Burnaby Mountain Gondola: Making the Rapid Transit Connection

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Author: Holly Foxcroft

Overview of TransLink

TransLink is Metro Vancouver's multimodal regional transportation authority. TransLink is responsible for the planning, operations, and maintenance of our bus and SkyTrain networks, SeaBus, commuter rail West Coast Express, roads, and bridges.

On a weekly basis we move 900,000 people, the equivalent of one third of the population in Metro Vancouver. Based on the American Public Transportation Association, TransLink's transit ridership is amongst the highest in North America on a per capita basis. SkyTrain is now the fourth busiest rapid transit system across Canada and the United States, only trailing behind New York, Toronto, and Montreal. Bus ridership is third highest of all transit operators in Canada and the US, despite having the 24th largest population.

Bio

Holly Foxcroft, MA Planning, has over 15 years of experience in land use and transportation planning. Holly has worked in the private and public sectors in development, community, and transit planning. Since 2020 she has been leading the project development and definition of the Burnaby Mountain Gondola. She continues lead the engagement, governmental, and technical analysis teams.

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Introduction

Gondolas that are part of regional transit systems can be seen on the skylines of Mexico City, Barcelona, and Medellin. But in North America, their uptake has been much more limited — often just to ski hills. But urban transit gondolas could move more people more efficiently and more comfortably, with a smaller infrastructure footprint, use renewable energy, and can be constructed quickly compared to other rapid transit projects. With their numerous potential benefits to transit customers and transit operators, why aren't there more urban transit gondola systems in operation in North America? This paper will explore this question through the lens of the Burnaby Mountain Gondola (BMG), exploring challenges that have arisen during the planning process and the project team's actions to address them.

The Burnaby Mountain Gondola is located within the City of Burnaby in the Metro Vancouver region (2.6 m residents). The BMG was first conceptualized as an extension of the rapid transit network in 2009. Since 2011, TransLink (Metro Vancouver's regional transportation authority) has been advancing the planning of a 3S gondola connection between the region's rapid transit network and the top of Burnaby Mountain and Simon Fraser University. The Project in is its final stages of planning prior to implementation, undertaking design, technical and financial analysis to support the full business case. The project will be considered for funding soon but remains unfunded at this time.

Project Overview

The BMG is a 3S gondola system that will extend from TransLink's SkyTrain rapid transit network to the top of Burnaby Mountain. (Transit is currently provided to Burnaby Mountain from four bus routes.) Every day there are about 25,000 daily transit trips to/from Burnaby Mountain.

The BMG route crosses through four distinct urban areas (see Figure 1). The lower terminal will be located at Production Way-University station which has a SkyTrain station and bus exchange. The route will then cross over an industrial and commercial area, the residential neighbourhood of Forest Grove, the Burnaby Mountain Conservation area, and end at Burnaby Mountain. The upper terminal will be located on the eastern side of campus near academic buildings and the residential neighbourhood of UniverCity. Burnaby Mountain is home to Simon Fraser University (Metro Vancouver region's second largest university), a growing residential neighbourhood, and is surrounded by an environmental conservation area.

Figure 1: Burnaby Mountain Gondola Route Map

Simon Fraser University is one of the Metro Vancouver region's largest employers, but the location of their Burnaby campus is isolated from the region and lacks resilience in the road network (with only two access roads). This has resulted in limited economic development and high car dependency.

A gondola connection would improve the transit customer experience. It would alleviate transit customers from daily reliability issues such as overcrowded buses and often poor road conditions during winter weather. It would also increase daily and seasonal reliability and decreasing travel times. The gondola would be the most direct and fastest route between the SkyTrain and the top of Burnaby Mountain (7 mins vs 15 mins by bus), with very frequent service (less than a meeting on opening day). Based on

forecasted demand the Project will have an opening day of 3,000 passengers per hour per direction (pphpd), with an ultimate capacity of up to 4,000 pphpd.

