network is becoming increasingly more important. The City of Edmonton’s Transport Master Plan sets out the City’s goal to develop a more multimodal transportation network that provides people of Edmonton with greater choice, consisting of walking, cycling, transit, goods and the supports the use of the private car.
- 6.12 The development of the options and the concept plans for the future low floor LRT have therefore been advanced in support of the City’s plans. The development of the LRT being focused within existing transportation corridors, as this provides opportunities to significantly increase the people carrying capacity.
- 6.13 In developing and evaluating the options the impacts to other roadway users has been considered and where necessary measures included mitigating identified impacts.
- 6.14 Within the downtown the proposed LRT route exemplifies these objectives. The route is proposed to run on 107 Street and 102 Avenues, which are currently more lightly trafficked routes within the City, used mainly within the morning and evening peak periods. The route minimises the traffic impact to the adjacent primary traffic streets whilst providing the highest level of connectivity for passengers to the developing areas and existing core of the City.
- 6.15 The people carry capacity of the corridor with and without LRT demonstrates the ability to significantly increase the use of the corridor. The 102 Avenue corridor today (2010) at its busiest location carries approximately 1,800 people in the AM peak hour, the addition of LRT increases this to approximately 5,500, with an ultimate capacity of over 11,500 people. Table 6.1 details the maximum number of people using the Downtown LRT corridor between each stop location.

TABLE 6.1 MAXIMUM PEOPLE CARRIED BETWEEN STOP LOCATIONS

	112 street to 108 Street	108 Street to 106 Street	106 Street to Centre West	Centre West to Churchill	Churchill to Quarters
2010 (Vehicles)	5,205	1,170	1,613	1,800	825
2016 (LRT & vehicles)	8,225	4,930	5,505	4,660	5,180
2016 & beyond Capacity	13,995	11,070	11,595	10,860	11,070

- 6.16 The number of people carried on the proposed Downtown LRT corridor is shown visually in Figure 6.1 below.

FIGURE 6.1 DOWNTOWN LRT CORRIDOR CARRYING CAPACITY



- 6.17 The red line showing the level of people using the corridor in the AM peak in 2010. The blue line shows the significant increase (doubling the people carried) by both cars and the LRT within the corridor in 2016. The white bar shows the potential car and LRT people carrying capacity in the future.

Traffic Impacts

- 6.18 The development of LRT within road ROW, along the approved corridors has necessitated the reallocation of some of the existing roadway space away from general traffic to the LRT. However this is not necessarily to the detriment of the network as demonstrated above the overall network people moving capacity will increase.
- 6.19 The arrangement of the LRT within the corridor has resulted in the following changes to the roadway network within the downtown:
- Reduction of one lane in each direction on 104 Avenue.
 - 107 Street between 103 and 102 Avenues reduced to a single traffic lanes in each direction.
 - 102 Avenue between 107 and 97 Street reduced to a single eastbound traffic lane.
 - 102 Avenue between 97 and 95 street reduced to a single westbound traffic lane.
- 6.20 On street parking along the corridor has been retained where possible.
- 6.21 The resulting traffic impacts within the downtown have been assessed using the 2010 count data and the associated Synchro model and the regional EMME model data for 2016 extrapolated into a Synchro model.

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- 6.22 The model result highlighted the minor changes within the downtown network, the 2010 model data showing increased impact to the level of service at a number of the downtown intersections over the modelled future 2016 year results. The difference being that the 2010 model results do not take into account the benefit of the LRT and the resulting mode shift from auto to transit.
- 6.23 The results do show that traffic is able to be adequately accommodated on the remaining parallel corridors. It is also proposed that the existing length of 103 Avenue between 99 Street and 103 Street be converted to two way operation to help mitigate the possible traffic impacts of LRT and aid traffic circulation within the downtown.
- 6.24 It is also proposed that 102A avenue be converted to two way operation to aid local circulation in the Quarters area.
- 6.25 The changes in the level of service assessment levels within the downtown for 2010 are shown in Figures 6.2 to 6.5 below.

