San Diego Bay to Balboa Park
Skyway
Feasibility Report

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Executive Summary

E.1 Study Overview and Purpose

The purpose of the *San Diego Bay to Balboa Park Skyway Feasibility Report* was to determine the feasibility of implementing an aerial cableway (Skyway) as a mode of urban mobility for the San Diego region. The success of this type of system as a high-capacity transit mode can be seen in other cities around the globe, including the Metrocable in Medellín, Colombia; Rio de Janeiro’s cableway launch in 2013; and the expansion of La Paz, Bolivia’s cableway system with six new urban lines. While the aerial cableway has enjoyed a high level of success in other countries, an urban cableway application in the United States has not yet been implemented.

The County of San Diego, through a “Neighborhood Investment Program” grant, partnered with the San Diego Association of Governments (SANDAG) and Metropolitan Transit System (MTS) and commissioned Parsons-Brinkerhoff to prepare an initial feasibility study for constructing a Skyway between the San Diego Bay and Balboa Park. A “Bay to Park” connection has long been identified as a key and desirable linkage between these two iconic features of the San Diego landscape, with the dual objectives of re-establishing Balboa Park’s relationship to downtown and better integrating downtown with the surrounding neighborhoods.

This report is limited to the issues and challenges of constructing an approximately 2-mile Skyway in the 6th Avenue corridor from the Gaslamp Quarter in Downtown San Diego to Balboa Park. The investigated alignment includes four stations—two end stations and two intermediate stations—as it travels from the Gaslamp Quarter to a terminus in Balboa Park at the parking lot immediately north and west of the Spreckels Organ Pavilion.

E.2 Skyway Advantages and Opportunities

In this corridor the Skyway offers many advantages over other transit modes in urban applications, such as light rail transit or rapid bus. Aerial cableways are particularly well suited to overcoming obstacles in the built environment, such as railway lines, freeways, water bodies, or significant changes in topography (e.g., canyons, valleys). The cableway can also avoid the need to build the highly expensive infrastructure typically required for light rail transit or major dedicated rapid bus facilities. The investigated alignment for the Skyway, which follows the existing street right-of-way, is essentially barrier free because it rises above the street and the towers supporting the system require a minimal footprint. Based on the tower height the cabins would be elevated 48 feet from existing street grade at the tower and only 35 feet at mid-span of the towers. The primary design features of the cableway technology allows more direct routings, often providing the fastest route from point to point in a safe elevated environment.
The initial capacity will be able to serve 2,000 passengers per hour. However, it should be noted that the cableway systems has the potential for high-capacity ridership, capable of serving 4,000 to 5,000 passengers per hour. This capacity is competitive with high-capacity bus service. It is anticipated that the travel time from end to end of the proposed Park to Bay connection would be less than 12 minutes, and with four station locations, would have the ability to serve a diverse mix of both local commuters and tourists.

E.3 Feasibility Findings and Conclusions

Major findings and conclusions regarding the feasibility of the proposed San Diego Skyway Project include:

- **System Infrastructure Requirements** – The small footprint of the stations and the support towers (5-foot by 5-foot base dimension and upward to 85 feet tall) would allow the major infrastructure elements of the cableway to be integrated sensitively into the existing corridor environment without any associated “fatal-flaw” issues. The support towers can be placed within the existing public street right-of-way with minimal or no loss of on-street parking.

- **Market Research and Ridership Potential** – Assessment of the potential market for ridership indicates that the alignment would serve a mix of daily commuters and a significant number of local and out-of-town tourists. An additional ridership boost simply due to the “novelty” nature of the system would also be expected. Conservative ridership estimates range from 3,000 to 4,000 a day, with an average of between 751,000 to 1,100,000 patrons on an annual basis. Depending on fare pricing, this level of ridership could generate annual revenues from $1.9 million to $4.9 million.

- **Implementation Cost** – Initial rough order-of-magnitude construction costs are estimated to range from $65 million to $75 million for the two-mile alignment, or approximately $32.5 million to $37.5 million per mile. In comparison, the cost for a mile of light rail transit can range from $150 million to $200 million per mile, indicating the anticipated cost-effectiveness of the cableway technology when compared to other transit modes for this corridor.

- **Operations and Maintenance Cost** – Preliminary annual operations and maintenance costs were estimated at $2.6 million to $2.8 million.

- **Energy Consumption** – The all electrical system supporting the cableway would have a low energy demand, in the range of 1.8 million kilowatts per year. By providing an alternative mode of
transportation for commuter trips, the Skyway could cause a mode shift away from automobile trips, which would result in a reduction in GHG emissions, thus supporting the regional efforts to reduce overall carbon output. As the system expands, additional emission reductions would be anticipated as commuter trips increase.

- **Funding Opportunities** – Finding and securing funding for any public transit project is a very competitive process. There are a number of viable funding sources, ranging from local improvements districts and public-private partnerships, to federal, state, and local transit improvement programs that could be sought. The innovative feature and cost effectiveness of the Skyway makes the project a strong candidate, setting the cableway apart from other more expensive transit systems and making it more competitive for transit-project funding opportunities and investments.

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**E.4 Skyway Challenges and Next Steps**

There will be a number of challenges when moving forward with the proposed Skyway project. The studied alignment traverses two designated historic districts (Balboa Park and Gaslamp District). Preliminary investigation indicates the Skyway could be an enhancement to both districts. Providing an aerial connection to the districts will increase access opportunity while lessening traffic and parking demands. Additional analysis and thoughtful integration will be required.

The investigated Skyway alignment would cross Interstate 5 and State Route 163. SR-163 is a designated Scenic Highway. The crossing will require coordination with and easements from Caltrans. The Ivy Street Station is in close proximity to the City’s Airport Overlay Zone. Preliminary investigation indicated the airport’s glide path can be avoided but additional analysis will be required.

Preliminary geotechnical investigation has determined that the load and foundation design for the towers and stations can be achieved within the space constraints. Additional analysis will be required to determined underground utility conflicts in the 6th Avenue right-of-way and other right-of-way challenges.

In conclusion, this study has determined that the Skyway would be feasible within the studied alignment. This assessment found no fatal flaws. While the study was relatively brief, the assessment focused on the key issues that would likely affect the project going forward. Additional analysis and engineering will be required to further develop this concept.
The idea of cableway as an urban transit mode is a unique concept. The Skyway is a new transit mode that has not been implemented in California or within the United States and has the potential to be both a bold and creative solution for the region’s future mobility. In the 1980s, the San Diego region was a national leader in reintroducing light rail transit, which helped set the stage for light rail transit to again be considered a viable mode of urban transport across the county. In a similar manner, the Skyway has the potential to be the next generation of mobility, once again placing San Diego at the forefront of transit and mobility innovation.

*Aerial Station Concept on 6th Avenue - Looking North on 6th Avenue*
1.0 INTRODUCTION

Aerial cableway (skyway) technology is gaining significant attention around the world as an efficient and affordable mode of urban transportation. The outstanding success of the Medellín Metrocable, implemented in Medellin, Columbia, over 10 years ago, has led to other cities from around the globe constructing similar systems, with many others being planned.

The success of these systems coupled with the San Diego region’s long-time interest in cost efficient and sustainable forms of urban transport has led the County of San Diego—through a “Neighborhood Investment Program” grant—to commission SANDAG to conduct the current feasibility study for constructing a skyway between the San Diego Bay and Balboa Park as illustrated in Figure 1-3. The “Bay to Park” connection has long been identified as a key and desirable linkage between two iconic features of the San Diego landscape, with the dual objectives of re-establishing Balboa Park’s relationship to downtown and better integrating downtown with the surrounding neighborhoods.

1.1 Study Purpose and Objectives

The purpose of this San Diego Bay to Balboa Park Skyway Feasibility Study is to assess the strengths and weakness of the proposed Bay to Park Skyway project, identifying project opportunities and threats while determining the type and extent of financial resources necessary for implementation. The study process has been structured to answer a set of questions—the answers to which would collectively determine the feasibility of the Bay to Park Skyway project and the available avenues for moving forward:

1. What would the project look like?
2. How would the project operate?
3. How much would the project cost to implement?
4. Who would use the Bay to Park Skyway?
5. What are the financing options for implementing the Bay to Park Skyway?
6. What regulatory issues might influence the project?
7. Are there physical features needing consideration for implementation?
1.2 Report Structure

Following this Introduction section, this San Diego Skyway Feasibility Report is divided into the following sections:

- **Section 2: Existing Conditions** provides an overview of the corridor features, facilities, regulatory, and associated environmental issues that could influence the implementation and operation of the proposed Skyway.

- **Section 3: Skyway System Requirements** identifies the various physical and operating components of the proposed Skyway project, including the guideway length, tower and station requirements, and power system. A preliminary operating concept and associated cabin requirements are also presented.

- **Section 4: Skyway Market Assessment** identifies likely market segments (commuters, residents, and tourists), likelihood of utilization or ridership propensity, and presents a preliminary range of ridership for near-term operations.

- **Section 5: Skyway Alignment Concept** presents preliminary drawings and conceptual specifications of the proposed Skyway alignment, the height and type of towers (including foundation requirements), and design concepts for both terminal and intermediate stations.

- **Section 6: Skyway Implementation Costs and Financing** provides estimates of the costs to construct and operate the proposed Skyway projects and reviews options for funding and implementing the project.

- **Section 7: Skyway Next Steps** outlines the next steps and design considerations necessary to carry the proposed Skyway project forward.

The report also contains the following supplemental appendices:

- **Appendix A**: Historic Districts and Points of Interest
- **Appendix B**: Utilities
- **Appendix C**: Typical Skyway Cabin Dimensions
- **Appendix D**: Airport Approach Overlay Zone Height Restrictions
- **Appendix E**: Soil Types
- **Appendix F**: Capital Cost Estimate
- **Appendix G**: Operation and Maintenance Cost Estimate
Figure 1-3. San Diego Bay to Balboa Park Skyway Investigated Alignment and Station Locations
2.0 **EXISTING CONDITIONS**

The alignment investigated with this study begins within the Gaslamp Quarter (Gaslamp Quarter Station) in downtown San Diego and runs north on 6th Avenue and enters Balboa Park north of Interstate 5 (I-5) at the western edge of Balboa Park. The alignment crosses State Route 163 and terminates near the parking lot west of the Organ Pavilion or an alternative location at Palm Canyon.

This Existing Conditions section explores the many features, facilities, and regulatory and environmental issues that could influence the implementation and operation of an aerial gondola system in this location.

2.1 **Regulatory Requirements**

The design of the Skyway would require adherence to regulations from several different governing bodies. An overview of these groups and their associated regulations is included below.

2.1.1 **Cal/OSHA**

The California Division of Occupational Safety and Health (Cal/OSHA) is the primary agency in charge of permitting aerial passenger tramways. Functions of the department include:

- Reviews official plans prior to issuing permit
- Oversees initial testing
- Retains as-built plans
- Inspects all facilities twice annually

The design and operation of the Skyway would require conformance with several statues and standards, including:

- **California Labor Code, Sections 7340-7357**: Legislative statute delegating Cal/OSHA with regulatory authority over aerial passenger tramways
- **California Code of Regulations, Sections 3150-3191**: Design and operational regulations issued by Cal/OSHA. Largely refers to ANSI B77.1
- **ANSI B77.1, Aerial Tramway Standards**: Large volume of specific standards, including design (height, approach path, load points, stations, electrical, etc.), operation, evacuation, personnel training, etc. Mostly written for ski areas and most recently updated in 2011.

