

AIRPORT TRANSIT LINE

ROUTE SELECTION & TECHNOLOGY STUDY

THE CITY OF CALGARY

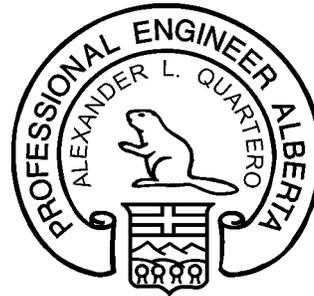
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1 EXECUTIVE SUMMARY

1.1 BACKGROUND

The City of Calgary (the City) undertook the Future Airport Transit Route Selection and Technology Study (“the Airport Transit Study”) to develop plans for a future transit connection that will connect the Blue Line LRT, Green Line LRT and the Calgary International Airport (YYC) while serving development in the local area. This “Airport Transit Line” is identified in Calgary’s *Route Ahead Transit Plan* and the *Calgary Transportation Plan*.

The current study area is illustrated in **Figure 1-1** below.

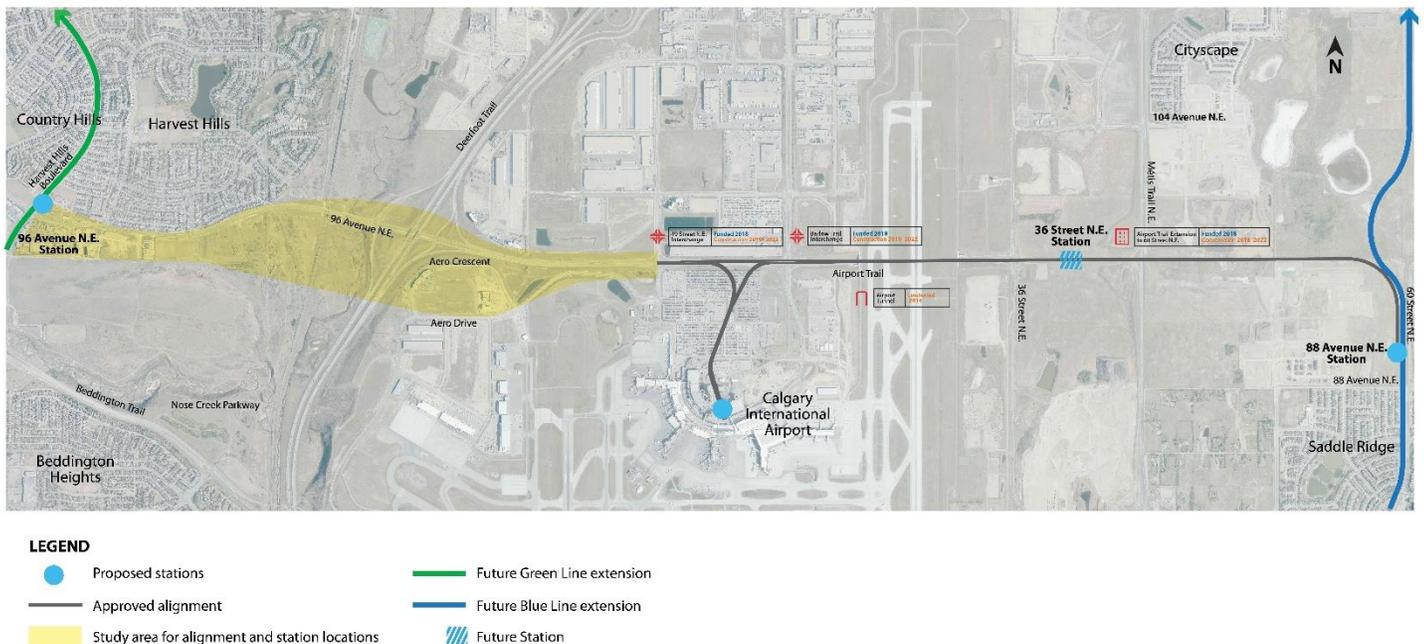


Figure 1-1: Study Area

There are three prior Council-approved functional plans that determined the approved alignment and the station locations for the Airport Transit Line indicated in the image above, for the section from approximately 19 Street N.E. to the eastern boundary of the study area:

- 96 Avenue N.E. (Airport Trail) Functional Planning Study (2012);
- 96 Avenue N.E. (Airport Trail) Functional Planning Study Update (2017); and
- Northeast LRT Functional Plan – Saddletoorne Circle to Stoney Trail (2012).

This study developed the scope and vision for the Airport Transit Line in greater detail and provides recommendations for:

- Route alignment and stations between the future 96 Avenue N.E. Green Line Station and 19 Street N.E.;
- Location for a maintenance and storage facility;
- Land requirements;
- Transit technology; and
- A preliminary staging plan and cost estimates.