FIGURE 6.2 2010 AM BASE - WITHOUT LRT

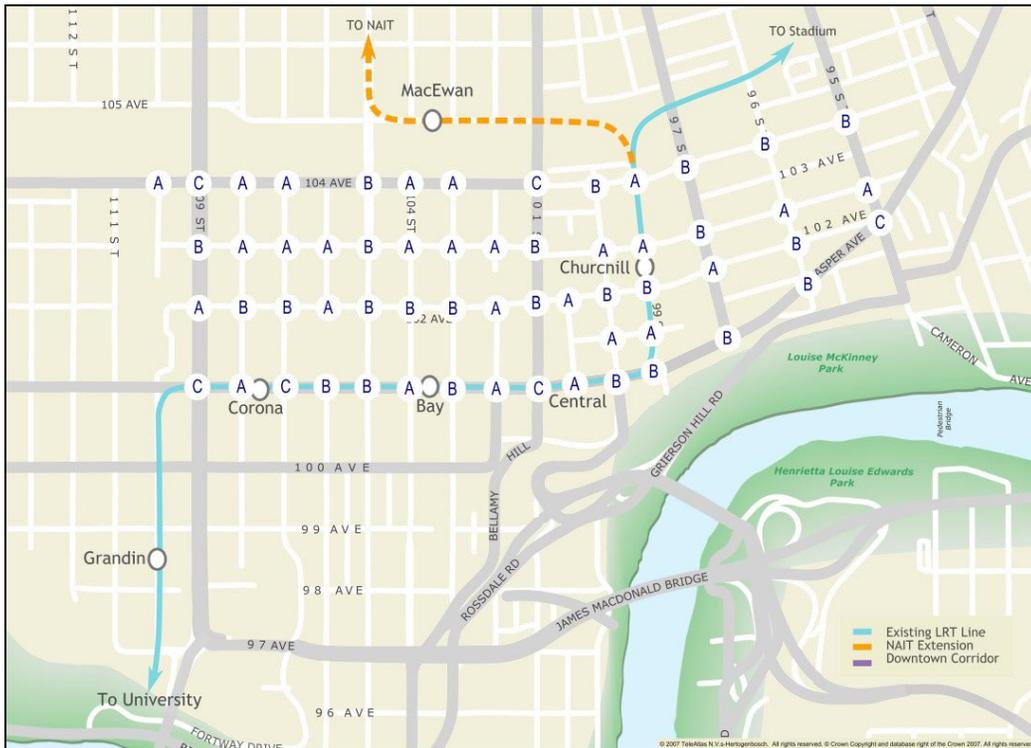


FIGURE 6.3 2010 AM WITH LRT

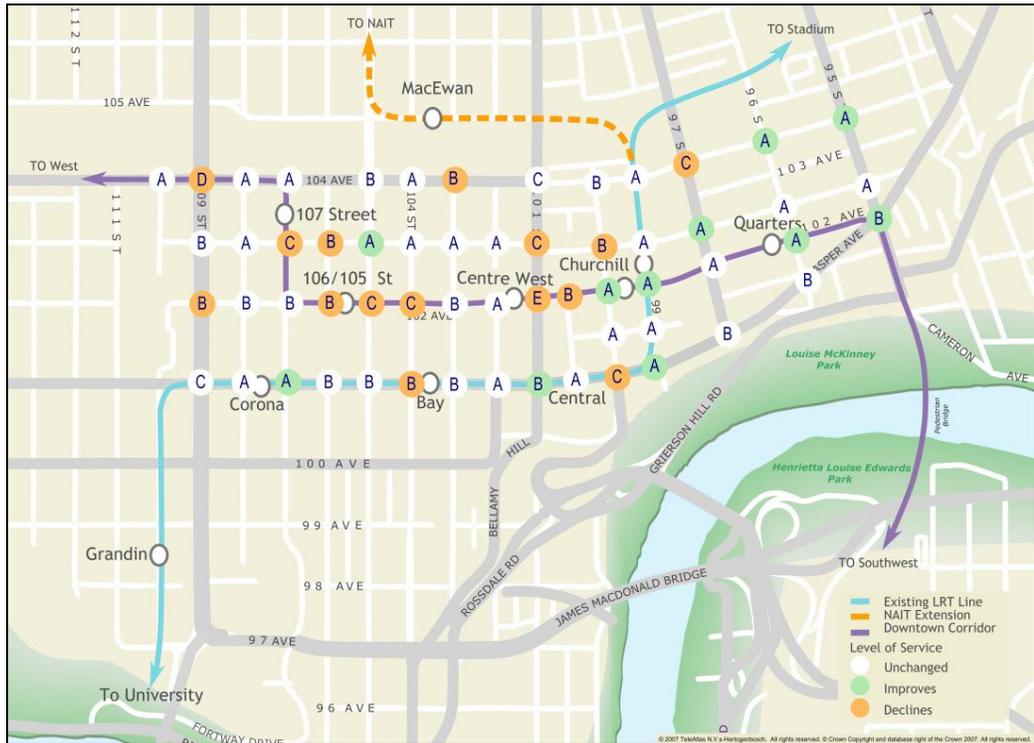


FIGURE 6.4 2010 PM BASE - WITHOUT LRT

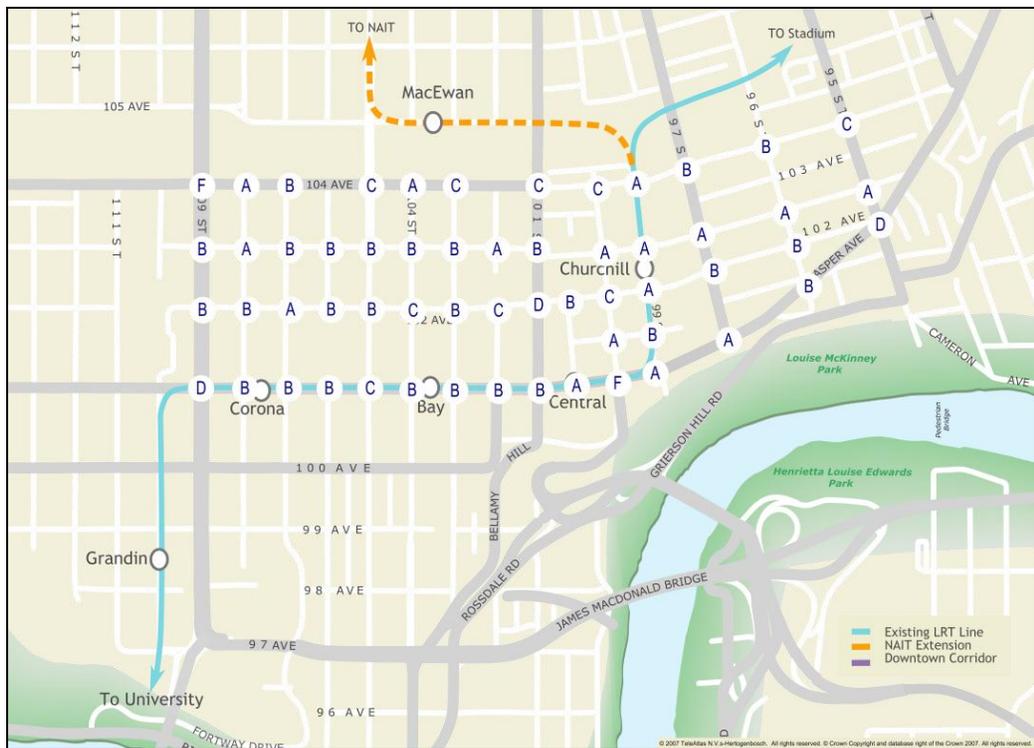
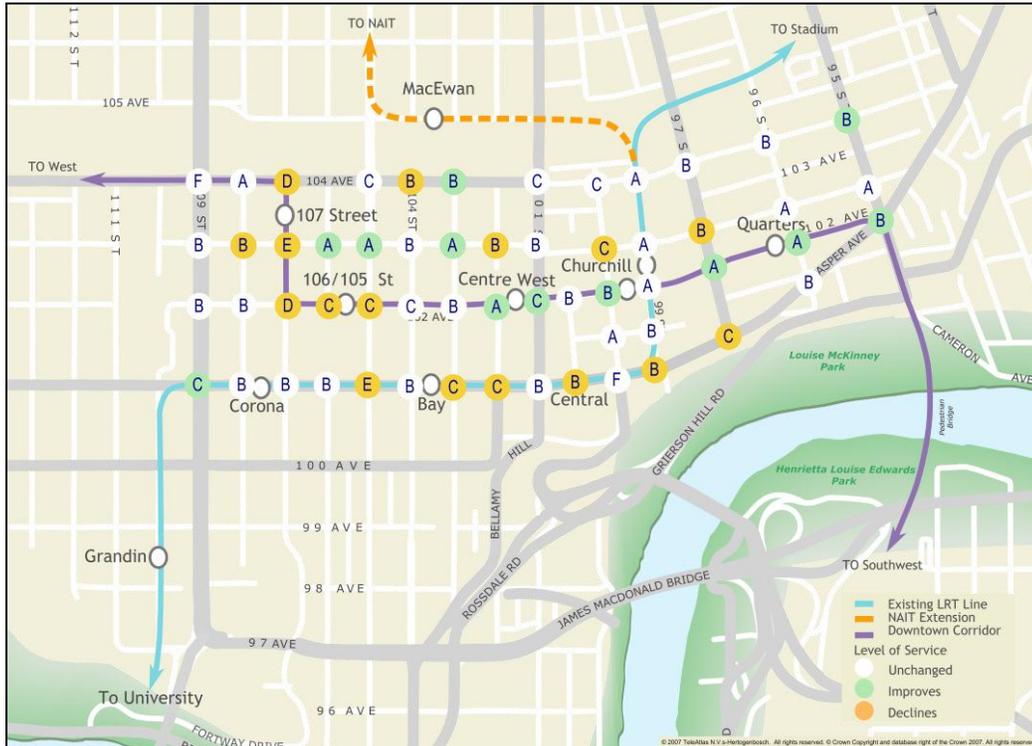


FIGURE 6.5 2010 PM LRT



Pedestrians

6.26 A major focus of an urban style LRT is the development of walking connectivity to provide increased walking catchment and increased single mode transit opportunities. The stop within the downtown are positioned to provide short walk catchments for passengers along the route. The ridership modelling projects over 6,000 passengers using the Downtown LRT stops. This number of people accessing and egressing the stops will act as a significant driver to development. New shops and services will be attracted due to the more pedestrian focused streetscape.

6.27 The LRT stop locations have been specifically identified to provide direct walking connectivity to their surrounding areas and the activity centre nearby these are:

- 107 Street
 - MacEwan University
 - NorQuest College
- 105/ 106 Street
 - Jasper Avenue
 - Corona Station
 - Link to slightly more distant Provincial buildings
- Centre West
 - Shopping - Centre West

- Central Business District
- YMCA
- Jasper Avenue
- Movie theatre
- Future arena
- 101 Street bus services

I Churchill Square

- Shopping Centre East
- Library
- Citadel
- Winspear Theatre
- Churchill Square
- Existing Churchill LRT
- Law Courts
- Art Gallery of Alberta
- City Hall
- Federal buildings
- Jasper Avenue

I Quarters

- Chinese Elders Mansions
- Chinese Community facilities
- Salvation Army
- Louise McKinney Park

6.28 The development of the LRT within the corridor, results in the provision of wider sidewalks on the LRT side of 102 Avenue. It is also recommended that the City examine the sidewalk width on the cross corridor streets where these provide access to the proposed stops in the subsequent stages of design. This would further improve the walking connectivity to and from the LRT, with a major part of the downtown covered within less than a 10 minute walk distance, this is graphically represented in Figure 6.6.

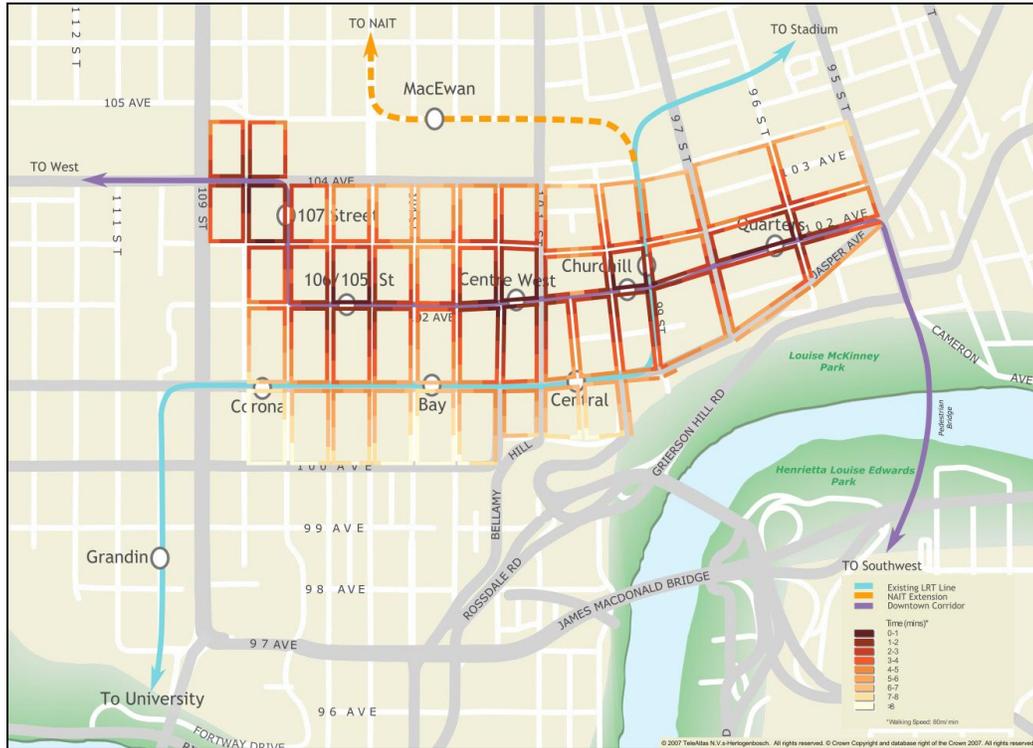
6.29 Wayfinding and associated signage should be developed in conjunction with the development of the LRT to improve pedestrian navigability. The consistency of, and the branding of the transit system should also be improved, this would improve the on street visibility of all the transit within the downtown.

Cyclists

6.30 The CCDP identifies 102 Avenue as an east-west cycle route through the downtown. This development of the bicycle route is targeted to occur well in advance of the LRT. The development of the LRT therefore will continue to make provision for bicyclists on the corridor. A dedicated two way cycle way is proposed along 102 Avenue, turning north on 99 Street and then east on 102A Avenue.

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FIGURE 6.6 WALK TIME FROM STOPS



6.31 With the development of the LRT on 102 Avenue, it will become a slower traffic street more focused on local access rather than through movements. This will reduce traffic and improve the road environment for both cyclists and pedestrians. Transit

Bus

6.32 The provision of an additional LRT corridor through the downtown will significantly improve capacity and provide improved connectivity within the downtown and the wider city. However LRT on 102 Avenue will necessitate the removal of bus services on the corridor. To provide additional bus routes within the Downtown it is recommended that 103 Avenue between 103 Street and 100 Street be converted to two way traffic flow.

6.33 The bus network would be revised to complement the LRT routes, minimise service duplication, maximise the return on the LRT investment and improve network efficiency. This reduction and revision in service will help mitigate the loss of buses on 102 Avenue.

6.34 A draft complementary bus network plan has been developed for the downtown to support and facilitate the introduction of the LRT network. This will require updating to support the potential staged development of the LRT and the associated changes to the bus network at the PE design stage.

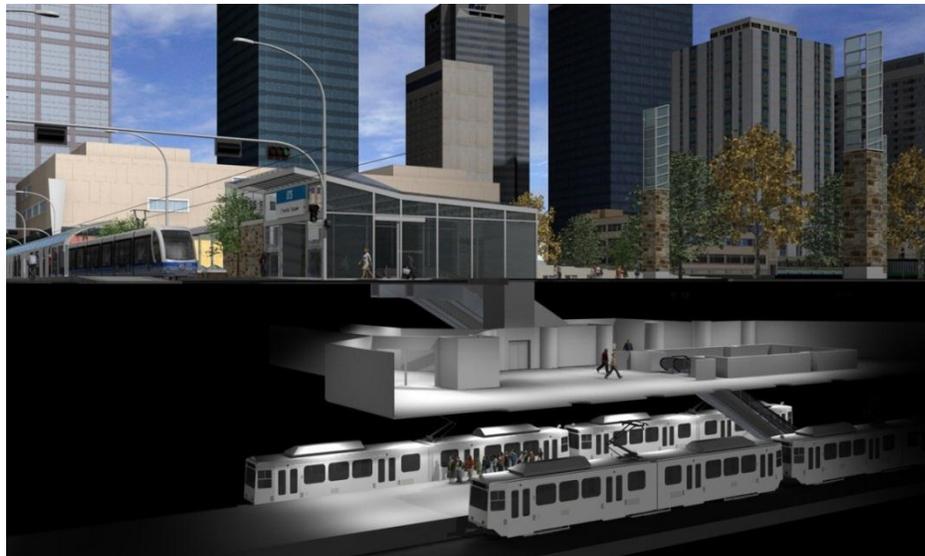
- 6.35 In conjunction with the Downtown LRT, consideration should be given to improved transit facilities on 101 and 100 Street for the retained bus services to aid integration and to enhance the customer’s experience.