2.1.2 **California Public Utilities Commission**

While the California Public Utilities Commission (CPUC) does not have regulatory authority over aerial passenger tramways, the CPUC does have jurisdiction over light rail transit (LRT) corridors, which includes the Skyway’s planned crossing of C Street.

The clearance above trolley contact/span wires can be interpreted as a vertical clearance under signs, which is the closest comparison to a non-energized object such as gondola covered in the regulation. Per CPUC regulations, this would require 3 feet of separation between the bottom of the gondola and the top of the overhead contact/span wires.

Based on this, a 22-foot minimum clearance would be required from the lowest part of the gondola to a street surface where energized trolley wires are present. This must take into consideration cable sag and dynamic motion of the gondola cabin.

For the purpose of the conceptual designs of the Skyway, a minimum of 25- to 35-foot clearance was assumed.
2.1.3 California Coastal Commission

In the study area, the Coastal Zone boundary extends along Harbor Drive in an east-west direction. Assuming that all construction was to remain north of Harbor Drive, a Coastal Development Permit would not be required.

2.1.4 Federal Transit Administration

Should the Skyway qualify as a federal funds recipient from the FTA, it would be subject to environmental review under the National Environmental Policy Act (NEPA). As such, the Skyway would have to conform to federal regulations including Section 4(f), which applies to parklands and historic properties.

2.1.5 San Diego International Airport Operations

Due to its proximity to San Diego International Airport (SAN), the Skyway would be subject to development restrictions issued by the Federal Aviation Administration (FAA), the City of San Diego, and the San Diego County Regional Airport Authority (SDCRAA). Each agency conducts independent evaluations of developments near SAN, with the City of San Diego issuing development permits for projects that comply with regulations.

Development regulations for each agency are described in more detail below.

Federal Aviation Administration

Per the City of San Diego Municipal Code, the Skyway would be subject to review by the FAA. The FAA issues national regulations on airspace. The FAA does not issue development permits, but rather evaluates permit applications for compatibility with airport operations, and issues a “Determination of No Hazard to Air Navigation” for compatible projects.

Compatibility is evaluated using an imaginary surface to determine whether or not developments would be considered obstructions to air navigation near airports (per Code of Federal Regulations Part 77). Near SAN, the “Part 77” surface generally follows a 20:1 slope east of the end of Runway 27 (at the eastern edge of the airport).

City of San Diego Airport Approach Overlay Zone

The Skyway study area is within the City of San Diego Airport Approach Overlay Zone (AAOZ) boundary. As such, City review would be required to ensure the Skyway conforms to the AAOZ restrictions. In particular, the Skyway would need to be constructed in a manner that maintains the minimum vertical buffer between the Part 77 surface established by the Federal Aviation Administration (FAA).

The approach surface is similar to the Part 77 surface; however, it is considered more restrictive as it starts 50 feet west of the east end of Runway 27 at SAN. The maximum allowable height for new structures at a given point is the elevation of the FAA Part 77 surface, minus the ground elevation.

It should be noted that any structure that has a maximum height of 40 feet or lower is exempt from the AAOZ regulations, provided that the FAA has issued a “Determination of No Hazard to Air Navigation” as described above.

San Diego County Regional Airport Authority

Per the City of San Diego Municipal Code, the Skyway would be subject to review by the SDCRAA. The SDCRAA operates the San Diego International Airport and manages the surrounding airspace. The SDCRAA serves as the Airport Land Use Commission and adopts the Airport Land Use Compatibility Plan (ALUCP). It does not issue development permits, but rather evaluates permit applications from the local municipalities for compatibility with the ALUCP.

The ALUCP uses an approach surface that is similar to the FAA Part 77 surface—named the “Threshold Sighting Surface”—to determine whether or not structures would be considered an obstruction.
2.1.6 Caltrans
The right-of-way along I-5 within the study area, the 6th Avenue Bridge and the crossing of SR-163, is Caltrans' property. Coordination with Caltrans would be necessary for clearance and permitting requirements to ensure construction of the Skyway would not cause any adverse effects within Caltrans rights-of-way.

2.2 Potential Environmental Issues
The following sections provide potential environmental regulations that could affect the implementation of the Skyway.

2.2.1 City of San Diego Parklands Protection
Article 5, Section 55 of the City of San Diego Charter prohibits takes of parklands without a city-wide public vote. However, the opinion of SANDAG legal staff is that the Skyway would qualify as a park feature and would be exempt from regulations related to Article 5, Section 55.

2.2.2 Historic Districts/Landmarks
Several areas and locations within the study area are within designated historic districts and/or include designated historic landmarks (see Appendix A). Implementation of the Skyway would need to consider the effects on the locations listed below:
- The Gaslamp Quarter, which is included on the National Register of Historic Places (NRHP)
- Balboa Park itself, as well as several locations within the park, are included as historic districts and landmarks on the NRHP
- SR-163 is a designated historic parkway and NRHP eligible

Additionally, consultation with Caltrans would be necessary to determine whether or not a Skyway crossing over the SR-163 freeway would require federal approval.

2.2.3 Visual Impacts
A more detailed assessment would need to be performed to determine whether or not the Skyway would cause any adverse visual impacts. This includes:
- View of the guideway, including across the SR 163 historic parkway corridor
- Views of the Laurel Street Bridge
- Views of stations, bulk and mass within historic districts
- Various downtown view corridors, as defined by the Downtown Community Plan (Centre City Development Corporation, 2005)

2.2.4 Noise Impacts
While noise from aerial operation would likely be minor, noise levels at stations from the slowdown and the acceleration of the cabins are the most problematic. Noise, either created at the stations or along the cableway would need to be evaluated to ensure no adverse effects are created by the Skyway to adjacent land uses.

2.2.5 Air Quality/Greenhouse Gas Emissions
Greenhouse gas (GHG) emissions from the Skyway are anticipated to be minimal and could be reduced with increased Skyway utilization and a corresponding reduction in automobile travel. The all electrical system supporting the cableway would have a low energy demand, in the range of 1.8 million kilowatts per year. By providing an alternative mode of transportation for commute trips, the Skyway could cause a
mode shift away from automobile trips, which would result in a reduction in GHG emissions. This supports the regional efforts to reduce overall carbon output. As the system expands, additional emission reductions would be anticipated as commuter trips increase. Further assessment would be required to determine the extent of GHG emissions.

2.3 Corridor Mobility Features

2.3.1 Roadways

Within the study area, 6th Avenue operates as a one-way (southbound), three-lane Collector roadway south of Elm Street. North of Elm Street, 6th Avenue operates as a two-way, four-lane major arterial. On-street parking is available on both the east and west side of the street throughout the study area.

Average daily traffic (ADT) along 6th Avenue ranges from 5,000-6,000 vehicles the Gaslamp Quarter (south of Broadway), to between 12,000-14,000 vehicles north of Broadway.

2.3.2 Transit Service

Balboa Park is served by several local bus routes. Both MTS Route 7 and Route 215 (Mid-City Rapid) provide daily service along Park Boulevard. MTS Route 3 and Route 120 provide daily service on 4th Avenue and 5th Avenue along the western edge of the park. No bus routes operate directly on 6th Avenue.

Within Balboa Park, a free tram runs daily, providing visitors with access to parking facilities, museums and attractions.

The MTS Trolley Blue and Orange Lines provide service to the Core neighborhood of Downtown, while the MTS Green Line provides service near the Gaslamp, at the existing Gaslamp Quarter Trolley Station.

2.3.3 Bicycles and Pedestrians

Currently, “sharrow” bike lanes are located along 6th Avenue. Buffer-separated “bikeways” run along 4th Avenue and 5th Avenue, just west of the park. A Class III facility runs through Balboa Park, connecting 6th Avenue with Park Boulevard via Laurel Street and Village Place.

Pedestrian sidewalks are in place on both sides of 6th Avenue throughout the length of the study area. Pedestrian paths and walkways are abundant throughout Balboa Park.

2.4 Land Use

The study area for the Skyway includes some of the most densely developed land uses in the region; as well as some of the most diverse. South of I-5, land uses include higher density multi-family residential units, commercial retail and office space, and land use dedicated to tourism and entertainment. North of I-5 and west of 6th Avenue, land uses include less-dense single- and multi-family residential units, medium-density commercial retail and office space. Areas east of 6th Avenue include land use dedicated to parks, recreation, and tourism.

2.5 Right-of-Way

The existing 6th Avenue right-of-way varies slightly throughout the study area and can be divided into two distinct segments:

- **North of Interstate 5** – The 6th Avenue right-of-way north of Elm Street is typically 60 feet wide, with a total of four general-purpose lanes (two northbound and two southbound) separated by double yellow striping. Parallel, on-street parking is available on both sides. Sidewalks exist and are separated by a landscaped buffer on both sides of the roadway.
South of Interstate 5 – The 6th Avenue right-of-way south of Elm Street is typically 52 feet wide, with a total of three general-purpose lanes allowing for travel in the southbound direction only. Parallel, on-street parking is available, and sidewalks are located directly adjacent to the parking right-of-way on both sides of the roadway.

### 2.6 Utilities

Utility constraints within the Skyway study area could affect the design of the Skyway system, particularly with regards to tower location. Underground utilities within the corridor primarily include water, sewer, and electrical, as well as storm drains (see Appendix B). Additional information is included below.

#### 2.6.1 Sewer

Sewer lines within the study area generally run directly beneath 6th Avenue, as well as the roadways that intersect it. A major concrete conduit runs from east to west between A Street and Ash Street.

Within Balboa Park, two lines could affect the design of the Skyway. The first runs between the area just east of the intersection of 6th and Balboa Drive (just inside the park) to a line that follows the SR-163 right-of-way. The second runs from the area just north and west of Alcazar Garden to the line underneath SR-163.

#### 2.6.2 Water

Water lines within the study area generally run directly beneath 6th Avenue, as well as the roadways that intersect it.

Within Balboa Park, three lines could affect the design of the Skyway. The first two run beneath Balboa Drive and 8th Avenue, just east of 6th Avenue. The third includes a cluster of lines directly underneath the parking lot west of the Organ Pavilion.

#### 2.6.3 Storm Water

Storm water pipes intersect with 6th Avenue at several locations within the study area, including at or adjacent to the following roads: Market Street, F Street, E Street, Broadway, C Street, B Street, as well as within the I-5 right-of-way.

Within Balboa Park, a line runs along the SR-163 alignment. Another pipe exists near the eastern edge of the parking lot west of the Organ Pavilion.

#### 2.6.4 Electrical

Electrical lines are located underground throughout the study area, and City of San Diego engineering staff report that these lines are typically buried on both sides of roadways, adjacent to each curb. More detailed information regarding utility locations would need to be requested from the San Diego Gas and Electric Company.

### 2.7 Topography

The topography varies throughout the study area. Ground elevation along 6th Avenue generally increases from south to north along a moderate grade. The overall average slope along 6th Avenue is 3 percent. The average slope is 2 percent south of I-5, and increases to an average of 5 percent north of I-5.

Through Balboa Park, the ground elevation changes significantly from east to west, specifically as it approaches SR-163. The average slope between 6th Avenue and SR-163 is about 5 percent, and increases to an average of approximately 14 percent between SR-163 and the parking lot west of the Organ Pavilion.
2.8 Planned and Future Facilities

Several planning documents include plans for improvements to facilities within the study area. Specific improvements are described in more detail below.

