



THE COLLEGE OF WOOSTER

Passenger Rail Station Location Analysis

DEPARTMENT OF URBAN STUDIES

INTEGRATED TRAVEL

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Table of Contents

<i>Introduction</i>	3
<i>Phase 1: Variables of Transit Station Locations</i>	5
1. Access	5
a. Trip generators	5
i. Local economy (businesses, shops, restaurants)	5
ii. Transit (metro, bus, airport, light rail).....	6
iii. Culture and leisure (libraries, museums, etc.)	7
b. Safety	9
i. Lighting/visibility (eyes on the street)	9
ii. Crash risk / safe crossings (intersection density, crosswalks, speed environment)	9
c. Station access	10
i. Park and ride (cars).....	10
ii. Bikes	11
d. Mobility	12
i. Walkability (covered walkways).....	12
ii. Disability Access	12
2. Demographics of likely users	13
a. Population density	13
b. Employment density	14
c. Special populations	15
3. Logistics	18
a. Infrastructure (physical)	18
b. Cost (financial)	18
<i>Phase 2: Weights and Justifications of Each Variable:</i>	19
<i>Conclusion:</i>	25
<i>Appendix A</i>	27
<i>Appendix B</i>	28
<i>Bibliography:</i>	29

Introduction

Integrated Travel is a not-for-profit organization that advocates for the needs of rail passengers, prioritizing regional concerns over provincial and international boundaries. Integrated Travel aims to reestablish safe, reliable, and sustainable passenger rail service in the province with a goal to increase opportunities and contribute to the health and well-being of people across Alberta [1]. Using Riipen, the leading online, project-based experiential learning platform that connects post-secondary students with companies for short-term, real-world work experiences [2]. Our team combined our knowledge in urban studies, environmental studies, political science, and statistical and data sciences to create a report for Integrated Travel that discusses the most important variables to consider for the development of central transit stations.

Our project was divided into two phases. Our first phase was to analyze literature that supports the creation of central transit stations. We collected fourteen variables that consistently appeared in the literature that are most important to consider. Following this conclusion, we decided to apply these variables to our case study, Calgary, Canada. The two potential project sites we considered were the already existing Calgary tower and available land about a half mile away that is the desired location in Calgary's Phase 1 Green Line LRT project. Phase two began with the application of the collected variables to Calgary. We then used The Analytical Hierarchy Process to weigh the options of the stations and develop explanations for our variables and their associated weight. This phase concluded with the following final report write-up.

City of Calgary Proposed Green Line Light Rail Transit

The Green Line LRT is included in the following 4 city plans: Municipal Development Plan, Calgary Transportation Plan, RouteAhead, Calgary's Greater Downtown Plan. Phase one of the development plans began work on the Southeast segment in June 2025. This new line covers 17.2 kilometers with twelve new stations and 3 park and ride lots. This segment is from Shepard to the city's proposed future Event Centre/Grand Central Station. The Province of Alberta has plans for a future Grand Central Station located in Victoria Park that will be integrated into the existing Red and Blue Line in phase 2 Downtown segment. This location will bring life to the underdeveloped area. Its plans to connect Scotia Place to Calgary Stampede grounds is just the start of this major development project.

Phase 1: Variables of Transit Station Locations

1. Access

Regarding factors related to a railway station's location, prior research broadly recommends that stations should be in a location that is 1) easily accessed by a diversity of likely users, 2) close to local amenities such as businesses and employers, and 3) interconnected with other transit modes [3], [4], [5], [6].

a. Trip generators

i. Local economy (businesses, shops, restaurants)

In general, a successful transit station will be one with significant ridership and a positive effect on the local economy [7]. To analyze this, we searched for Google Maps “restaurants” and “shops” around both of the possible station locations:

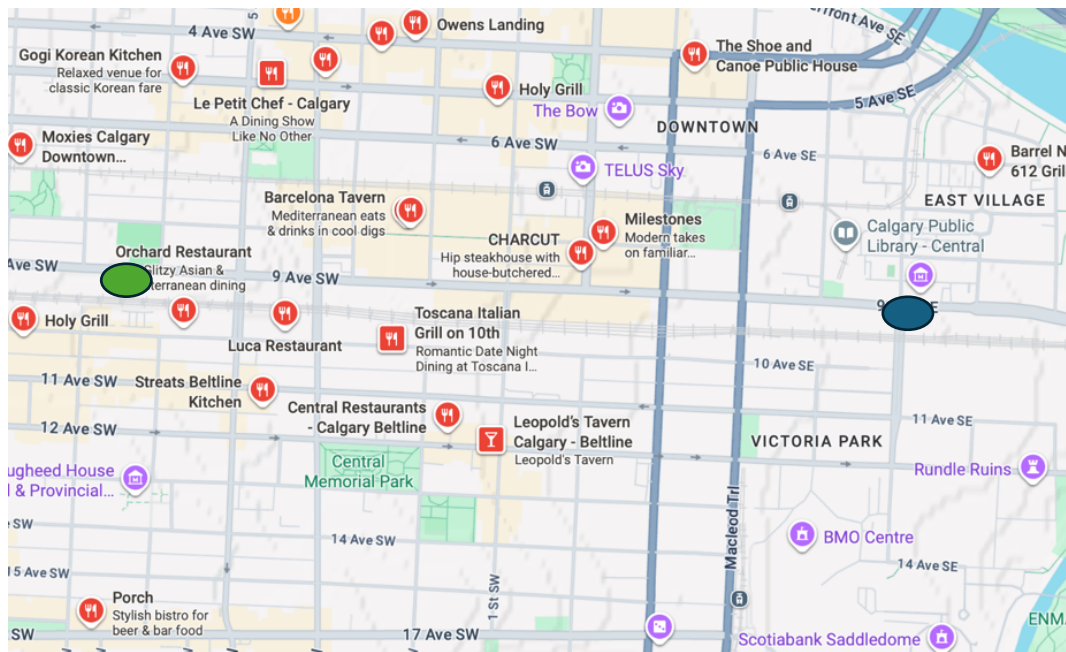


Figure 1: Restaurants in Calgary. Screenshot from Google Maps (2026) Green dots represent Calgary Tower and blue dots represent Central Station. .