This study was conducted to ensure the future Airport Transit Line is:

- Coordinated with the Preliminary Engineering design for the Blue Line extension;
- Aligned with the updated Functional Plan for Green Line;
- Accommodated in the Aurora Business Park Outline Plan update;
- Coordinated with Airport Trail Interchange Projects @ 19th Street and Barlow; and
- Considered in the Airport Authority Master Plan update.

1.2 PROJECT PROCESS

The technical work for the Airport Transit Study began in 2017, and included:

- Working with the Calgary International Airport to understand their future plans;
- Conducting research to understand ridership projections and investigate airports across North America with rail connections;
- Consulting with industry experts in airport transit;
- Conducting technical analysis to understand constraints unique to the airport; and
- Screening potential technology options.

Key external stakeholder agencies were contacted by the project team to arrange for their direct participation in the study, including Calgary Airport Authority (YYC), Alberta Transportation (AT), and Canadian Pacific Rail (CP).

A series of workshops were arranged by the project team to collaborate with key stakeholders to review and establish consensus on the following for technology and alignment scopes:

- The range of options to be reviewed;
- Selecting appropriate options for next stage (“short-listing”); and
- Establishing the selection criteria for detailed evaluation of the carried forward options.

The public and stakeholder engagement approach, described more fully in Section 1.6 of this executive summary, was based on the guidelines for a Transportation Corridor Study Policy. The engagement approach was iterative and allowed stakeholders to see how their input was incorporated at each stage.

1.3 RIDERSHIP

A ridership forecast was developed to aid high level project planning and inform the technology that was needed to adequately support future demand for the Airport Transit Line. The forecasts are based on outputs from The City’s Regional Transportation Model (RTM) with adjustments made to enhance the modelling in the airport area. The forecasted airport travel demand was adjusted using research into mode share data from comparable North American cities and qualitative analysis of the anticipated airport transit markets in Calgary. **Figure 1-2** shows a comparison of the current daily ridership for airport transit routes and annual volume of airport passengers in Calgary, Toronto and Vancouver.

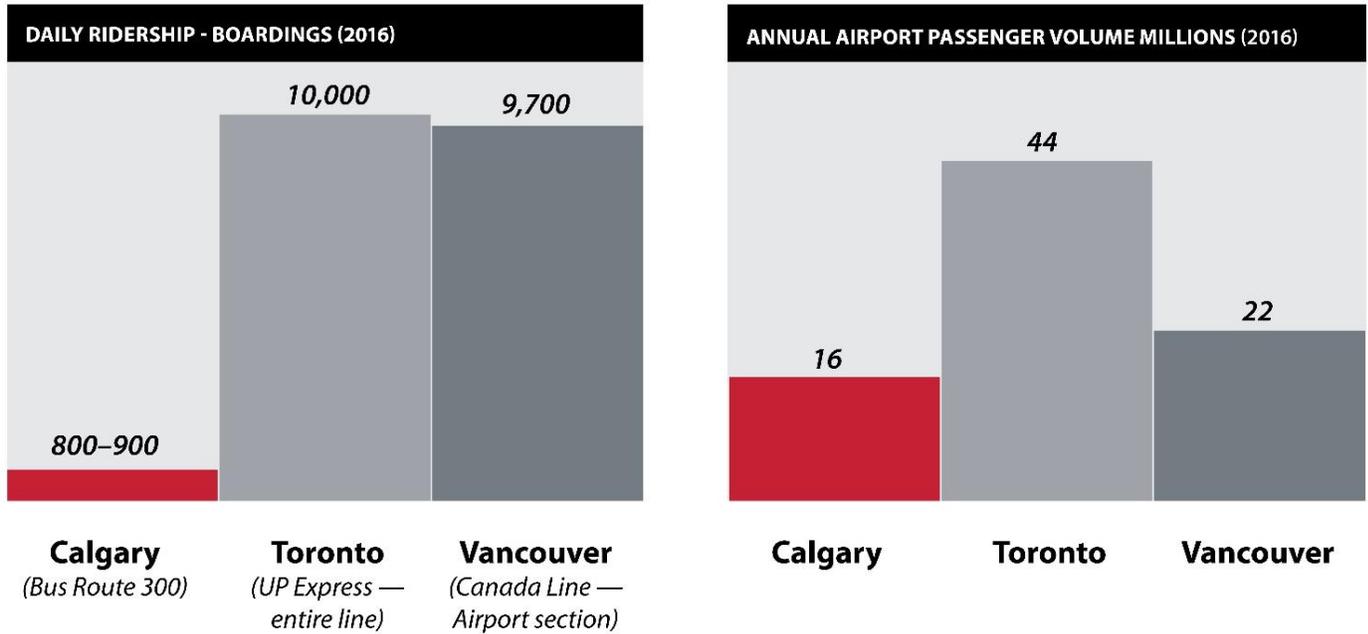


Figure 1-2: Comparison of Daily Ridership and Airport Passenger Volume

Ridership estimates were developed based on characterisation of both airport employee, passenger travel to and from the airport, and north cross-town riders. Passenger travel was further disaggregated into the business and leisure travel markets for both residents and visitors to the Calgary area. Airport employee travel was characterised based on three categories including terminal based employees, off-terminal employees, and surrounding area employees.