Transit Integration

LRT

- 6.36 The development of the new surface low floor LRT will necessitate the need to integrate the new line with the existing system at Churchill Square. It is proposed that a new fully accessible entrance be constructed on the southeast corner of Churchill Square to provide a new direct entrance from the low floor on-street platforms down to the existing Churchill Station concourse.
- 6.37 The connection would provide a covered route between the surface and underground stations with escalator/s and an elevator to provide a high level of accessibility. Ticketing etc would be provided on the surface LRT stop and at the concourse level of the existing underground station. A Graphic of the proposed arrangement is shown in Figure 6.7 below.

FIGURE 6.7 NEW PASSENGER CONNECTION BETWEEN LRT SYSTEMS



- 6.38 The proposed entrance would be constructed over the existing pedway network running east-west under the south end of Churchill Square. A new entrance down into the existing concourse would be constructed behind north wall of the pedway and the west wall of the existing LRT. The existing west wall of the LRT would be opened up to connect to the new elevator, stair and escalator well. Outline Drawings of the arrangement are included within the Downtown LRT Connector Plan Workbook.

Bus

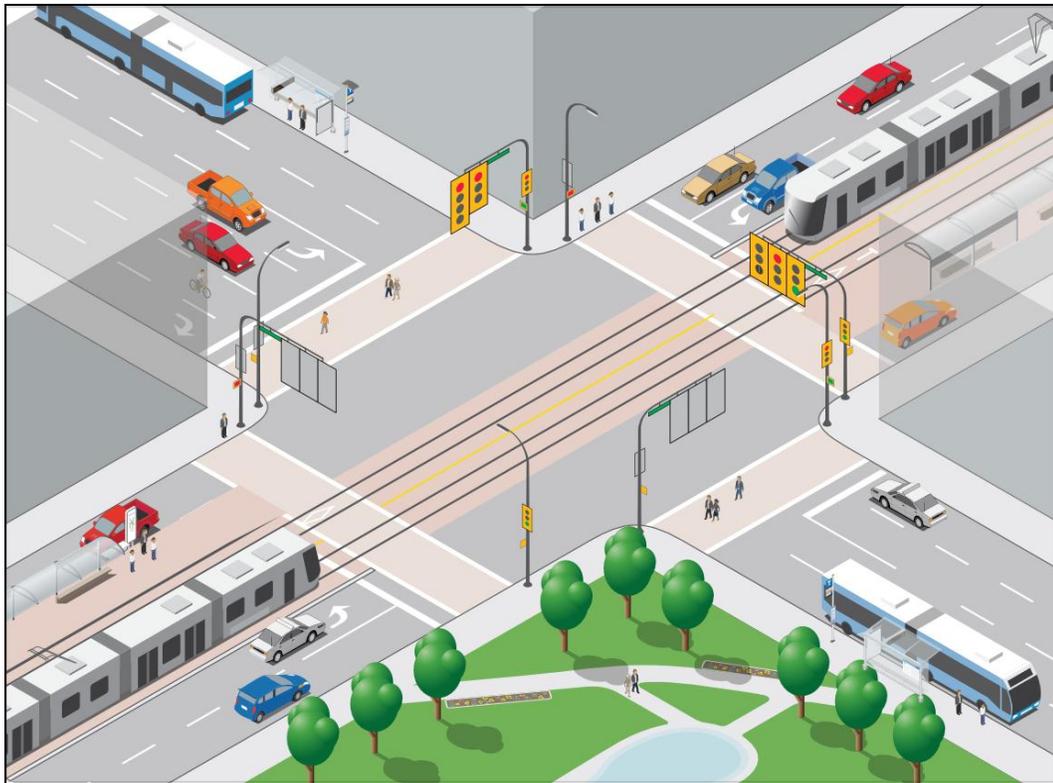
- 6.39 With closer LRT stop spacing encouraging a greater walk-in and bike catchment there is an opportunity to review the role of local bus services. The introduction of modern low floor LRT provides an opportunity to restructure local bus services to play a

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complementary role supporting the new LRT service. Major bus transfer centres can often be removed and replaced by smaller scale (cross platform) facilities, or with local bus services designed to service cross streets with simple bus shelter facilities and coordinating crossing providing easy access to and from the LRT stop.

- 6.40 Bus stops should be sited to provide connections at intersections of the LRT and bus routes with the bus stops sited in the cross streets or alongside the LRT platforms to provide cross platform interchange. An example of bus integration is shown in Figure 6.8.
- 6.41 This is the arrangement proposed within the downtown, the LRT stops have been located to provide bus integration with services operating on 100 and 101 Streets. These streets being adjacent to the Churchill and Centre West stops respectively. Consideration should be given to the future location and the bus facilities in these locations to maximise the passenger experience and encourage interchange and transit use. A common form of branding and clear wayfinding should aid customers to navigate between the LRT and the respective stops for each of the retained bus services.

FIGURE 6.8 EXAMPLE OF CROSS CORRIDOR BUS INTERCHANGE



Transportation Demand Management (TDM)

- 6.42 A TDM strategy should be developed in parallel with the ongoing planning and development of the LRT extensions. This should be looking to use TDM measures to

mitigate the impacts to transit and road users during construction of the projects and the development of ridership following the opening of the future lines.

- 6.43 For example, the City of Ottawa is implementing a TDM strategy to maximise the use of transit and active modes during the construction of their new LRT line. The focus being the reduction in the need to use the private car within the City and in particular within the areas affected by the construction of the line.
- 6.44 Equally a program should be developed to educate the public about the new LRT lines prior to their opening, how they should interact with the system, and most importantly how they can use and connect to the system and the benefits. The focus will be to generate new ridership through walking, cycling and transit integration; journey planning; and setting out the benefits to the user, the City, and sustainability in general.
- 6.45 These type of programs have been shown to be very cost effective and highly supportive of new transit interventions, maximising the benefits of the new asset.

Access & Loading

- 6.46 In development the concept plan for the LRT route through the downtown; existing building access and egress arrangement have been reviewed. The arrangement of the LRT within each of the identified downtown roads, does not directly impact upon any existing building accesses directly. A number of lanes are closed on the north side of 102 Avenue, in all cases other point of access and egress are available.
- 6.47 The only location where an issue was raised is the lane access to the Bill Reese YMCA, where further work may be needed to ensure service vehicles can access the property.

Emergency Services - Access & Egress

- 6.48 The proposed LRT route runs on 107 Street, adjacent to Fire Station Number 2. The LRT alignment is on the west side of the street, the Fire Station on the east side, with two way traffic retained on 107 Street enabling emergency vehicle to egress as today to the north or the south.
- 6.49 Returning fire service vehicles may need to turn onto the LRT alignment to then reverse into the Fire Station. This arrangement is similar to today where the vehicles cross onto the opposite traffic lanes and reverse. A similar level of care and the agreement of this movement with the operation of the LRT will need to be agreed in subsequent stages of design.
- 6.50 Throughout the downtown the LRT tracks will be constructed to enable emergency vehicle access along the LRT alignment if required. In an emergency, fire, ambulance, police or other emergency vehicles would have precedence, particularly in relation to any incident related to a building adjacent to the LRT. The LRT operating rules will need to be developed to take account of such issues if required.

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Utilities

- 6.51 The proposed LRT route will impact on the majority of the utility provider's facilities within the corridors. The area of influence of the LRT is shown on the utility drawings within the accompanying Downtown LRT Concept Plan Workbook. Additional details are provided in the utilities memorandum in Appendix B.
- 6.52 It is recommended that a utility relocation policy be written for the project that aims to balance the impacts and cost of utility relocation. This can result in some utilities being left in place such as storm water and waste water, with access chambers reconstructed to provide offset access. Cross corridor utilities below the construction depth could also be retained. The policy would set out the conditions under which utilities would be:
- Relocated.
 - Protected & retained.
 - Revised.
 - Renewed.
 - Retained.
- 6.53 The policy would also vary depending on the agreement of each of the utilities. The policy would also need to take into account the issues of stray current from the LRT and the potential impact or effects on adjacent utilities.

Drainage

- 6.54 A preliminary drainage review for the proposed LRT Downtown Concept Design has been undertaken. This analysis provided technical input to the conceptual drainage plan for the Concept Plan. The detailed preliminary drainage review is provided in Appendix C. The following sections summarize the key findings of the study that influenced the overall Concept Design.
- 6.55 The drainage review examined existing drainage data from the City of Edmonton to understand the performance of the existing underground drainage system and to identify known areas of concern including localized flooding that may impact the design of the proposed LRT line. The review also confirmed the proposed inlet locations and examined the potential changes in imperviousness levels, if any, due to the new line. Finally, the drainage review identified the opportunities to enhance water quality in runoff as per City of Edmonton objectives.

Existing Drainage Data

- 6.56 The City provided information regarding the existing drainage system within the study area. A site visit was conducted following the meeting to gain a better understanding of the proposed LRT alignment and contributing drainage areas. Based on discussion with the City staff, it is understood that surcharging is not a significant issue along the proposed route.
- 6.57 The team also reviewed a report prepared by Stantec Consulting Ltd. (July 2009). This 2009 study indicated that the hydraulic performance of the existing combined sewer

system along the proposed LRT alignment is relatively good with adequate capacity during a 1:5 year design rainfall event. When ultimate infill/redevelopment in the downtown area is considered, there is only a marginal increase in pipes exhibiting poor hydraulic performance.

- 6.58 Based on discussions with City staff and review of available information, no major issues have been identified regarding the performance of the existing underground drainage system to accept surface runoff along the proposed Downtown LRT.

Proposed Stormwater Concept Plan

- 6.59 The proposed Downtown LRT will include tracks at grade within the existing road ROW and mostly minor regrading along the adjacent area. As a result, the amount of impervious area along the proposed alignment will not be significantly increased. The drainage component of the proposed track system will involve cross drainages to convey runoff along the rail track and catch basins to collect off-site runoff. The rail track cross drainages will be designed to prevent off-site runoff from entering the track and to reduce the chance of accumulation and ice build-up. To accommodate the proposed LRT route and to minimize ponding at pedestrian crossings, relocation of catch basins and new connections to existing and additional manholes will be required. Therefore, the proposed LRT system will not increase/modify significantly the stormwater peak flow or runoff volume that currently contributes to the underground combined sewer system, and it will have minimal impact on the current drainage condition or planned improvements.