With its upper limit on cabin capacity, it would provide a more comfortable ride compared to bus which is only limited by the number of people that can squeeze on to the bus. It will support climate objectives by using electricity and support the 100% conversion of what is currently a diesel hybrid fleet. From the transit agency's perspective there are benefits to the lower operating costs (than the two bus routes it is replacing) and also introducing a new transit mode that will better match transit demand that exceeds a bus or rapid bus route (about 1,000-1,500 pphpd) and the SkyTrain system during the peak hour of travel (10,000-18,000 pphpd). Further, the gondola technology is more suited to the mountain terrain and weather condition on Burnaby Mountain. Additional benefits of the BMG include:

- Dedicated right of way, reliability, on time performance;
- Unencumbered from the road network;
- Improved customer experience;
- Increased transit mode share;
- Operating cost savings; and
- Incremental revenue opportunities from tourism.

TransLink is working in close collaboration on the Project design and development with Project partners, City of Burnaby, and Simon Fraser University. In 2019, the City of Burnaby established core principles to guide the project development. These core principles were applied in the 2020 evaluation of three potential routes and in the current business case phase.

- Residents: Minimize impact to people living near the gondola, in all stages of the project.
- Environment: Minimize the impact to areas with high ecological values.
- Compensation: Ensure fair compensation to all impacted property owners.
- Consultation: Engage communities and stakeholders in meaningful consultation and report back to Council.

TransLink has been engaging with four participating First Nations that have overlapping territory on Burnaby Mountain – kʷikʷəƛ̓əm (Kwikwetlem First Nation), xʷməθkʷəy̓əm (Musqueam Nation), Sḵwxwú7mesh Úxwumixw (Squamish Nation) and sḷilwətaʔɬ (Tsleil-Waututh Nation). TransLink has been engaging on the BMG and the Rights and Title and interests of these First Nations. TransLink is committed to advancing reconciliation through the BMG project development by incorporating interests directly into the Project's technical analysis and design direction.

A recent round of public engagement (Nov 2023) found continued strong regional support for the project with 83% of 4,600+ survey respondents supportive or very supportive of the project. Public engagement in 2020 demonstrated the same level of support for the project, 83%.

Discussion

TransLink has been advancing the planning of the BMG since 2011. How can we explain this lengthy planning timeline? There are two key challenges that have influenced the timeline of the planning process – heuristics and public acceptability, transit agency's perspective and urban considerations. These considerations apply to other urban areas and transit agencies considering an urban transit gondola and can serve as lessons learned.

Heuristics and Project Acceptance

Understanding the psychology of heuristics is crucial to understanding the impression and support of the gondola project amongst the general public's impression and decision makers.

Heuristics (or bias) are the mental shortcuts that we use every day to simplify complex problems, thereby reducing mental load. Heuristics are often employed when people are presented with new information or

concepts, like the urban application of gondolas. Where heuristics help us to move quickly through complex decision-making this is at the cost of oversimplification. There are three types of heuristics – availability, anchoring, and representative. By exploring heuristics, we can gain an insight into the psychology of why gondolas have been slow to be accepted by the public and decision makers in urban areas.

The *availability heuristic*, "the ease with which instances or occurrences can be brought to mind.[1]" When thinking about a gondola in the Metro Vancouver context a person is likely to draw on the occurrence of gondolas within our region or located nearby (e.g., Whistler).

- Gondolas are located on ski hills, not in cities: Gondolas are for use by people who have the skills, time, and money to dedicate to alpine sports. Ski hills are privately owned and operated.
- Gondolas are for tourists: Gondola systems are privately owned and operated tourist attractions. These systems have flexibility in when they operate as they are a non-essential purpose.

The *anchoring heuristic* derives from an initial value that we ascribe to something. We may take in new information, but we anchor back to that initial value or input.[2]

- Urban transit gondolas operating in Mexico and South America are not the same as North America: Perceptions run the gamut from different perceptions of property rights, safety considerations and risks to life, or the trade-offs people will make to have improved transit.
- Gondolas are not accessible: Rapid transit vehicles are stationary when loading and unloading, so a moving vehicle must not be accessible.