Estimated 2048 ridership with a staged implementation is summarized in **Table 1-1**.

Table 1-1: Estimated 2048 Ridership for Staged Construction

	Daily Riders (passengers per day)	AM Peak (passengers per hour per direction)	PM Peak (passengers per hour per direction)
East Segment Only (Stage 1)	8,500 – 17,500	650 – 1,450	650 – 1,400
Fully Constructed (Stage 1 + Stage 2)	16,500- 28,500	1,050 – 1,750	1,000 – 1,650

**Ridership rounded to nearest 500 passengers (for daily numbers) and nearest 50 passengers (for hourly)*

High = 22% Employee Mode Share, 15% Passenger Mode Share, 5% Misc.;

Low = 9% Employee Mode Share, 8% Passenger Mode Share, 2% Misc.

Daily ridership estimates in 2028 and 2048 are summarized in **Table 1-2**.

Table 1-2: Daily Ridership Estimates by Segment

ALL DAY	2028		2048	
	East	West	East	West
Share of Ridership	65%	35%	61%	39%
Eastern Segment Ridership	3,849-8,145		6,636-14,042	
Western Segment Ridership	2,089-4,422		4,308-9,116	
Through Ridership (Network Baseline)	1,600		5,500	

Figure 1-3 illustrates the expected transit ridership today and in the short-, medium-, and long-term. The figure demonstrates the likely transition of transit mode from priority bus service to staged implementation of a rail based rapid transit service, along with approximate ridership thresholds anticipated at each mode progression.

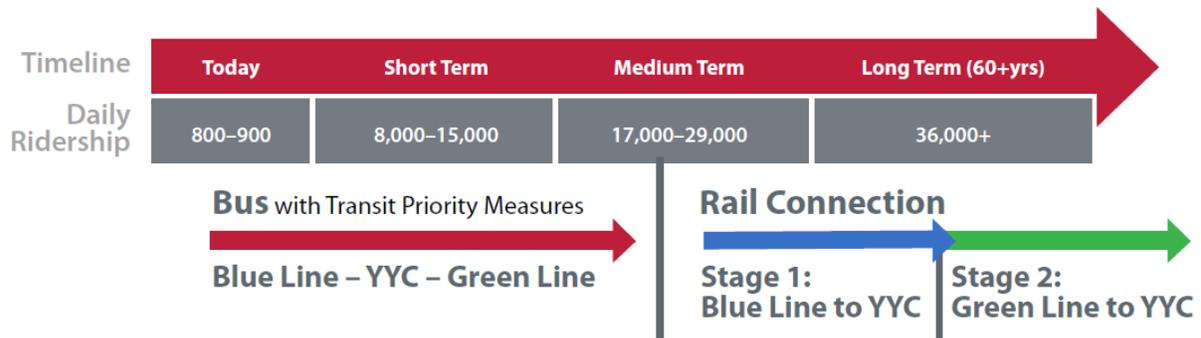


Figure 1-3: Transit Ridership Timeline

1.4 TECHNOLOGY STUDY

A list of 10 potential transit technologies was developed by the project team to meet the connectivity goals of the route. The preferred transit technology for the Airport Transit Line was identified through progressive refinement of a list of options through application of screening and evaluation criteria. The resulting short list was evaluated in detail by using a Multiple Accounts Evaluation (MAE).

The potential technologies included high-floor and low-floor LRT, Bus Rapid Transit (BRT), Personal Rapid Transit (PRT), Group Rapid Transit (GRT), Monorail, Aerial Tramway, and Automated People Mover (APM), among others. Eight screening criteria were applied to narrow down the list of potential transit technologies, including:

- Regulatory: Meets all applicable codes and regulations
- Healthy and Green City: Environmentally-friendly and -sustainable technology
- City of Inspiring Neighbourhoods: Flexibility to expand service to existing and future land use
- Financial and Economic Case: Potential for financial feasibility
- A City that Moves: Ability to attract riders and reasonably handle ridership growth

- Customer Experience: Provides a convenient, safe, accessible, and reliable system that is attractive to all riders
- System Delivery: Ability to leverage or integrate into planned facilities and infrastructure
- Proven Technology: Supplier has successfully implemented the same or similar technology option in similar weather conditions

Based on the screening criteria, the following short list of transit technologies was identified:

- High/Low Floor LRT – vehicles that match those operating on the existing Blue/Red Lines, or on the future Green Line;
- Automated People Mover (APM) – an automated vehicle operating either on rubber or steel wheels similar to Canada Line in Vancouver; and
- Bus Rapid Transit with Transit Priority Measures.