Opportunities for Water Quality Enhancement

- 6.60 The Downtown LRT will comply with the City of Edmonton's 2006 Drainage Services Stormwater Quality Strategies document, the Strategic Planning vision of the Drainage Services. The proposed Downtown LRT is expected to have a positive impact on the quality of the runoff from the road surface compared to the buses and/or cars they are replacing. Furthermore, given the lack of any significant increase in impervious area, no significant water quality impacts are anticipated. In general, there will be no need for water quality control facilities to specifically address this new LRT line. Nonetheless, some water quality control, upon further study, can be considered at specific locations to improve existing conditions and contribute to any future upgrades of the existing combined sewer system. The implementation of oil/grit separators and catch basin filter inserts as structural and operational BMPs would likely enhance the stormwater quality within the study area and may be considered in the detailed drainage design given space limitations.

Geotechnical

- 6.61 A review of the geotechnical conditions and potential design considerations was conducted for the Downtown LRT Concept Design. The detailed geotechnical review is provided in Appendix E. The following sections summarize the key findings of the study that influenced the overall Concept Design.

Subsurface Conditions

- 6.62 A desktop review has been conducted of boreholes obtained from the archival data and City of Edmonton database. In general, the subsurface conditions along the proposed alignment are highly variable. Based on the borehole information, the near surface stratigraphy generally comprises surficial concrete or asphalt pavement with bedding sands underlain by clay fill and/or sand and gravel fill to depths ranging approximately from 1.0 to 3.0 m below road surface along the majority of the proposed LRT line. Native lacustrine clay was encountered underlying the fills to depths ranging from 5 to 9 m below grade. Underlying the lacustrine deposits are highly variable strata of clay till, sand and bedrock.

Groundwater Conditions

- 6.63 The boreholes reviewed in this report were generally deep boreholes drilled for commercial developments. The standpipes installed within these boreholes generally extended to till stratum and did not capture the perched groundwater level within the upper lacustrine deposits. However, it is likely that the groundwater levels are highly variable across the alignment.

Primary Areas of Concern

- 6.64 Two areas of concerns have been identified from a geotechnical perspective that could impact the long term performance of the proposed LRT tracks. These concerns include subgrade non-uniformity and frost heave susceptibility.
- 6.65 In order to achieve a reasonable level of performance from the subgrade for the proposed LRT line, it is essential to have a relatively uniform subgrade. Differential movements and poor performance of the subgrade are typically related to variations in the subgrade support. Uniformity in material, moisture content and density is of importance to the track performance. This generally requires the same fill type throughout the entire subgrade, placed at a similar moisture content and density.
- 6.66 Frost effects (heaving) occur when frost susceptible soils within the depth of frost penetration freeze with an available source of groundwater. Upon freezing, ice lenses form in the subgrade, causing frost heave. Upon thawing, the ice lenses thaw resulting in a saturated subgrade which tends to be weak and prone to non-uniform settlement, particularly in response to cyclic loading as would be expected to occur from LRT vehicle traffic. Based on the available information, the near surface fills and native lacustrine deposits along the Downtown LRT are considered to be moderately frost susceptible.
- 6.67 Potential frost susceptibility in the subgrade is generally addressed by eliminating the frost susceptible soils from the subgrade, removing the source of water from the freezing zone, or insulating the subgrade to reduce or prevent frost penetration. Possible remedial options to mitigate the effects of frost heave are beyond the scope of this report.

Environmental

- 6.68 The proposed Downtown LRT is within an existing urban environment, primarily situated within existing roadways within the downtown. The location of the proposed corridor runs within an fully built environment, and as such limited impacts to the natural environment are anticipated. An environmental screening review and potential design considerations was conducted for the Downtown LRT Concept Design. The detailed review is provided in Appendix F. The following sections summarize the key findings of the study that influenced the overall Concept Design.
- 6.69 Assessment of the area included a review of background information using aerial photos, existing reports and databases, including Species at Risk (Environment Canada, 2011), Committee on the Status of Endangered Wildlife in Canada (COSEWIC, 2010), Species Assessed by Alberta's Endangered Species Conservation Committee (ESCC, 2010), and Alberta Conservation Information Management System (ACMIS, 2011). A field survey was completed on September 10, 2010, to identify physical land features, street trees and landscaping, and signs of wildlife. Appendix F provides a summary table of environmental attributes.
- 6.70 Natural elements in the downtown (such as trees) take on an even more important role to offset the heavily urbanized environment. A detailed inventory of vegetation and trees was completed along the alignment.

Existing Conditions

Vegetation

- 6.71 The proposed corridor is fully developed and contains no native vegetation. All vegetation consists of ornamental species planted for landscape beautification. Two hundred and four (204) boulevard trees were identified and were valued at a total of approximately \$500,000. Some are in poor condition and regular limb trimming is required to avoid intersecting overhead wires. All efforts will be made to maintain existing mature vegetation (where possible).

Soils

- 6.72 The proposed corridor generally consists of concrete and asphalt and has very little exposed soil. Soil present consists of imported topsoil and planting mix for trees and shrubs. Additional details on the subsoil and geotechnical aspects is included in Appendix E of this report.

Wildlife

- 6.73 The project area does not provide habitat for most wildlife species due to the high level of disturbance and human activity. Some boulevard trees have nests created by black-billed magpies (*Pica pica*).

Hydrology

- 6.74 As a result of the project, the amount of impervious area along the proposed alignment will not be increased. The drainage component of the proposed track system will involve cross drainages to convey runoff along the rail track and catch

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basins to collect off-site runoff. Additional details on the drainage aspects is included in Appendix E of this report.

Geology

- 6.75 A geotechnical overview is detailed earlier in this report. As the addition of the new track and subgrade is expected to affect only a 0.6 m to 1.0 depth, area geology will not be affected. This disturbance will take place under the existing roadways which already have roadbed substructure to accommodate vehicular traffic loadings.

Noise/Odour/Visual

- 6.76 The present conditions have significant car, truck and bus traffic resulting in typical urban core noise, odour from vehicles and poor aesthetics.
- 6.77 The low floor LRT system will need to be designed, constructed, operated and maintained to minimise noise and vibration impacts to adjacent land use. Potential noise receptors along the corridor are detailed in Table 6.2 below.

TABLE 6.2 NOISE/VIBRATION RECEPTORS

Building	Location	Use
Women’s Building Futures Training Centre	10326 107 Street	Residential Training Centre
ADAC Centre	107 Street	Community Facility
Live / work development	107 Street	Residential / work space
Monaco	10707 -102 Avenue	Residential
Monaco II	10606- 102 Avenue	Residential
Stanley A Milner Library	7 Sir Winston Churchill Square	Library
Citadel Theatre	9828 101A Avenue	Theatre
Winspear Centre	Sir Winston Churchill Square	Concert Hall
Chinese Masons Elders Mansion	9620 - 102 Avenue	Residential
Chinese Elders Mansion	9550 - 102 Avenue	Residential
Chinese Elders Mansion II	9520 - 102 Avenue	Residential

Historic

- 6.78 The Register of Historic Resources was reviewed to identify any resources currently listed as designated municipal resources (legally protected) or historic resources (merit conservation, but not legally protected). Additional details are included in the historic memo in Appendix G. One designated municipal resource and six historic were identified along the project corridor. Table 6.3 provides details of each of the

identified buildings. None of these resources are directly impacted by development of the Downtown LRT Connector. As design progresses, additional examinations will need to be completed to verify these resources are not adversely affected.

TABLE 6.3 HISTORIC RESOURCES

Designated Historic Municipal Resource	Address	Postal Code	Use	Impact
CHURCHILL WIRE CENTRE	9 - SIR WINSTON CHURCHILL SQUARE	T5J 0E5	Commercial	Adjacent to Corridor - No direct impact
Historic Resource				
JOHN DEERE CO LTD BLDG	10309 - 107 STREET	T5J 1K3	Commercial	Adjacent to Corridor - No direct impact
ROSS BLOCK/THE BOARDWALK	10310 - 102 Ave	T5J 0Y8	Commercial	Adjacent to Corridor - No direct impact
McKENNEY BUILDING	10187 - 104 STREET	T5J 0Z9	Commercial	Adjacent to Corridor - No direct impact
WESTERN SUPPLIES LTD BUILDING	10301 - 108 STREET	T5J 1L7	Commercial	Adjacent to Corridor - No direct impact
METALS LIMITED BUILDING	10190 - 104 STREET	T5J 1A7	Commercial	Adjacent to Corridor - No direct impact
REVILLON BUILDING & ANNEX	10201-10247 - 104 STREET	T5J 1B1	Commercial	Adjacent to Corridor - No direct impact

Socioeconomic

- 6.79 The primary focus of developing improved transit within Edmonton is to support the aims and objectives of the City's municipal development and transportation master plans. The focus of which is to improve transportation options and connectivity to support sustainable development and growth.

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6.80 The development of the LRT line will reinforce the downtown as the heart of the City and having been developed in conjunction with the CCDP, it aims to be supportive of development, business and job creation.

6.81 The addition of the LRT, will bring significant accessibility improvements to the areas through which it operates, resulting in improvements in general connectivity and access to jobs both within the downtown and along the length of the route. These improvements will reduce the City's dependence on the use of the private auto, reducing traffic and emissions.

Surrounding Land Use

6.82 The surrounding land uses consist of urban commercial, institutional and residential development. This mix is not expected to change although the improved accessibility provided by the LRT route and associated stops will be supportive of the aims and objectives of the CCDP. To support development, redevelopment and sustainable growth within the individual districts through which the route runs, Campus warehouse, Jasper Avenue, Commercial/Cultural Core, and the Quarters.

Impacts & Mitigation

6.83 The following impacts and mitigations have been identified in undertaking the development and assessment of the proposals for the LRT corridor.

Vegetation

6.84 The development of the proposed LRT route could impact on approximately 100 existing street trees on the associated corridor. The replacement cost would be about \$250,000.

6.85 The development and construction of the LRT would provide the opportunity to provide infill tree planting along the corridor to provide more consistent tree lines street. The lane ends closed could also be used to provide replacement tree planting and community areas.

Soil

6.86 No impacts are expected on soils

Wildlife

6.87 No impacts are expected. Improvements to the amount and type of vegetation/landscaping would improve habitat for birds and squirrels although other wildlife species are not typically compatible with dense urban development.