2.8.1 SANDAG 2050 RTP (San Diego Forward)

Neither the Skyway, nor projects that are similar in nature, are identified as a potential mode of transportation in the SANDAG 2050 Regional Transportation Plan. However, it should be noted that construction and operation of a facility similar to the Skyway has the potential to reduce GHG emissions, as promulgated by the RTP and would likely improve the chances of meeting the GHG emissions targets that are mandated by SB 375.

2.8.2 SANDAG Regional Bike Plan Early Action Program

The SANDAG Regional Bike Plan Early Action Program includes plans for several bicycle facilities within the study area, primarily along roadways which would intersect the Skyway alignment, including Market Street, C Street, and B Street. Consideration would need to be taken in order to ensure that Skyway towers do not cause an impact on the proposed facilities.

2.8.3 City of San Diego Bicycle Master Plan

The City of San Diego Bicycle Master Plan (BMP) includes plans for several new facilities within the study area, most notably a Class II facility along 6th Avenue north of Broadway. It is not anticipated that the proposed Skyway would have an adverse impact on the planned Class II facility.

Improvements to the bicycle network are included along several other roadways that would intersect the Skyway alignment at 6th Avenue, including Broadway, C Street, and B Street. Consideration would need to be taken in order to ensure that Skyway towers do not cause an impact on the proposed facilities.

2.8.4 Downtown Community Plan

The Downtown Community Plan (CCDC, 2005) has designated 6th Avenue between Harbor Drive and Date Street as a “Pedestrian Priority Zone,” meaning the concentration of pedestrian volumes is likely to be greater than areas outside these zones. Consideration would need to be taken to ensure pedestrian facilities would not be adversely affected by the construction of the Skyway.

The Plan has also designated 6th Avenue north of Grape Street as a potential “Bay to Park” shuttle route. Consideration would need to be taken to ensure the Skyway would not adversely affect the ability to operate the shuttle.

2.8.5 Balboa Park Master Plan and Central Mesa Precise Plan

The Balboa Park Master Plan includes a system of trails within Balboa Park, providing visitors with access to more naturalized areas within the park. Some of these trails are located on the hillside east of SR-163 and south of the Laurel Street Bridge including the archery range and targets in this area. Consideration would need to be taken to ensure elements of these networks would or uses not be adversely affected by the construction of the Skyway.

The Plan also identifies 8th Drive and Balboa Drive—which run in a north-to-south direction just east of 6th Avenue—as principal circulation routes within the park. Consideration would need to be taken to ensure these roadways would not be adversely affected by the Skyway.
The Plan identifies the surface parking lot west of the Organ Pavilion as a parking area, containing 137 spaces. Any encroachment into this parking area would likely require mitigation measures to offset the taking of any parking spaces.

None of the aforementioned elements were modified as part of the more-recently adopted Balboa Park Precise Plan.

2.8.6 Downtown San Diego Mobility Plan

The Downtown San Diego Mobility Plan, developed by Civic San Diego and projected to be adopted by the City of San Diego City Council in July 2015, is proposing to add several new facilities to facilitate safer and more efficient movement of cyclists and pedestrians throughout the Centre City. The Skyway would need to consider the effects on any facilities that run along or intersect the proposed alignment.
3.0 SYSTEM REQUIREMENTS

The following section provides an overview of the Skyway system requirements, including operations and capacity, station sizes and cabin requirements.

3.1 System Design

The preliminary conceptual design specifications for the Skyway system are described in more detail below.

3.1.1 System Length

The overall system would run approximately 2 miles (10,486 feet) in length. It would run approximately 1.53 miles along 6th Avenue through Downtown and Banker’s Hill, and another 0.45 miles through Balboa Park.

3.1.2 Operations and Capacity

The typical travel speed for the Skyway system would be 1,200 feet per minute (13.6 mph). While unloading and loading passengers at each mid-station, the cabins would travel at a slower speed of 60 feet per minute and take approximately one minute to pass through each station. Assuming these speeds, the overall end-to-end travel time for the 2-mile alignment would be approximately 12 minutes.

Assuming a travel speed of 1,200 feet per minute, the cabins would be spaced 240 feet apart between stations. At each station, the cabins would cluster together while running at slower speeds, with as many as five cabins grouped together at any given time. At maximum operation, the Skyway could serve up to 2,400 persons per hour (PPH) per direction.

3.1.3 Cabins and Cable Type

Skyway cabins would be about 6.5 feet by 6 feet by 7 feet in size, and would accommodate a maximum of eight (8) passengers at a time (see Appendix C). The Skyway cabins could be modified to include features designed to enhance the overall passenger experience, such as enhanced ventilation, air conditioning, and internet access (wi-fi). The Skyway cabins could also be fitted with bicycle racks on the exterior of the cabins, making them a more attractive option for cyclists and as a “first mile – last mile” option.

The cabins would be connected to a cable type ropeway made of woven steel, which would run in a continuous loop throughout the system.

3.1.4 Power System

Assuming operations would serve 2,400 persons per hour (PPH), the Skyway would be powered by a 500 horse power motor, resulting in a power usage of 360 kilowatts (KW) or about 0.15 KW/PPH.

3.1.5 Tower Type and Options

Between stations, the Skyway would be supported by several towers. Within the urban areas of the alignment, the towers would be spaced approximately 370–380 feet apart, dependent on block lengths. Within Balboa Park, the distance between towers could vary.

The height of the Skyway towers is dependent on the following:

- Minimum clearance desired between the ground level and the bottom of the cab (25 feet to 35 feet)
- Spacing of the towers (370–380 feet)
- Cable sag based on tower spacing (3.5 percent of horizontal distance between the towers or 13 feet)

The towers would be approximately 77 feet to 87 feet in height, depending on the desired clearance.
Within Balboa Park, it may be beneficial to follow the natural terrain to maintain the required vertical clearance without increasing the tower heights.

There are a number of options for the tower designs that could be used for this alignment. A single tower, cantilevered, “whale bone” or a configuration spanning the street may be used depending on the environment and cost, among other factors. Tower options are shown in Chapter 5.3. For this study, the cantilevered tower was selected due to small footprint and lower visual impact to the streetscape in 6th Avenue. For the towers in Balboa Park, the single tower configuration was selected. The width of each tower would be approximately 5 feet by 5 feet.

3.1.6 Safety

Skyway operation would be possible at wind speeds of up to 100km/hr (60 m/hr), though full speed operation is only possible up to wind speeds of around 40 MPH. Should wind speeds increase to 40-60 MPH, the system can operate at slow speeds, and would typically be done with the purpose of unloading the system. System evacuation measures would need to be established before operations begin, and would require coordination with local emergency services departments.

During operations, an attendant would be present at each station to monitor the safety and security of Skyway passengers.

3.1.7 Americans with Disabilities Act

The Skyway system would by necessity be ADA compliant. Level-access boarding would enable boardings for passengers with mobility challenges. An attendant would be available at each station to assist passengers, if needed. Elevators would be present at each station, providing passengers with access to the station platform.

3.1.8 Station Footprint

Skyway stations would vary in size, depending on their location within the system.

End Station: Overall, the end station footprint would be about 50’ by 110’ in size. This would include a traction unit that is approximately 28’ by 85’ in size and the boarding and disembarking areas. The width can increase if an end station is elevated to provide vertical access features – such as elevators and stairs.

At one end station, more room would be required for cabin storage and maintenance facilities. Specific storage requirements would vary based on ridership demands. Typically, the storage area is located either adjacent to the station platform or placed under that station depending on the site constraints.

Intermediate Station: The footprint for the intermediate station would be approximately 50 feet x 160 feet to 180 feet, and would require more room to incorporate elevators and stairs. The longer length is due to both the boarding and disembarking occurring on one side for each direction. Whereas the end station the boarding takes place on one side and the disembarking occurs on the other side of the station platform as illustrated in Figure 5-1.

3.2 Preliminary Operating Concept

A preliminary operating concept was developed based upon typical requirements and utilization expectations as detailed below. With further study, refinements would occur along with actual operating experience.

3.2.1 Service Period

It was assumed that the Skyway would generally operate seven (7) days per week, between 12–16 hours per day, depending on the day of the week. Specific operating windows would be as follows:

- Monday thru Thursday – 8:00 AM to 8:00 PM
- Friday thru Sunday – 8:00 AM to 12:00 PM
3.2.2 Service Frequency and Capacity

In order to avoid costly upgrades several years into operations, Skyway system infrastructure would be designed to accommodate the maximum demand of 2,400 PPH in one direction. An estimate of the number of cabins, however, can be calculated based on anticipated operational frequencies, which would consider actual passenger demands, as well as seasonal changes in demand.

Table 3-1 displays relationship between service frequencies, capacity, and cabin requirements. As shown, with higher service frequencies, the more capacity is provided along with higher cabin requirements.

<table>
<thead>
<tr>
<th>Interval between Cabins (Seconds)</th>
<th>Directional Capacity¹</th>
<th>Number of Cabins Needed²</th>
<th>Number of Intermediate Stops</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hourly</td>
<td>Daily</td>
<td></td>
</tr>
<tr>
<td>12.0</td>
<td>2,400</td>
<td>28,800</td>
<td>141</td>
</tr>
<tr>
<td>20.0</td>
<td>1,440</td>
<td>17,280</td>
<td>99</td>
</tr>
<tr>
<td>30.0</td>
<td>960</td>
<td>11,520</td>
<td>78</td>
</tr>
<tr>
<td>45.0</td>
<td>640</td>
<td>7,680</td>
<td>64</td>
</tr>
<tr>
<td>60.0</td>
<td>480</td>
<td>5,760</td>
<td>57</td>
</tr>
<tr>
<td>120.0</td>
<td>240</td>
<td>2,880</td>
<td>47</td>
</tr>
<tr>
<td>240.0</td>
<td>120</td>
<td>1,440</td>
<td>41</td>
</tr>
</tbody>
</table>

Source: Doppelmayr

Notes: 1) Directional capacity based on 8-person cabins;
       2) Assumes a spare ratio of 1.2 (170 cabins total at highest capacity)
4.0 MARKET ASSESSMENT

Chapter 4 provides a preliminary indication of the ridership potential of the proposed Skyway project. In general, the Skyway’s ridership would be a function of two primary factors: 1) the utility of the Skyway in serving localized travel needs and patterns; and 2) the novelty or ultimate popularity of the Skyway itself to attract new and additional tourist activity.

The market assessment process included a number of key steps as depicted in Figure 4-1. Including an initial identification of market segments based upon trip purpose, developing estimates of low to high propensity or likelihood of using the Skyway by market segment, leading to an annualized estimate of Skyway ridership incorporating peak seasonal utilization by locals as well as increased levels of tourist activity. The market assessment focused on the year 2020 as the near-term planning horizon.

4.1 Identification of Market Segments

Market segments – or types of trips – were identified in order to provide an estimate of potential Skyway ridership. The process used to identify the study areas, as well as the aforementioned market segments, is outlined in more detail below.