As a result of the public feedback and through review of the detailed MAE, summarized in **Table 1-3**, APM was identified as the preferred technology in the medium to long term. Key benefits of this technology include:

- Reduction in capital cost associated with smaller stations and maintenance facility as compared to LRT and BRT due to the higher frequency of service and thus reduction in fleet size requirement
- Automation allows for flexibility of service, permitting the service to match or exceed demand without major impacts to operating costs.
- A faster turn-around time at the airport station allows for more frequent service and savings of 25% in travel and wait times as drivers are not required to change ends of the lead vehicle at the station.
- Reduced round-trip travel times will provide a better quality of service for Transit customers.
- APM provides better customer experience with wider doors and accommodation of luggage.
- APM would guarantee no local emissions and reduce environmental impact from roadway maintenance.
- APM creates less noise than bus transit
- APM is anticipated to have significant operating cost benefit compared to LRT and BRT for similar passenger capacities.

Table 1-3: Transit Technology MAE Results

Account	LRT	APM	BRT
 Sustainable Environment			
 Urban and Neighbourhood Development			
 Financial Capacity			
 Transportation			
 Community Well-being			
 Feasibility and Deliverability			
		Recommended	

1.5 ROUTE SELECTION AND STATION LOCATIONS

Development of the preferred route alignment and station locations for the Airport Transit Line followed a similar process to that of the technology study; progressing from a list of potential options, to a short list, and ultimately a MAE to develop a recommendation. Engagement with key project stakeholders including Calgarians, adjacent land-owners, Calgary Transit, AT, and YYC occurred throughout the options development and evaluation process. This ensured that feedback from stakeholders was considered when evaluating options.

The project area was separated into segments with similar project context where discrete alternatives could be assessed. The segments were:

- 1 Transfer station at Green Line (future 96 Avenue N.E. Green Line station) to Deerfoot Trail
- 2 Deerfoot Trail to 19 Street N.E.
- 3 19 Street N.E./Barlow Trail N.E. to Calgary International Airport Terminal Approach
- 4 Barlow Trail to Blue Line transfer station (future 88 Avenue N.E. Blue Line station) – Route determined via *Airport Trail Functional Planning Study* (2012) and *Blue Line LRT Functional Planning Study* (2011)

While the complete route from the transfer station at Blue Line to the transfer station at Green Line is included in the recommended plan, the route selection study was limited to discussion and assessment of options in segments one through three. The study area is illustrated above in **Figure 1-1**. Alignments for segment four of the route have already been determined through previous studies, with minor geometric design adjustments to suit the preferred rail technology, maintenance facility site selection, and coordination with Airport Trail interchange configurations.

Through successive workshops to identify, develop, evaluate and refine alignment and station location options in each segment of the study area, four feasible routes were prepared connecting all segments of the study area. Options that were considered as part of the MAE are provided below in **Figure 1-4** to **Figure 1-7**. The Option 3 characteristics associated with the alignment and station location listed in **Table 1-4** best meet the MAE criteria out of all considered options.