The *representative heuristic* is the propensity to group events or objects to instances we are already familiar with.[3]

- Trees are logged underneath gondola systems: Familiarity with alpine gondolas leads to the assumption that the trees under the system will be logged. However, trees are cleared under gondola routes to allow people to ski under them.
- Gondola systems could be the target of vandalism: Two recent acts of vandalism at a recent gondola system (Sea to Sky) have called the safety of gondola systems into question and the safety of the land uses below them.
- Gondolas are not safe: When an incident does occur on a gondola system it is widely reported in the media and gondolas are attributed an outsized risk, like when there are reports on airplane incidents. What is not as widely reported on is the incident of motor vehicle accidents. In Canada in 2021, there were about 295 motor vehicle accidents every day, with five fatalities a day.[4] Comparatively, fully enclosed aerial lifts in North America operated without a fatality for 40 years (as per 2016 research).[5]
- Gondola cabins and systems are noisy: Comparing aging infrastructure to new infrastructure, e.g., a 40+ year aerial tram that buzzes it is assumed that all gondolas make this noise.

The mental shortcutting has played a role in the perceptions of the visual spatial understanding of the BMG project credibility, project need, and potential project impacts. An example has been the consideration of the project as a "nice to have" and not a "need to have" because the technology was saddled with preconceptions. This perception has contributed to the lengthy planning process, as the project had to overcome heuristics.

With understanding the role of heuristics on BMG, it has been challenging to visualize and understand the spatial interactions of the Project. Many questions have arisen – how high will it be in the air? How tall will

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[1] Tversky, A. and Kahneman, D. (1974). Judgment Under Uncertainty: Heuristics and Biases. *Science*. 185(4157), 1124-1131
[2] Ibid
[3] Ibid
4 "Canadian Motor Vehicle Traffic Collision Statistics: 2021" https://tc.canada.ca/en/road-transportation/statistics-data/canadian-motor-vehicle-traffic-collision-statistics-2021
5 CUTRIC. (2024) Non-Traditional Modes of Transportation. Non-traditional modes of transportation by CUTRIC_CRITUC - Issuu

the towers be? Where will it go? What will you be able to see from it? How far away will you be able to see it? What will the terminals look like? Road based or rail-based transit does not evoke the same questions as people have familiarity. A vehicle operates on the road, in mixed traffic or in a dedicated lane, or a train on a dedicated rail. But due to the lack of urban transit gondolas there are not examples that people can readily point to. Faced with this challenge the BMG project team took steps to break down the barriers to an experiential understanding of the gondola, to make it as real and relatable as possible this was achieved by.

While decision makers and the public sought to gain an experiential understanding of the Project, some sought to understand the impacts of the gondola on the urban and natural environment. The project team heard that there were concerns about the human environment and natural environment.

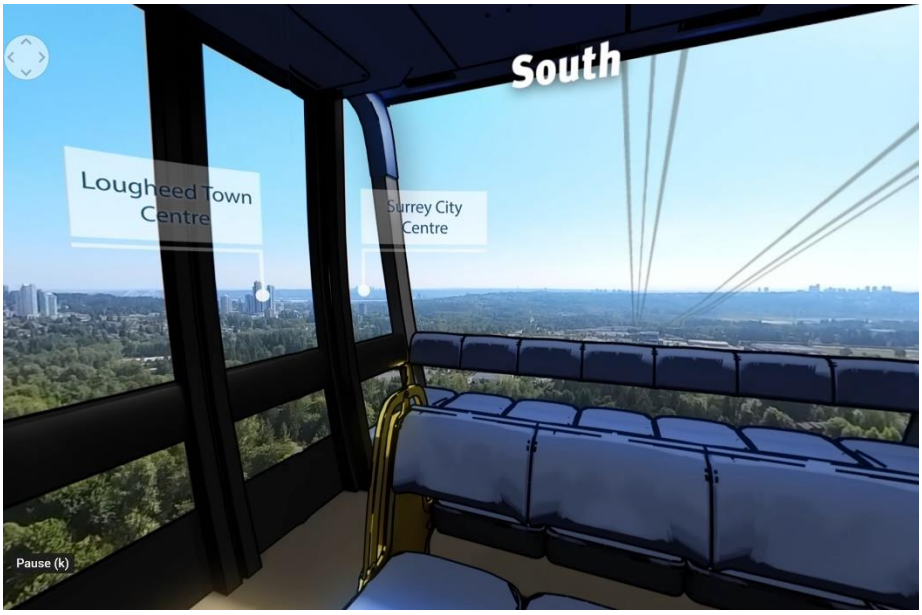
Concern has been raised about the potential for construction and operational impacts on the human environment. Interest in the impacts has related to how noisy the gondola may be, if the gondola would reduce privacy of residential neighbourhoods, and questions related to compensation.

