City of San José DOT

San José International Airport Automated Transit Network Feasibility Study

Final Report

4-05

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1 Executive Summary

The City of San José (City) Department of Transportation is evaluating the feasibility of developing an Automated Transit Network (ATN or Project) in and around the Norman Y. Mineta San José International Airport (Airport). The Project was undertaken in partnership with the Airport and the Santa Clara Valley Transportation Authority (VTA).

The purpose of the study was to determine the feasibility of using an ATN to fulfill a Santa Clara County 2000 Measure A project, namely constructing an automated passenger rail system connecting the Airport to VTA's Light Rail line towards the east and Caltrain commuter rail and planned BART station toward the west.

The analysis was conducted by two consultants, who served as the City's Project Team: Arup North America, Ltd. (Arup) and The Aerospace Corporation (Aerospace). Aerospace analyzed ATN technological issues and Arup was responsible for developing options and evaluating feasibility in terms of physical context, alignment, ridership, capital and operating costs, and preliminary business case analysis. Arup concluded that:

- An ATN could offer a higher quality passenger experience than the current bus shuttles by providing minimal wait time, direct point-to-point service and a private riding experience.
- The Recommended Alignment demonstrates that at least one conceptual route is feasible given the physical constraints of the study area and the required connections of the ATN.
- The estimated capital cost of the ATN Project, including appropriate levels of contingency, is less than the cost of the APM system that had been planned for the Airport.
- The estimated operating cost of the ATN is comparable to the savings that would be achieved by discontinuing the VTA and Airport bus shuttles.[1]
- The Project meets four of the City's five Project Delivery Objectives (Project Delivery Objectives 1, 2, 4, 5) and there are no apparent "fatal flaws." A fatal flaw is a technical or financial factor that would rule out proceeding with the Project to the next level of evaluation. A technical fatal flaw may involve the ATN technology, the Project's physical context, alignment or ridership. A financial fatal flaw may involve the City's affordability limit with regards to operations and maintenance costs and construction costs. An absence of apparent fatal flaw at this stage is not a recommendation to proceed but rather an absence of evidence that would bar the Project from proceeding to the next level of evaluation.

[1] Subsequent to the preliminary business case analysis, the Airport reduced its shuttle bus budget for FY 2012-2013. If the City were to move forward with this project at some time in the future, all potential revenue sources would be reevaluated at that time.

2 Introduction

The City of San José (City) Department of Transportation is evaluating the feasibility of developing an Automated Transit Network (ATN, or Project) in and around the Norman Y. Mineta San José International Airport (Airport). This project is being completed in partnership with the Airport and the Santa Clara Valley Transportation Authority (VTA). ATN, also referred to as Personal Rapid Transit, is an innovative, emerging transit system concept. The purpose of this study is to determine the feasibility of the ATN to perform the role of an Airport Transit Connector (ATC). The project seeks to fulfill the 2000 Measure A ballot provision to provide an automated guideway passenger transit system to connect the Airport terminals with VTA's Light Rail service towards the east and with existing Caltrain commuter rail and planned BART services toward the west. This study is focused specifically on the ATN mode of transportation, and Arup did not conduct a detailed comparison of ATN technology to other modes. However, it does offer a high-level cost comparison.

The City selected two consultants, Arup North America, Ltd. (Arup) and The Aerospace Corporation (Aerospace), to initially assess the feasibility of using an ATN as the ATC. The Feasibility Study contains objective analyses to inform the City's decision-making. Following conclusion of the Feasibility Study, the City will decide whether it will proceed with the Project.

This Arup Final Report provides contributory information to the Feasibility Study. Under supervision of the City, Arup and Aerospace carried out their respective work in parallel, collaborating with each other and the City at critical junctures. Arup was primarily responsible for the following topic areas:

- Outreach;
- Physical context;
- Design criteria;
- Route options development and evaluation;
- Conceptual design;
- Ridership forecasts;
- Capital and operating costs;
- Environmental issues and strategy; and
- Preliminary business case analysis.

2.1 Project Goals and Objectives

The City has identified goals that pertain to the overall ATN Project and separate goals and objectives that apply specifically to the current Feasibility Study.

Primary Project Goal: Fulfill the 2000 Measure A ballot measure to build an automated people mover connecting the Mineta San José International Airport terminals to BART, Caltrain, and the VTA LRT.