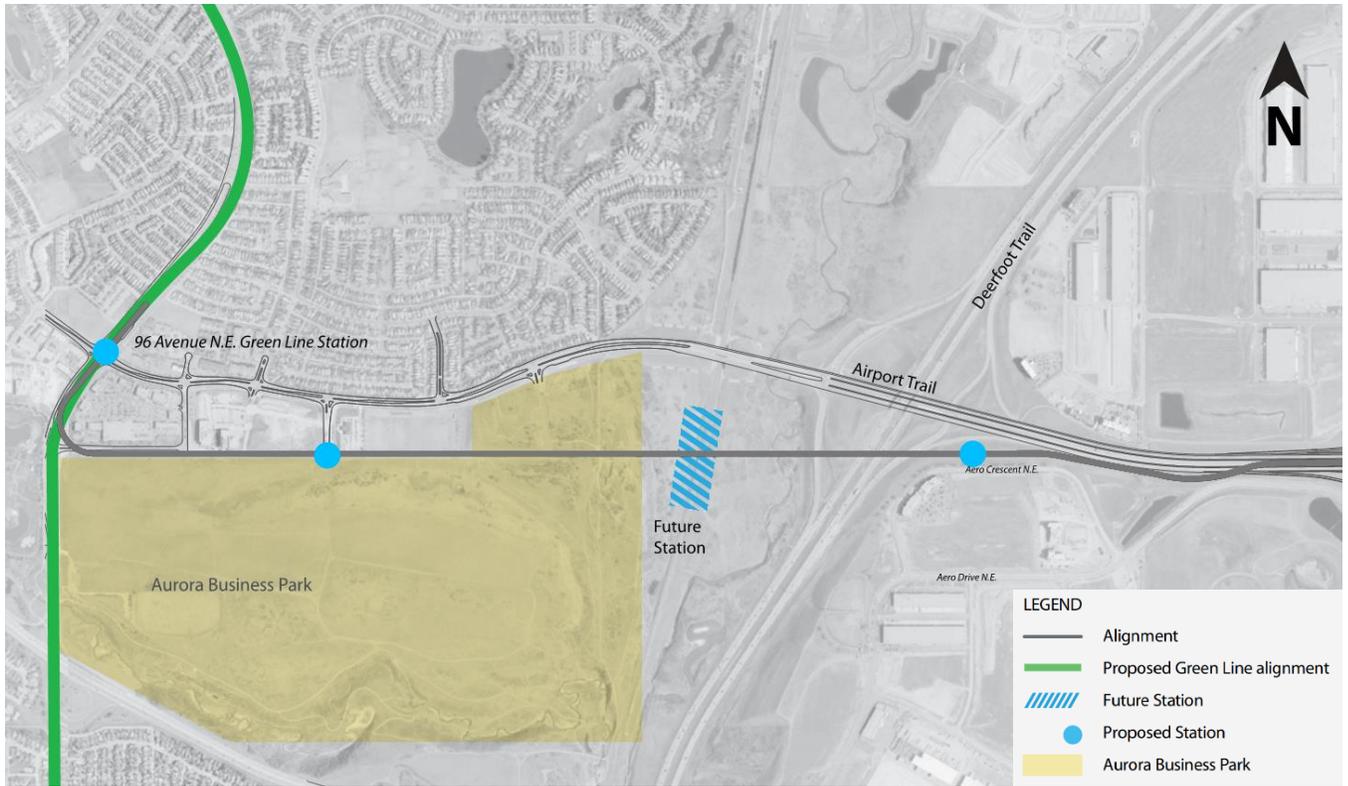


Figure 1-4: Airport Transit Line Route and Station Option 1



Figure 1-5: Airport Transit Line Route and Station Option 2



Figure 1-6: Airport Transit Line Route and Station Option 3 (Recommended)