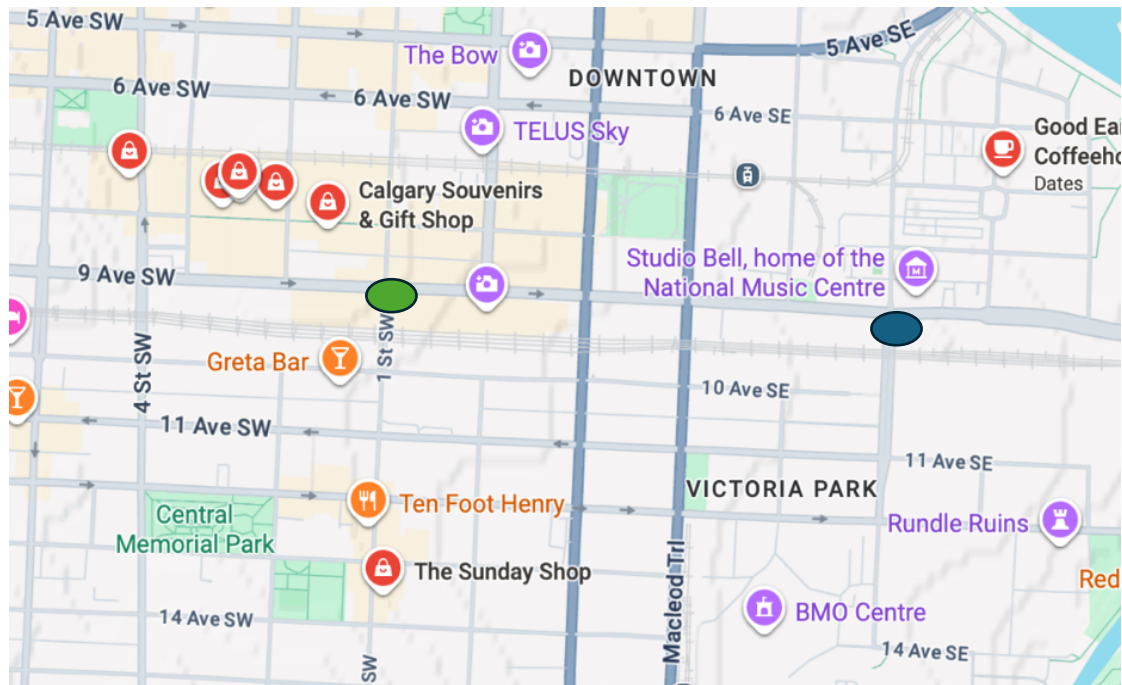


Figure 2: Shops in Calgary. Screenshot from Google Maps (2026).

We can observe through these maps that there is a much higher density of restaurants and shops around Calgary Tower compared to Grand Central Station. This allows us to give a greater value to Calgary Tower when it comes to the local economy. We decided to weigh Calgary Tower a 6 compared to Grand Central. This gives the stations the following weights: Calgary Tower 85.7% and Grand Central 14.3%.

ii. Transit (metro, bus, airport, light rail)

The decision of where to place access nodes, such as stations, is paramount to the success of any transportation system [8]. Using information from the General Transit Feed Specification (GTFS) available on the City of Calgary Open Data which is released by Calgary Transit Service Design, we have a map of all the transit stops in Calgary using red dots (See Appendix A). Taking into account that a point will exist multiple times if the stop is used by multiple routes, in a 600ft radius from Calgary Tower there are 12 different transit stops, meanwhile in the same distance from Grand Central station, there are only 5. This allows us to give greater value to Calgary Tower

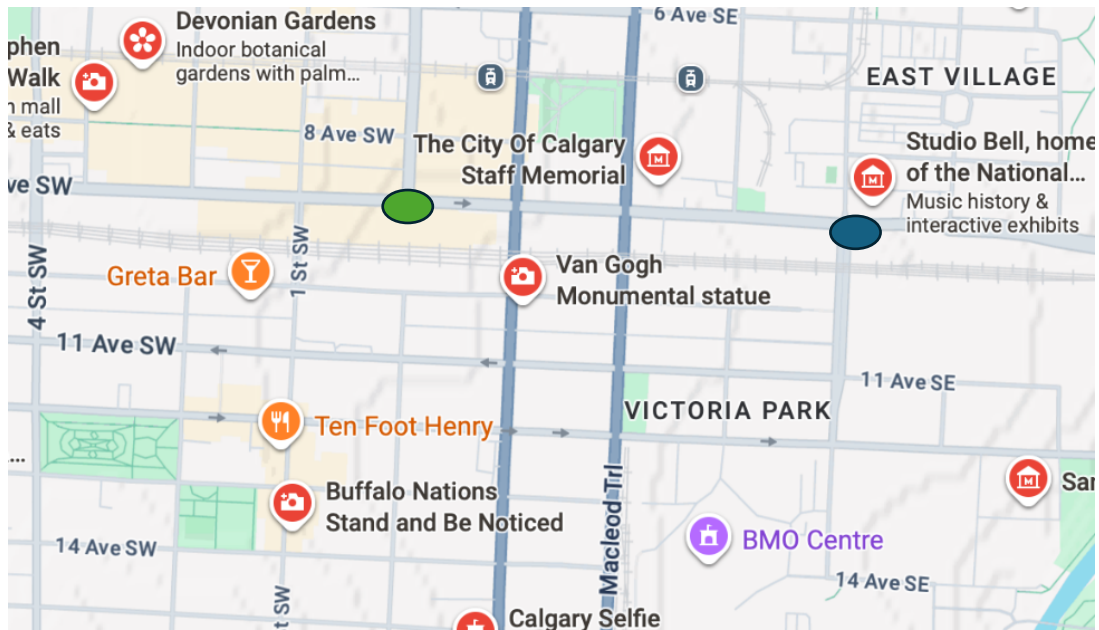


Figure 4: Museums in Calgary. Screenshot from Google Maps (2026).

We can observe that there seems to be a higher density of libraries and museums around Grand Central Station compared to Calgary Tower. However, according to the literature, we could also argue that more of these locations will appear and Grand Central station as it is used more. Since we can argue either way so we don't believe either station should be given a value greater than the other when it comes to culture and leisure. This brought us to weigh Calgary Tower equally compared to Grand Central. This gives the stations the following weights: Calgary Tower 50% and Central Station 50%.