4.1.1 Assessment Study Area

The Skyway Study Area represents the functional activity area that would be served by the Skyway, and hence the area that would function as the market catchment area; e.g. the source of ridership. The identified Skyway Study Area includes the community planning areas of Centre City and Balboa Park, as well as a portion of the Uptown community. The Study Area, as shown below in Figure 4-2, was subdivided into 25 subareas to facilitate a more detailed review of activity and travel patterns.
Figure 4-2. Skyway Study Area
4.1.2 Study Area Activity

The identified study area for the Skyway includes some of the most densely developed land uses in the region; as well as some of the most diverse. Land uses within the study area include higher density single- and multi-family residential units, commercial retail and office space, and land use dedicated to parks, recreation and tourism. Table 4-1 provides a quantitative summary of forecast land use and associated activity levels within the study area.

<table>
<thead>
<tr>
<th>Activity</th>
<th>2020</th>
<th>Buildout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>55,900</td>
<td>98,000</td>
</tr>
<tr>
<td>Employment</td>
<td>78,600</td>
<td>92,600</td>
</tr>
<tr>
<td>Dwelling Units</td>
<td>30,100</td>
<td>53,100</td>
</tr>
<tr>
<td>Hotel Rooms</td>
<td>9,500</td>
<td>20,000</td>
</tr>
<tr>
<td>Office (Msf)</td>
<td>14.5</td>
<td>29.8</td>
</tr>
<tr>
<td>Retail (Msf)</td>
<td>2.8</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Recreation and tourism also account for a significant amount of activity within the study area. Downtown San Diego is home to several major tourist destinations within the region, including the historic Gaslamp District, Seaport Village, and the USS Midway Museum. Balboa Park is one of the largest urban parks in the country, and along with the San Diego Zoo, attracts several million visitors annually. Annual attendance information for the major visitor and tourist destinations within the study area is summarized below in Table 4-2.

<table>
<thead>
<tr>
<th>Tourist Attraction</th>
<th>Annual Attendance (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balboa Park/Zoo</td>
<td>14,000,000 (2014)</td>
</tr>
<tr>
<td>SD Convention Center</td>
<td>800,000 (2014)</td>
</tr>
<tr>
<td>Petco Park</td>
<td>2,700,000 (2014)</td>
</tr>
<tr>
<td>USS Midway Museum</td>
<td>1,100,000 (2012)</td>
</tr>
<tr>
<td>Gaslamp District</td>
<td>6,800,000 (2008)</td>
</tr>
<tr>
<td>Seaport Village/Embarcadero</td>
<td>4,100,000 (2014)</td>
</tr>
</tbody>
</table>
4.1.3 Skyway Market Segments

Both residents and tourists alike are drawn to the study area due to a wide range of activities and attractions, providing a source of potential trip activity for the Skyway. The market for Skyway trips can be broken down into individual segments as follows:

- Resident Commuter Trips: commute trips made by residents who work within the study area
- Resident Non-Work Trips: trips made by residents for non-work related activities, such as shopping, personal business, and for purposes of recreation
- Tourist/Visitor Trips: trips made by local residents and out-of-town visitors to attractions such as Balboa Park and the Gaslamp Quarter.

Travel data for the 2020 forecast year was derived from the SANDAG Transportation Model (Series 12), including the number of daily person-trips within the study area. The study area person-trips were then aggregated and summarized based on associated trip types and market segments, including whether or not they were internal or external to the study area. A summary of daily person-trips for the Skyway study area is shown below in Table 4-3.

<table>
<thead>
<tr>
<th>Trip Type</th>
<th>Resident Work</th>
<th>Resident Non-Work</th>
<th>Visitor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>21,700</td>
<td>247,200</td>
<td>54,600</td>
<td>323,500</td>
</tr>
<tr>
<td>External</td>
<td>123,400</td>
<td>586,900</td>
<td>98,600</td>
<td>808,900</td>
</tr>
<tr>
<td>Total</td>
<td>145,100</td>
<td>834,100</td>
<td>153,200</td>
<td>1,132,400</td>
</tr>
</tbody>
</table>

4.2 Candidate Skyway Trips

A multi-tiered screening process was undertaken to produce an estimate of candidate trips for the Skyway, e.g. trips that would potentially utilize the Skyway. The initial screening assumed any potential Skyway would be internal to the study area, with both origin and destination within the study area. As shown above, the number of internal trips in the study area is projected to be approximately 323,500.

4.2.1 Viable Trip Interchanges and Candidate Skyway Trips

The second-level screening involved estimating from the internal study area trips, the number of trips that are truly viable Skyway trip interchanges with origins and destinations that would logically be served by the Skyway alignment and station locations. For example, a trip from the Gaslamp Quarter to Balboa Park could logically be made via the Skyway, whereas a trip from the East Village to Little Italy would not likely use the Skyway. Figure 4-3 displays those subareas of the study area, which would logically be served by the Skyway. Trip interchanges between these subareas were identified as viable Skyway trip interchanges.

The SANDAG Series 12 model data is generally used to model bus and rail transit modes, and has not previously been used to model a gondola system. In order to estimate ridership, the Skyway was modeled with similar characteristics—speed and fare price—as bus rapid transit, or BRT.
Figure 4-3. Viable Trip Interchanges
The Series 12 model data represents an average weekday condition, and does not account for fluctuations in travel activity on weekends or peak seasonal (June through August) activity. Since the objective in preparing an annualized ridership estimate is to account for all levels of trip activity during a year, a series of “day types” based upon peak and off-peak conditions were established, and candidate trip activity was estimated for each. The different day types that were used are:

- Non-Peak Weekday: this is the day type that is modeled by the Series 12 model and represents an average weekday.
- Non-Peak Weekend: these represent weekend days during non-peak months. Resident based trips (both work and non-work) tend to be lower than weekdays, whereas visitor/tourist trips tend to increase.
- Peak Weekday: represents a weekday during peak seasons. Resident work activity is similar to a non-peak weekday, whereas resident non-work and visitor/tourist activity tend to increase.
- Peak Weekend: represents a weekend day during peak seasons. Resident work and non-work activity is similar to a non-peak weekend. Visitor/tourist activity is the highest of all day types.

Historic visitor attendance data from the USS Midway museum was used to estimate the variations in visitor/tourist travel activity throughout the year. Data from the Midway shows the highest attendance occurs during the months of June, July and August. Attendance increases by approximately 30 percent between May and June, and again by approximately 30 percent from June to July. Attendance decreases significantly (35 percent) between August and September.

The Transit Cooperative Research Program (TCRP) Report 73: Characteristics of Urban Travel Demand (Transportation Research Board, 2002) was used to estimate the changes in resident based activity (work and non-work) for weekends versus weekdays.

The resulting number of candidate trips for the Skyway (internal/viable trip interchanges), based on the SANDAG Series 12 forecast and incorporating estimates for each of the additional day types, is shown below in Table 4-4 by market segment.

| Table 4-4. Candidate Skyway Trips by Market Segment and Day Type (Year 2020) |
|---------------------------------|-----------------|
| **Non-Peak Weekday**            | **Candidate Trips** |
| Resident Work                   | 3,400            |
| Resident Non-Work               | 29,800           |
| Visitor/Tourist                 | 8,500            |
| **Total Trips**                 | **41,700**       |

| **Non-Peak Weekend**            | **Candidate Trips** |
| Resident Work                   | 1,100             |
| Resident Non-Work               | 20,900            |
| Visitor/Tourist                 | 12,860            |
| **Total Trips**                 | **34,860**        |

| **Peak Weekday**                | **Candidate Trips** |
| Resident Work                   | 3,400             |
| Resident Non-Work               | 29,800            |
| Visitor/Tourist                 | 14,239            |
| **Total Trips**                 | **47,439**        |

| **Peak Weekend**                | **Candidate Trips** |
| Resident Work                   | 1,100             |
| Resident Non-Work               | 20,900            |
| Visitor/Tourist                 | 18,219            |
| **Total Trips**                 | **40,219**        |
4.3 Skyway Ridership Propensity

Propensity factors account for likelihood of utilization based upon such considerations as travel patterns and accessibility, distance and travel time, and cost. A range of propensities were derived for each market segment based upon knowledge of typical transit services and likely utilization, and are summarized below in Table 4-5. In general, the assumption is that, compared to the tourist/visitor trip, the resident based trips would have a lower propensity to use the Skyway.

<table>
<thead>
<tr>
<th>Market Segment</th>
<th>Candidate Trips</th>
<th>Skyway Propensity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>High</td>
</tr>
<tr>
<td>Resident Work</td>
<td>3,400</td>
<td>5–8%</td>
</tr>
<tr>
<td>Resident Non-Work</td>
<td>29,800</td>
<td>3–5%</td>
</tr>
<tr>
<td>Tourist/Visitor</td>
<td>8,500</td>
<td>10–15%</td>
</tr>
<tr>
<td>Total</td>
<td>41,700</td>
<td></td>
</tr>
</tbody>
</table>

4.4 Preliminary Skyway Ridership Forecasts

Preliminary Skyway ridership forecasts were estimated using a multi-step process, which is described in more detail in the following section.

4.4.1 Annualized Base Estimates

As trip activity fluctuates throughout the year, it is important to view activity on an annual basis. In order to do so, the following steps were undertaken:

The application of the ridership propensities (as noted above) to daily trips to estimate trips by market segment for each day type

The annualization of trips by multiplying “low” and “high” propensities by the number of calendar days in a year for each corresponding day type.

Calculate a “Base Ridership” range by summing “low” and “high” annualized trips for each day type, for each corresponding market segment.

A summary of annualized base estimates is included below in Table 4-7. As shown, the Skyway is projected to produce between 610,000 and 910,000 annual trips.

4.4.2 Special Event Trips

While general visitor and tourist activity can be accounted for by the Series 12 forecast, it does not take into account special event activity. Events such as Comic Con, Padres games, and December Nights can cause a surge in visitor and tourist activity within the study area, as well as demand for Skyway use. An estimate of annual Skyway ridership from special event trips is included below in Table 4-6.

<table>
<thead>
<tr>
<th>Event</th>
<th>Annual Attendance (^1)</th>
<th>Propensity</th>
<th>Projected Ridership</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comic Con</td>
<td>130,000</td>
<td>10%</td>
<td>13,000</td>
</tr>
<tr>
<td>Petco Park Events</td>
<td>2,700,000</td>
<td>1%</td>
<td>27,000</td>
</tr>
<tr>
<td>December Nights</td>
<td>325,000</td>
<td>10%</td>
<td>32,500</td>
</tr>
<tr>
<td>Total Ridership</td>
<td></td>
<td></td>
<td>72,500</td>
</tr>
</tbody>
</table>

4.4.3 Novelty Effects/Induced Tourist Activity

Another type of trip not accounted for in the model is that which is created based on the provision of Skyway service alone. This is often described as “induced demand” or the “novelty effect.” An additional conservative factor of 10 percent was applied to the base ridership and special events trips to account for the likely addition of attracted trips, and would generate between approximately 68,000 and 98,000 additional annual trips.

A summary showing the total candidate trips is included below in Table 4-7. As shown, when factoring in trips for special events and those attracted by the “novelty effect,” it is estimated that between approximately 751,000 and 1,100,000 Skyway trips (one-way) would be made on an annualized basis.