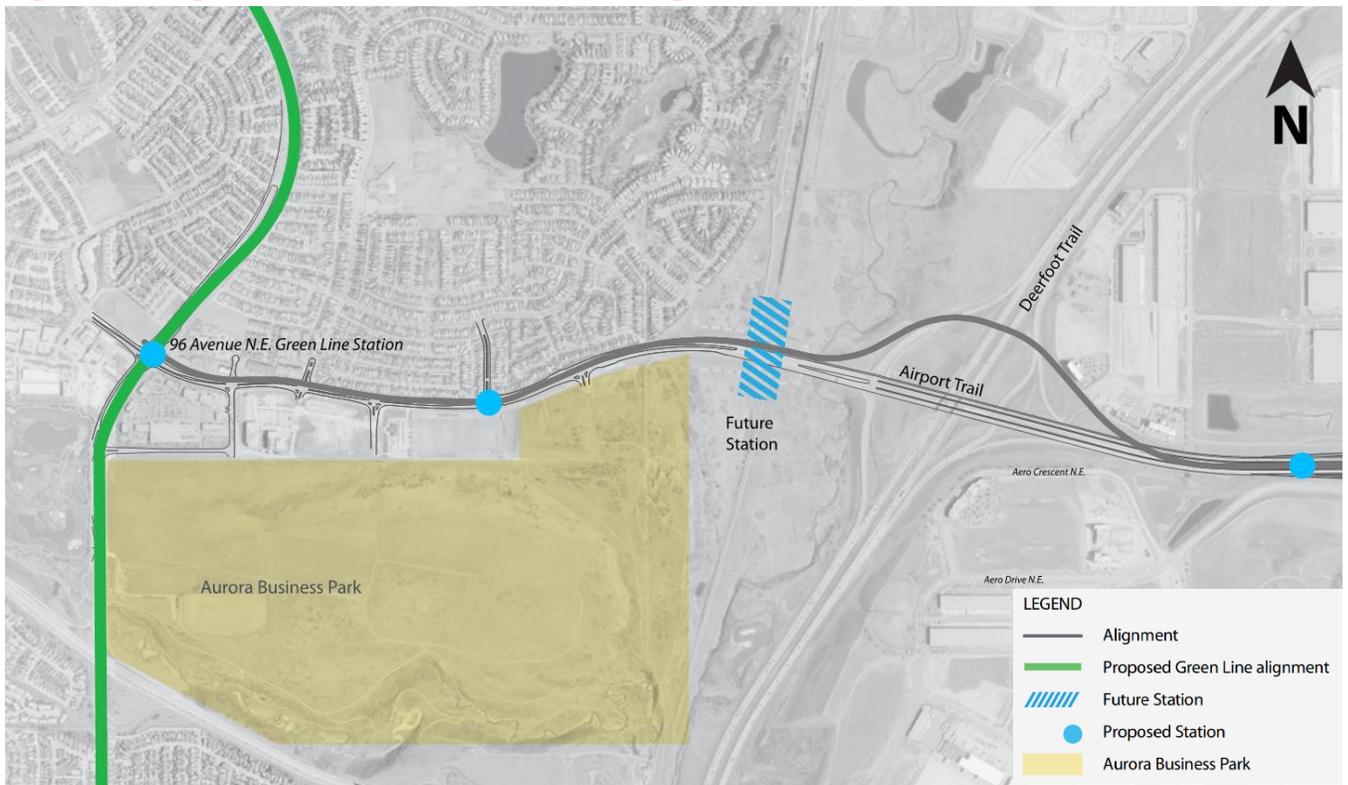


Figure 1-7: Airport Transit Line Route and Station Option 4

Based on the results of the MAE, summarized in **Table 1-**, Option 3 is the recommended alignment and provides the preferred location for the Aurora Station, adjacent to 96 Avenue N.E. with balanced service to both businesses and residents. The alignment also provides development opportunity around the Aero Drive Station.

Table 1-4: Option 3 Alignment and Station Location Details

Key Benefits	Alignment: From the future 96 Avenue N.E. station, travels east along 96 Avenue N.E. to Aurora Business Park, near Harvest Hills Link N.E.
Alignment	<ul style="list-style-type: none"> – Permits a shallower tunnel to connect with the future 96 Avenue N.E. station / Green Line – More cost-effective station configuration as compared to Option 1 due to shallower excavation and reduced overall alignment length.
Station Location	<ul style="list-style-type: none"> – 96 Av N Station to connect with Green Line and bus terminal. – 96 Av at Harvest Hills Li NE central between Aurora Business Park and the community of Harvest Hills
Key Benefits - Operations	<ul style="list-style-type: none"> – Higher ridership potential due to optimal distance between stations and potential development along recommended alignment. – Improved travel time over Option 1 – The best balance of connectivity to other transit modes and the adjacent residential community. – A direct route from east to west would reduce travel time and increase average travel speed. – The station locations were selected as they provide an excellent connection to the Aurora Business Park, the best access for buses as well as pick-up/drop-off locations and serve more riders than other options.
Development	<ul style="list-style-type: none"> – The Aero Drive is central to Deerfoot North Global Logistics Park and would encourage transit-oriented development. – Aero Drive Station location is most supportive of Transit Oriented Development opportunities. – Provides excellent connection to developments near and to Aurora Business Park.

Table 1-5: Alignment and Station Location MAE Results

Account	Option 1	Option 2	Option 3	Option 4
 Community Well-being				
 Feasibility and Deliverability				
 Financial Capacity				
 Sustainable Environment				
 Transportation				
 Urban and Neighbourhood Development				
			Recommended	

1.6 ENGAGEMENT

The engagement approach was based on the guidelines from the Transportation Corridor Study Policy. It included an iterative approach where stakeholders saw how their input from prior engagement was incorporated at each stage.

There were three phases to the engagement process, as shown in **Figure 1-8**.



Figure 1-8: Public Engagement Process

1.6.1 PHASE 1 ENGAGEMENT

In **Phase 1**, The City sought input from the public and stakeholders on what criteria should be considered when making decisions about technology, alignment and station locations, and solicited general concerns and ideas. This phase involved conducting a meeting with the Calgary Transit Advisory Group (CTCAG), two public open houses, a landowner workshop, and an online survey.

What We Heard

Integration with existing transit systems emerged as the highest-rated evaluation criterion when participants were asked to rank important considerations when evaluating technology options and indicated it would be important in

making the final decision. Speed was the second-highest criterion followed by cost effectiveness and accessibility at third and fourth, respectively.

Integration with existing LRT systems and station locations emerged as the highest-rated evaluation criterion when participants were asked to rank important considerations when evaluating alignment and station location options. Ride time was the second-highest rated criterion and cost was ranked third.

What We Did

Feedback from all in-person and online engagement activities were transcribed and themed according to the topics of technology, and alignment and station locations. This information provided the project team with an understanding of citizen priorities for the evaluation of options and in decision-making. The themes were then incorporated into the MAE criteria and used to evaluate each option.

1.6.2 PHASE 2 ENGAGEMENT

In **Phase 2**, The City presented the technology, alignment and station location options that were considered and demonstrated how each of the options addressed the important criteria as identified by stakeholders and the public in Phase 1 as well as how well each option met The City's technical criteria. Stakeholders and the public were then asked for feedback on the study recommendations through two public open houses, a CTCAG meeting, and an online survey.

What We Heard

Participants were asked what they liked and didn't like about the recommended plan, and how the plan could be improved. The following responses summarize the most frequent themes captured within each category during this phase of engagement.