Secondary Project Goals

A. Advance the City's "Green Vision" goals, which seek to more than halve the City's carbon footprint by 2022 (see http://greenvision.sanjoseca.gov/). Those goals include:
    i. Greening the transportation system,
    ii. Reducing per capita energy use,
    iii. Increasing the number of clean tech jobs, and
    iv. Obtaining all of the City's electrical power from renewable sources.
B. Leverage Automated Transit Network to advance the City's environmental, transportation, and economic development goals, including increasing the use of public transit.
C. Increase Airport patronage by improving the convenience of public access to and from the Airport.
D. Capitalize on the strength of the local high tech industry.
E. Reinforce San José's reputation as a center of innovation by leading the adoption of new technology and identifying creative strategies to finance the construction and operation of those improvements.
F. Contribute to and encourage sustainable development, including efficient use of land.
G. Encourage energy efficiency and maximize the opportunity to use renewable energy sources to power the system.

Feasibility Study Objectives

The City's objectives for the Feasibility Study are as follows:

A. Understand the technical and financial feasibility of using an ATN to fulfill the primary project objectives.
B. Determine whether currently-constructed ATN systems would be able to meet the goals of the project.
C. Identify a "notional" route and phasing, and potential financing and funding plans, for further development.
D. Identify next steps and/or options for proceeding.
E. Produce a report that describes the systems engineering, financing/funding strategies, and technological issues identified in the Feasibility Study and strategies to address any obstacles identified.

In addition to these joint objectives, Aerospace also led a process to document more detailed Project Requirements for an ATN system that would achieve the project goals.

2.2 Outreach

An Outreach Plan for the Feasibility Study was developed to identify key stakeholders of the Project and to define appropriate times and purposes for contacting them. The plan detailed numerous potential participants, including local officials, participating agencies, other related agencies and business and community groups. In the course of the Feasibility Study, it was found that many of the third-party outreach activities would be premature given the uncertainties around project definition (network scale and alignment) as well as the feasibility of ATN technology to fulfill the project goals. A focused outreach effort with the project partners (VTA and the Airport) at key milestones was determined to be appropriate during the Feasibility Study.

Arup also participated in telephone meetings with potential system vendors to learn about current technical capabilities and industry readiness following the second Vendor Request for Information (2011). In the future, should the Project proceed, the Outreach Plan may be used to coordinate outreach efforts given sufficient project definition.

2.3 Context

To inform the Feasibility Study, Arup gathered information and data about the physical, policy, and transportation context of the study area.

2.3.1 Regulatory Context

There are no regulations, codes, standards, or guidelines explicitly associated with the infrastructure to support an Automated Transit Network (ATN) system. Nor is there direct regulatory precedent in California for an ATN system. Some portions of Light Rail or Automated People Mover (APM) standards might apply to the ATN, whereas others will not, given the unique operating and physical characteristics of ATNs. This topic is covered in more detail in Aerospace's report.

It is probable that the California Public Utilities Commission (CPUC) would assume governmental regulatory authority over the San José ATN, given their federally-delegated and statutory authority for overseeing public transit in

California and their broad definition of Light Rail Vehicle in General Order 143-B. Following the ULTra ATN model at London Heathrow Airport, the CPUC should be consulted to agree their role in the regulatory process for a new ATN system.

Overall, at least fourteen regulating agencies and governmental bodies will likely be involved in a new ATN system:

- California Public Utilities Commission
- City of San José
- City of Santa Clara

- Santa Clara Valley Transportation Authority
- Caltrain/Peninsula Corridor Joint Powers Board
- Norman Y. Mineta San José International Airport
- Federal Aviation Administration
- California Department of Transportation
- California Division of the State Architect
- California State Fire Marshal
- Local Fire Departments
- Union Pacific Railroad
- Pacific Gas & Electric Company (PG&E)
- Santa Clara Valley Water District

More agencies may need to be involved if any of the following complications is called for by the ATN alignment:

- Passing near overhead electrical lines;
- Relocating utilities;
- Over- and under-crossing roadways;
- Passing near Airport communications and radar facilities;
- Crossing bodies of water;
- Evaluation and retrofit of existing structures under the jurisdiction of other authorities.