Hydrology

6.88 Rail track cross drainages will be designed to prevent off-site runoff from entering the track and to reduce the chance of ice build-up. To accommodate the proposed LRT route and to minimize ponding at pedestrian crossings, relocation of catch basins and new connections to existing and additional manholes will be required. The proposed catch basins are generally located at the intersections throughout the proposed route and at most locations where catch basins currently exist. The cross drainages along the rail track will connect directly to the underground system where appropriate.

Therefore, the proposed LRT system will not increase/modify significantly the stormwater runoff volume that currently drains into the underground combined sewer system. The following structural and operational BMPs are potential strategies to enhance the stormwater quality within the study area and may be considered in the detailed drainage design: oil/grit separators and catchbasin filter inserts.

Geology

- 6.89 No impacts are expected as the project will result in disturbance of only the top 0.6 m to 1.0m of land surface.

Noise/Odor/Visual

- 6.90 In general, the proposed intervention should have no negative impacts. Lower noise levels, reduced traffic emissions and improved landscaping aesthetics can be expected. As detailed early, the low floor LRT system will need to be designed, constructed, operated and maintained to minimise noise and vibration impacts to adjacent land use. This could include the use of encapsulated track, flange lubrication, LRT vehicle wheel dampers and float track.
- 6.91 Potential noise receptors along the corridor are detailed in Table 6.4 below.

TABLE 6.4 NOISE/VIBRATION RECEPTORS

Building	Potential Impact	Potential Mitigation
Women’s Building Futures Training Centre	Noise for 104 Avenue Curve and stop location	Use of largest curve radi, flange lubrication, wheel dampers, vehicle speed limit and track maintenance.
AADAC Centre	107 Street Stop option	Good neighbour operational practices (minimise noise, horn, bells , PA etc)
Live / work development	107 Street Stop option	Good neighbour operational practices (minimise noise, horn, bells , PA etc)
Monaco	107 Street to 102 Avenue curve	Use of largest curve radi, flange lubrication, wheel dampers, vehicle speed limit and track maintenance.
Monaco II	Adjacent to route	Good neighbour operational practices (minimise noise, horn, bells , PA etc)
Stanley A Milner Library	Churchill Square stop	Good neighbour operational practices (minimise noise, horn, bells , PA etc)
Citidel Theatre	Adjacent to route	Consideration of floating track to minimise noise and

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		vibration impact into adjacent auditorium
Winspear Centre	Adjacent to route	Consideration of floating track to minimise noise and vibration impact into adjacent auditorium
Chinese Masons Elders Mansion	Quarters Stop	Good neighbour operational practices (minimise noise, horn, bells , PA etc)
Chinese Elders Mansion	Adjacent to route	Good neighbour operational practices (minimise noise, horn, bells , PA etc)
Chinese Elders Mansion II	Adjacent to route	Good neighbour operational practices (minimise noise, horn, bells , PA etc)

Historical

6.92 No impacts have been identified.

Socioeconomic

6.93 The positive socioeconomic impacts have been considered in the assessment and development of the proposed concept design.

Surrounding Land Use

6.94 No negative impacts are expected. Improved access will likely improve redevelopment opportunities.

Property Impacts

6.95 The concept planning for the downtown LRT has focused where possible, on limiting the need for property acquisitions. The exception to this would be the potential proposals for the joint development of the diagonal 107 Street stop and associated higher education facility on the city block to the southwest of 107 Street and 104 Avenue. The property impacts are detailed in Table 6.5 below. Additional details are included in the property memo in Appendix H.

TABLE 6.5 PROPERTY IMPACTS

Location	Use	Impact
Lots 115 -122 - 108 Street	Surface parking	Complete site- in conjunction with area redevelopment
Lots 123 -126 - 107 Street	Low rise commercial	
Lots 129 - 107 Street	Surface parking	
Lots 130-132 - 107 Street	ADAC - Facility	

Northeast corner 107 Street and 102 Avenue	Surface parking for Fire Station	5 metre strip along 102 Avenue frontage
Southeast corner 96 Street and 102 Avenue	Surface parking	5 metre strip along 102 Avenue frontage
Lane improvements between Jasper and 102 Avenues east of 96 Street	Surface parking	Complete site
Southwest corner 102 Avenue and Jasper Avenue	Surface parking	Complete site - Construction only
Southeast corner 95 Street and Jasper Avenue	Surface parking	Complete site - Construction only

6.96 The majority of the identified land impacts are either associated with the diagonal 107 Street stop development and the proposed redevelopment of the associated land, or relate to construction impacts, that once complete would allow redevelopment of the land. At the east end of the route two of the identified property impacts relate to the provision of revised access arrangements to property and lots on the south side of 102 Avenue.

Property - LRT Electrification

6.97 A number of Sub-Stations may be required. The location of these will be dependent on the phased construction of the project. The appropriate locations are likely to be either side of the downtown to mitigate impacts of such a requirement in the core of the downtown. Identified locations within the concept design are:

- The Quarters:
 - Lands at the corner of 102 Avenue, Jasper Avenue and 95 Street.
 - Land on north side of Jasper Avenue between proposed lanes.
- West end of the route:
 - 105 / 106 Street Stop, City owned lands for a future park.
 - Northeast corner of 107 Street and 102 Avenue.
 - Southwest corner of 107 Street and 104 Avenue.
 - Diagonal 107 Street stop development.

6.98 The potential sub-station locations identified within the Quarters area could be contentious given the community sensitivity to the development of the LRT route through the area. Sub Station locations that could be integrated with the development of the tunnel such as the southwest corner of Jasper Avenue and 95 Street may be preferable than a location adjacent or close to 102 Avenue between 97 and 95 Street. Any location should primarily be focused on minimising any impacts to the community within this area.

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- 6.99 All the identified locations are either within the boundaries of the identified property impacts or existing City lands. Other sites are currently available but have not been included within the cost estimate.

Structures

- 6.100 The focus in developing a low floor urban style LRT system is to minimise the need for structures wherever possible, to maximise integration within communities and minimize associated impacts.
- 6.101 The proposed Downtown LRT Concept Design is proposed to run at grade within the existing road ROW, wherever possible. The exception to this is the proposed tunnel portal west of 95 Street on 102 Avenue. This structure provides the connection from the surface route through the downtown to the proposed tunnel under 95 Street to the North Saskatchewan River crossing.
- 6.102 The structure is proposed to be 9.5 metres wide at road level, descending over a length of approximately 120 metres. The details relating to the structure and the proposed tunnel arrangement under 95 Street are provided in the separate Southeast LRT Concept Design documents. The portal design and aesthetic treatments will include additional stakeholder involvement during subsequent stages of design. The design should reflect the area's cultural heritage.
- 6.103 The arrangement of the proposed structure and the curvature for the connection to the tunnel under 95 Street has been revised to mitigate impacts to property. The width of the structure being reduced through the elimination of centre overhead line poles and their replacement with side poles, cantilevered arms from the portal wall and the use of roof fixings. The structural arrangements would be similar to those detailed in the Southeast LRT Concept design report.

Land Use Influences

- 6.104 The introduction of urban-style LRT in Edmonton brings significant opportunities for new urban development, including TOD, along the entire corridor. New development along the alignment can be a means of servicing, supporting, and sustaining existing and currently proposed development. It also can potentially stimulate development that might not otherwise take place, change land use, or instigate development earlier than it otherwise would have occurred. Numerous studies in North America in recent years have pointed out the potential economic uplift and other benefits of well-planned TODs for local communities. The Downtown LRT can similarly benefit from TOD implementation and can meet its fullest development potential and maximize its benefits by fully integrating its construction and operations only if there is well-planned and orderly development along the alignment.

What is Transit-Oriented Development?

- 6.105 TOD principles have been developed and applied over the last two decades to many new transit systems throughout North America and around the world. TOD involves partnerships between the transit authority, local municipalities, and the private sector

to plan, design, and construct new developments clustered around transit alignments and stops. Key elements of TOD include:

- Walkability - TOD communities should be pedestrian- and bicycle-friendly areas providing easy access to and from the LRT system and stops.
- Mix of land uses - A mix of uses, services, and amenities will provide a more diverse community to be supported by the LRT system.
- Connections - The LRT system should be part of a wider integrated transit network, with links to local bus services and other parts of the LRT network.
- Accessibility - The LRT system and the TOD around stops should be designed to be accessible for all sectors of the community, with well-designed and barrier-free pathways.
- Density - A higher-density land use will create more activity and more riders.
- Safety - The design of all aspects of the LRT system and its supporting TOD should create a safe and comfortable environment for all users, with an aim to increasing higher activity around stops to promote safety.
- Security - Crime prevention through environmental design (CPTED) techniques should be used to create an inherently secure environment around stops.
- Comfort - The LRT system and its TOD should create pleasant, inviting places that encourage activity.
- Legibility - The LRT system and its TOD should be understandable to users and should help passengers orient themselves easily and efficiently.
- Quality - LRT facilities and the surrounding developments should be built with lasting materials to create a high-quality environment.
- Economy/energy - LRT facilities and related TOD should be built to be sustainable from an economic and energy efficiency standpoint.
- Stakeholder engagement - Public, private, and community stakeholders should all be involved in the development of integrated LRT/TOD solutions.

6.106 In addition, the City's Integrated Transit and Land Use Framework established several key principles to guide transit-supportive development throughout Edmonton, including:

- Focusing higher residential and employment density around transit stops.
- Designing each stop to reflect the characteristics of the surrounding area.
- Creating a framework for convenient circulation of all modes, with a special emphasis on pedestrians and bicycles.
- The use of open space near stops wherever possible to help 'animate' the platform and to help support or balance higher densities around the stops.

6.107 The addition of a transit station to a neighbourhood or community provides a concentration of movement and activity that can support a TOD, commonly leading to local economic uplift - primarily increases in local property values and business activity. For example, in the downtown area alone, the Downtown LRT will result in almost 8,000 people walking to and from LRT stations in the morning rush hour (almost 43,000 people daily).

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How Does the LRT Line Support Future Growth?

- 6.108 The development of the LRT through the downtown will support the creation of ‘complete’ communities and a more compact region, support and enhance existing development along the alignment, and contribute to ‘city shaping’ by stimulating future concentrated and mixed-use development along the corridor.
- 6.109 The development of LRT presents an excellent opportunity for the City to implement the principles embodied in “The Way We Grow” and the “Integrated Transit and Land Use Framework” by focusing higher-density development along the alignment. This new development will provide opportunities for residents to live near where they work or have convenient transit access to their jobs, reducing reliance on the auto, alleviating demand on the regional transportation network, and freeing up capacity for longer-distance trips and goods movement. This shift in use from auto traffic also will assist the City in reducing its per capita greenhouse gas emissions.