The elements of the plan that participants liked included the planning of public transit link to the airport as it is necessary/overdue, the choice of technology (APM), the east-west connection the Airport Transit Line creates between Blue/Green Line, and the benefits provided to the surrounding areas.

The elements of the plan that participants thought could be improved upon included connecting the Blue and/or Green Line to the airport directly (no transfer), expediting and securing funding for the project, providing considerations for luggage and future expansion of service, and minimizing travel times and stops.

The elements of the plan that participants did not like included the lack of a direct link to downtown (i.e. transfer required from Blue Line or Green Line), and the project is not enough of a priority and is progressing slowly. There were also many participants that offered general support and did not have anything they didn't like about the proposed plan.

What We Did

The project team used the feedback to finalize the study recommendations. The What We Did Report describes how the recommended plan does or does not address participants' feedback. This report is available for public review at www.calgary.ca/airporttransitstudy.

1.7 RECOMMENDED PLAN & PROJECT DELIVERY

The Recommended Plan was developed to consolidate a preferred alignment and station locations, the preferred transit technology, and adjustments to previously approved segments of the route. The Recommended Plan is shown in **Figure 1-9**.

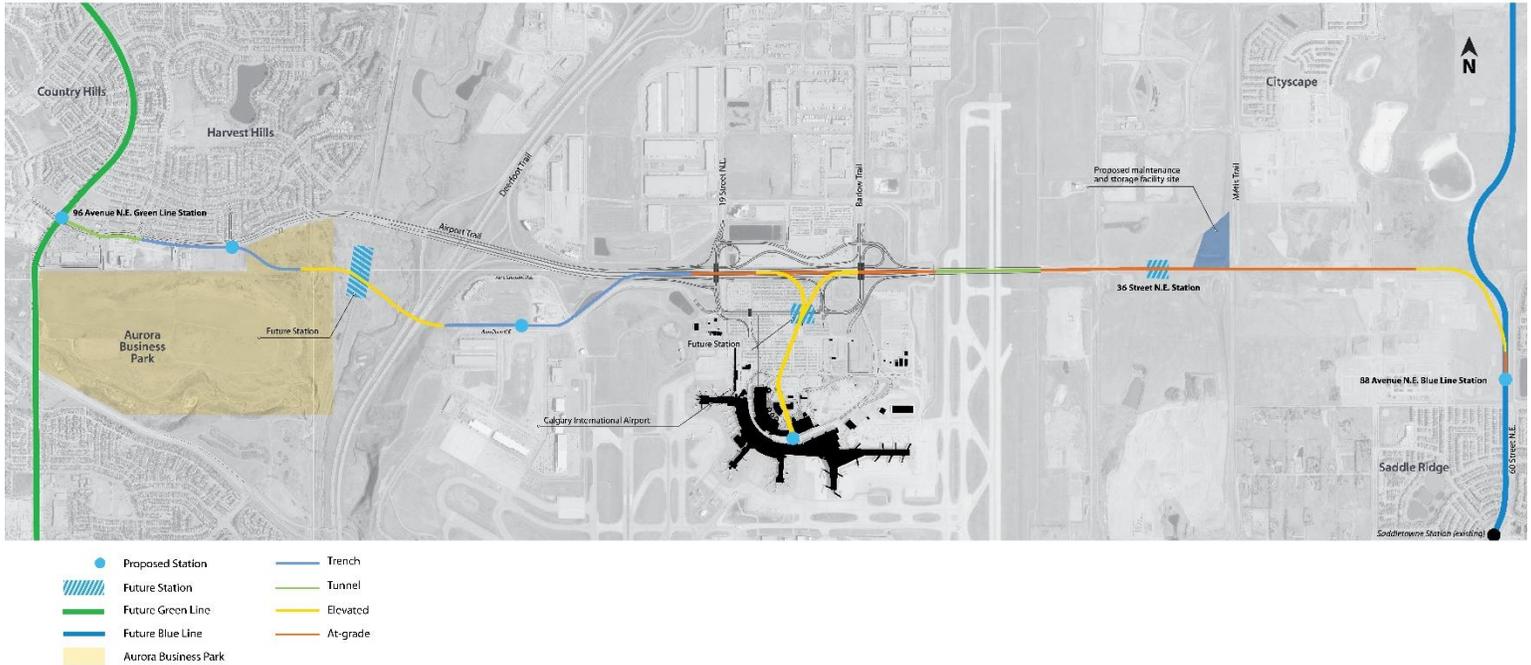


Figure 1-9: Recommended Alignment and Station Locations

The Recommended Plan shows Option 3 from the alignment and station location study in combination with an optimised alignment for the segment between 19 Street N.E. and the eastern Terminus at Blue Line (future 88 Avenue N.E. Blue Line station). Alignment of the Airport Transit Line has been adjusted relative to previously approved plans between 19 Street and Barlow Trail N.E. to improve operating speeds and reduce structure costs, and at 36 Street N.E. to provide an access route to the preferred maintenance facility site.

