

Calgary



Green Line LRT

Station Connections Framework

OCTOBER 2017



DOWNTOWN

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The objective of the Station Connections work is to:

Enable users of the Green Line LRT to access all stations by identifying and prioritizing local infrastructure projects. This can be achieved by removing existing barriers, enhancing current networks and building networks where none exist for all modes of transportation.

This document provides the Framework for the Station Connections work, which addresses Layer 2 of the Green Line 4 layered approach. The station connection, Layer 2, work address the need for transit riders to access stations as pedestrians, cyclists, bus riders, automobile passengers or drivers. As the Green Line is being built in established communities this Framework provides a method of analysis and prioritization for infrastructure improvement projects that will ultimately improve access for users of the Green Line. Finally, this document presents a list of projects to be included in the initial construction phase of the Green Line Stage 1 in order to drive ridership on the line.

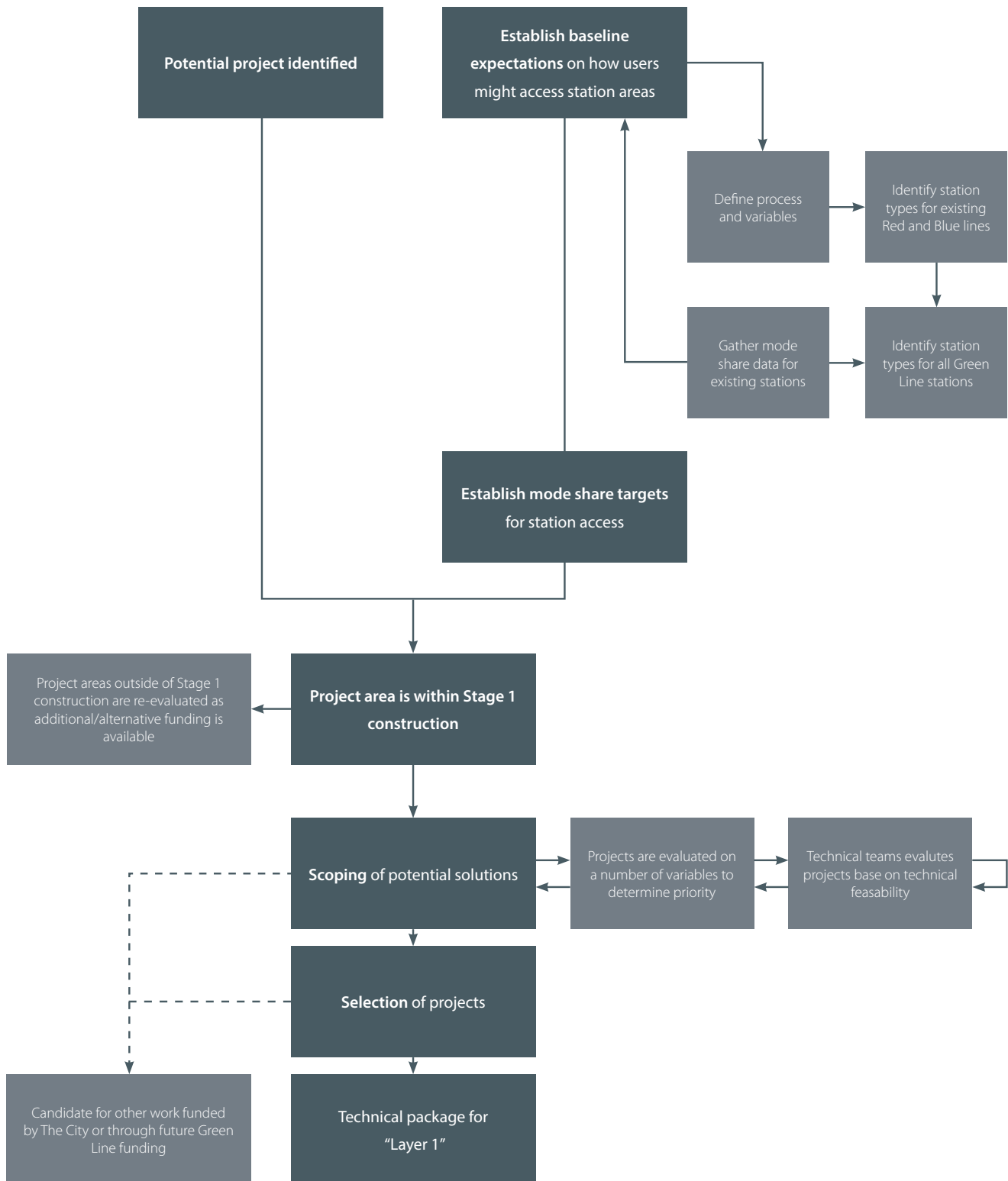
This Framework presents a clear process to inform decisions that are Calgary specific and was endorsed by various city stakeholders, this process is outlined in the flow chart presented. The process resulted in an improved understanding of the station areas on the Green Line through which objectives and long-term targets for mode share have been established.

This Framework recommends \$28million in critical infrastructure to directly serve riders of the green line in accessing the station. This investment is summarized in the table below. This Station Connections Framework provides detailed maps and description of each of the projects recommended. Finally, an outline is presented for the supporting work required including implementation, monitoring and evaluation.

The Station Connections work supports the future shifting travel patterns of existing and future residents in Calgary. The recommendation enables the Green Line to meet and exceed the potentials in ridership, development and community safety. Corporate partners, like the Canadian Municipal Land Corporation are making parallel investments to integrate their developments with the Green Line, and the Framework recommends the potential to achieve expectations of the public.

| | Number of improvements | Length (Metres) | Total Cost Rounded (\$million) |
|---------------------------|------------------------|-----------------|--------------------------------|
| Pedestrian Improvements | 50 | 22,196 | \$16.0 |
| Intersection Improvements | 7 | N/A | \$3.0 |
| Active modes Improvements | 20 | 13,815 | \$8.0 |
| Transit Improvements | 115 | N/A | \$1.0 |

Overview of the Station Connections process and analysis





Introduction

The Green Line is firmly embedded in Calgary's plan for the future. The Calgary Transportation Plan (2009) and RouteAhead (2013) include the Green Line as a priority LRT line to be built in Calgary. The "Green Line LRT Long Term Vision: 160 Avenue N to Seton SE", approved by City Council in June 2017 provides a guide for future investments to demonstrate a readiness for delivery and a commitment to a common vision.