<table>
<thead>
<tr>
<th>Skyway Ridership</th>
<th>Annual Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Base Annual Trips</td>
<td>610,000</td>
</tr>
<tr>
<td>Total Special Event Trips</td>
<td>72,500</td>
</tr>
<tr>
<td>Annual Trips with Special Events</td>
<td>682,500</td>
</tr>
<tr>
<td>Novelty Trips (10%)</td>
<td>68,250</td>
</tr>
<tr>
<td>Total Annual Trips</td>
<td>750,750</td>
</tr>
</tbody>
</table>

4.4.4 Station Boarding Activity

Skyway station boarding activity from the SANDAG Series 12 model was examined. Generally, boardings by station vary depending on activity within the study area. The model data for an average weekday shows a higher percentage of boardings at each of the two mid-stations (Juniper Street and B Street) during an average day. It would be anticipated that a higher percentage of boardings at the terminal stations (Gaslamp Quarter and Balboa Park) would occur on weekends, and for special events and tourist activities. Figure 4-4 shows the variation in the estimated distribution of boardings by station under average weekday and that which would more likely occur during special events or periods of high tourist/visitor activity.
Figure 4-4. Station Boarding Activity
5.0 ALIGNMENT CONCEPT
This section provides a review of the proposed Skyway including assumed alignment, station locations, tower types and tower locations.

5.1 Alignment
The proposed cableway alignment would be approximately 2-miles (10,468-ft) in length, starting in the Gaslamp Quarter and following 6th Avenue, ending in the West Parking Lot of Balboa Park. Four possible station locations would support the investigated alignment as illustrated in Figure 5-2. The distances between the stations would vary, as shown below:

- Gaslamp Quarter Trolley Station to B Street: 0.80 mile (4,224 ft.)
- B Street to Ivy Street: 0.73 mile (3,864 ft.)
- Ivy Street to West Parking: 0.45 mile (2,380 ft.)

The cableway alignment would be within the street right-of-way along east side 6th Avenue. Generally, the cabins would be overhead of the travel lanes on 6th Avenue. When the alignment reaches Ivy Street it would turn to the east and then travel within Balboa Park to the West Parking lot west of the Organ Pavilion. Where the alignment crosses SR-163 it is approximately 630 feet south of the Laurel Street Bridge.

5.2 Station Design and Locations
Four stations would provide access points to the cableway, including two “End Stations” (one at the south end of 6th Avenue and adjacent to the Gaslamp Quarter trolley station plaza and the other located in the parking lot west of the Organ Pavilion in Balboa Park) and two “Intermediate stations” (one at 6th Avenue and north of B Street and the other at the intersection of 6th Avenue and Ivy Street). The following is a brief description of each station type requirements and then an overview of the station locations.

5.2.1 End Stations
A typical end station footprint would be approximately 120 feet x 60 feet and would accommodate all the workings of the cableway system plus the platform area for boarding and debarking. If elevated, this station would also require elevators and stairs to provide access and provisions for ADA requirements. A typical end station footprint is illustrated in Figure 5-1.
Figure 5-2. Skyway Investigated Alignment with Station Locations
Gaslamp Plaza Station

Several alternatives for an elevated station at this location were reviewed. The primary requirement would be to line up the north end of the station with 6th Avenue, thus enabling the cable and cars to exit the station in a direct line along the eastside of 6th Avenue. An adequate amount of lateral clearance from the Omni Hotel would also need to be provided. The different alternatives are illustrated in Figure 5-3 and Figure 5-4.

Another station option at this location would be an elevated station on the north side of L Street as illustrated in Figure 5-5. This would allow the station and the cabins to be in direct vertical and horizontal alignment with the proposed towers on 6th Avenue and avoid any potential conflicts with the Omni Hotel.

In all cases the station would be elevated in order to achieve the 25- to 35-foot clearance over the street level as the cabins exit the station.

Figure 5-3. Gaslamp Station Alternative 1
Figure 5-4. Gaslamp Station Alternative 2

Figure 5-5. Gaslamp Station Alternative 3 – North of L Street
Balboa Park

Two options were reviewed for the end station in Balboa Park, and are described in more detail below.

**West Parking**: To the west of the Organ Pavilion is a 137-space parking lot. For this assessment the station was placed at-grade near the southwest end of the parking lot facing toward SR-163. There would be sufficient room for the station footprint, but there could be a loss of parking spaces. This would depend on the final placement of the station and the reconfiguration of the lot to accommodate the facility.

The site plan as illustrated in Figure 5-6 shows the tentative station location. The station would also provide for the cabin storage and maintenance facility necessary for the cableway to operate. This storage area would be placed under the station platform and built into the hillside. The dashed line in Figure 5-6 illustrates the potential outline of the storage and maintenance area.

This placement of the station in this location would require the shortest alignment distance and the least amount of effect to the surrounding hillside. This location however, would be somewhat hidden from the remainder of the park and could prove difficult for transit patrons to locate.

*Figure 5-6. West Parking – End Station location in Balboa Park*
Palm Canyon: The Palm Canyon station would be located further east of the West Parking station location and face out toward the park near the Speckles Organ Pavilion as illustrated in Figure 5-7. This location would present a better connection to the park’s Central Mesa area and would have higher visibility to park users and potentially result in higher patron use. However, the longer distance up Palm Canyon and the placement of the storage and maintenance requirements could have more impacts to the surrounding hillsides, trails and the collection of palm trees for which the canyon is noted.
5.2.2 Intermediate Stations

Intermediate station sizes can vary but are typically longer than end stations. This is due to access requirements of both departing and embarking of passengers happening on one side. The length of the platform tends to be longer (140 feet to 160 feet), while the width of the station remains the same as an end station. Two intermediate station locations were reviewed, and are described in more detail below.

B Street and 6th Avenue

This station is in the heart of downtown business district and would primarily serve commuter patrons. The elevated station is illustrated in Figure 5-8 and Figure 5-11. As shown, the station would be located north of B Street with fewer potential effects on the surrounding land uses. On the west side of the street there is vehicle access to a parking garage, a service area, and small commercial store front facing 6th Avenue but taking it access from B Street. On the east side there is a large plaza and ingress and egress to the parking garage serving the Bridgeport building at 600 B Street.

There would be challenges fitting an elevated station in at this location. However, of all the blocks serving the business district, this has perhaps the fewest constraints and issues associated with the adjacent land uses. Street level retail is limited and pedestrian entrances to buildings would not be located under the footprint of the station. Minimizing the impacts to vehicular access and placement of the necessary columns/foundations to support the elevated station would be among the key issues that would need to be addressed.

Figure 5-8. Site Plan of B Street Station
Figure 5-9. Looking West on the North Side of B Street

Figure 5-10. Looking West on the North Side of B Street

Figure 5-11. Elevated Station Concept at B Street
Ivy Street and 6th Avenue

The Ivy Street Station would be an elevated station wherein the cableway would turn east into Balboa Park and toward the end station proposed at either West Parking or Palm Canyon. This station location (and the tower height at Hawthorne) would fit within the height restriction imposed by the City’s Airport Approach Overlay Zone (AAOZ) as shown in Appendix D). To adequately provide for the length of the station platform, the station would have to be extended to the centerline of 6th Avenue as illustrated in Figure 5-12. A concept sketch of a station elevation is provided in Figure 5-13.

Careful placement would be needed to avoid the existing Chess Club building to the north of the station as well as to minimize the impact to the small canyon located just to the east.

A “Turn-Station” without a station boarding area was also considered at this location. However, it was determined based upon the ridership assessment that a full intermediate station at this location would be important to linking with the adjacent neighborhoods and capturing a larger share of commuter trips.
5.2.3 Other Stations Studied

Several other station locations were studied to determine if alternative locations would improve the alignment or provide better access to Balboa Park. These stations are described in more detail below.

Juniper Street Station
A station was studied at 6th Avenue and Juniper Street as illustrated in Figure 5-14. This station was eliminated from consideration due to the AAOZ restrictions as illustrated in Appendix D. The station and the support tower at Ivy Street would conflict with allowable height at this location. However, in future studies, consideration to revisiting this location and confirming the height restrictions is recommended. This station is closer and more accessible to the more intensive land uses north of the station and could potentially serve the commuter patrons better than the Ivy Street Station.

Figure 5-14. Elevated Station Concept at Juniper Street

Figure 5-15. West Side View of Juniper Street at 6th Avenue
Elm Street Station

An Elm Street Station was reviewed in order to facilitate a modified alignment with a terminal cableway station at the Air and Space Museum. The station would be located in Caltrans right-of-way just south of the 6th Avenue exit ramp from I-5 as illustrated in Figure 5-16. The elevated station at this location would fit based upon spacing requirements; however, it would only be applicable if the cableway alignment were to terminate at the Air and Space Museum.

This station, if pursued, could also become part of the broader vision for the bridge improvement plans at 6th Avenue proposed by Civic San Diego. It should be noted that having the turn-station at this location would lose the commuter patron and potentially significantly reduce the ridership.

Figure 5-16. Station Concept at Elm Street and 6th Avenue

Figure 5-17. View Looking East from 6th Avenue
5.3 **Tower Types and Location**

5.3.1 **Cantilever Towers**

While a number of tower types were reviewed for 6th Avenue, it was determined that a cantilevered tower would have the least impact when placed within the street right-of-way. A single tower would have to been placed within the roadway travel lanes requiring the street section to be modified. With the cantilevered tower, it could be placed on the eastside of 6th Avenue with the arm extending over the travel lanes as illustrated on the left side of Figure 5-18.

The height of the tower is determined by the clearance needed from the bottom of the cabin and the travel way below. Also, the “sag” of the cable between the towers needs to be considered. The “sag” is calculated at 3.5 percent of the distance between adjacent towers. For this initial feasibility study, clearances of both 25 feet and 35 feet above the travel ways were studied. Placing one tower per block would require a spacing of approximately 380 feet, resulting in a “sag” of approximately 13 feet.

Based on this clearance the tower heights of 77 feet to 87 feet would be necessary to achieve the desired clearances of 25 feet and 35 feet, respectively. Both towers are illustrated in Figure 5-19.
Figure 5-19. Typical Tower Heights for 25-foot and 35-foot Clearance from Ground
Cantilever Tower Location South of I-5

Along 6th Avenue, the towers would be located on the southeast corner of each intersection from L Street to Cedar Street. A new “pop-out” could be installed to capture the placement of the towers as illustrated in Figure 5-20. A typical placement of towers in a three-block span is illustrated in Figure 5-22. Placing the towers in this location accomplishes several things:

- Setback of the tower from the intersection reduces the visual interference for motorists
- Creates a shorter distance for pedestrians crossing 6th Avenue
- Does not remove on-street parking
- Provides an opportunity to create urban “parklets” to enhance the urban texture in this corridor as described in Section 5.3.3.

Figure 5-20. Site Plan Illustrating Typical Location of Tower Placement South of I-5

Figure 5-21. View Looking North on 6th Avenue

Figure 5-22. Typical Tower Placement in Blocks South of I-5
Cantilever Tower Location North of Interstate 5

The placement of towers along this portion of the corridor would be at the various intersections in the “red curb” no parking zone on the east side of 6th Avenue as illustrated in Figure 5-23.

Due to the influence of the AAOZ (see Appendix A-4) on the height of structures in the corridor, the last tower along 6th Avenue would be located at Hawthorne Street. This would allow the intermediate station to be at Ivy Street, which would also turn the cableway east toward the end station in Balboa Park.
5.3.2 Single Towers

Single towers or “T” type towers, typically used by most cableways, would be used in the park. The same clearance and tower spacing as on 6th Avenue was considered, thus keeping the tower heights the same. However, when the cableway crosses SR-163, it is suggested that the towers be placed outside the envelope of the Laurel Street Bridge when viewed from the freeway below. This would require a tower span of approximately 550 feet when crossing the freeway s illustrated in Figure 5-25. The alignment is approximately 630 feet south of the bridge as illustrated in Figure 5-28. The towers on either side of the bridge would be approximately 83 feet high on the west side and 60 feet high on the east side. The cabins, at the lowest point, are 60 feet above the travel lanes. The intent is to place the towers so as to reduce the visual effect of the cableway on the bridges profile.