We would also like to discuss the role of the Stampede Grounds when discussing culture and leisure. The Calgary Stampede grounds is a large festival space that hosts an annual rodeo that attracts over one million visitors to the city. These are located close to Grand Central station and highly affect the ridership of the station when the event is taking place. That said, since the event attracts visitors to the city of Calgary, we can also argue that Calgary Tower will have an increase in its ridership as well and that when a city hosts such a large event, they must implement temporary transit no matter what to make up for this large difference. Although this should be

taken into account for a final report before deciding on which station makes more sense to implement, we decided not to let it affect our final score because there is a gap in our knowledge about the event and its inner workings and felt we were not qualified to argue in either direction. This is a perfect example of some of the ways in which our research (and AHP model, which will be explained briefly) can be changed and tweaked according to city officials' opinions.

b. Safety

i. Lighting/visibility (eyes on the street)

Poor lighting and limited sightlines around stations reduce perceived safety, particularly during early morning and evening commutes, which are common for rail users [3]. Barrier-free and accessible design is essential to station success, and visibility conditions are a core component of that standard, especially given Calgary's long winter nights. When looking at the Calgary Tower location, it benefits from the activity and lighting generated by surrounding businesses and street life. Grand Central Station's adjacent event center does have some lighting, but this is intermittent. However, since lighting infrastructure can be installed relatively easily at either location, the gap between the two sites on this criterion is less pronounced than on others. Therefore, the stations have the following weights: Calgary Tower at 50% and Grand Central Station at 50%.

ii. Crash risk / safe crossings (intersection density, crosswalks, speed environment)

The pedestrian safety environment surrounding a station plays a significant role in shaping ridership. Stations located at high-traffic intersections with poor pedestrian infrastructure create barriers to access, as users are less likely to walk to stations where crossing conditions feel unsafe. Walkable access conditions significantly predict boardings, meaning that unsafe crossing environments suppress the ridership potential that density alone would otherwise generate [8].

According to Calgary Police Service data of 2025, the entire Downtown Commercial Core — the district in which both Grand Central Station and the Calgary Tower are located — shows consistently high levels of assault, theft, disorder, and suspicious person calls every year, suggesting it is one of Calgary's less safe urban areas [10]. This means the differentiating factor between the two locations comes down to the immediate physical environment of each site. Grand Central Station is situated near the event center, an area that is generally dimly lit and perceived as uninviting. Calgary Tower, by contrast, benefits from wide sidewalks, active local businesses on surrounding streets, and greater natural surveillance from people; however, there isn't much greenery or shade other than the large buildings themselves [11], [12]. On balance, the Calgary Tower location scores more based on the environment; therefore, we weighed Calgary Tower at 66.7% and Grand Central Station at 33.3%.

c. Station access

i. Park and ride (cars)

Park-and-ride facilities extend a station's effective catchment area well beyond walking distance, making them especially important in lower-density or auto-oriented contexts. Park-and-ride capacity is a statistically significant predictor of light-rail boardings, demonstrating that car access can compensate for limited residential density nearby [8]. Grand Central Station is in a comparatively underdeveloped area with few established destinations and limited road connectivity, which currently reduces its car-based access, but it is also seen that there are a few streets.

Based on the City of Calgary data found on ArcGIS, Grand Central Station has more parking lots in the direct area around the station compared to Calgary Tower (see Appendix A). Around Grand Central station there is a surface parking lot that houses 159 parking spots right across the

street from the station [13]. In a one block radius there is also a parkade that has 509 spots. For Calgary Tower, there is no parking directly around the station but in a one and a half block radius there are two surface lots and one parkade with a total of 331 spots. The parkade space is not desired due to the expense, with parking spots costing \$8 per hour and \$27 per day. This is an additional cost to the Red Line and Blue Line transit fare of \$4. All of these are paid parking places. Therefore, we weigh Calgary Tower at 25% and Grand Central Station at 75%.

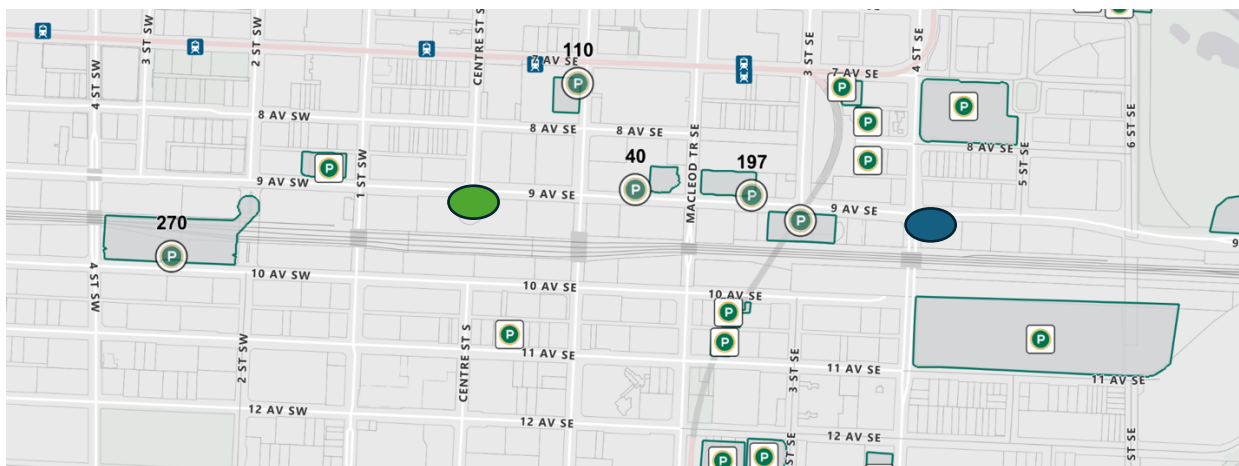


Figure 5: Parking in Calgary. Screenshot from ArcGIS (2026).