The long term vision of the Green Line has intentionally considered transit oriented development (TOD) and City Shaping, adjusting the transit line and station locations to maximize their potential for ridership and accessibility. Calgarians in all walks of life for generations to come will benefit by connecting people to programs, spaces and places they care about.

Layer 2 of Green Line program focuses on the infrastructure connecting riders to stations. This includes pedestrian, cycling, bus and automobile connections to the Green Line to ensure stations are accessible to all riders. Enabling citizens to safely and conveniently access stations will be crucial to Green Line ridership.

The objective of the Station Connections work is to:

Enable users of the Green Line LRT to access all stations by identifying and prioritizing local infrastructure projects. This is achieved by removing existing barriers, enhancing current networks and building networks where none exist for all modes of transportation.

Strategies of this Framework include:

Detailed costing and recommendations for Layer 2 infrastructure critical to the success of Layer 1

The Station Connections Framework is intended to support the staging of Green Line stations by providing a comprehensive view of all local infrastructure works for future stages, ensuring costing and program delivery for the long term future of the Green Line remains predictable.

Supporting Transit Oriented Development (TOD) and City Shaping on the Green Line

A focus on improving connectivity and access to stations can help to reduce capital costs for new development around a station area. A shift towards supporting more sustainable transportation modes to stations reduces the overall need for parking, leaving more developable land.

Safe, convenient and accessible connections are key to the Green Line vision of City Shaping. As programs, destinations and services begin to develop around each station, Calgarians will benefit from active mode links to new services.

Plan and where possible, implement a multi modal network along the Green Line corridor

As some stations are closely integrated into a community, improving mobility and access around a station area also serves to improve mobility and access within a community. As the Green Line is constructed there are specific areas of the alignment in which a key multi modal network can be accommodated that will run parallel to the Green Line. In other areas, this network moves off the alignment into the community to capitalize on already existing infrastructure or local connections. A Framework to identify and prioritize multi modal investments will help support the Calgary Transportation Plan objectives. The determined routing of this key multi-modal corridor from North Pointe to Hospital is presented in the "Active Modes Parallel Pathway" section of the Appendix.



West LRT runs from Downtown West/Kerby station west to 69 Street SW station

The most recent major LRT project built by the City of Calgary was the West LRT, an 8.2 kilometer extension of the Blue Line LRT. The West LRT was completed in late 2012, and with 6 new stations, serves communities in the west and connects them to the center city and light rail service to the other quadrants of Calgary.

An analysis of multi-modal access to West LRT stations was performed through Mobility Assessments & Plans (MAPs), completed for each station during the late planning phases. The MAPs recognized the changing emphasis around mobility decisions in Calgary and the increasing support for sustainable and active modes of transportation. As stated in the MAPs “These assessment reports examine the impacts of an LRT alignment, its stations, and associated land uses in the area on all modes of travel. MAPs for the West LRT project identified the infrastructure requirements to accommodate those modes and focused on identifying traffic measures that would mitigate West LRT-related traffic impacts in the surrounding community”.

KEY LESSONS

MAPs were successful in identifying specific near- and medium-term transportation improvements around the 6 stations. There were critical lessons learned regarding the priorities, scope of the MAPs, and implementation of these improvements after opening day. Some of the lessons learned from this process include:

1. Initiating the MAP process from the beginning

A Mobility Assessment Coordinator was assigned the task half way into the West LRT Planning/Design process. The preliminary design had already been completed, limiting the ability to incorporate station area improvements recommended in the MAPs. Potential station area improvements need to be identified at the planning stage, specifically before the preliminary design phase begins.

2. Separating non-project related traffic improvements and station access improvements

Traffic measures were recommended independent of their value to the transit project. This diverted staff attention and infrastructure recommendations away from improvements that would benefit LRT users. The MAPs and funding should focus exclusively on station area improvements that support transit ridership. (Example: the right-in, right-out island at 35 Street and 19 Avenue to limit increased volumes on 35 Street does not facilitate ridership).

3. Identifying the major station access improvements early

The sooner the need for infrastructure is identified, the better the chances for incorporating the work into an initial overall project cost estimate. This may have been a factor in the decision to not include a pedestrian bridge crossing between Sirocco Station and the Park and Ride situated south of 17 Avenue.

4. Including station connections improvements as part of “All costing”

Most, if not all, of the West LRT station improvements were part of a secondary procurement contract separate from main procurement which was less-infrastructure intensive. This resulted in at least one station area without sidewalks on opening day to manage transfers from buses to trains. Successful multi-modal access to LRT stations needs to be fully complete by opening day.

5. Constructing critical station area improvements for opening day

Good public realm and station area active modes infrastructure should not be deferred until a future development is complete. In the case of Westbrook Station, the boulevard treatments along 33 Street to the east and 17 Avenue to the south were not completely built by opening day. A 3 meter pathway and street trees were installed, but the adjacent 3 meter sidewalk was deferred for future redevelopment to construct. Though redevelopment was some years out, transit riders and other users of these areas could have benefited from this infrastructure on opening day.

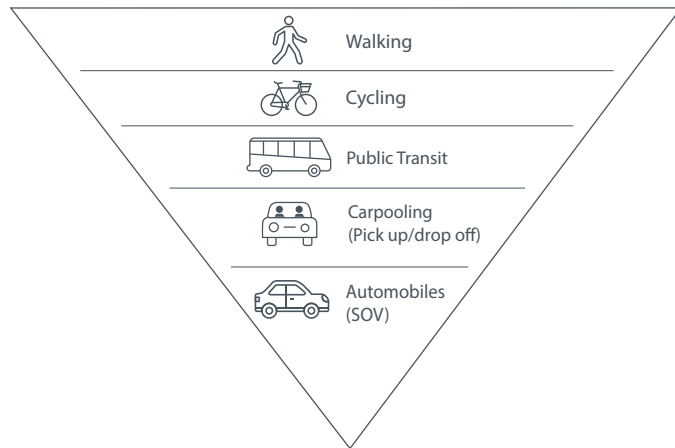
6. Creating a comprehensive implementation plan

If station area improvements are included early, they will likely be constructed as part of the major transit project. Other improvements requiring more planning, design and funding (e.g. enhanced bike infrastructure into a station area), will take longer to implement. Many of the station area improvements identified for West LRT were of this nature. An implementation plan was key to track improvements (including scheduling, budget, asset owner), and delegating the implementation of these improvements to the appropriate transportation departments. The Green Line will require a robust and comprehensive implementation plan to ensure the station area improvements are prioritized and implemented. The implementation plan should have a required reporting mechanism back to senior Transportation leadership on a regular basis as its success requires the resources and cooperation of several business units.