Additionally, at least 19 California-specific structural codes, regulations, and standards should be considered for inclusion in the draft design guidelines. Local standards and local utility requirements will also need to be considered.

The type of ATN system technology that is selected will be one of the most important factors in infrastructure design, cost, and feasibility. ATN systems developed elsewhere differ in terms of the specifications of the vehicles and the form of the guideway. Vehicles could be either supported by or suspended from the guideway; on supported guideways, vehicles either run on a rail (captive bogey) or drive on an open channel. While vendors have indicated a general flexibility to customize systems to suit specific project requirements, the variety of proposed guideway and drive systems speaks to the potential variability in infrastructure, i.e. station design and location, and guideway configuration and alignment.

2.3.2 Policy Context

Seven policy documents were found particularly relevant to the San José ATN Feasibility Study:

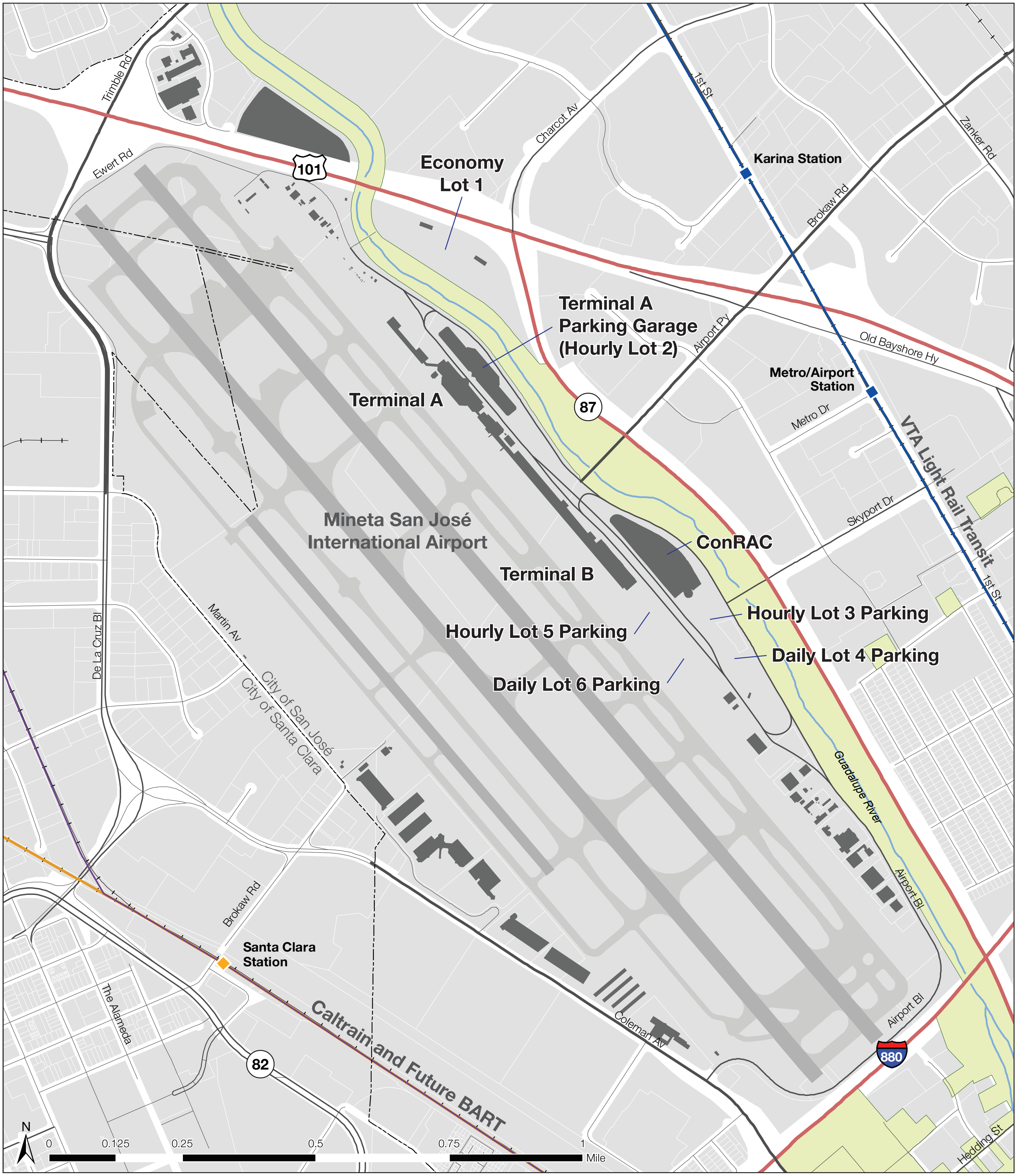
1. Santa Clara County Measure A (2000)
2. City of San José 1999 Airport Traffic Relief Act (ATRA)
3. City of San José 2003 Airport Security and Traffic Relief Act (ASTRA)
4. City of San José 2007 Green Vision
5. City of San José 2010 General Plan update: Envision San José 2040
6. City of San José Vision North San José policy documents (2008-2010)
7. City of San José 1998 Rincon South Specific Plan
8. City of San José, City of Santa Clara, and VTA joint Santa Clara Station Area Plan (2010)
9. Mineta San José International Airport Master Plan and Environmental Impact Report (2010)