ii. Bikes

Bicycle access expands access to the area of a station beyond typical walking distance at low cost and with minimal emissions. Multimodal connectivity is a key predictor of station performance, and cycling infrastructure is an increasingly important component of that integration in mid-sized Canadian cities [7]. The Calgary Tower area has bike infrastructure present on the surrounding roads, meanwhile the Grand Central Station area, being less developed, has no clearly visible dedicated cycling facilities in the immediate vicinity, though the broader area does have some bike infrastructure [13]. Both stations have a parkade within a one block radius that has a

similar number of spaces for bike parking. We weigh Calgary Tower at 50% and Grand Central Station at 50%.

d. Mobility

i. Walkability (covered walkways)

Walkability is one of the strongest predictors of transit ridership, as stations surrounded by a well-connected street network generate more spontaneous use. Stations lacking sheltered walking routes to nearby destinations will likely underperform relative to their population density, as harsh weather conditions deter pedestrians from completing the last leg of their journey on foot, a particularly relevant concern given Calgary's extreme winters [3]. Grand Central Station's surrounding area is underdeveloped and does not present as a walkable environment to the casual observer. The Calgary Tower has good sidewalk infrastructure and street connectivity, though covered walkways connecting to the broader sidewalks are limited unless accessed through adjacent commercial buildings. On balance, we weigh Calgary Tower at 66.7% and Grand Central Station at 33.3%.

ii. Disability Access

Accessibility ensures that stations serve the full population of their catchment area, including seniors, people with disabilities, and those with strollers or mobility aids. Barrier-free design is a necessary dimension of successful station placement. Grand Central Station's underdeveloped surroundings make accessibility difficult to assess, with limited visible infrastructure, and there is seemingly no street access, however due to this it can be built and improved with a project [3]. The Calgary Tower location benefits from wide sidewalks and standard curb cuts at crosswalks, though these are limited to intersections rather than distributed

throughout the streetscape. Therefore, we weigh Calgary Tower at 50% and Grand Central Station at 50% for accessibility.



Figure 6: A sidewalk by Calgary Tower: Screenshot from Google Maps (2026).

2. Demographics of likely users

Ridership is an important metric for determining the success of a transit system. Ridership is influenced by many factors, including travel demand. Therefore, it is important to appropriately assess who will demand to use your transit system, your likely users. In some places, the demographic of this likely user base could be young professionals. In other places, the likely user base could be middle-aged working class. The likely user base and their demographics are context dependent. Rail stations should be located in areas where the demographics match those of likely users [14].

a. Population density

Areas with higher population density typically generate greater transit ridership because more people live within walking distance of stations [14]. Dense residential neighborhoods increase the

likelihood that residents will rely on transit for commuting, shopping, and other daily activities. Lower-density areas generally produce lower ridership unless supported by strong park-and-ride access or connecting services. Looking at ArcGIS for population density around both stations, both stations seem to be the same. We weigh Calgary Tower at 50% and Grand Central Station at 50% for accessibility. While this metric shows that each station has the same population density, it is important to note the nuances that this data does not capture. Immediately south of Calgary Tower is the Beltline neighborhood, a high-density residential neighborhood. North of Grand Central Station is the East Village, another high-density residential neighborhood that is currently being developed. With more recent and granular data it is likely that the station locations would have their population densities evaluated differently. However, with the data source that is currently available, population densities are evaluated as equal.

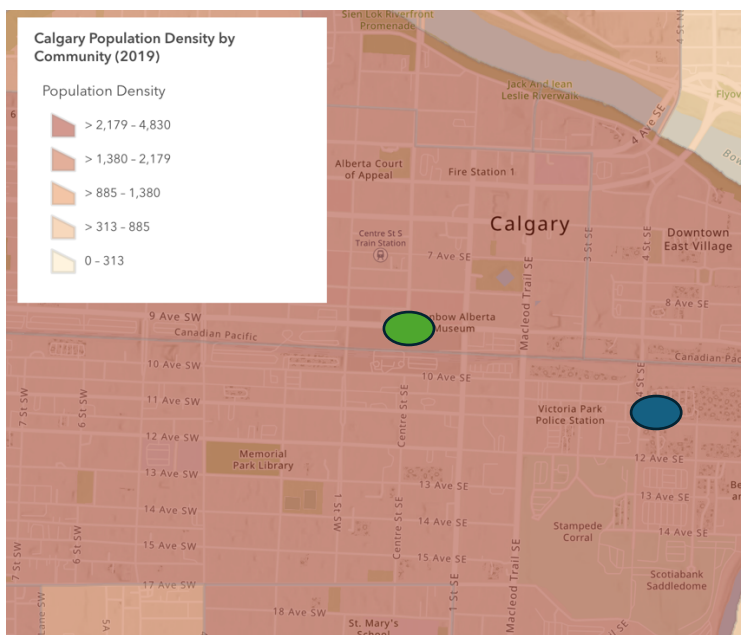


Figure 7: Population density in downtown Calgary. Screenshot from ArcGIS (2026).

b. Employment density

Employment density refers to the concentration of jobs in a given area. Stations located near major employment centers tend to attract consistent ridership, particularly during peak

commuting hours[8]. Office districts, industrial areas, and commercial hubs generate regular travel demand, making them strong anchors for transit service.

Using the data we had collected for the “local economy” variable, we can continue to argue that there is a higher density of employers in the Calgary Tower area compared to Grand Central. Just north of Calgary Tower is Calgary’s central business district which is home to many office buildings for the Canadian Oil & Gas industry. Grand Central station, in contrast, has no such office space, and only has the Calgary Stampede grounds and convention space as possible employers. We decided to weigh Calgary Tower a 6 compared to Grand Central. This gives the stations the following weights: Calgary Tower 85.7% and Grand Central 14.3%.

c. Special populations

Certain population groups are more likely to depend on transit due to age, mobility, or limited access to private vehicles. These may include students (near schools, colleges, or universities), older adults (near senior housing or nursing facilities), and individuals with disabilities [15]. Areas with hospitals, government service centers, or large educational institutions can also create steady transit demand throughout the day.