7. Dedicating full time resources to follow through on implementation

Immediately after the opening of the West LRT, the MAP project manager was tasked to other project work and was not able to continue coordination of the implementation plan. As a result, many projects stalled and even today have not been implemented. The implementation of this work can be missed if not assigned to an individual or team to collaborate and deliver. It is critical that a resource is identified to assemble an implementation plan, present it for approval, and administer it with regular reporting back to senior Transportation leadership until all station area improvements have been implemented.

The Station Connections Framework focuses on five modes highlighted in the Calgary Transportation Plan (CTP) figure below. Modes that are more sustainable (found near the top) require less energy, less infrastructure investment and are more readily available to all Calgarians.



Each of these modes has defining characteristics and potential issues in designing for that mode.

| Mode | Defining characteristics | Potential issues |
|---|---|---|
| Walking | Flexibility in routing, and resilient to change. Cost of infrastructure is comparatively low. | Established communities often have significantly limited pedestrian infrastructure. Qualitative infrastructure (street furniture, trees etc.) can be hard to implement in a retrofit. |
| Cycling | Riders will travel up to 5km to access a station. Diversity of users across ages, abilities and economic status. | Bicycle infrastructure, required for user comfort and safety on high speed motor vehicle routes, can be challenging to introduce without compromise. |
| Public transit (transfer) | Routing planning and scheduling serving a station can significantly support major activity centres beyond catchment area. | Dependent on operational conditions which can change over time. |
| Carpooling/Pick up drop off/ Carshare | Dependent on street network surrounding station area | Increases circulation around station areas, especially in more congested areas. |
| Single Occupant Automobiles / Park and Ride | Is a Park and Ride provided or community parking facilitated | Significant space requirements and land costs in surrounding area to build automotive network which impacts the quality for other modes. |

The Green Line is The City's largest capital investment infrastructure project to date. The Station Connections Framework included in this report is integrated closely with the work that has occurred at all layers as part of the Green Line's four layered approach as highlighted below.



Long Term Vision (160 Avenue N - Seton)

A holistic guide for future investments towards transforming communities along the Green Line LRT corridor focused on reliable transit, people, places and programs.

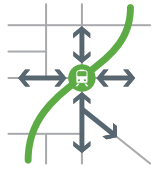
Led by:
All departments
Layers 1-4

| | | |
|------------|---|--|
| Layers 1-3 |  <h3>Green Line Urban Integration (GLUI) Vol. 1</h3> <p>A set of principles to guide the implementation of the Green Line LRT transit infrastructure from 160 Avenue N to Seton to fit into, enhance and transform the communities it connects.</p> | <p>Led by: Transportation, Planning & Development</p> |
| Layer 1 |  <h3>Green Line LRT Operations Plan</h3> <p>An operations plan for a fast, frequent, and reliable Green Line LRT from 160 Avenue N to Seton considering the communities it connects to.</p> | <p>Led by: Transportation</p> |
| Layers 1&2 |  <h3>Stage 1 - Opening Day</h3> <p>Details of the first construction project for the Green Line LRT from 16 Avenue N in the community of Crescent Heights to 126 Avenue SE in the community of Shepard.</p> | <p>Led by: Transportation</p> |
| Layer 2 |  <h3>Station Connections Framework</h3> <p>An analysis and recommendation to address missing links for all modes connecting to the Green Line LRT stations from 160 Avenue N to Seton with the goal of increased ridership.</p> | <p>Led by: Transportation</p> |
| Layer 3 |  <h3>Framework for a Transit Oriented Development Implementation Strategy</h3> <p>An overview of the objectives, initiatives and key partners that are required for effective implementation of Transit Oriented Development in specific station areas from 160 Avenue N - Seton</p> | <p>Led by: Planning & Development</p> |
| Layer 4 |  <h3>Framework for a City Shaping Implementation Strategy</h3> <p>A set of principles, goals and strategies to guide the next steps towards City Shaping implementation along the entire Green Line LRT corridor from 160 Avenue N to Seton.</p> | <p>Led by: Community Services</p> |

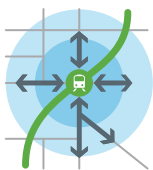
THE FOUR LAYER APPROACH OF THE GREEN LINE



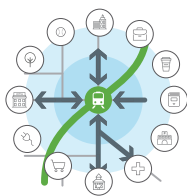
1 Transit infrastructure



2 Connections to stations



3 Transit Oriented Development



4 City-shaping

The four layered approach to planning the Green Line

The Green Line is about planning for Calgary's future growth, with the goal of providing more choices to citizens in the way they move, live, work and play. This will be achieved through a layered approach that will integrate core transit infrastructure, Station Connections, Transit Oriented Development (TOD), and City Shaping. Collaboration with city departments, external partners, industry and all levels of government will be essential to ensuring all four layers are successfully implemented.

Layer 1 will consist of everything the City of Calgary will build to operate low-floor light rail within the Green Line corridor. This includes trackways, overhead contact system/electrification, power, structures, all components necessary to operate trains safely adjacent to or crossing other modes, stations and passenger facilities.

The Green Line LRT is envisioned to be operated using a modern urban low floor light rail vehicle (LRV). This vehicle technology is different from the existing Calgary C-Train technology in several ways. With access to and from the vehicle being at regular street curb heights, Green Line stations will have smaller footprint, compared to the current high floor platform configuration of the Red and Blue lines. The low height of station platforms means that stations can be more compact with no need for long access ramps at either end of the station. (CITE : GL vision report (pg. 36 of 150))

Layer 3, Transit Oriented Development (TOD) refers to a form of development that is typically characterized by multi-storey buildings, designed to encourage walking, cycling and transit use. A core element of a TOD is a major transit station that is within walking distance of a large number of residents and businesses and is therefore a convenient and attractive mobility choice. The streets in a TOD are designed to contain residences, shops and services and allow for easy pedestrian connections to the various destinations. TOD plays a key role in developing complete communities that help achieve the City's vision for the future as outlined in the Municipal Development Plan (MDP) and the Calgary Transportation Plan (CTP).