Public and political acceptability are key aspects of transit capital infrastructure projects. Having public and government support are critical to securing funding for new capital projects. TransLink's capital funding is provided by the region, provincial and federal governments.

Public support is crucial to launching public transit projects from concept to operation. The BMG project team addressed heuristics through technical actions, information gathering and sharing, and engagement with an objective of providing more information to address the heuristics. By collaborating with ropeway suppliers and peer cable car agencies the project team gathered information about the planning, design, and operation of gondola. In these engagements the team were able to learn about present examples. This information was summarized into a comprehensive document of questions and answers related to gondolas and urban transit gondolas (e.g., operating in high winds, system safety, etc.) that was made available on the project's website.

The BMG project team has collaborated and engaged closely with project partners, participating First Nations, key stakeholders, and decision makers between 2020 and 2024. The objectives of this engagement have been to continue to advance the concept of the BMG, collect feedback, and incorporate interests into the project's technical analysis.

Figure 2: Still from the BMG Flyover Video



To support these engagements and address the questions about the visual/spatial concept of the BMG supportive imagery has been developed including conceptual renderings of the terminals and towers. Finally, riding in the gondola was simulated by a 360° drone video flown along the route at the height and speed of travel with a 3D cabin modelled around the video footage (see Figure 2). This footage has supported the visual/spatial concept of the gondola and also sought to address concerns over loss of privacy.

Considerations: Transit Agency Perspectives

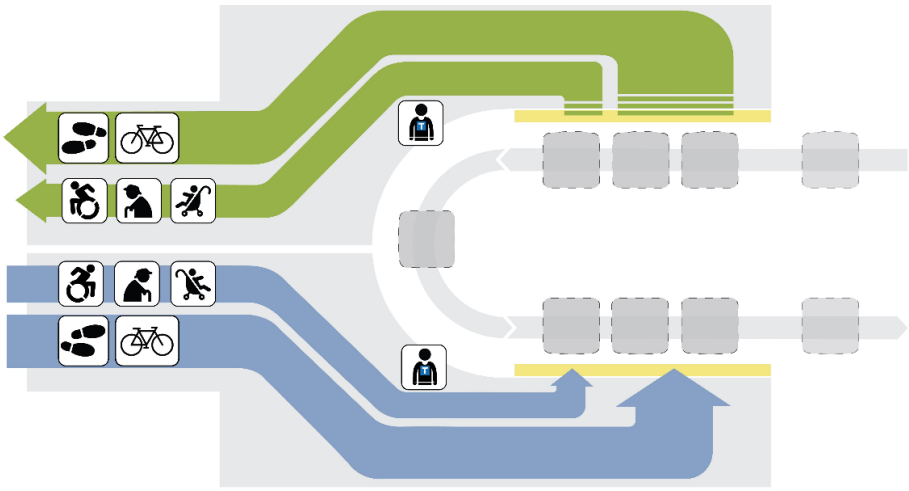
1. Transit Customer Needs

TransLink is very customer focused. Meeting the needs of transit customers is intrinsic to the designing, planning and operation of TransLink's transit system. Transit customer needs factor into the design, integration, operation, and performance of the 3S gondola integration into TransLink's customer network. There is a relationship between transit ridership and the experience of customers – is the transit reliable in all kinds of operating conditions, does it have good on-time performance and are shutdowns limited? For example, our SkyTrain system has an on-time performance measure of 95%±. The dedicated aerial right of way and gondola system operation shows indication of high levels of on-time performance.