Based on the review of these policies, the key considerations for the development of an ATN system in San Jose include the following:

- The ATN needs to connect the airport passenger terminals directly with BART, Caltrain and the VTA Light Rail line (Measure A).
- The ATN should ideally use renewable energy or alternative fuels (San José Green Vision).
- The ATN should ideally help create Clean Tech jobs (San José Green Vision).
- The ATN offers the potential to support the development potential envisioned in North San José and Downtown San José (Envision San José 2040).
- The ATN offers the potential to support a mode shift toward transit and support transit oriented development (Envision San José 2040).
- The ATN offers the potential to support transit-oriented development at the Santa Clara Station (Santa Clara Station Area Plan) and high density residential and mixed-use development in the area east of the Airport, along the Light Rail line (Rincon South Specific Plan).
- The ATN has the potential to meet airport service demands such as inter-terminal movement of passengers and access to airport facilities and parking.

2.3.3 Physical Context

Arup’s review of the physical context included the Airport itself, as well as roadways, utilities, groundwater depth, soil type, geologic hazards, and flood zones in the study area. See Figure 1 for a general Airport location map.



Legend

City Boundary

Transit Routes

Caltrain Commuter Rail

VTA Light Rail

ACE Commuter Rail

Creek or River

Park / Open Space

Sources

City of San José Department of Transportation 2010,
San José International Airport 2011,
Metropolitan Transportation Commission 2010,
Arup 2012.

Figure 1
Airport Physical Location

San José ATN Feasibility Study

June 2012

CITY OF SAN JOSE CAPITAL OF SILICON VALLEY

ARUP

Key findings about the physical context include the following:

- The Airport parking garages are located in close proximity to the terminal buildings (this influences passenger decision-making regarding mode of access).
- The Airport has a high degree of highway and local roadway access.
- The Terminal A curbside currently experiences congestion with curb congestion at the departures curb in the mornings and at the arrivals curb in the evenings, and is projected to continue to operate near capacity during peak conditions in the future.[1] This affects the extent to which Terminal Drive can be modified.
- The Guadalupe River is adjacent to the east side of the Airport and must be crossed to reach the VTA Light Rail corridor. The river corridor provides habitat for sensitive species.
- The Airport is bounded on three sides by major freeways that would require careful consideration for ATN crossings, including Guadalupe Parkway (SR-87) which is parallel to the Guadalupe River east of the Airport, US-101 along the north edge of the Airport, and I-880 along the south side of the Airport.
- The "Green Island" (the area northeast of Terminal A used for public long-term parking) is only easily accessible by vehicle and not by pedestrians.
- Apart from the high-voltage electrical lines, the other utilities (water, recycled water, sanitary sewer, storm drain, and high pressure gas) are below grade and do not necessarily preclude an ATN alignment, although some local diversions may be necessary.
- The northern and southern edges of the Airport are physically constricted by roadways and a high density of utilities, and have non-negotiable height limitations dictated by the Federal Aviation Administration ("TERPS" and "OEI" restrictions).
- During design phases, consideration should be given to potential issues arising from flooding, groundwater depth, and geologic hazards.