Layer 4, City Shaping, is leveraging Calgary's investment in transit infrastructure to strengthen and support the social needs of communities along Green Line. It is indicative of The City's effort to create a series of well-planned, connected, accessible, affordable and vibrant communities, starting from Green Line LRT construction and evolving into the future. City Shaping is about investing in people, places, and programs that are near high-quality transit service, making it easy and convenient for Calgarians to access them.

See the Council-approved "Green Line Long Term Vision: 160 Avenue N to Seton" report for a more comprehensive discussion of the Green Line four layered approach .

GREEN LINE URBAN INTEGRATION

The Green Line Urban Integration (GLUI) document aims to integrate transportation and land use around a set of guiding principles that will inform how the Green Line will look, feel and operate in Calgary's communities. Connections to stations reflects improvements to how transit users connect to the Green Line. Recommendations from the Station Connections Framework should be sensitive to the community characteristics that the Green Line Urban Integration supports. See the "Green Line Urban Integration Vol. 1" report approved by City Council in June 2017.

PUBLIC ENGAGEMENT

Public engagement has played a key role during the long term planning for the Green Line. Discussions regarding access and mobility occurred over a number of months, incorporated into Station Area Workshops, Transit Oriented Development (TOD) Charrettes ensuring recommendations made as part of the Station Connections Framework were supported by stakeholders. A list of public engagement events where discussions on station access and mobility was discussed can be found in the Appendices under "Public engagement".

TOD Charrettes

Charrettes are a collaborative community design event which aims to bring experts, City staff and the community together in creating a vision for the future for the community. The Green Line program included 23 charrette days across 10 stations. Information for Layer 2 was a critical outcome of these projects as the communities identified current and future routes to access the stations and connect their communities. Input from these events was evaluated and incorporated into the planning process.

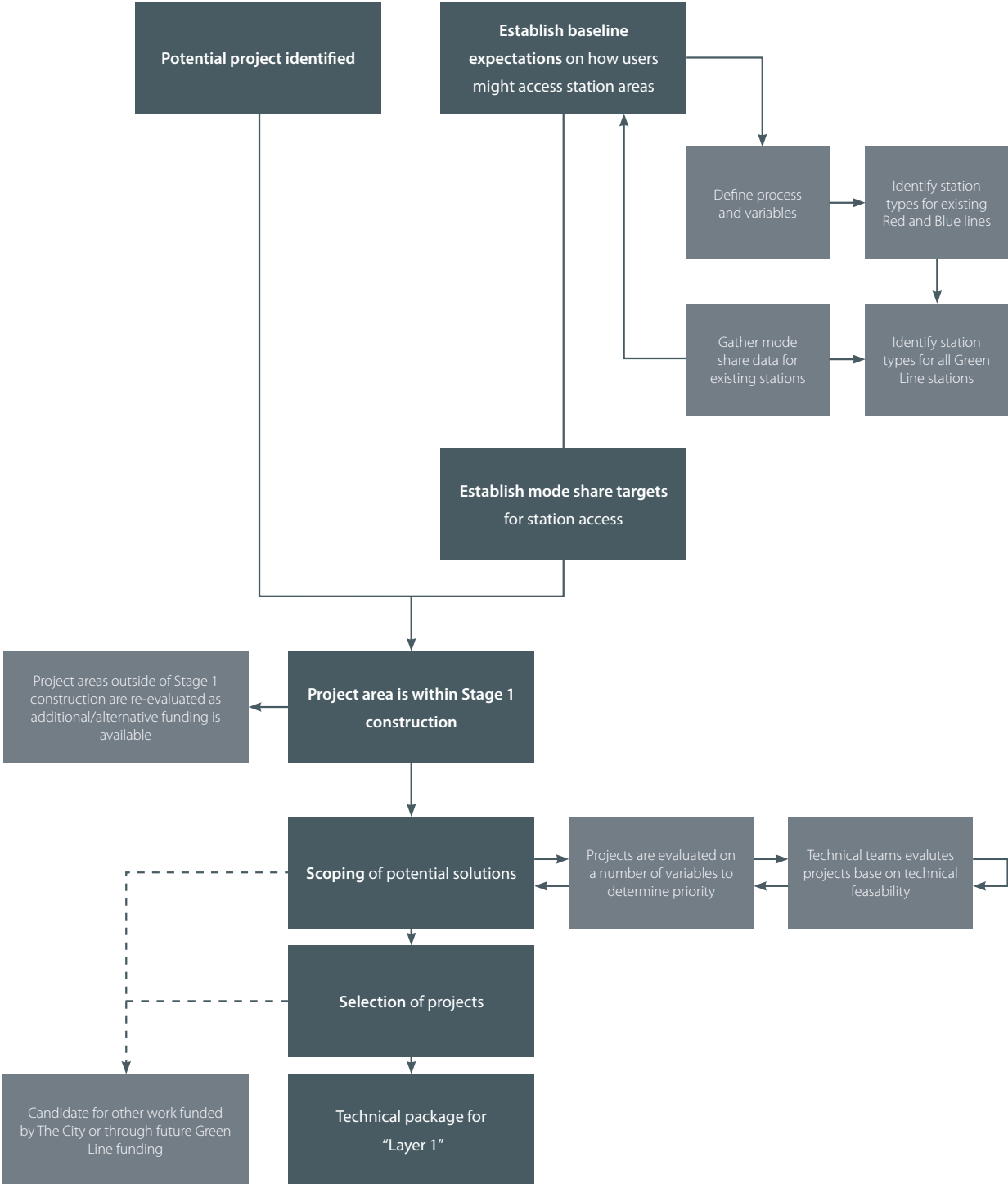
Station Area Workshops and the functional planning

In planning the alignment and functional plan for the Green Line the community was asked to identify areas of concern and anticipated station access. This information was collected both generally and specifically across a number of events. The community input and comments were collected and evaluated in the process of developing a recommendation for Layer 2.



Analysis

The Framework process begins with research that identifies current gaps in station area infrastructure and establishes expectations for how Calgarians will access the Green Line. Engagement both internally at The City and with Calgarians occurred to support the work through collecting feedback and identifying gaps in mobility and access within a community.