1.7.1 MAINTENANCE FACILITY

Selection of a site for a maintenance and storage facility for vehicles required to deliver this service was based on availability of land in the corridor and probable phasing of construction. Following the downgrading of Métis Trail from an expressway to an arterial street, it was determined that the future interchange loop on the northwest corner of this interchange is no longer required. As such, this piece of City owned land was selected as the preferred location for an MSF. A schematic site plan of an APM maintenance facility was developed as a proof of concept and is included as **Figure 1-10** although additional design effort is required to confirm access, functionality and boundary conditions following confirmation of the design.

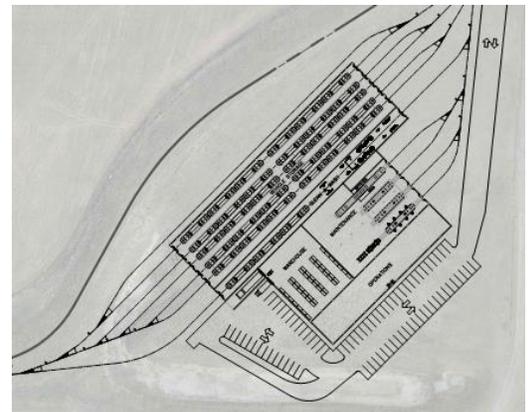


Figure 1-10: Schematic MSF Site Plan

1.7.2 CONSTRUCTION STAGING

Staging delivery of the Airport Transit Line is based primarily on the incremental capital cost to provide rapid transit access to the airport terminal. The preliminary staging plan reflects building Blue Line connection prior to Green Line connection for the following reasons:

1. Ease of design and construction due to its mainly at-grade alignment and therefore more cost effective;
2. Recommended location for a maintenance and storage facility (MSF) on City owned land;
3. Proximity of the current Blue Line NE terminus, Saddletowne station, to the Airport Transit Line's transfer station at 88 Avenue station (850m);
4. The ridership estimates indicate that approximately 39% of ridership is utilizing the west segment and 61% the east segment; and
5. Ridership analysis suggests that most employment trips to the terminal will come from northeast Calgary.

Reconsideration of the preferred phasing plan may be warranted in the event that Green Line is funded and constructed to 96 Avenue N.E. prior to commitment of funding to the Airport Transit Line. The Airport Transit Line staging will be further evaluated and confirmed through the RouteAhead capital project prioritization

1.7.3 CONSTRUCTION & OPERATING COSTS

An estimate of construction costs has been developed for the project based on the information developed as part of the study, and the experience of the project team on similar scopes of work. The estimate is presented to a Class 4 level of certainty, with expected variance from -30% to +50%. A risk-based review of project costs as well as a constructability review are recommended as next steps for the project's anticipated functional planning study scope. A summary of the staged capital and annual operating costs for the project is presented in **Table 1-**

Table 1-6: Summary of Project Costs

East Leg– Blue Line to Calgary International Airport	West Leg – Calgary International Airport to Green Line
Estimated Capital Cost: \$400M - \$800M	Estimated Capital Cost: \$500M - \$1B
Estimated Annual Operating Cost: \$14.5M	Estimated Annual Operating Cost: \$20.5M

1.7.4 LAND REQUIREMENTS

The majority of the Airport Transit Line is proposed to exist on lands owned by The City, or on lands owned / administered by other public entities including AT (Deerfoot Trail right-of-way) and YYC. Private property impacts are anticipated at the west end of the route adjacent to 96 Avenue N.E. Parcels on the south side of the street may be impacted to permit transition of the route from - a tunnel within the existing 96 Avenue N.E. right-of-way - to a trench cross-section south of 96 Avenue N.E.

While currently no land is required to construct the future station at 36 Street N.E., further consideration of land and access is required to ensure adjacent development is coordinated with the potential station site.

Refinement of the property requirements is recommended through a comprehensive land study and informed by a constructability review.

1.8 CONCLUSIONS & NEXT STEPS

The following next steps have been identified to further advance the detail in the Airport Transit Line design development:

- Revisit and refine the technology recommendation based on technological advancement and current market offerings and use result to re-verify alignment geometry and MSF layout;
- Develop detailed project design criteria for infrastructure and operation of the service including geometric design guidelines, operational performance criteria, architectural design criteria, etc.;
- Complete a comprehensive engineering data collection and analysis program to develop understanding of geotechnical, environmental, biophysical, historical, utilities, stormwater and drainage, TOD planning, and acoustical risks to the project;
- Complete a constructability review; and
- Develop a construction preliminary staging plan to minimize impacts on adjacent businesses and residents.