Figure 5-25. Tower Placement Crossing SR-163

Figure 5-26. View Looking North along SR-163

Figure 5-27. View Looking North along SR-163
Figure 5-28. Tower Alignment from Ivy Street to West Parking in Balboa Park
5.3.3 Urban Enhancement

There is the potential to enhance the urban streetscape as part of the corridor improvements on 6th Avenue where the towers are placed. In the proposed tower “pop-outs” there could be areas where “Parklets” are created. Parklets are small spaces serving as an extension of a sidewalk allowing for amenities or green space for people to use. Parklets are best served when located near activity street level uses, such as restaurants or other retail services. These are shown in more detail in Figure 5-29 and Figure 5-30.

Figure 5-29. Typical Parklet Site Plan and Sketch

Figure 5-30. Aerial View of Parklet
5.3.4 Tower Foundations

An analysis and assessment was undertaken to determine the type and size of foundations needed to support the cableway towers. The alignment was divided into three zones as shown in Appendix E with each zone being of a different soil type. Zone 3 is made up primarily of bay fill, which provides low-carrying capacity for foundations.

Based on these soil types, the height of the towers, and the tower loading factors, it was determined that the required width of foundation would be 6 feet in diameter with a depth of:

- 35 feet for Zone 1: Sandstone/siltstone with high bearing capacity
- 41 feet for Zone 2: Sandstone/siltstone with moderate bearing capacity
- 51 feet for Zone 3: Fill with low bearing capacity

It should be noted that in Zone 3, no support towers for the cableway would be provided. Only the columns associated with elevated Gaslamp Station would be placed in this zone.
6.0 IMPLEMENTATION COSTS AND FINANCING

This section provides estimates of the costs to construct and operate the proposed Skyway projects and reviews options for funding and implementing the project.

6.1 System Cost Estimates

The Skyway system costs include both the capital costs to construct the Skyway and the annual operation and maintenance costs to support the on-going operation of the Skyway.

6.1.1 Capital Costs

The capital costs of the Skyway project would be driven by two primary components: construction costs for the guideway elements and construction costs for the associated stations. Each of these components were analyzed to create an order-of-magnitude capital cost estimate for the proposed Skyway project as a whole.

Construction costs for the Skyway project have been prepared on a conceptual level using the Federal Transit Administration's (FTA) Standard Cost Category format, which breaks costs down into seven broad categories corresponding with the following:

- Aerial Guideway & Elements
- Stations Infrastructure
- Site Work and Special Conditions
- Systems
- Right-of-way, Land and Existing Improvements
- Professional Services

The construction costs associated with each of the above components are itemized in Table 6-1. The cost estimate as developed was based on the proposed study Skyway alignment on 6th Avenue starting at the Gaslamp Quarter Trolley Station and terminating at the parking lot west of the Organ Pavilion in Balboa Park. There would be four stations (two end stations and two intermediate stations) serving the alignment. While the system at full capacity could operate a maximum of 170 cabins as noted in Table 3-1, only 80 cabins were included in the initial cost of the overall system. This is the number of cabins needed to serve the system based on initial ridership levels. As shown in Table 6-1, the preliminary “Rough Order-of-Magnitude” cost estimates for construction of the approximately 2.0 miles (10,468 feet) Skyway alignment is approximately $65 million, with the station guideway infrastructure being the highest cost component. A more detailed cost breakdown is provided in Appendix F.

While it is difficult to provide a direct and comparable comparison of costs from other gondola system of a similar type to what is being proposed with this project, there are, however, several examples both within and outside of the US:

- Whistler’s Peak2Peak Gondola: $51 million (2008), 14,000 feet long, 10,000-foot span over land already owned by the resort, with only one stop at each end. Carries 4,100 passengers each hour
- OHSU Tram Portland: $57 million (2006), fixed two-car tram, 3,300 feet long, 1,500 passengers each day, 5,000 predicted in future
- London 2012 Olympics Gondola: $95 million (estimated), 3,280 feet long

Footnote: Citytank - Ideas for the City (February 21, 2012)
### 6.2 Annual Operation and Maintenance Costs

Based upon the preliminary operating concept presented in Section 3, an estimate of annual operation and maintenance costs was developed utilizing typical staffing and associated labor hours, along with assumptions related to on-going maintenance and service requirements.

Table 6-2 provides a breakdown of the various components that comprised the estimated annualized costs of operating and maintaining the Skyway project. As shown, annualized operating and maintenance costs are estimated at approximately $2.7 million, with staffing and associated labor costs being the highest component. It should be noted that expanding the Skyway in the future has the potential of reducing the marginal O & M costs. A detailed O&M cost is provided in Appendix G.

<table>
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<th>Item Description</th>
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<td>Operating Hours per Year</td>
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<tr>
<td>Non-Operating Hours per Year</td>
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<td>Staffing During Shutdown</td>
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<td>Hours Worked per Employee</td>
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<td>Total Miscellaneous Cost</td>
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<td>Total Project O&amp;M Cost</td>
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6.3 Farebox Revenue Potential

The annual revenue generated from the fare box would depend on the fare charged and ridership levels for the Skyway. Several concepts were reviewed, including a single fare option for all riders at two different price points. Additionally, a split fare option was evaluated which charges a different rate for residents (commute and non-commute trips), and another fare for tourists. The low fare is assumed at $2.50 per trip and the high fare $5.00 per trip. The calculations assume 100 percent of the riders pay full fare. This would not be the case if discounted fares are provided for the elderly, disabled, and children.

It should be noted that the SANDAG Series 12 ridership forecasts are based on a fare of $2.50 for all riders, and do not reflect a $5.00 fare. Transit ridership demand—particularly for residents—is elastic, and tends to decrease as transit fares increase. In order to estimate fare revenue generated by a $5.00 fare, resident work and non-work trips were reduced by 30 percent, per TCRP Report 95, Transit Pricing and Fares: Traveler Response to Transportation System Changes. Visitor and special event trips were held constant, as they are less sensitive to increases in fare price.

Table 6-3 and Table 6-4 present a summary of the initial fare revenues that could be generated by the Skyway. Estimated revenue ranges from $1.9 million to $4.9 million, depending on fare structure.

<table>
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<th>Skyway Annual Estimated Farebox Revenue - Single Fare Pricing</th>
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<tr>
<td>Projected Ridership ($2.50 Fare)</td>
<td>750,750</td>
<td>1,080,750</td>
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<td>Estimated Fare Revenue ($2.50 Fare)</td>
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<td>$2.7 million</td>
</tr>
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<td>Projected Ridership ($5.00 Fare)</td>
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<tr>
<td>Estimated Fare Revenue ($5.00 Fare)</td>
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<td>$4.9 million</td>
</tr>
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* Assumes a ridership reduction of 30 percent for resident trips; based on elasticity factors presented in TCRP Report 95, Transit Pricing and Fares: Traveler Response to Transportation System Changes

<table>
<thead>
<tr>
<th>Skyway Annual Estimated Farebox Revenue - Split Fare Pricing</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected Resident Ridership ($2.50 Fare)</td>
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<td>341,000</td>
</tr>
<tr>
<td>Estimated Fare Revenue</td>
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<td>$0.9 million</td>
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<tr>
<td>Projected Visitor Ridership ($5.00 Fare)</td>
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<tr>
<td>Estimated Fare Revenue</td>
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</tr>
<tr>
<td>Total for Split Fare Pricing</td>
<td>$3.2 million</td>
<td>$4.6 million</td>
</tr>
</tbody>
</table>

6.4 Project Delivery Options

There are several types of project delivery methods feasible for implementing the Skyway. An important decision in the case of any large complicated transit projects is to select an appropriate process that will best secure the project and minimize the initial investment and future operation and maintenance cost. The following are examples of possible delivery methods for the Skyway:
6.5 **Project Operational Methods**

At the completion of the project there would be several methods the Skyway project could be turned over for operations and maintenance. The following examples include:

- **SANDAG / MTS** - The Skyway project could be 100 percent implemented by SANDAG and delivered to San Diego MTS for operations and maintenance. The project would become a part of the overall San Diego MTS transit system. MTS would collect the fare and hold the revenue risk.

- **Public/Private** – The Skyway would be completed, turned over to San Diego MTS, and then be operated under contract by a private vendor for a select period of time. MTS would collect the fare and hold the revenue risk.

- **Private Owner/Operator** – The entire Skyway project would be franchised out for both construction and then for operations to a private entity. The private entity could collect the revenues and hold the revenue risk. Alternatively, MTS could collect the fare revenue and hold the revenue risk and then pay the private entity an “availability payment.” An availability payment is a type of performance-based payment method and is paid to the private entity based on the availability of the system in operation.

6.6 **Project Financing Options**

One of the primary challenges for the implementation and maintaining of any transit project is finding and securing funding. This section provides a description for some of the possible funding opportunities available for the San Diego Bay to Balboa Park Skyway project. As with all projects of this type, a combination of creative leveraging from multiple funding sources would most likely be required. These sources include federal, state, local, and even private sources that may be necessary to make the project a reality. There is a wide array of potential funding options for the Skyway project as discussed in the following sections.

6.6.1 **Federal Funding Sources**

Small Starts funding through the Federal Transit Administration (FTA) also offers a potential source to help pay for the capital costs of the Skyway. The project would meet the basic eligibility requirements as a fixed guideway, with an anticipated capital cost less than $250 million. The Small Starts program could provide up to 80 percent of the capital funding, with a maximum of $75 million.
Small Starts is a discretionary program with a unique set of procedures, FTA approval steps, and project evaluation criteria. Figure 6-1 illustrates the process.

Challenges and issues associated with this funding source are:

- The procedural steps shown in Table 6-4 need to be followed, with FTA engagement at critical approval steps.
- There is no certainty of receiving a grant until the grant is actually awarded; all of the pre-grant steps are carried out “at risk.” Federal funding also brings with it other federal requirements, such as the National Environmental Policy Act, that are overlaid on the Small Starts process.
- The project would need to get at least a medium rating on FTA’s project justification and local financial commitment criteria. The justification criteria are mobility improvements, environmental benefits, congestion relief, land use, economic development, and cost effectiveness. At this stage of project planning it is unclear how well the project would rate on these criteria.
- The Skyway would also be eligible for other federal funding as well. The following are some options:
  - The TIGER program offers another discretionary program where SANDAG might compete for funds. TIGER might be a good fit for the Skyway, as the program seeks to help projects that do not naturally fit into the regular funding programs. Grants tend to be no more than $20 million.
  - The FTA formula program (Section 5307) and the flexible funding programs under the Federal-Aid Highway Program (Surface Transportation Program, CMAQ) are other potential sources of federal funding for the Skyway. As formula programs, they do not have the benefit of bringing new money to the San Diego region. Although eligible for these funds, the Skyway would compete with other San Diego MTS and SANDAG priorities.