The Station Connections Framework focuses on stations within Stage 1 of the Green Line (16 Avenue N - 126 Avenue SE (Shepard)). The full Green Line alignment from 160 Avenue N to Seton was considered during this initial research phase of work, excluding station areas where communities had recent Area Structure Plans (ASPs).

Stations with ASPs include:

- » 160 North Station
- » 144 North Station
- » Auburn Bay Station
- » Hospital Station
- » Seton Station

Station Areas where recent Area Structure Plans (ASP) have been approved by Council generally include multi-modal connections to LRT stations to current standards.

Centre City stations were not included in this Framework, as the Centre City contains complete grid network with little opportunity to change the design to impact Green Line riders only. The Centre City Mobility Plan (2012) highlights a number of considerations that are unique to the area:

“The Centre City is Calgary’s most important economic generator and convergence point for Calgarians who use a variety of modes to travel to/from and within this destination. However, Centre City is constrained by very high density, relatively new development and a well-established road network. These limitations provide challenges to dealing with the mobility of Calgarians in the downtown area.”

Additionally, the Centre City stations including the Beltline, have access to other funding sources that other stations along the alignment do not. For example Calgary Municipal Land Corporation (CMLC) Business Plan 2017-2019 includes:

“Green Line Interface (in Victoria Park): In 2017 we will begin planning, investigate options and undertake preliminary site studies. The total budget allocated for this project is \$40 million. We are currently seeking approval for \$5 million to fund Phase 1 and will request additional funding once we are ready for construction.”

This critical investment by a corporate partner anchors the value of the active modes infrastructure and enables the Station Connections Framework to prioritize program funding to stations that do not have access to alternative sources of funding.



| |
|---|
| Area Structure Plan approved Not analyzed |
| Future Stages Partially analyzed |
| Stage 1 - Fully analyzed |
| Centre City Not analyzed |
| Stage 1 Fully analyzed |
| Future Stages Partially analyzed |
| Area Structure Plan approved Not analyzed |

Partial analysis was completed for future stage LRT station areas to ensure the information available for future staging and other City programs or policies as they become available.

Potential improvement projects are the result of either addressing existing gaps in the infrastructure (e.g. a missing sidewalk) or a change in how the existing transportation network is expected to operate (e.g. the need for a traffic signal on a significant access route). The Station Connections analysis was done within an 800m distance (10 minute walk) from each station. The 10 minute walk is generally considered the access distance around LRT transit stations for users. During the identification of potential projects, the three segments - North, Centre City and Southeast, were examined independently as the Green Line program was at different stages of planning.

When identifying potential infrastructure improvements, two considerations are key:

- Identified projects that will provide safer, more convenient access to stations
- Identified projects that will support stations in accordance with ridership

Station Area Workshops and extensive public engagement in the north occurred during the analysis phase of the Station Connections Framework. Discussions with the public on station mobility and access took place over 37 events that were attended by over 2,500 Calgarians. These events included:

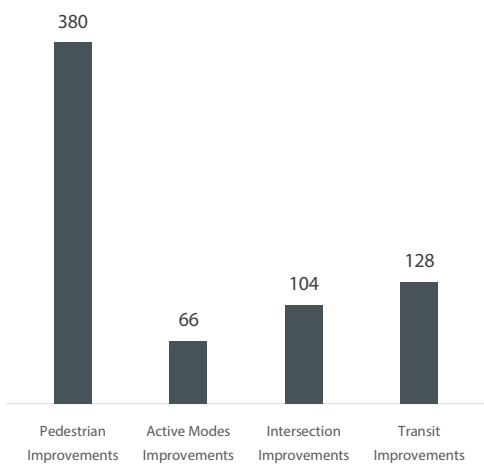
- Station Area Workshops
- Transit Oriented Development Charrettes

The Southeast leg of the Green Line had already completed its engagement activities; therefore, the following material was reviewed to determine potential projects along the southeast:

- Urban Integration Drawings;
- Mobility Scans;
- Station Workshop reports; and
- Transit Oriented Development Charrettes/reports.

As the Centre City was not evaluated in this Framework, information collected at public engagement events relating to connectivity to stations in that area is considered when providing recommendations for other work not included.

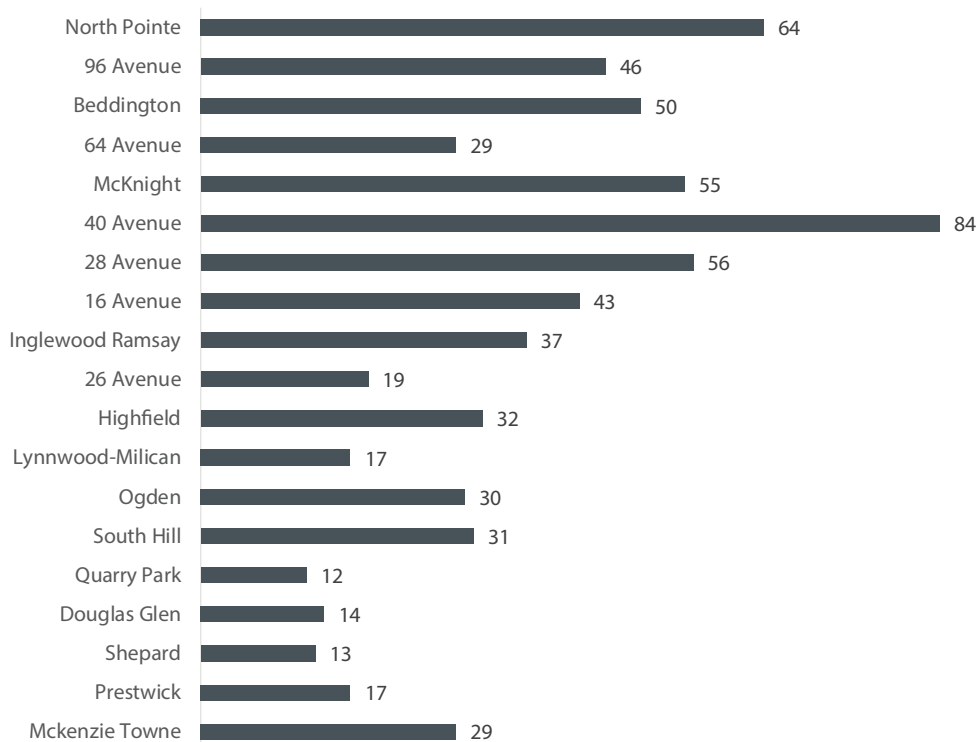
A summary of the number of improvements by station area is presented in this section. This work identified over 700 potential projects, which would support ridership of the Green Line through one of the five modes. The project types were broadly categorized as outlined in the table below.