2.3.4 Regional Public Transit

Arup reviewed the major transit services that connect to or could connect to the Airport, including VTA, Caltrain, and BART services (as illustrated on Figure 2). The key findings are as follows:

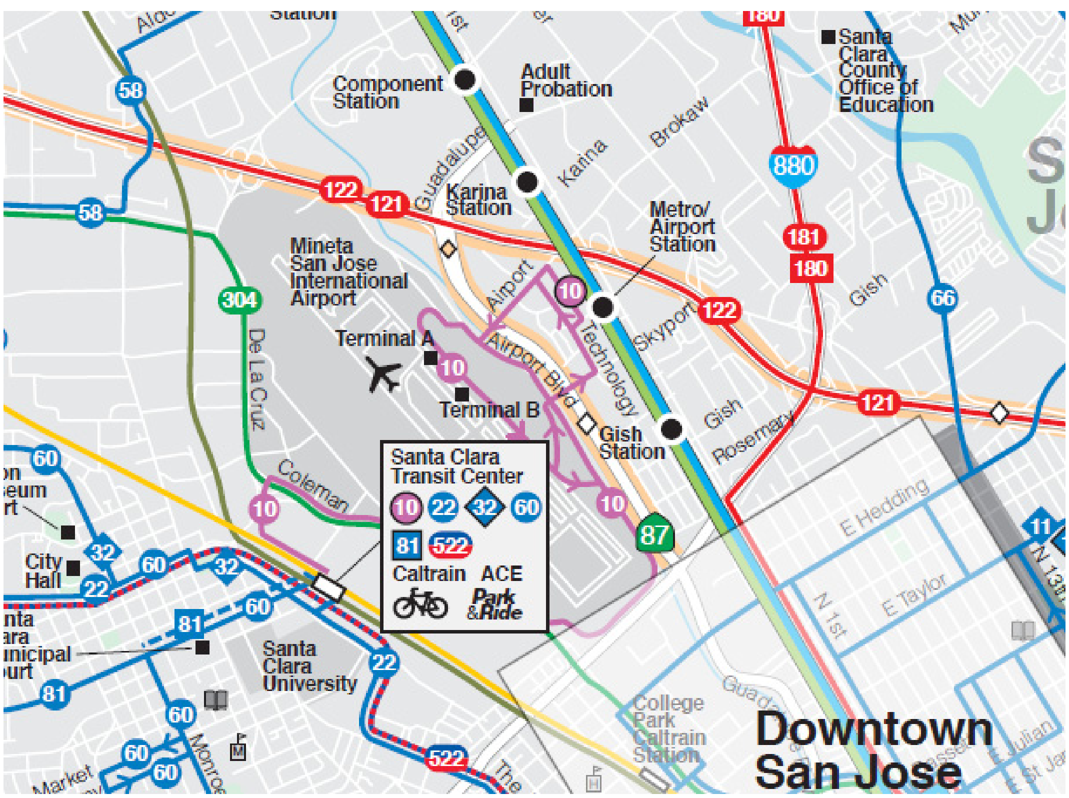
- Santa Clara Station is served with local and Limited Stop Caltrain service. It is not currently served by express "Baby Bullet" service. It is also served by the popular VTA Route 22/Route 522 bus service. The station is located approximately 1.15 miles from the airport terminals, but is on the opposite

[1] San Jose International Airport Groundside Simulation Report, DMJM Aviation Inc., July 2007, p. 26.

side of the airfield necessitating a 3.4-mile roadway trip. The station is also on the far (west) side of the railroad tracks from the Airport, requiring some type of pedestrian over/undercrossing to connect to an ATN station on the east side of the tracks. In the future, it is envisioned that the Bay Area Rapid Transit (BART) heavy metro system will be extended through downtown San José and terminate at Santa Clara Station, on the Airport side of the railroad tracks. The BART project would include construction of a pedestrian crossing connecting the BART and ATN stations to Santa Clara Station.

- VTA Light Rail Stations on the North First Street corridor are served by two Light Rail lines, resulting in a high level of service (the average combined headway between trains is 7.5 minutes per direction during peak hours). The closest Light Rail station is the Metro/Airport Station which is 0.65 miles from the Airport.
- The VTA Airport Flyer Route 10 bus service currently connects the Airport with VTA Light Rail and Caltrain. The Airport Flyer operates 19 hours a day with a typical headway of 15 minutes. The Airport Flyer services Santa Clara Station, Airport Terminals A and B, Metro/Airport Light Rail Station, and intermediate stops. The Airport Flyer is jointly subsidized by VTA and the Airport; the route is fare-free.