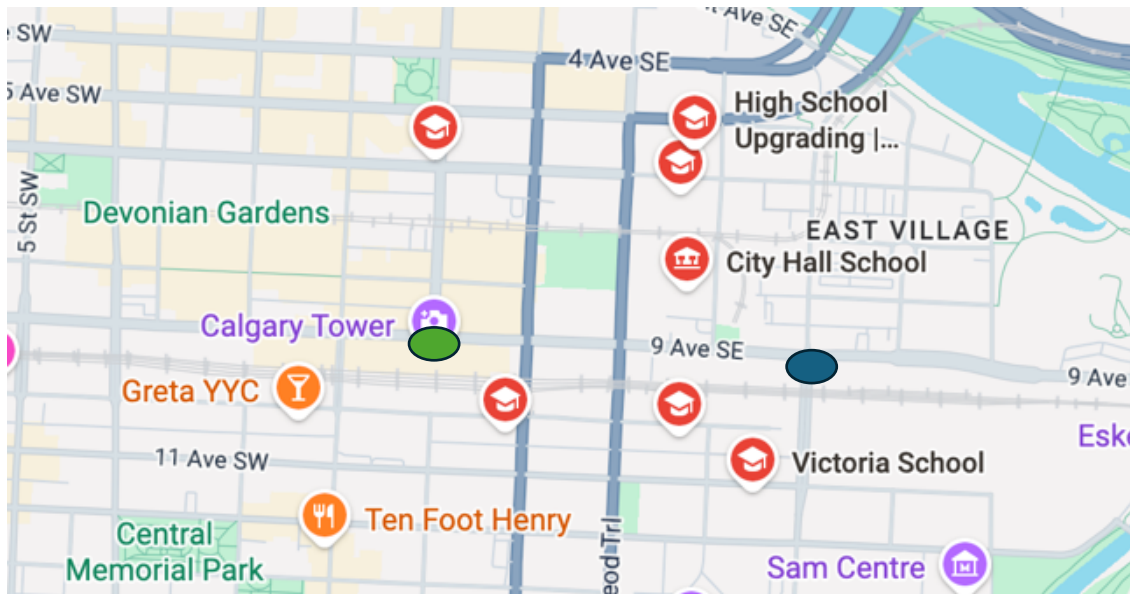


Figure 8: Schools in Calgary. Screenshot from Google Maps (2026).

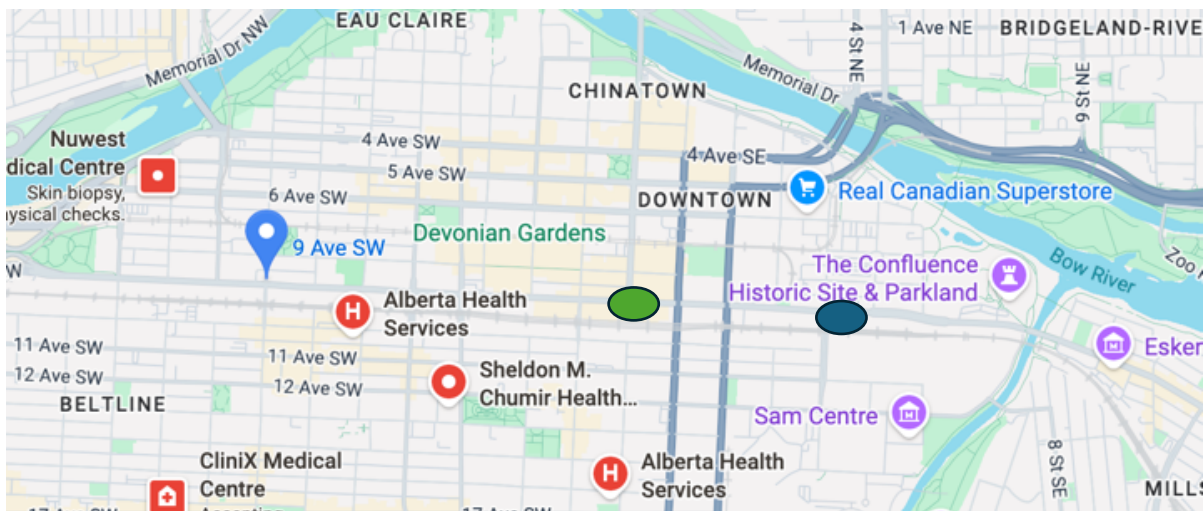


Figure 9: Health Services in Calgary. Screenshot from Google Maps (2026).

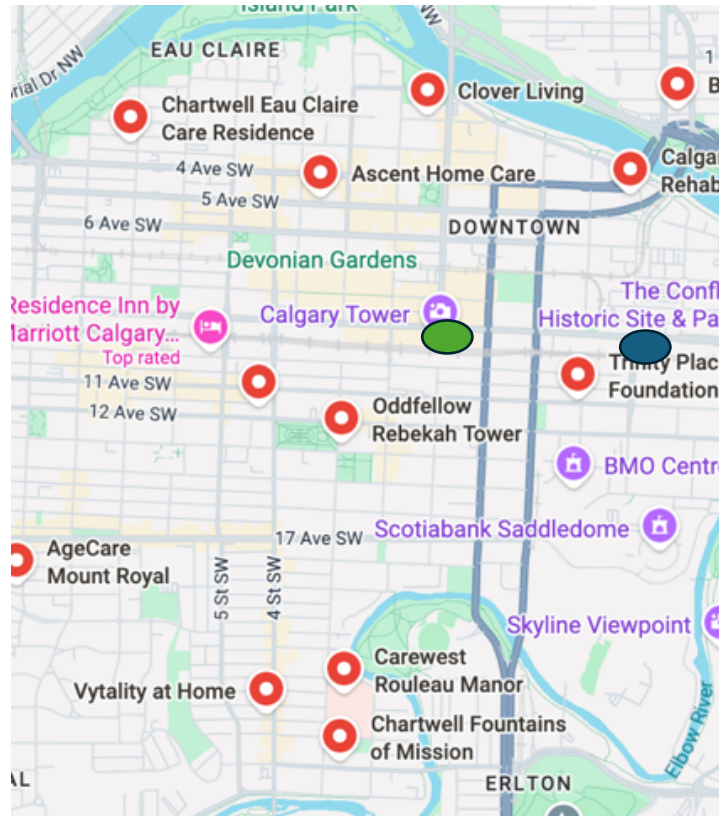


Figure 10: Senior Housing in Calgary. Screenshot from Google Maps (2026).