Total number of potential infrastructure improvement projects by category

| Pedestrian Improvements | Active Modes Improvements | Intersection Improvements | Transit Improvements |
|-------------------------|---------------------------|--------------------------------------|----------------------|
| New Sidewalk | Bike Lanes | Roadworks | Bus Pad Needed |
| Sidewalk Replacement | Cycle Tracks | Traffic Control Device | Bus Pad Replacement |
| Sidewalk Widening | Bicycle Boulevard | Roadworks and Traffic Control Device | |
| Landscaping | | | |
| Lighting | | | |
| Traffic Calming | | | |
| Overpass | | | |
| Underpass | | | |
| Multi-Use Pathways | | | |

Transit Priority Signals and Queue Jump lanes are additional transit supportive improvements that are available to support bus-to-transit LRT trips. These were not included in the recommendation, and should be evaluated in future work.



Total number of potential infrastructure improvement projects by station area

The TCRP report provides the following LRT station types:

- *Urban Commercial*
- *High Density Urban Neighborhood*
- *Medium-Density Urban Neighborhood*
- *Urban Neighborhood with Parking*
- *Suburban TOD*
- *Suburban Neighborhood*
- *Suburban Employment Centre*
- *Suburban Retail Centre*
- *Intermodal Transit Centre*
- *Special Event/Campus*

The objective of the Station Connections Framework is to ensure transit riders can access a station. Baseline expectations facilitate this through a detailed understanding of how Calgarians travel in order to access the new Green Line stations. As Green Line stations are being introduced into established communities with existing travel patterns, trends observed on the current Red and Blue lines were used to inform anticipated behavior.

Previous research, Transit Cooperative Research Program Report 153 was used to develop the foundation for variables and mode share expectations. The use of that report allowed the Framework to remain consistent with North American and previous academic research. The report has enabled this Framework to calibrate the solutions for Calgary while comparing and contrasting results against other cities.

The station types for existing Red and Blue Line stations were used to average the existing rider behavior, and the mode numbers applied to stations of the same typology. This process resulted in the expected mode share. The table below presents the modeled station type for each station.

“Station type variables” in the Appendix presents each Green Line station with the associated variables and “Station types mode share” in the Appendix shows the modeled mode share for each station type.

| Station Name | Typology |
|------------------|------------------------------------|
| North Pointe | Intermodal Transit Centre |
| 96 AV N | Suburban Neighbourhood |
| Beddington | Intermodal Transit Centre |
| 64 AV N | Suburban TOD |
| McKnight | Medium-Density Urban Neighbourhood |
| 40 AV N | Urban Neighbourhood with Parking |
| 28 AV N | Medium-Density Urban Neighbourhood |
| 16 AV N | High-Density Urban Neighbourhood |
| Inglewood/Ramsay | Medium-Density Urban Neighbourhood |
| Crossroads | Special Event/ Campus |
| Highfield | Suburban Employment Centre |
| Lynnwood | Suburban Neighbourhood |
| Ogden | Suburban TOD |
| South Hill | Intermodal Transit Centre |
| Quarry Park | Suburban Employment Centre |
| Douglas Glen | Intermodal Transit Centre |
| Shepard | Intermodal Transit Centre |
| Prestwick | Suburban Neighbourhood |
| McKenzie Towne | Suburban Neighbourhood |

The next phase of the analysis examined each station on the Green, Red and Blue lines using a set of variables associated with nine different station types. These variables were measured, where possible, using City of Calgary specific data. Several stations were studied in increased detail by Calgary Transit to provide a higher level of accuracy. More information can be found in the “Station type variable” section of the Appendix.

| Variable | Purpose/definition | Measurement (data source) |
|---|--|---|
| Density | Provides measurement for potential passengers that live or work within 800m buffer of the Green Line station. | Jobs and Population with the 800m buffer. This is broken into: Low, Low-Medium, Medium, High-medium and High (City Data) |
| Scale | Building scale relates to walkability, density, and activity levels, and helps to illustrate the feel of the station area when combined with other categories. | Permitted as of right zoning in meters (Land Use Bylaw) |
| Distance from Central Business District (CBD) | Stations closer to downtown have a different population type and serve a different market. | All lines separated into three zones based on distance from CBD: Urban, Near Suburban and Far Suburban (Examination of current condition) |
| Supporting transit network | Level of transit connectivity serving the station which supports bus-train transfers. | Reflects level of transit service based on: primary Transit connections and number of buses in the peak hour. This is divided into three categories: Transit Hub 1, Transit Hub 2 and Local station service (Calgary transit) |
| Pedestrian/Bike access | Completeness and attractiveness of networks supports mode share. | Completeness and/or existence of barriers (Station area workshops and examination of current built form) |
| Surrounding land use | Description of land use mix in the area which serve/define different communities types. | Permitted as of right land uses (Land Use Bylaw) |
| Parking facilities | Level of off-street parking provided around the station indicates car dependence of area and decreases accessibility for other modes of access. | Park and Ride and other off-street parking availability (Layer 1 park and ride accommodations and Examination of current condition for private property parking) |
| Access/Egress (On/Offs) | Some stations are located at the “home” end of the journey for most passengers, while others represent the destination. Passengers are more likely to have access to a private vehicle at the “home,” or access station. | This was divided into three categories based on the forecasted travel pattern during the morning rush. These categories are: Access (on the train), Egress (off the train), and Both (Calgary Transit forecasting data) |



Ogden - Today



Ogden - Opening day



Ogden - Long term vision

There are two outcomes from setting targets for the Station Area Connections Framework. The first is the target directions that determine what the expected mode share will be for each station. The second is targets for Opening Day (OD) and 2076 based on the expected mode share.

The inclusion of targets for station area connections work is crucial to understanding and achieving success. The outcome of the targets is measurable and can be tracked as part of the continued performance metrics in the program.