Station Areas

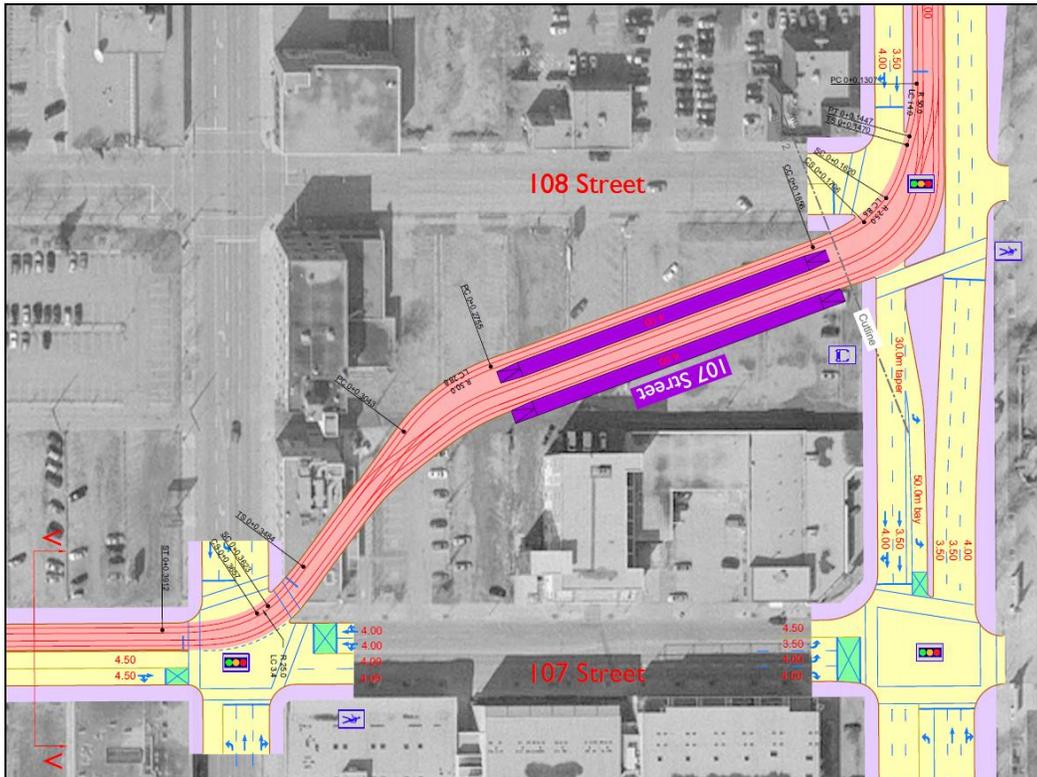
- 6.110 Conceptual transit-oriented development concepts have been developed for several stops along the Downtown LRT alignment with the aim of demonstrating the TOD potential of the system and its passenger stops. These are high-level concepts that are not aimed at developing specific economic uplift projections for TOD. Instead, they have been conceived as starting points for consideration by City staff and Downtown stakeholders to show how future development might arise around LRT stops.
- 6.111 Not all Downtown stops are conducive to an analysis of TOD potential, as they are located in highly developed areas already. This analysis focuses on three stops where development potential may exist by virtue of the amount of vacant or underutilized land around them. Those three stops are:
- 107 Street.
 - 105/106.
 - Quarters.
- 6.112 For each stop analyzed, two basic development scenarios have been developed (with minor variations in some instances):
- A ‘base case’ that focuses on low-level development of vacant parcels adjacent to the stop, with existing buildings retained wherever possible.
 - A ‘moderate case’ that examines the potential of replacing some buildings.
- 6.113 Several key principles were used in the creation of development concepts for the stops, including:
- A focus on mixed use retail, commercial, and residential immediately adjacent to platforms, with less emphasis on commercial and more emphasis on retail and residential on parcels farther away from platforms.
 - Alley access wherever possible to eliminate the need for street frontage vehicular access.

- The division of City blocks into two pieces wherever possible to create a more pedestrian scale and provide more pedestrian access.
- Parking or other ancillary activities in rear courtyards (off alleys) when needed.

Diagonal 107 Street Stop

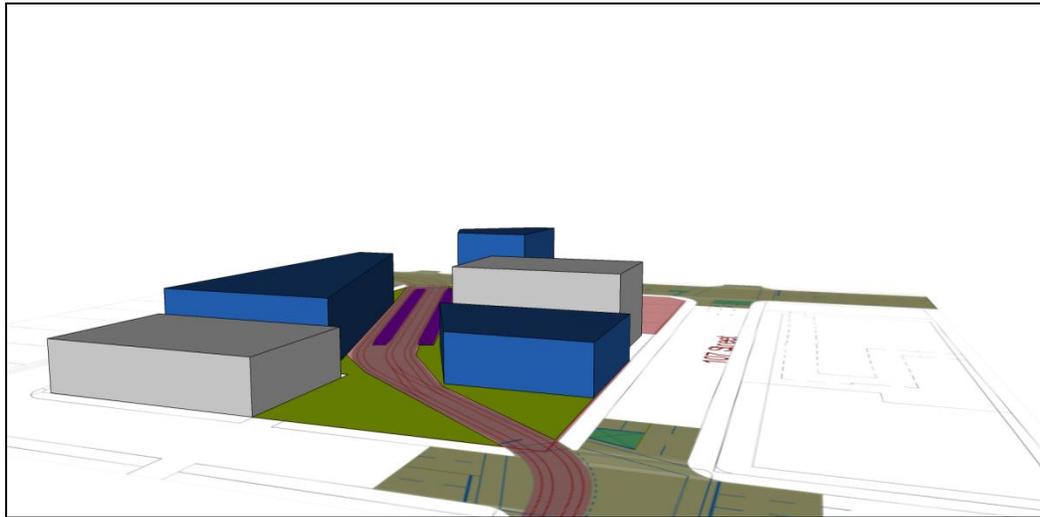
6.114 Two development scenarios were developed for the diagonal 107 Street Stop: a Base Case and a Moderate Case.

FIGURE 6.9 PROPOSED DIAGONAL 107 STREET STOP ARRANGEMENT



6.115 The Base Case scenario retains all existing buildings around the stop (except for the one structure required for the construction of the LRT guideway itself). It combines open space and pedestrian/bicycle access immediately around and at the ends of the platform with redevelopment of currently vacant parcels (parking lots) into mixed-use campus oriented retail and commercial of 2-4 storeys.

FIGURE 6.10 DIAGONAL 107 STREET BASE CASE



- 6.116 The Moderate Case scenario maintains the open space and pedestrian/bicycle access along the platform and at each end, but it provides for moderate redevelopment of the remainder of the site with some existing buildings (primarily the retail area on the northeast corner) being replaced with mixed-use campus-oriented retail, commercial, and residential. One scenario would be for the 1st floor to accommodate campus-oriented retail and commercial, the 2nd floor to include campus-related office space, and the 3rd and 4th floors to include campus residential units. The concept envisions a building ‘spanning’ the guideway and platform to provide development ‘air rights’ over the alignment.

FIGURE 6.11 DIAGONAL 107 STREET MODERATE CASE



FIGURE 6.12 DIAGONAL 107 STREET STOP - DEVELOPMENT POTENTIAL



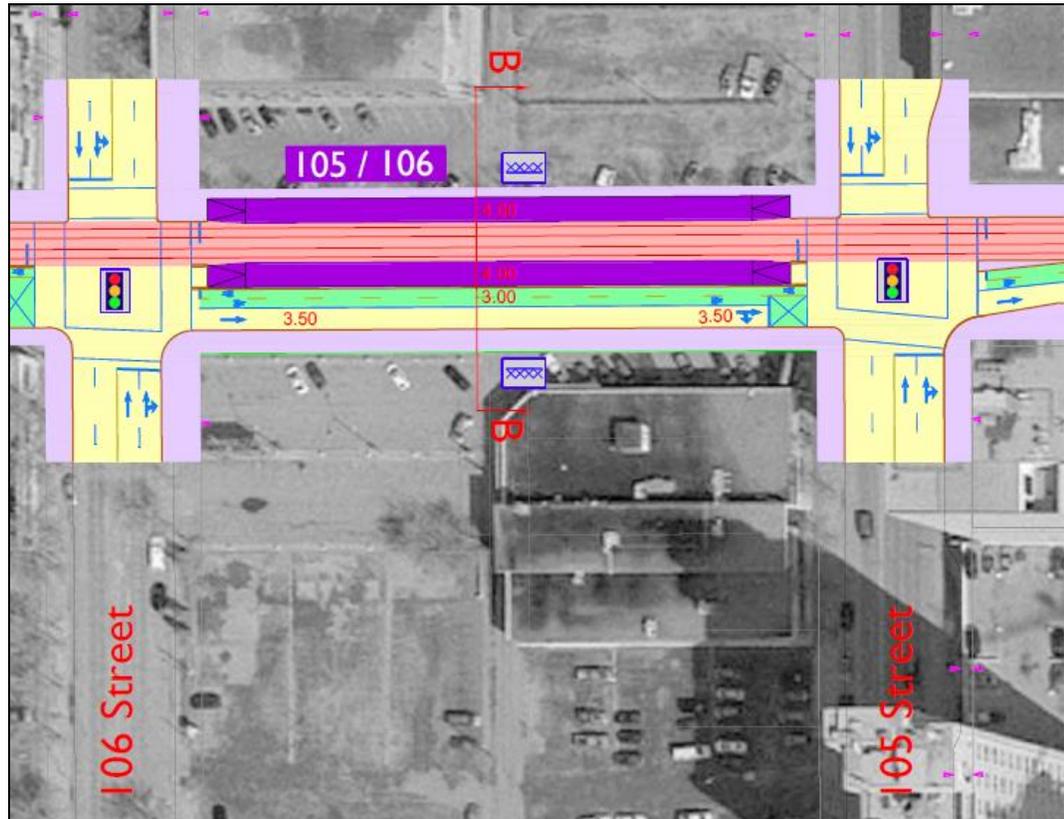
FIGURE 6.13 DIAGONAL 107 STREET STOP - DEVELOPMENT POTENTIAL



105/106 Stop

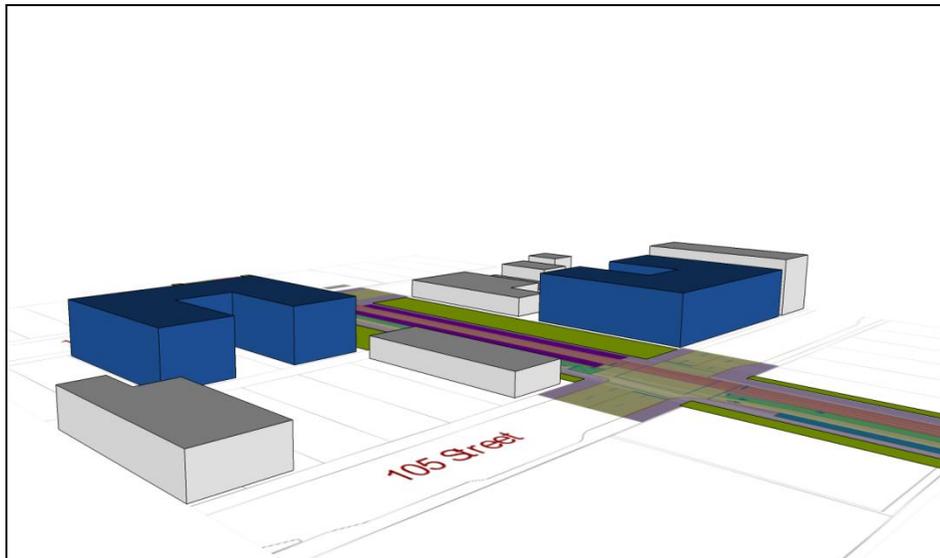
- 6.117 Three development scenarios were developed for this stop: a Base Case, a Base Case Plus, and a Moderate Case.