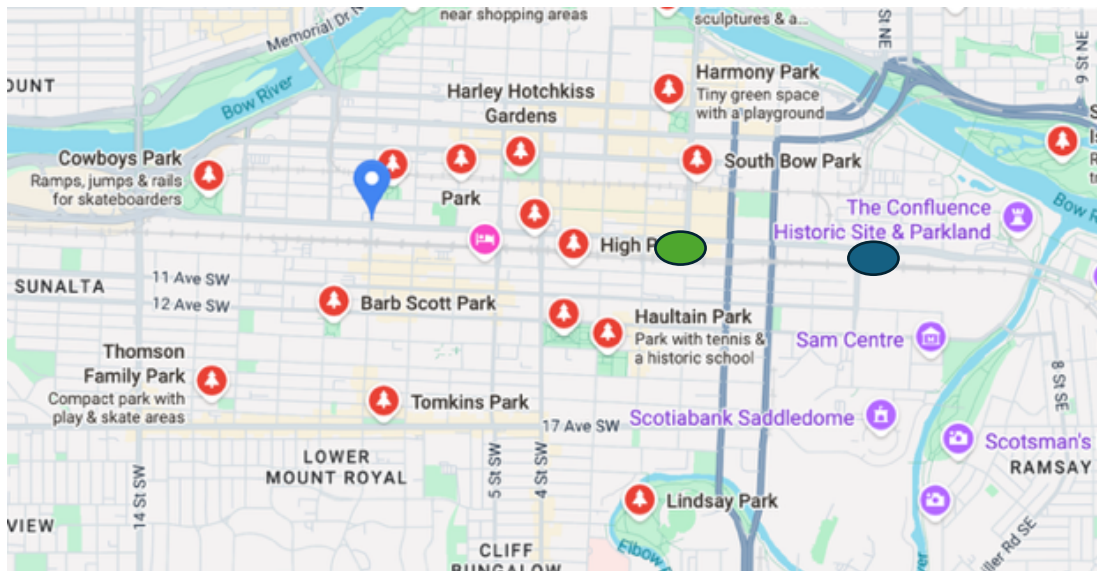


Figure 11: Parks in Calgary. Screenshot from Google Maps (2026).

We can see from these maps that nursing homes, hospitals, parks and schools are denser around the Calgary Tower than Grand Central. We weigh Calgary Tower at 66.7% and Grand Central Station at 33.3% for accessibility.

3. Logistics

a. Infrastructure (physical)

Good physical infrastructure helps connect Calgary's Central Station with the city's existing rail lines and road networks. Analyzing available land and space for development ensures the station can grow in the future and fit smoothly into the city's transportation system to create harmony between new projects and existing urban design [16].

Central station ranks two times more than Calgary tower because there is more available land (if they want to expand beyond just the tower itself: open land up for other developers). We weigh Calgary Tower at 33.3% and Grand Central Station at 66.7% for infrastructure.

b. Cost (financial)

Calgary's Green Line LRT connects Shepard to downtown, which includes a central segment through the downtown core, and has funding commitments of about \$6.2 billion, showing how costly major downtown transit projects can be [17]. Any new station in Calgary would face similar high costs for rail structures, platforms, utilities, and possible tunneling or elevated tracks.

Land and development around Central Station is costly, with higher land values and added development charges in established redevelopment areas. Developing a central station near the Calgary Tower wouldn't be starting from scratch; it could build on or reconnect with existing infrastructure and historical precedent with specifically the VIA Rail. The base of the Calgary Tower was once a central rail hub that operated effectively using the existing rail infrastructure

that had long served on the site. This historical architecture to support the VIA Rail that used to serve the city, can be repurposed for the development of Calgary's Grand Central Station.

A station near Central Station would need a budget for acquiring property, relocating existing uses, and paying city levies tied to infrastructure upgrades. Although both are expensive, we believe Calgary Tower would cost less for the city. We weigh Calgary Tower at 66.7% and Grand Central Station at 33.3% for cost

Phase 2: Weights and Justifications of Each Variable:

To analyze the variables and criteria for passenger rail station location placement (which you can observe in a figure in Appendix B), we used Analytical Hierarchy Process (AHP) which is a two-step, structured decision-making process that incorporates various criteria and weights them with relevant importance according to stakeholder values.

The first step of AHP involves ranking all the criteria involved in the decision-making process by relative importance. For example, the primary node 'Access' was deemed to be twice as important as 'Logistics'. After grouping the identified variables into their primary categories these variables were also ranked among each other by relative importance.

The second step of AHP involves scoring each option according to the identified variables and then weighing the scores using the values determined in the previous step of the analytical hierarchy process. AHP was an appropriate methodology for this project due to the flexible and varying priority of the factors influencing rail station placement. The final variable weightings are visualized in a full web map, included in Appendix B.

For the broadest set of categories (access, demographics, and logistics), the importance is deemed to be the following:

1. Access: due to the fact its subcategories directly influence station usage.

2. Demographics: in between the two (see above and below for justification).
3. Logistics: least important due to its flexibility to change infrastructure based on the environment around it.

Resulting Priorities

Priorities

These are the resulting weights for the criteria based on your pairwise comparisons:

Cat		Priority	Rank	(+)	(-)
1	Access	41.3%	1	9.5%	9.5%
2	Demographics	32.7%	2	7.5%	7.5%
3	Logistics	26.0%	3	6.0%	6.0%

Decision Matrix

The resulting weights are based on the principal eigenvector of the decision matrix:

	1	2	3
1	1	1.00	2.00
2	1.00	1	1.00
3	0.50	1.00	1

Figure 12: Weighing variables. Screenshot from AHP-Online System BPMSG (2026).

For the next subcategory under “Access” (trip generators, safety, station access, and mobility) we deemed the importance to be the following:

1. Trip generators: most important because without a reason to take public transport, it wouldn’t exist.
2. Mobility: since the locations we are considering are both downtown, where the majority of users are using these stations as a natural shift between walking and riding the train, our research deems the role of mobility more important than parking. Also, according to the TOD standard, the most important principle is walkability.
3. Station access: According to the TOD standard, cycling is the second most important principle.
4. Safety: in this scenario it is least important. Infrastructure will be put in place along with the development of the station.