### 6.6.2 State Funding Sources

The following public and private sources could be used for implementation of the Skyway or for annual O&M:

- **California Cap and Trade Sustainable Communities Grants**: This is a new program whose deadline has already passed for this year. This program should continue in 2016. Some facts are:
  - The State has allocated 20 percent of auction proceeds under the State Cap & Trade program
  - $120M in FY 2015, $200M in FY 2016
  - Two eligible Project Area Types
  - Transit Oriented Development (TOD)
  - Integrated Connectivity Projects (ICP)
  - Eligible projects are TOD Neighborhoods, Districts or Corridors
  - This program ties together transit, affordable housing and infrastructure
  - TOD Area loans/grants are $1M to $15M
  - ICP Area loans/grants are $500K to $8M
6.6.3 Local Funding Sources

**SANDAG Funds:** The Skyway project could be eligible for the discretionary SANDAG grant, the Smart Growth Incentive Program, a part of the SANDAG TransNet sales tax measure program.

**Parking Revenues:** There are several parking districts in the area of the Skyway project alignment. This revenue type could be collected via a formal agreement or commitment from parking districts within the project area. A multiyear commitment by the districts would be preferred to aid in future maintenance of the project.

**Foundation Donations:** SANDAG could form a non-profit/private partnership group that could advocate for private donations to the Skyway project. As an example, the San Francisco Planning and Urban Research Association in their 9/2011 report, “SPUR Seeking Green – Funding public parks in a challenging financial climate” advocates philanthropy as a way of raising funds for parks. They also support leveraging the work of the San Francisco Parks Trust and the Neighborhood Parks Council. In SPUR’s 2011 publication “Beyond the Tracks,” it laid out a roadmap for how the state and local authorities could make the stations something much more than just a transfer point.

A successful example of innovative donations is the High Line Park in New York City. The Friends of the High Line (FHL) was able to raise 25 percent of the cost of the park improvements through private donations. The FHL also partnered with the Design Trust for Public Spaces, which provided a fellowship to conduct research and outreach for the park. The Campaign for the High Line raised money for construction of the new park and an endowment for the parks future maintenance and operations.

SANDAG could potentially form a partnership with the following groups to assess this option:

- Balboa Park Plaza de Panama Committee
- San Diego Zoological Society
- Legler Benbough Foundation
- Balboa Park Conservancy
- Balboa Park Committee of 100
- Balboa Park Cultural Partnership
- Balboa Park Central
- Downtown San Diego Partnership
- Civic San Diego
- City of San Diego Parks and Recreation Department

**Transportation Infrastructure Finance and Innovation Act (TIFIA) Direct Loan Program:** Administered by USDOT, a TIFIA loan typically finances up to 33 percent of project cost for projects valued at $50 million or
more. The project also has to be eligible for federal funding. Preliminary indicators are that the Skyway project would exceed $60 million in costs and if this were to require financing that is not available or preferred from SANDAG or private sector, then this might be an option.

**Other Revenues:** Other revenues to support the operations and maintenance of the Skyway system would include:

- **Fare Revenues:** Based upon ridership, the system would generate fares that would, in part, fund the operations of the system. A two-tiered fare structure—one for commuters and the other for tourists—would likely maximize this source. Alternatively, the fare system could mirror MTS’s fare policies.

- **Advertisement Revenues:** This revenue type could be established by SANDAG through an RFP procurement process to hire a transit advertisement management company. The advertisement management company would be responsible for generating sales on the project and share gains with SANDAG on an agreed upon annual percentage.

- **Transient Occupancy Tax (TOT):** Share of existing TOT fees or an increase allocation to the Skyway.

- **Naming Rights at Station Sites:** Naming rights could be auctioned for each station location.

### 6.6.4 P-3 and Joint Development Opportunities

There are a variety of potential public/private partnership and value capture opportunities that would be available for the Skyway project. Options are described in more detail below.

**Public/Private Partnership Opportunities:** In addition to this public sector model, there potentially could be an opportunity for a private sector model, also known as a Public/Private Partnership, or P3. If the currently proposed Skyway project is envisioned as the initial link of a larger, connected regional guideway system, then it would follow that it would be important for SANDAG/MTS to be the owner of this project.

**Value Capture Opportunities:** Value capture includes a variety of techniques to extract value or fees due to the value a transit project brings to the community. These techniques include joint development at station sites, assessment districts and tax increment financing.

With the demise of redevelopment agencies in California, there is a new approach to tax increment financing. Incremental property taxes can now be captured through a Joint Powers Authority (JPA). Details include:

- JPA participants would include cities, counties, and possibly school districts
- Powers would be limited to tax sharing only for the transit activities (either to fund the system or to support TOD development for designated transit areas)
- Percentage of shared taxes negotiated among the JPA participants

Another financing technique is a Community Facilities District or other assessment district. A new assessment district for the Skyway project could be formed or the project could be funded through expanding an existing assessment district or districts. In order to implement these financing techniques, SANDAG could:

- Work with the City and other stakeholders to develop support for a corridor based Community Facilities District or other assessment district
- Determine an assessment rate that would not place a particular burden on the property owners
- Use its own land and resources to create better land uses around stations
- Capitalize on joint development opportunities
- Evaluate air rights sale or long-term lease
7.0 Skyway – NEXT STEPS!

With a growing reputation as a highly versatile mode of transportation, urban gondolas are gaining significant interest both nationally and globally. The dynamics of the technology allow enhanced abilities to integrate within an urban environment while providing a conveyance of people at a rate comparable to many urban transit systems. Additionally, with the ability to traverse and serve a wide variety of urban conditions, the cableway can offer distinct advantages for particular applications, such as steep topography, the crossing of major freeways or other natural obstacles such as rivers, canyons, and the potential of extending transit service areas by providing last/first mile connections, thus filling gaps in local transit networks.

The purpose of the San Diego Bay to Balboa Park Skyway Feasibility Report was to determine the feasibility of implementing an aerial cableway (Skyway) as a mode of urban mobility for the San Diego region. The evaluations and assessments completed thus far indicate that the Skyway project as proposed is feasible and could be implemented successfully. However, a number of issues will need to be addressed and resolved to move the Skyway project forward. Next steps will have to focus, not only on the engineering/design considerations, but also a number of environmental challenges and regulatory issues, including:

- ACLUP Glide Path Clearance
- Balboa Park – Parkland Protection
- Caltrans – Interface with Interstate 5 and SR-163
- Historic Districts and Properties - Gaslamp District and Balboa Park
- Visual issues with nearby communities
- Permitting - CAL/OSHA
- California Public Utility Commission - Crossing of the C Street Trolley corridor.

With success of the Skyway project between Balboa Park and downtown San Diego would likely come additional interests in expanding this initial line or implementing a similar Skyway application elsewhere in the region. Other potential applications within the region could include one or more of the following areas:

- Hillcrest
- Mission Valley
- Beach communities
- Sorrento Valley COASTER connections

In the search for mobility solutions, the Skyway may be an application that suits the region’s needs to provide a cost effective mode of transport that can readily be integrated into the existing urban environments. Expanding the Skyway in future would also reduce the marginal O & M costs and generate additional ridership while increasing fare revenue as more trip origins and destinations are served.

The idea of cableway as a transit mode is a unique concept. The cableway has the potential to be both a bold and creative solution for the region’s future mobility. In the 1980s, the San Diego region was a national leader in reintroducing light rail transit, which helped set the stage for light rail transit to again be considered a viable mode of urban transport across the county. In a similar manner, the Skyway has the potential to be the next generation of mobility, once again placing San Diego at the forefront of transit and mobility innovation.
Appendix A: Historic Districts and Points of Interest
Appendix B: Utilities
Appendix C: Typical Skyway Cabin Dimensions
Typical 8-person Cabin – Elevation and Plan View
Appendix D: Airport Approach Overlay Zone Height Restrictions
Airport Approach Overlay Zone and Ground Elevation: Grape Street

Maximum Allowable Height: 105 feet
Airport Approach Overlay Zone and Ground Elevation: I-5 Crossing

Maximum Allowable Height: 168 feet
Airport Approach Overlay Zone and Ground Elevation: Ivy Street

Maximum Allowable Height: 56 feet
Airport Approach Overlay Zone and Ground Elevation: Juniper Street

Maximum Allowable Height: 37 feet
Appendix E: Soil Types
Zone 1 (Qlv, Tsd): Sandstone/siltstone with high bearing capacity