FIGURE 6.14 PROPOSED 105/106 STREET STOP ARRANGEMENT



- 6.118 The Base Case assumes that all existing buildings in the vicinity remain, with infill development on some vacant parcels on adjacent blocks. It provides for open space and pedestrian/bicycle access immediately adjacent to the platform, with development of vacant parcels outside the ‘buffer’ of the open space to the northeast and southwest of the platform. This development could be mixed-used neighbourhood retail, commercial, and residential, 3 to 4 floors or higher, with retail and commercial focused on the lower floors and residential on the higher floors.

FIGURE 6.15 105/106 BASE CASE



6.119 The Moderate Case builds on the Base Case and Base Case Plus by providing for moderate redevelopment of some existing buildings northwest and southeast of the platform. The mix of uses would be similar to that of the Base Case (mixed-used neighbourhood retail, commercial, and residential, 3 to 4 floors or higher, with retail and commercial focused on the lower floors and residential on the higher floors).

FIGURE 6.16 105/106 MODERATE CASE

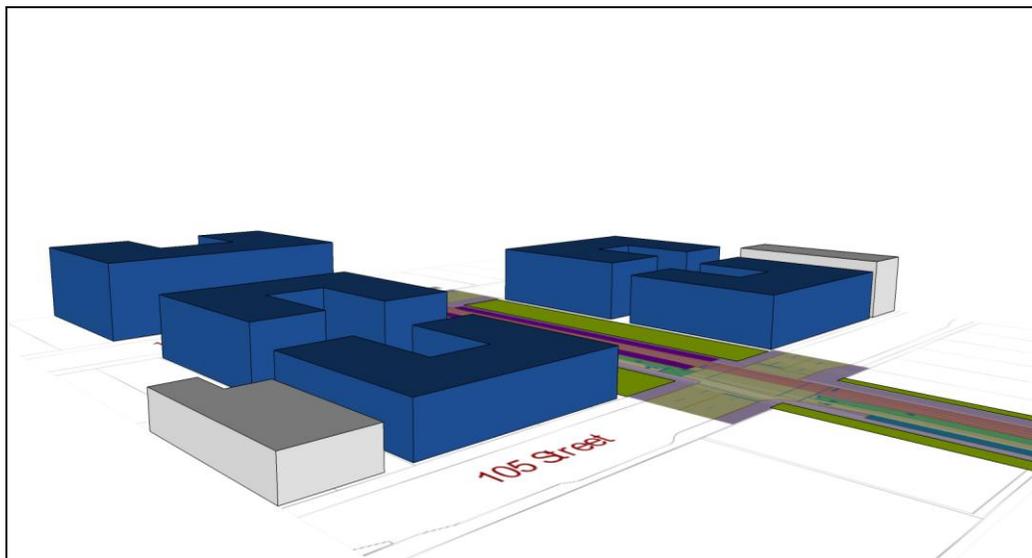


FIGURE 6.17 105/106 DEVELOPMENT POTENTIAL



Quarters Stop

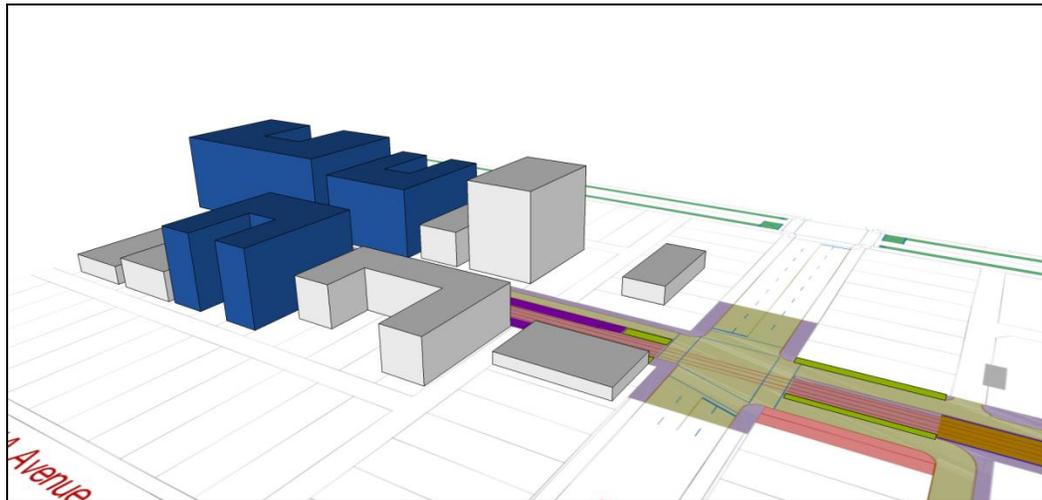
- 6.120 As with the 105/106 stop, three development scenarios were developed for this stop: a Base Case, a Base Case Plus, and a Moderate Case.

FIGURE 6.18 PROPOSED QUARTERS STOP ARRANGEMENT



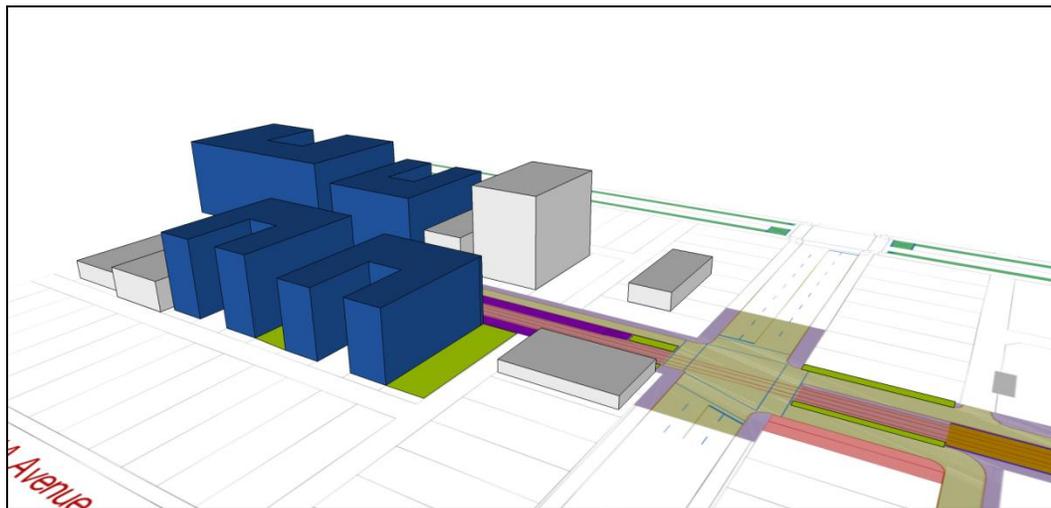
- 6.121 The Base Case assumes that all existing buildings in the vicinity remain, with infill development on some vacant parcels on adjacent blocks. It provides for open space and pedestrian/bicycle access at each end of the platform, with development of vacant parcels along the alignment to the northwest and southwest of the platform. This development could be mixed-used neighbourhood retail, commercial, and residential, 3 to 4 floors or higher, with retail and commercial focused on the lower floors and residential on the higher floors.

FIGURE 6.19 QUARTERS BASE CASE



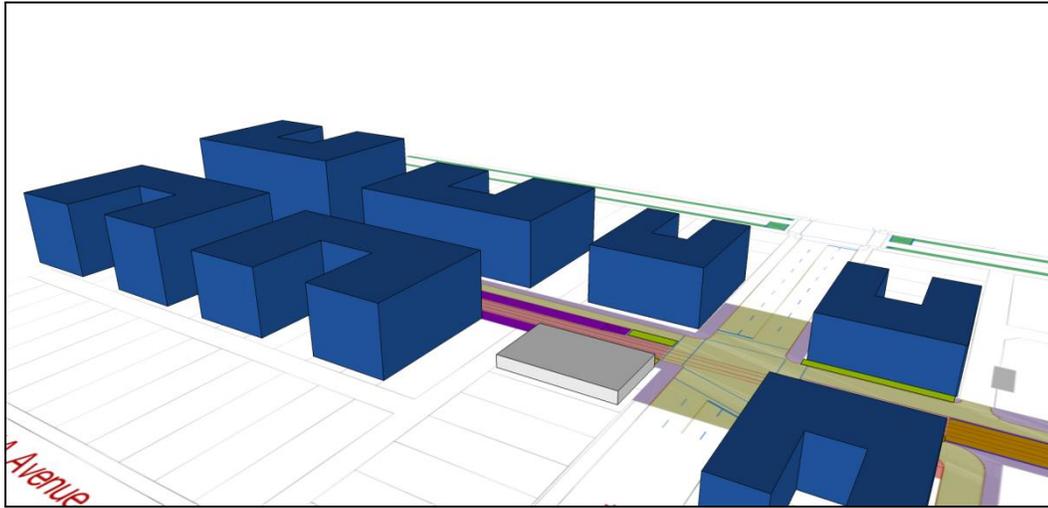
- 6.122 The Base Case Plus assumes the same retail, commercial, and residential development as the Base Case, with the addition of infill redevelopment of a small number of existing buildings immediately south of the platform.