Transit customers have a greater diversity of abilities and needs than alpine gondola users. This diversity merits exploring the fundamentals of gondola-based tourism, how people access the system, load and unload, and cabin configurations. TransLink has design standards for our SkyTrain and bus facilities, but not for gondola. The project team worked closely with the group responsible for these standards to adapt and create new standards for the BMG.

The project team has adopted an equity-based approach to designing an urban transit gondola that will support universal access while efficiently moving customers. The project team has been advancing this approach by developing and iterating on design principles, testing design with different equity groups (e.g., newcomers to Canada, people living with disabilities, youth, seniors, 2SLGBTQA+, and Indigenous peoples), and incorporating feedback into the design.

Figure 3: BMG Terminal Boarding and Alighting Areas



To support an equity-based design the project team focused on the key areas of passenger interface – design of the loading/boarding and unloading/alighting areas, cabin operation in the terminals, and design of the cabins (see Figure 3). We received feedback that there we a desire for there to be organization in the boarding and alighting area to allow for priority boarding and alighting areas that will allow customers to interact with the attendants if needed and create dedicated space for priority customers to enter and exit the gondola at their own speed rather than the speed of the crowd. Further, we heard strong interest in the cabins stopping in terminals to allow a stationary boarding rather than boarding the cabins while they are in motion. Analysis is currently underway to assess the option to stop every or every few cabins at the opening day capacity of 3,000 pphpd and the ultimate capacity of 4,000 pphpd.

TransLink has looked to peer agencies to understand their design and policy considerations. An example of this is bikes on the 3S gondola cabins. Moving bikes and wheels on transit is part of TransLink's multimodal mandate. As the 3S gondola is a new vehicle type for TransLink we have looked to Tisseo, a peer transit agency in Toulouse, France to understand their bike policy. The Téléo allows one bike per cabin during peak and off-peak travel. The project team has assumed one bike per cabin as a holding policy, subject to implementation phase assessment. Allowing one bike per cabin will allow for over 60 bikes per hour to be moved, while bus could only move about 30-40% during the same time period.

2. Design Expertise

In absence of the extensive adoption of urban transit gondolas there is also a lack of urban transit gondola planning expertise within transit agencies. This presents another challenge to urban transit gondolas as a new form of transit. Transportation planners can advance the planning process but can be limited by the lack of knowledge about gondola route, system, operations, and maintenance.

To supplement the in-house transportation expertise the project team engaged consultants to support the design and technical analysis of the BMG. TransLink contracted a team of consultants to support in the design and development of the BMG. The project team has engaged with the consultants in a collaborative and problem-solving approach and by doing so has facilitated the greatest opportunity for creativity and innovation.

3. Operations and Maintenance

TransLink prioritizes reliability, resiliency, and comfort of travel on our transit network. There is a correlation between these values and transit ridership. By focusing on these values, we can attract more riders to our transit system and limit negative impacts to ridership by avoiding or minimizing unexpected closures, downtimes, and unforeseen operations and maintenance challenges and costs. Oftentimes maintenance needs and requirements are accounted for at a late stage in design, so are “fit in” with the risk being that there are compromises made to the maintenance needs. The project team, in collaboration with the owner’s engineer team, has adopted a best practices approach to develop the concept of operations and maintenance. The objective developing the concept of operations and maintenance at this early stage has been to ensure that there would be adequate space provided in the terminal design for maintenance operations and needs, accurate costing of staff, and an input of the operating hours.