Priorities

These are the resulting weights for the criteria based on your pairwise comparisons:

Cat		Priority	Rank	(+)	(-)
1	Trip Generators	45.5%	1	12.4%	12.4%
2	Mobility	32.0%	2	7.7%	7.7%
3	Station Access	13.9%	3	2.6%	2.6%
4	Safety	8.6%	4	1.8%	1.8%

Decision Matrix

The resulting weights are based on the principal eigenvector of the decision matrix:

	1	2	3	4
1	1	2.00	3.00	4.00
2	0.50	1	3.00	4.00
3	0.33	0.33	1	2.00
4	0.25	0.25	0.50	1

Figure 13: Weighing variables. Screenshot from AHP-Online System BPMSG (2026).

For the subcategory under “trip generators” that includes the variables of local economy, transit, culture & leisure we deemed the importance to be the following:

1. We deem local economy and transit to have equal importance
2. Culture & leisure

Priorities

These are the resulting weights for the criteria based on your pairwise comparisons:

Cat		Priority	Rank	(+)	(-)
1	Local Economy	40.0%	1	0.0%	0.0%
2	Transit	40.0%	1	0.0%	0.0%
3	Culture and Leisure	20.0%	3	0.0%	0.0%

Decision Matrix

The resulting weights are based on the principal eigenvector of the decision matrix:

	1	2	3
1	1	1.00	2.00
2	1.00	1	2.00
3	0.50	0.50	1

Figure 14: Weighing variables. Screenshot from AHP-Online System BPMSG (2026).

For the subcategory under “safety” that includes the variables of lighting & visibility and crash risk & safe crossings we deemed them to have equal importance because they are both factors that require infrastructure that can be developed around the development of the station.

Resulting Priorities

Priorities

These are the resulting weights for the criteria based on your pairwise comparisons:

Cat	Priority	Rank	(+)	(-)
1 Lighting & Visibility	50.0%	1	0.0%	0.0%
2 Crash Risks / Safe Crossing	50.0%	1	0.0%	0.0%

Decision Matrix

The resulting weights are based on the principal eigenvector of the decision matrix:

	1	2
1	1	1.00
2	1.00	1

Figure 15: Weighing variables. Screenshot from AHP-Online System BPMSG (2026).

The subcategory of "station access" includes the variables of park + ride (cars) and bikes. 44.7% of people are navigating to downtown Calgary via public transportation. People who are driving are not using the station, meanwhile bikers use public transportation as an add on (last mile transportation). Hence, bikes are important, but cars are not when it comes to parking around the station. The importance is the following:

1. Bikes
2. Park + ride (cars)

Resulting Priorities

Priorities

These are the resulting weights for the criteria based on your pairwise comparisons:

Cat	Priority	Rank	(+)	(-)
1 Park and Ride (cars)	33.3%	2	0.0%	0.0%
2 Bikes	66.7%	1	0.0%	0.0%

Decision Matrix

The resulting weights are based on the principal eigenvector of the decision matrix:

	1	2
1	1	0.50
2	2.00	1

Figure 16: Weighing variables. Screenshot from AHP-Online System BPMSG (2026).

The subcategory under “mobility” includes the variables of walkability and disability access. Access for everyone is access for all, so disability is more important than walkability.

1. Disability
2. Walkability access

Resulting Priorities

Priorities

These are the resulting weights for the criteria based on your pairwise comparisons:

Cat	Priority	Rank	(+)	(-)	
1	Walkability	33.3%	2	0.0%	0.0%
2	Disability Access	66.7%	1	0.0%	0.0%

Decision Matrix

The resulting weights are based on the principal eigenvector of the decision matrix:

	1	2
1	1	0.50
2	2.00	1

Figure 17: Weighing variables. Screenshot from AHP-Online System BPMSG (2026).

For the next subcategory under “Demographics” (population density, employment density, and special population) we deemed the importance to be the following:

1. Population density and employment density: ranked the same because transportation is influenced by both population and employment
2. Special populations: less likely to depend on public transportation

Resulting Priorities

Priorities

These are the resulting weights for the criteria based on your pairwise comparisons:

Cat		Priority	Rank	(+)	(-)
1	Population Density	40.0%	1	0.0%	0.0%
2	Employment Density	40.0%	1	0.0%	0.0%
3	Special Populations	20.0%	3	0.0%	0.0%

Decision Matrix

The resulting weights are based on the principal eigenvector of the decision matrix:

	1	2	3
1	1	1.00	2.00
2	1.00	1	2.00
3	0.50	0.50	1

Figure 18: Weighing variables. Screenshot from AHP-Online System BPMSG (2026).

For the next subcategory under “Logistics” (infrastructure [physical] and cost [financial]) we deemed the importance to be the following:

1. Infrastructure: the existence of a physical station makes it much easier to get a transit line up and running
2. Cost: less finance is more likely to reduce the ability to build a station

Resulting Priorities

Priorities

These are the resulting weights for the criteria based on your pairwise comparisons:

Cat		Priority	Rank	(+)	(-)
1	Infrastructure [physical]	75.0%	1	0.0%	0.0%
2	Cost [financial]	25.0%	2	0.0%	0.0%

Decision Matrix

The resulting weights are based on the principal eigenvector of the decision matrix:

	1	2
1	1	3.00
2	0.33	1

Figure 19: Weighing variables. Screenshot from AHP-Online System BPMSG (2026).

Conclusion:

From our analysis of all fourteen variables and their weights according to the Analytical Hierarchy Process, we found the Calgary Tower is deemed a more desirable location for a passenger rail station compared to Grand Central Station.

The main factors that stood out about the Calgary Tower were local economy, transit access, and employment density. These variables relate directly to the development of the downtown Calgary area. We also found that the existing infrastructure at Calgary Tower is more advantageous to developers and could also lower their costs compared to building an entire station from scratch.