FIGURE 6.20 QUARTERS BASE CASE



- 6.123 The Moderate Case builds on the Base Case and Base Case Plus by providing for moderate redevelopment of some existing buildings north and south of the alignment and platform. The mix of uses would be similar to that of the Base Case (mixed-used neighbourhood retail, commercial, and residential, 3 to 4 floors or higher, with retail and commercial focused on the lower floors and residential on the higher floors).

FIGURE 6.21 QUARTERS MODERATE CASE



Constructability

6.124 The constructability and the mitigation of the associated construction impacts will need to be developed through both the ongoing development of the design and the future construction stages. The potential staging of the development of the LRT through the corridor in support of phased extensions will be a critical input.

6.125 The following elements will need to be considered:

- Regulatory permits and approvals.
- Business impacts.
- Public communication.
- Property acquisitions.
- Laydown areas.
- Construction staging.
- Intersections.
- Traffic management.
- Utility relocation or protection.
- Testing & trial operations.

6.126 These elements are presented in the order they might present themselves through the construction phase of the project, though the planning for each of these elements should be ongoing through the design development, the associated works leading to construction, through the construction phase and testing and trial running. The systems construction is only complete, when all remedial works are complete and the system is operationally meeting the performance specifications.

Regulatory Permit Approval

6.127 The permitting for the project should be identified and actioned early in the development of the PE design process.

Business Impacts

- 6.128 The development of a mitigation plan for the construction impacts to business will be critical through the downtown core, to minimise the effect to business both on the corridor and the surrounding areas. The mitigation plan needs to consider more than the traffic management plan, which will itself deal with vehicle circulation, access to parkades, frontage parking, good and servicing and emergency access.
- 6.129 The plan will need to manage the impact on pedestrians and the associated effects on business, as any reduction in pedestrian activity in the downtown along the commercial and retail streets will directly impact businesses. Critical through walk routes should be provided wherever possible in preference to dedicated walk routes to effected businesses.
- 6.130 As part of the traffic management diversionary routes will be signed, this should also be considered for pedestrians along with temporary business and retail signage to direct people to effected properties.
- 6.131 The plan should work in conjunction with the other the traffic management, pedestrian management and construction staging minimise impacts to reduce the potential impacts to business and the potential need for compensatory schemes.

Public Communication

- 6.132 The City of Edmonton has undertaken exemplary public engagement in the development of the project to date this will need to continue, and aim to inform and mitigate the impacts of the development of the system, and educate the city on the project and importantly how they will interact with it when it commences trail running and the subsequent operation.

Property Acquisitions

- 6.133 The property impacts are detailed earlier in the report, to avoid project delay these any future requirements will need to be acquired in advance of the construction.

Sub-station Equipment Cubicles

- 6.134 Potential Sub-Station locations for the electrification of the LRT are included within the property impacts section. The final locations will need to be identified based upon the electrification plan and the phased development of the project. The property impacts as above will need to be acquired in advance of the construction of the route.

Laydown Areas

- 6.135 The construction of the LRT will necessitate the need for construction laydown and staging areas. The majority of the construction associated with the LRT will be undertaken along the alignment within the street environment. The laydown and staging areas will therefore be required for local site offices equipment and material storage.
- 6.136 Within the Downtown there are currently large areas of surface parking both at the east and west ends of the route, these could be leased under temporary agreements to provide the necessary laydown and staging areas.

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Construction Staging

- 6.137 The plans for construction staging can vary greatly depending on the phased development of the project, the form of procurement, the type/s of track design /form of construction and the individual contractor/s and sub-contractor/s.
- 6.138 An outline construction phasing plan should be developed in conjunction with the development of the PE design, this will need to be refined and agreed with the ultimate contractor.

Intersections

- 6.139 The staging of the construction of the works across each intersection can be the most complex. Consideration could be given to the methods developed in the construction and maintenance of European LRT systems to pre-construct the intersection, sections of the LRT alignment at a remote fabrication facility. These are then installed over a single weekend, limiting the disruption to weekday traffic.

Traffic Management

- 6.140 The downtown LRT line is located through the core of the City. In providing this exemplary connectivity, the construction of the alignment will need to be undertaken in a manner that minimises the impact of construction on the continued daily activities within the area.
- 6.141 The corridor itself does benefit from having very few vehicular accesses to properties and no parkade accesses, which will reduce the potential impact. Traffic circulation and cross corridor movements are likely to be most affected.
- 6.142 The concept plans for the Downtown LRT reference proposals to turn 103 between 100 and 103 into a two way street and for 102A to be converted to two way operations between 99 and Jasper Avenue. The advanced construction of these elements would help improve vehicle circulation and aid the traffic management for the more major LRT works.

Transportation Demand Management

- 6.143 Consideration should be given to the development of complimentary TDM measures to support the development of the Downtown LRT particularly through the Construction phase to reduce traffic into the Downtown. This was discussed earlier under Transit integration.

Traffic Management Plan

- 6.144 In conjunction with a construction staging plan, a comprehensive traffic management plan will need to be developed to support the construction of the LRT.
- 6.145 A number of LRT construction projects have successfully used the strategy of completing the final roadway reconfiguration works first. This approach leaves clear the space for the LRT and the associated works and enables traffic to become used to the revised arrangements.
- 6.146 The construction of the intersections and the staging of works are likely to be one of the more major impacts within the downtown particularly on the cross LRT corridors

that connect to the river crossings. Consideration could be given to the methods developed in the construction and maintenance of European LRT systems to pre-construct the intersection, sections of the LRT alignment at a remote fabrication facility. These are then installed over a single weekend, limiting the disruption to weekday traffic.

- 6.147 The Traffic Management Plan will need to consider:
- Advance notification of each stage of the Traffic Management Plan.
 - Reduction of traffic during construction.
 - Diversion of traffic onto parallel routes.
 - Communication of diversionary routes.
 - Limiting works to one of the cross corridor connections to the bridges at a time.
 - Provision of access on 107 Street and 102 Avenue.
 - Revised Downtown circulation.
 - Provision for Emergency Services.
 - Revision of Transit routes (Permanent relocation).
- 6.148 The Traffic Management Plan should include the development of individual plans for some of the major downtown parkades in conjunction with the building owners /managers to alleviate these more time focused (peak hour) users.

Utility Relocation/Protection

- 6.149 Cover earlier in the report.

Testing & Trial Operations

- 6.150 Through the ongoing development of the LRT, a testing and operations plan should be developed. This will need to include details relating to the operation of the LRT system itself and the bringing into service of the system. It will also need to include details on how the general public will be informed and educated about the system prior to operation and how the initial interaction with other street users will be controlled during the testing, commissioning and early operation of the system.
- 6.151 This plan could include strategies such as:
- A City wide education program.
 - Schools education program.
 - Open days for a small completed section near the maintenance/park and ride facility, to allow people to interact with the system.
 - Initial LRT movement can be escorted, with a police presence.
 - Initial more defensive operation strategy:
 - Reduced initial service frequency.
 - Operation at a slower speed (increased journey time).
 - Extended “early” red time at intersections.
- 6.152 The operation plan should set out the approach to the early phases of the system operation through the first 18 months. This should detail the service frequencies and

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there increases, the operating speed and increases and the improvement in journey time over the early implementation phase. It should also set out how a strategies for journey time improvements will be implemented, such as all door opening, proactive door tones to speed boarding and door closure.

- 6.153 The plan should also set out how any initial operational incidents will be dealt with, and how the service will be degraded and operated on either side of, or around any incident.

Cost Estimates

- 6.154 The estimate of the cost of the alignment is a critical component of the planned LRT corridor and the routes connectivity through the downtown for the Southeast and West routes.
- 6.155 The cost estimates for the entire Downtown connector detailed below in Table 6.6 is based upon the development of the diagonal 107 Street stop option, and includes, construction, land and engineering and construction administration.

TABLE 6.6 COST ESTIMATE - DIAGONAL 107 STREET

Item	Cost Estimate
Construction (\$ M)	\$120
Roadway and Trackwork	\$65
Signals and Systems	\$35
Stations	\$20
Land (\$ M)	\$40
Engineering and Construction Admin (\$ M)	\$15
Total	\$175

- 6.156 The cost estimates for the entire Downtown Connector detailed below in Table 6.7 is based upon the development of the 107 Street stop option, and includes, construction, land and engineering and construction administration.

TABLE 6.7 COST ESTIMATE - 107 STREET

Item	Cost Estimate
Construction (\$ M)	\$120
Roadway and Trackwork	\$65
Signals and Systems	\$35

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Stations	\$20
Land (\$ M)	\$20
Engineering and Construction Admin (\$ M)	\$15
Total	\$155

7 Next Steps

- 7.1 With the approval of the Downtown LRT Concept Design by City Council on January 31, 2012, the project enters the next phase of design, Preliminary Engineering. The Downtown LRT is part of the larger Southeast to West LRT project. This project is aimed at developing low-floor LRT from Lewis Estates in the west, through Downtown Edmonton, and then south to Mill Woods. The preliminary engineering of the entire project has begun and was staged to allow for the Downtown LRT Concept Design to be completed. The Downtown LRT now becomes a segment of the larger Southeast to West LRT.
- 7.2 Preliminary Engineering for the downtown segment will include developing the detailed horizontal and vertical designs for the LRT. This will include:
- Preliminary track work design.
 - Catenary design and placement.
 - Geotechnical analysis.
 - Preliminary tunnel and structural designs.
 - Stop infrastructure designs and layouts.
 - Preliminary systems and signalling designs.
 - Street designs (parking, traffic).
 - Development of a draft operations plans for the LRT.
 - Drainage designs.
 - Cost estimating.
 - Utility design, placement, and relocations.
 - Formal property acquisition requirements.
 - Urban realm designs including pedestrian and cycle facilities.
- 7.3 The Preliminary Engineering will be based off of the specific layouts presented in the approved Concept Designs. Each subsequent level of design builds on the previous, becoming more detailed in each phase.
- 7.4 It is critical that the low floor concepts that serve as the basis for this new system are not lost in the further design. The urban-style LRT has been envisioned as a simple system, with less infrastructure and minimal separation. Ensuring these concepts are carried through Preliminary Engineering is critical to the overall outcome of a new system that will result in the city-shaping benefits. The city-shaping elements of this project have long been a part of the City's plans for LRT as tool to create denser and more sustainable urban areas.
- 7.5 The Preliminary Engineering phase will allow the City to fully identify the design requirements, cost, and phasing of the new low floor LRT. This level of design will further support the City's efforts to identify all manner of funding to realise this visionary project.