TransLink monitors on-time performance, crowding and system shutdowns/cancellations for our bus and SkyTrain network. This information is used to gauge customer experience, assist with transit service planning, route, and fleet planning.

TransLink’s approach to transit system operations is driven by matching service times to ridership demand and maintenance need. In assessing the ropeway maintenance requirements of daily and seasonal operation the project team has sought to continue this principle to align with our existing approach, meeting ridership demand while minimizing annual shutdowns. The project team is currently working with the ropeway suppliers to understand operationally feasible operating hours.

4. Engaging with Ropeway Suppliers

Developing an urban transit gondola requires a new approach to design for transit agencies. Typically transit agencies would engage with suppliers at a much more mature stage of design than is necessitated by an urban transit gondola. The BMG project team found that early engagement with the ropeway suppliers is key to understanding the efficacy of the urban transit gondola design. The goal of this engagement were to engage fairly with both suppliers to develop a system that was supplier agnostic.

The BMG team has been actively engaging with the ropeway suppliers actively since 2022. Both suppliers have been willing and interested participants in these engagements with expertise drawn from the local Canadian offices, supported by European ropeway design expertise. Another objective of the engagement with the suppliers has been to develop an unbiased feasible reference concept design that can be costed to support funding discussions. There has been mutual learning about the ropeway design and development process from the suppliers and the needs and interests from the transit agency’s perspective.

5. Regulators of Passenger Ropeways and Air Space

In the Province of British Columbia (where Burnaby is located) passenger ropeways are regulated by the provincial body, Technical Safety British Columbia (TSBC). They are responsible for the approval and monitoring of passenger ropeways under CSA Z98:19. TSBC is typically engaged at a mature stage of project design and delivery to ensure that the code requirements are met. However, recognizing that an

urban transit gondola is new to this regulatory environment and no precedent exists within Canada, it is anticipated that updates or changes to the code may be needed. Code updates can take time and could impact the construction schedule. In response the project team has been engaging with Technical Safety BC on the design of the BMG and areas where code changes may be required. In addition, the project team has engaged with Technical Safety BC on the potential interactions of the gondola system and electricity infrastructure.

In Canada, commercial airspace is federally regulated by NavCan which is a part of Transport Canada. The project team engaged with NavCan as the gondola system would be located under the Vancouver International Airport flight path. The objective of this engagement was to gather information and to proactively de-risk the project. NavCan has provided guidance about intrusion into airspace for consideration in the BMG design (e.g. beacons on towers).

6. Project Funding

TransLink leverages senior government and regional funding for most of its transit expansion projects. The BMG provides an opportunity to extend the rapid transit network at a lower cost than SkyTrain infrastructure. Overall urban transit gondolas promise short construction timelines, minimal infrastructure footprints, and lower capital costs compared to other forms of rapid transit. At the time of writing, there is volatility in the Metro Vancouver construction environment impacting the project costs and interest during construction (with the highest interest rates seen in a generation) making BMG and even more attractive rapid transit option.

Considerations: Urban, Environmental, and Archaeological

1. Urban

The short construction timelines of gondolas are enticing to transit agencies, but their application in the urban area is complexified by the presence of utilities, something that is absent from their alpine applications. Underground utilities are typically located in road rights of way or setbacks. Relocating utilities on other rapid transit projects is commonplace, but the aerial nature of the gondola is a new consideration.

On the BMG, the project encountered this risk as it crosses over transmission and distribution electricity lines. Nowhere else in the Province of British Columbia, or in Canada, has another system crossed above electricity lines. To address this risk the project team the electricity company to initiate a technical assessment of the potential interactions with the ropeway system and the electricity infrastructure. The results of this analysis are still pending, but engagements have been promising.

The linear nature of a gondola route is often at odds with the curvilinear nature of the urban form or road network that operates below it and with property lines. On other rapid transit projects there is a very limited acquisition of aerial property rights, whereas aerial property rights are required throughout the alignment. Acquiring these rights is through a negotiated process with individual property owners which can take time. The BMG has sought to limit the number of properties that the alignment crosses, limit uses that it crosses (open space vs homes) and limit the amount of land that the alignment crosses. Property acquisition would commence once the project receives funding.