Setting Target Direction

This is the objective of the infrastructure recommendation made by this Framework. Target directions were established in order to address some limitations of this approach to measuring access mode share: current infrastructure, which heavily shapes user behavior, will change from what is available on Opening Day at Green Line stage 1 stations. The use of target directions in this context is not to establish a goal, but instead inform our understanding of future user behavior when we have limited information to inform how the infrastructure decisions will change.

This was established through examining the opportunities and constraints for each mode in the environment around each station. This type of analysis is meant to respond to the variation in the built environment, when compared to other station areas of the same typology.

The target direction indicates:

1. Higher use of that mode expected/desired
2. Lower use of that mode expected/desired
3. Maintaining the use of that mode at approximately that level

The directions informs the expected targets set for Opening Day and 2076.

Setting targets for Opening Day (OD) and 2076

These are the goals associated with the infrastructure recommendation. Setting targets for Opening Day and 2076 uses base assumptions from the target directions described above. The set of targets for OD and 2076 are percentage based goals that are adjusted from the expected mode share. The setting of targets supports the long term performance measurement discussed within the Program.

The process to set targets first begins with the expected mode share at each station, considered as the baseline expectation. The expectation is adjusted based upon the target direction to reallocate mode share percentages. The method distribute percentage points based on the expectations/desires for that mode at each station.

The only mode share target that is strictly defined is Park and Ride, as there is a known number of stalls provided to determine the allowable mode share. Park and Ride mode share numbers are based upon the number of stalls available with the understanding of the expected ridership on both Opening Day and 2076. When the Layer 1 infrastructure does not provide any Park and Ride facilities the target was set at 0 for that mode.

As a result of this process, two targets were set, targets for opening day for Stage 1, and 2076 targets for the entire line. Targets for each station can be found in the "Station mode share targets" section of the Appendix.

Many potential projects considered will support access to the stations in the future, the scoping stage was used to identify projects with the most support from the community, within The City and most critically would support Green Line ridership. The scoping was conducted in three steps:

1. Staging considerations
2. Priority analysis
3. Value calculation

This three-stage approach was used to focus efforts from a list of over 700 projects. With each scoping stage, more details for each project were considered and projects removed to be considered for other work streams outside the Green Line program.

Staging considerations

An initial focus was to scope out projects that would most likely fall within a recommended first stage of construction for the Green Line. Three of the four potential staging options included segments from Centre City to Shepard. McKenzie Towne and 16 Avenue N were also included in our initial scoping work for completeness. For more information on the staging of the Green Line, see Strategic Meeting of Council – C2017-0467 “Green Line LRT: Building the Core”.

Of the 678 projects identified during the potential project identification stage, 248 projects from between 16 Avenue N and Shepard were carried to Scoping 2.

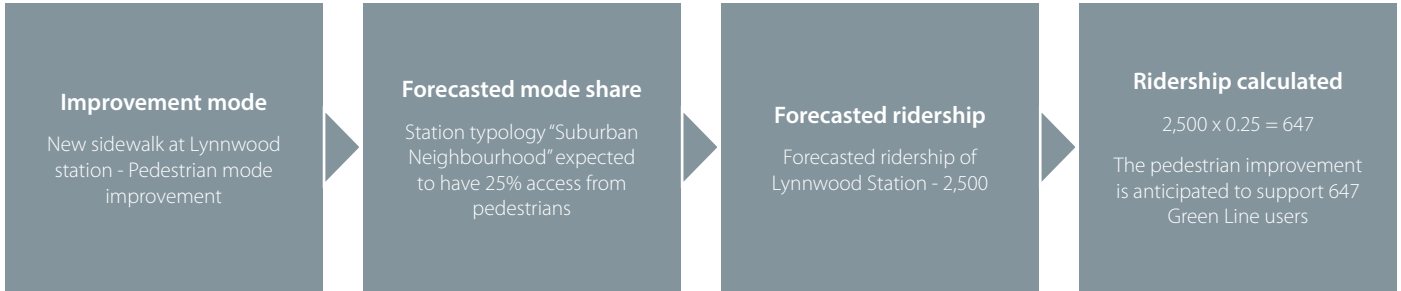
City priority analysis

The second stage in the scoping exercise was a high-level analysis to ensure that projects were aligned with city policy or other key components. This was achieved through five variables shown below.

| Variable | Definition |
|--|---|
| Alignment with City policy | Does this project align with existing City policy, for example Complete Streets |
| Alignment with target direction | Does this project align with the target direction explored in the Targets direction of this Framework. |
| Level of Engagement to achieve public acceptance | The Green Line has conducted extensive engagement. Recommendations from this Framework should not require significant additional public engagement. |
| Component of parallel pathway | The parallel pathway is an opportunity of the Green Line to support a multi-modal network through the established communities from which other active modes infrastructure, existing or planned, can connect. |
| Connectivity with network beyond study area | The Green Line project is primarily a transit project not an all-mode corridor project. The projects selected should connect with existing network wherever feasible. Where connectivity is not feasible a first connection should be made that supports future planned work in the City. |



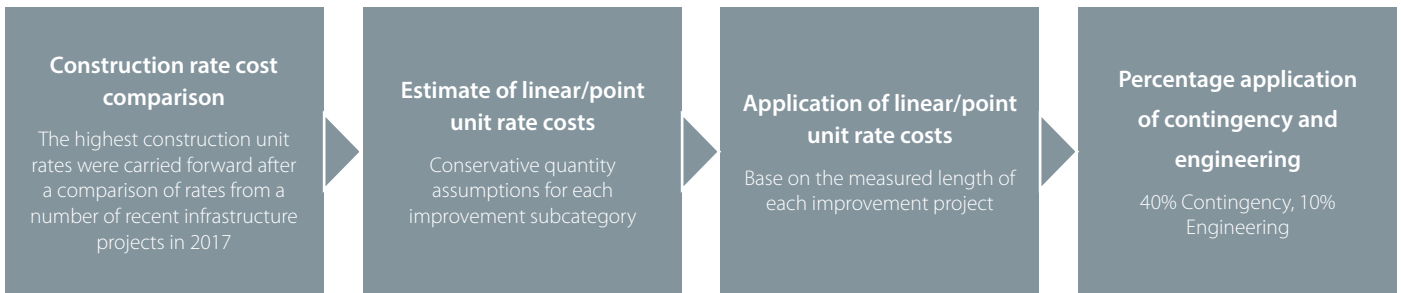
The final step in scoping projects was a value calculation based on ridership and order of magnitude cost. Ridership, in this case, is representative of the number of Green Line users that will benefit from the improvement in the network for their mode of access. This number was based on forecasted ridership with the mode share percentage applied.