It is also important to note that the way our team weighed and scored decision variables should not be taken as a universal determinant for a rail station. Decision variable weights and scores can vary depending on the priorities of stakeholders and the perspectives of decision makers. The case of the Calgary Stampede Grounds is a good example of how weighing and scoring and AHP can differ depending on the team doing the calculations. While conducting our analysis, our team did not consider the significance and impact of the annual Calgary Stampede due to our unfamiliarity with the location and the event. However, decision makers in Calgary may decide that the consideration of this event may be crucial for selecting an appropriate rail station. This is just one example in which decision making can vary depending on stakeholder preferences. Our analysis is not prescriptive but rather serves as a framework that officials can adapt to their preferences and priorities to use when determining rail station placements.

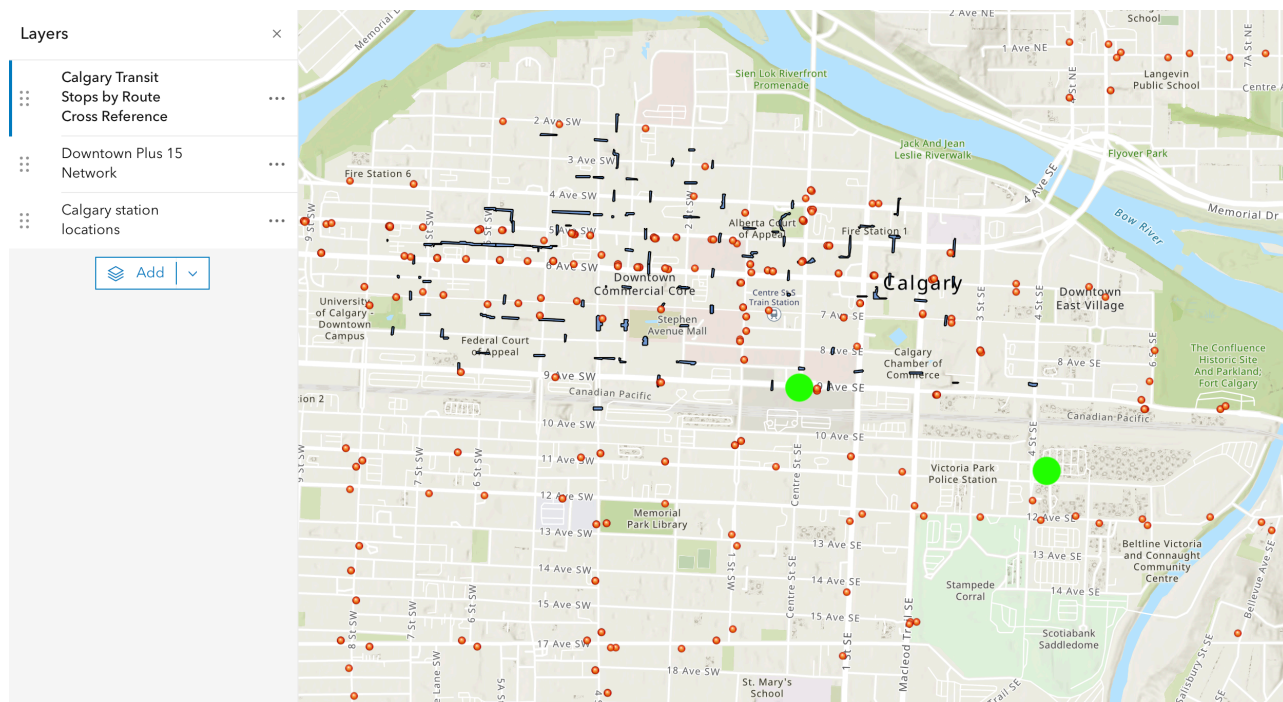
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Appendix A

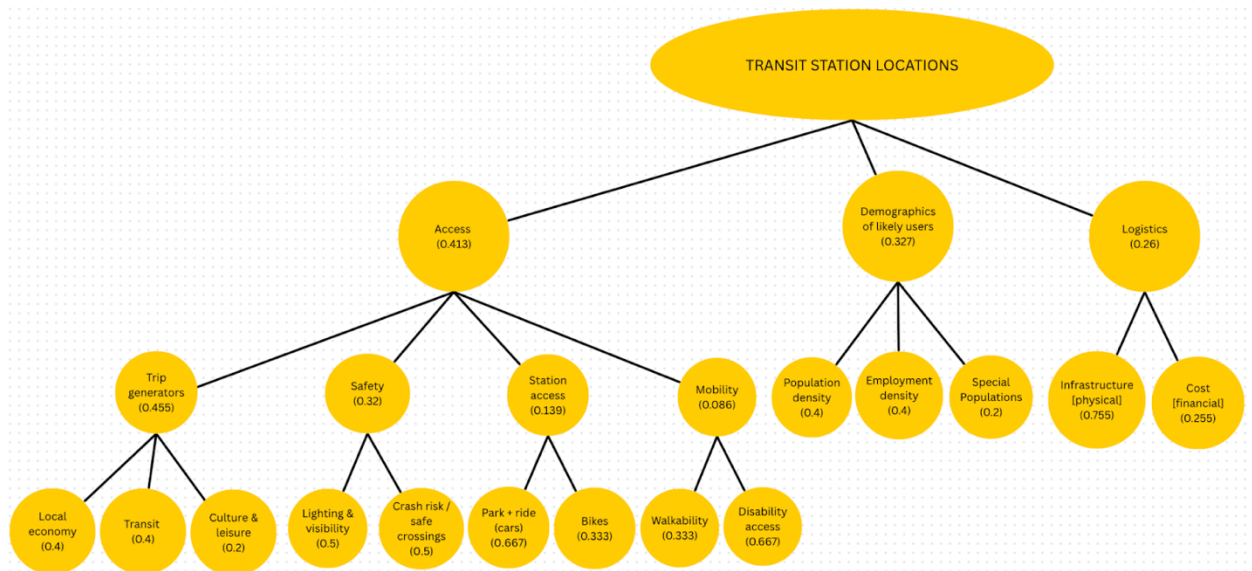
Esri, “Web map, ArcGIS Online Map Viewer,” ArcGIS Online, [Online]. Available: <https://wooster.maps.arcgis.com/apps/mapviewer/index.html?webmap=69ce4c52a992443b8f2b5fdb0bbf21f2>. [Accessed: Apr. 2, 2026].



Appendix B

Web of all our variables: Canva [Online]. Available: <https://canva.link/onh6h8shk5ktqt7>

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