Zone 2 (Qbp): Sandstone/siltstone with moderate bearing capacity

Zone 3 (Qaf): Fill with low bearing capacity
Appendix F: Capital Cost Estimate
<table>
<thead>
<tr>
<th>Item Description</th>
<th>Unit of Measure</th>
<th>Quantity</th>
<th>Unit Price (US $)</th>
<th>Total Price (US $)</th>
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</thead>
<tbody>
<tr>
<td><strong>AERIAL GUIDEWAY &amp; ELEMENTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Guideway: Aerial Cable</td>
<td>RM</td>
<td>1</td>
<td>$400,000.00</td>
<td>$400,000.00</td>
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<tr>
<td>6th Avenue Tower: Cantilever includes sheaves and concrete</td>
<td>EA</td>
<td>22</td>
<td>$150,000.00</td>
<td>$3,300,000.00</td>
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<tr>
<td>Park Tower: Single includes sheaves and concrete</td>
<td>EA</td>
<td>8</td>
<td>$60,000.00</td>
<td>$480,000.00</td>
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<td>Zone 3 Foundation</td>
<td>EA</td>
<td>16</td>
<td>$66,940.00</td>
<td>$1,071,040.00</td>
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<td>Zone 2 Foundation</td>
<td>EA</td>
<td>14</td>
<td>$53,158.00</td>
<td>$744,212.00</td>
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<td>Station Piles Foundations - Zone 1</td>
<td>EA</td>
<td>2</td>
<td>$66,800.00</td>
<td>$133,600.00</td>
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<td>Station Piles Foundations - Zone 2</td>
<td>EA</td>
<td>4</td>
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<td>$212,000.00</td>
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<td>Station Piles Foundations - Zone 3</td>
<td>EA</td>
<td>6</td>
<td>$45,300.00</td>
<td>$271,800.00</td>
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<td>Cabins: 8 passenger</td>
<td>EA</td>
<td>80</td>
<td>$35,000.00</td>
<td>$2,800,000.00</td>
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<td>Electric controls, comm line, conduits, etc</td>
<td>EA</td>
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<td>$500,000.00</td>
<td>$500,000.00</td>
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<tr>
<td>Installation: Job site supervision, etc (this is estimated for all the mechanical components)</td>
<td>EA</td>
<td>1</td>
<td>$4,500,000.00</td>
<td>$4,500,000.00</td>
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<td><strong>STATION GUIDEWAY INFRASTRUCTURE:</strong></td>
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<tr>
<td>Gaslamp - End Station</td>
<td>EA</td>
<td>1</td>
<td>$1,750,000.00</td>
<td>$1,750,000.00</td>
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<tr>
<td>B Street - Intermediate Station</td>
<td>EA</td>
<td>1</td>
<td>$2,750,000.00</td>
<td>$2,750,000.00</td>
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<tr>
<td>Ivy Street - Intermediate Stations - pass through terminal only</td>
<td>EA</td>
<td>1</td>
<td>$1,750,000.00</td>
<td>$1,750,000.00</td>
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<tr>
<td>Balboa Park - End Station w/Cabin Storage</td>
<td>EA</td>
<td>1</td>
<td>$3,750,000.00</td>
<td>$3,750,000.00</td>
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<tr>
<td>Station Platforms: cabin guidage, access ways, elevators, etc - average for the 4 terminals</td>
<td>EA</td>
<td>4</td>
<td>$2,250,000.00</td>
<td>$9,000,000.00</td>
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<tr>
<td><strong>SUPPORT FACILITIES: YARDS, SHOPS, ADMIN BLDG</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>SITE WORK &amp; SPECIAL CONDITIONS</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Demolition, clearing, earthwork</td>
<td>LS</td>
<td>1</td>
<td>$250,000.00</td>
<td>$250,000.00</td>
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<tr>
<td>Site utilities, utility relocation</td>
<td>RM</td>
<td>20</td>
<td>$30,000.00</td>
<td>$600,000.00</td>
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<tr>
<td>HAZMAT, contamination mitigation, water treatments</td>
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<td>$250,000.00</td>
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<td>Environmental mitigation</td>
<td>RM</td>
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<td>$150,000.00</td>
<td>$150,000.00</td>
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<tr>
<td>Site furniture, paving treatment - parklets</td>
<td>EA</td>
<td>5</td>
<td>$30,000.00</td>
<td>$150,000.00</td>
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<tr>
<td>Curbs and gutters</td>
<td>LF</td>
<td>3,000</td>
<td>$10,000.00</td>
<td>$30,000.00</td>
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<tr>
<td>Pedestrian facilities (sidewalks - public r.o.w.)</td>
<td>SF</td>
<td>15,000</td>
<td>$8.00</td>
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<tr>
<td>Bicycle facilities - Class 2 (pavement and striping)</td>
<td>SF</td>
<td>1</td>
<td>$-</td>
<td>$-</td>
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<tr>
<td>Bicycle facilities - Class 1 (12' section / Balboa Park)</td>
<td>SF</td>
<td>1</td>
<td>$-</td>
<td>$-</td>
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<tr>
<td>Landscaping (planting and irrigation)</td>
<td>LS</td>
<td>1</td>
<td>$250,000.00</td>
<td>$250,000.00</td>
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<tr>
<td>Temporary facilities and other indirect costs - staging areas</td>
<td>LS</td>
<td>1</td>
<td>$150,000.00</td>
<td>$150,000.00</td>
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<tr>
<td><strong>SYSTEMS</strong></td>
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<tr>
<td>Traffic signals and crossing protection</td>
<td>RM</td>
<td>7</td>
<td>$75,000.00</td>
<td>$525,000.00</td>
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<td>Communications</td>
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<td>$1.00</td>
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<td>Fare collection equipment (included in station costs)</td>
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<td>$1.00</td>
<td>$1.00</td>
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<tr>
<td>Central control</td>
<td>RM</td>
<td>1</td>
<td>$1.00</td>
<td>$1.00</td>
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<tr>
<td>RM 1</td>
<td>1</td>
<td>$1.00</td>
<td>$1.00</td>
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<tr>
<td><strong>CONSTRUCTION SUBTOTAL</strong></td>
<td></td>
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<td></td>
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<tr>
<td><strong>R.O.W., LAND, &amp; EXISTING IMPROVEMENTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Purchase or lease of real estate</td>
<td>NA</td>
<td></td>
<td>$-</td>
<td>$-</td>
</tr>
<tr>
<td>Relocation of existing households and businesses</td>
<td>NA</td>
<td></td>
<td>$-</td>
<td>$-</td>
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<tr>
<td><strong>PROFESSIONAL SERVICES (39%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preliminary engineering (5.0%)</td>
<td>LS</td>
<td>5</td>
<td>$1,795,882.85</td>
<td>$1,795,882.85</td>
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<tr>
<td>Final design (10.0%)</td>
<td>LS</td>
<td>10</td>
<td>$3,591,765.70</td>
<td>$3,591,765.70</td>
</tr>
<tr>
<td>Project management for design &amp; construction (7.0%)</td>
<td>LS</td>
<td>7</td>
<td>$2,514,235.99</td>
<td>$2,514,235.99</td>
</tr>
<tr>
<td>Construction administration &amp; management (10.0%)</td>
<td>LS</td>
<td>10</td>
<td>$3,591,765.70</td>
<td>$3,591,765.70</td>
</tr>
<tr>
<td>Professional liability and other non-construction insurance (2.5%)</td>
<td>LS</td>
<td>3</td>
<td>$897,941.43</td>
<td>$897,941.43</td>
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<tr>
<td>Legal: Permits, review fees, etc. (1.0%)</td>
<td>LS</td>
<td>1</td>
<td>$359,176.57</td>
<td>$359,176.57</td>
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<tr>
<td>Surveys, testing, investigation, &amp; inspection (2.0%)</td>
<td>LS</td>
<td>2</td>
<td>$718,353.14</td>
<td>$718,353.14</td>
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<tr>
<td>Start up (1.5%)</td>
<td>LS</td>
<td>2%</td>
<td>$538,764.86</td>
<td>$538,764.86</td>
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<tr>
<td><strong>CONSTRUCTION, R.O.W., &amp; PROFESSIONAL SERVICES SUBTOTAL</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>UNALLOCATED CONTINGENCY (30%)</strong></td>
<td>LS</td>
<td>30%</td>
<td>$14,977,662.97</td>
<td>$14,977,662.97</td>
</tr>
<tr>
<td><strong>TOTAL PROJECT COST</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$64,903,206.20</td>
<td>$64,903,206.20</td>
</tr>
</tbody>
</table>

*Unit of Measure Legend: RM = Route Mile SF = Square Foot EA = Each LS = Lump Sum
Appendix G: Operation and Maintenance Cost Estimate
## Operation Schedule

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Days per year **</td>
<td>360</td>
<td></td>
</tr>
<tr>
<td>Hours per day (open to public)</td>
<td>14</td>
<td></td>
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<tr>
<td>Operating hours per year</td>
<td>5,040</td>
<td></td>
</tr>
</tbody>
</table>

| Non-Operating hours per year | 1,260  |

## Staffing During Operation

<table>
<thead>
<tr>
<th>Role</th>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>Manager</td>
<td>2</td>
</tr>
<tr>
<td>Mechanic</td>
<td>2</td>
</tr>
<tr>
<td>Operator</td>
<td>4</td>
</tr>
<tr>
<td>Attendant</td>
<td>4</td>
</tr>
</tbody>
</table>

## Staffing During Shutdown

<table>
<thead>
<tr>
<th>Role</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanic</td>
<td>2</td>
</tr>
</tbody>
</table>

## Hours Worked per Employee

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Hours</td>
<td>2080</td>
<td></td>
</tr>
<tr>
<td>Holiday</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Vacation</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Sick</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Hours available for work</td>
<td>1880</td>
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</table>

## Required Staffing Level

<table>
<thead>
<tr>
<th>Role</th>
<th>Man-Hours</th>
<th>Number</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Manager</td>
<td>10,080</td>
<td>5.0</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>Mechanics</td>
<td>12,600</td>
<td>7.0</td>
<td>6.7</td>
<td></td>
</tr>
<tr>
<td>Operators</td>
<td>20,160</td>
<td>11.0</td>
<td>10.72</td>
<td></td>
</tr>
<tr>
<td>Attendants</td>
<td>20,160</td>
<td>11.0</td>
<td>10.72</td>
<td></td>
</tr>
<tr>
<td><strong>Total Staffing</strong></td>
<td>52,000</td>
<td>34</td>
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</table>

## Labor Cost

<table>
<thead>
<tr>
<th>Role</th>
<th>Number</th>
<th>Base Wage</th>
<th>Hours/ Year</th>
<th>Total Wages</th>
<th>Burden</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager</td>
<td>5</td>
<td>30.00</td>
<td>2080 $</td>
<td>312,000</td>
<td>30%</td>
<td>405,600</td>
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<tr>
<td>Mechanics</td>
<td>7</td>
<td>28.00</td>
<td>2080 $</td>
<td>407,680</td>
<td>30%</td>
<td>529,984</td>
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<tr>
<td>Operators</td>
<td>11</td>
<td>23.00</td>
<td>2080 $</td>
<td>526,240</td>
<td>20%</td>
<td>631,488</td>
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<tr>
<td>Attendants</td>
<td>11</td>
<td>10.00</td>
<td>2080 $</td>
<td>228,800</td>
<td>20%</td>
<td>274,560</td>
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<tr>
<td><strong>Total Labor Cost</strong></td>
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<td></td>
<td></td>
<td><strong>1,841,632</strong></td>
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<td></td>
</tr>
</tbody>
</table>

San Diego Bay to Balboa Gondola
Operating Cost Analysis - cash flow
Energy Cost

400 hp
298.4 kW
1,503,936 kWh
$0.09725/kWh

Total Energy Cost $ 146,258

Miscellaneous Annual Cost

<table>
<thead>
<tr>
<th>No. of employees</th>
<th>Uniforms (cost per employee) =</th>
<th>125</th>
<th>34</th>
<th>4,250</th>
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<tbody>
<tr>
<td>Recruit and training (% of expected employee turnover)</td>
<td>0.25</td>
<td>8,500</td>
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<tr>
<td>Rope Inspection</td>
<td>5,000</td>
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<tr>
<td>Lubricants and other disposable maintenance items</td>
<td>35,000</td>
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<tr>
<td>Consumable parts (elastomeric components)</td>
<td>50,000</td>
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<td></td>
<td></td>
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<tr>
<td>Carrier repair parts</td>
<td>55,000</td>
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<td></td>
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<tr>
<td>NDT Services</td>
<td>20,000</td>
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<tr>
<td>Insurance &amp; Indemnity</td>
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<tr>
<td>Recruitment and training (% of expected employee turnover)</td>
<td>0.25</td>
<td>8,500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tools and vehicle cost</td>
<td>150,000</td>
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<td></td>
</tr>
<tr>
<td>Office Supplies</td>
<td>2,500</td>
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<tr>
<td>Accounting and payroll services</td>
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Total Miscellaneous Cost $ 512,250

Annualized Cost for Major Repairs/Replacement - Reserve

<table>
<thead>
<tr>
<th>Cost</th>
<th>Interval (years)</th>
<th>Annualized Cost</th>
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<tbody>
<tr>
<td>Rope Change</td>
<td>250,000</td>
<td>15</td>
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<tr>
<td>Replacement Grips</td>
<td>450,000</td>
<td>15</td>
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<tr>
<td>General re-furbishment</td>
<td>2,000,000</td>
<td>20</td>
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<tr>
<td>Gearbox Replacement</td>
<td>400,000</td>
<td>15</td>
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<tr>
<td>Motor Replacement</td>
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<td>15</td>
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<tr>
<td>Office equipment and startup supplies</td>
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<tr>
<td>Facilities Maintenance</td>
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Total Annualized Cost for Major Repairs $ 246,500

Summary

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<th>Cost</th>
<th>Amount</th>
<th>Percentage</th>
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<tr>
<td>Labor Cost</td>
<td>$ 1,841,632</td>
<td>67%</td>
</tr>
<tr>
<td>Energy Cost</td>
<td>$ 146,258</td>
<td>5%</td>
</tr>
<tr>
<td>Annualized Reserve for Major Repairs/Replacement (not included above)</td>
<td>$ 246,500</td>
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<tr>
<td>Miscellaneous Annual Cost</td>
<td>$ 512,250</td>
<td>19%</td>
</tr>
<tr>
<td>Total Operating Cost</td>
<td>$ 2,746,640</td>
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<tr>
<td>Cost per Hour of Operation</td>
<td>$ 545</td>
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