Calculating value from planned improvement projects

Order of magnitude cost was calculated through a multi-stage process. The historical and anticipated costs were taken from City of Calgary projects or contexts. The highest of these construction costs was applied to the linear/point unit rate and contingencies / engineering was applied as 40% and 10% respectively. The resulting costs are considered highly conservative to ensure that the project recommendation is above the actual needed costs.

The ridership variable was then divided by the order of magnitude cost to develop a rider/dollar number for a future improvement.



Calculating value from planned improvement projects

The selection stage of this Framework was a two-step confirmation to ensure the recommendation aligned with the program priorities and was technically feasible. The process for the Selection stage is presented on page 15. A program priority workshop was conducted in order to ensure that through the scoping stage, projects were not eliminated or selected which were critical to supporting other program objectives. The workshop was asked the following questions:

1. **Financial Cost: Are we spending money in the right places?**
2. **TOD Station / Integration: Does this support / inhibit development opportunities?**
3. **City Shaping opportunities: Does this support / inhibit the goals of City Shaping?**
4. **Return on Investment: Is this defensible as an expense for the Green Line?**
5. **Available Time: Do we have time to implement this solution?**
6. **Revisiting Decisions: Have we made a promise that we are changing?**

This workshop had representation from the following areas:

- Layer 1: Program Delivery (North segment & South East segment)
- Layer 3: TOD
- Layer 4: City Shaping
- Green Line Strategic Lead

Following the program priority workshop a second workshop was held with technical experts to address concerns about redundancy with existing projects and constructibility. The aim of this workshop was to ask "If not why not?" for any project that could not progress. These workshops were held individually with Business Units and were conducted with Calgary Transit, Roads, Parks and Livable Streets.



Recommendation

The result of the Station Connections work is a comprehensive list of 207 projects which are the most cost-effective way to generate and facilitate Green Line ridership. A station by station map and list of approved projects is presented in the “Selected Projects” Appendix. The Appendix list includes the project, the extents and what type of project it is. The work recommends an investment of \$28 million, this is broken down by category in the table below.

| | Number of improvements | Length (Metres) | Total Cost Rounded (\$million) |
|---------------------------|------------------------|-----------------|--------------------------------|
| Pedestrian Improvements | 50 | 22,196 | \$16.0 |
| Intersection Improvements | 7 | N/A | \$3.0 |
| Active modes Improvements | 20 | 13,815 | \$8.0 |
| Transit Improvements | 115 | N/A | \$1.0 |

In developing this recommendation, the Station Connections Framework has developed a solution which is both cost effective and supports ridership to the planned Stage 1 Green Line stations. The Station Connections Framework and Green Line program is unable to provide funding support for the operational implication of these improvements. Some projects exist within the Green Line right-of-way and therefore a different funding model may be available.

RISKS

The recommendation of this Framework is designed to deliver ridership to the Green Line within the recommended and approved alignment. Not completing this work carries several risks:

1. Failure to achieve forecasted ridership

These projects recommend the construction of critical infrastructure based on travel patterns of the population. Failure of the program to construct this infrastructure may result in the program unable to support riders as they are not able to access the station or destinations.

2. Safety for Green Line users

In areas where infrastructure does not exist failure to build the infrastructure can lead to potentially dangerous interactions between users. The alignment with safety best practices and the Complete Streets Guidelines is critical for user safety.

3. Failure to support Transit Oriented Development and ridership growth

The recommended projects improve existing infrastructure, especially where it is under performing, to reflect the change the travel patterns of a community. Failure to build this infrastructure will negatively impact the potential of a community to

support development, a key promise of the Green Line. Interested developers require the supporting infrastructure for future occupants/users to be in place prior to the construction of their development. The challenging in creating new development is especially true in communities where the Green Line is the catalyst for mode/travel change. This can result in loss of developer activity until such a time as the required infrastructure is built.

4. Increase in costs for The City

The cost of a retrofit is higher, both in capital and time, than concurrent work with the Green Line Program. Much of this work will be identified and required later, should this priority work not be completed now the cost to The City for this work will increase.

5. Loss of trust within community and stakeholders

The Station Connections recommendation was woven within the extensive community engagement conducted by the Green Line program. In many cases a dominant concern of the public was the risk to their community mobility and access around a station. The recommendation includes those community concerns and failure to complete this portion of the project will require complex engagement to reestablish trust in the future.

NEXT STEPS

From this document, the Station Connections work requires an Implementation Plan, intended for 2018. This plan should address three key topics, but is not limited to:

- 1. Funding and Construction timing**
- 2. Associated policy updates and timings**
- 3. Monitoring and evaluation**

Funding and construction timing for recommended improvements

The Station Connections Framework has focused on ensuring riders can access Green Line stations, therefore a swift decision on funding and construction timing are critical to supporting the ridership objectives of the Green Line Program. Where other Business Unit programs or future action plans can be leveraged to coordinate the construction of projects both recommended and future plans should be considered.

The implementation plan should be tied with the construction timing of individual components of the Green Line. The work could be completed under the Green Line construction, enabling works or as part of a separate contract to support communities during construction. A different implementation strategy would be appropriate in several situations.

Associated policy updates and timings

The Station Connections Framework has combined infrastructure recommendations that are generally reflected across several city departments and programs. Examples of this include the Pathway Bikeways plan and local Area Restructure Plans. To ensure that the identified work, both recommended and future, can be addressed in alignment with the Green Line the implementation plan should identify associated plans and the content contributions. This approach will support the city shaping and Transit Oriented Development (TOD) opportunities and leverage the Green Line investment across all City departments.

Monitoring evaluating and calibrating

The Station Connections Framework has comprehensively studied and attempted to anticipate the impacts of infrastructure on opening day. The use of targets, and development of the implementation plan will develop the outline for a program which will aim to assess opening day conditions in order to calibrate recommendations around the built environment. This will leverage the Green Line as a tool to meet sustainability and community objectives and deliver on the long term potential.