The project team has heard questions and considerations about the interaction of the gondola system with the residential neighbourhoods – specifically privacy, noise, and visual impact. As a design response to privacy considerations the tower and alignment height were kept high to minimize privacy impacts. Further, to explore potential privacy impacts we employed the use of the 360° drone overflight to simulate the visibility from the gondola cabin to the residential homes. Potential noise impacts were assessed through noise monitoring and modelling around the residential neighbourhood. Through this assessment process the project team discovered that the increase in noise in areas near towers would increase above background noise levels but was not audible to the human ear (less than 3 decibel changes). The design

response to visual impact has been to separate the towers from residential areas and minimize the number of towers.

2. Environmental and Archaeological

The BMG will have limited ground impacts cross over the Burnaby Mountain Conservation Area (BMCA). It will have limited ground impacts with one tower located within its southern edge. The BMCA is an important natural environment for terrestrial and aquatic plants and animals. The BMCA is also used for recreation – walking, hiking, and mountain biking.

The BMG design considers limited environmental impacts from construction and operation on the BMCA. For example, questions about the impact of the gondola system on trees and tree removal. The design response has been to ensure that the system can operate over the tree canopy, leaving room for future growth, and minimizing impacts from wildfires. This may also limit the aerial interactions with the terrestrial environment and animals.

TransLink engaged environmental consultants to undertake a baseline environmental report, solicit feedback from the public about the scope of the environmental work, and then assess the potential environmental impacts of the project. The project team has been collaborating with the City of Burnaby and participating First Nations on the environmental review to share information and gather feedback.

With the BMG's increased access to the BMCA there may be an increase in recreational users, particularly mountain bikers, may use it to access trails. Like other natural areas within Metro Vancouver there was an increase in recreational use during the COVID-19 pandemic. This increase in use has led to greater erosion on the trails and illegal trails being cut into the BMCA. In response to the potential increase in use the project team has been closely collaborating with Partner agency, City of Burnaby. Burnaby is interested in supporting the natural and conservation functions of the BMCA while also allowing continued recreation.

In addition to the environmental importance of the BMCA there is also archaeological interest at the location of the tower that would encroach in the BMCA. The undisturbed nature of the BMCA has increased potential archaeological finds. Burnaby Mountain has overlapping territory of kʷikʷəƛ̓əm (Kwikwetlem First Nation), xʷməθkʷəy̓əm (Musqueam Nation), Sḵwxw̱ ú7mesh Úxwumixw (Squamish Nation) and sə́lílwətaʔɬ (Tsleil-Waututh Nation) who have used this land since time immemorial. The project team brought forward the archaeological assessment to review impacts of the tower ground disturbance to discover if there were archaeological resources present. The First Nations expressed interest in this work occurring, and the project team identified an opportunity to de-risk the project design and construction schedule.

Conclusions

This paper provides an overview of some of the most applicable considerations and challenges of gondolas in the urban environment. It has focused on sharing the actions and lessons learned by the BMG project team. By sharing this information, the intention is to share insights of a transit agency's perspective in planning a North American urban transit gondola, and share information with transit agencies that might be considering a gondola.

In summary, the multidisciplinary BMG project team adopted a collaborative and holistic approach to project planning to understand the interests and concerns of project partners, First Nations, key internal and external stakeholders, decision makers and the public. The project team has been intentional about building relationships, project support, and expanding project credibility. We have been curious, comprehensive, and iterative. We have sought to design a system that will meet the needs of transit customers while clearing the path to project delivery by de-risking project elements. The project team has benefited from generosity of peer ropeway agencies, and the interest of ropeway suppliers in breaking

into the North American market. The close and creative collaboration of the consulting teams has allowed the project team to explore, gather, and create rigorous solutions to complex problems.