Figure 2: Transit Service in the Airport Area



Source: VTA, 2010.

2.3.5 Airport Planning

In reviewing the planning context at the Airport, Arup considered the history of the Airport Master Plan, previous Airport Automated People Mover (APM) planning, and the current Master Plan for the Airport. Observations about the Airport planning context include the following:

- Following a period of intense construction, terminal-side construction activity at the Airport is complete until further expansion is determined to be necessary with future growth in air passenger volume.
- The Airport studied a potential APM system from 2000-2007. These studies identified proposed alignments, station locations, transit service levels, ridership forecasts, and capital costs.
- The Airport parking lots changed significantly in 2011, and on-Airport shuttle service was adjusted accordingly. Economy parking was moved from the northwest side of the airfield to the "Green Island" northeast of Terminal A, employee parking was moved from the northwest side of the airfield to the Terminal A garage, and new surface parking lots were opened south of Terminal B.
- Areas on the northwest side of the airfield were formerly used for Airport parking and, following the parking transition in 2011, are now slated to be redeveloped for expanded facilities for Fixed-Base Operators (FBOs, companies that provide support services to General Aviation users).

2.3.6 Airport Circulation

2.3.6.1 Roadways

Airport circulation is provided by a combination of public and limited-access service roads. The main access to the Airport from the surrounding roadway network is provided by Airport Parkway and Skyport Drive on the east side of the Airport, and on the west, Airport Boulevard connecting from Coleman Avenue.

Ewert Road is a two-lane limited-access road used to connect the east and west sides of the Airport, located on Airport property along the north edge of the airfield. Airport staff has indicated potential flexibility in the configuration of Ewert Road. It may be possible to configure the road to serve some combination of on-Airport roadway circulation, ATN, and/or a public bicycle or pedestrian path.

Terminal circulation on the east side of the Airport serves Terminal A, Terminal B, and the Consolidated Rent-A-Car Facility (ConRAC). The two primary roads comprising the north-south circulation system are Airport Boulevard and Terminal Drive. From the south end of the Airport heading northbound, Airport Boulevard is a two-way road providing access to various FBOs, General Aviation users, and non-passenger activities. Near Skyport Drive, Airport Boulevard splits into a one-way loop and serves as the primary circulation route for access to Terminal B and

ConRAC. Terminal Drive splits from Airport Boulevard to provide access to Terminal A. Terminal Drive merges with southbound Airport Boulevard south of Terminal A.

2.3.6.2 On-Airport Shuttles

The Airport operates three on-airport shuttle routes. One route connects Economy Lot 1 on the Green Island with both terminal buildings. This route runs 24 hours per day at frequencies of 10 to 15 minutes. The second route transports passengers between Terminal A and Terminal B / ConRAC. This route operates 22 hours per day at frequencies of 10 to 15 minutes. A third shuttle route connects Terminal B with Hourly Lot 5 and Daily Lot 6 and operates 20 hours per day. All on-airport shuttles are fare-free.

3 Route Options

Arup was responsible for developing a conceptual route that would fulfill the desired ATN connections. Working closely with the City and Aerospace, Arup used an iterative, multi-stage route option development process. The process used design criteria that were defined by using information supplied by vendors that responded to the City's Request for Interest (2008) that was then generalized in a conservative manner to avoid bias toward any one vendor. The resulting route and alignment concept is conceptual but provides a basis for analysis of feasibility. The conceptual route developed for the Feasibility Study is not final and is expected to be adjusted and refined if the project moves forward.

3.1 Physical Design Criteria

Basic design criteria for the ATN guideway and stations were created based on the information received from potential ATN vendors, especially those of vendors who currently have operating systems or test tracks. Criteria were developed for guideways, stations, and maintenance facilities.

3.1.1 Guideway Criteria

The assumption for guideway geometry was purposely conservative due to uncertainty in the application of regulatory requirements to the ATN in California. The table below includes the criteria used by Arup for the guideway.

Table 1: Guideway Criteria

Criterion	Arup Assumption
Minimum Radius of Curvature (feet)	50
Cross-Section Width per Guideway Lane, including Walkways (per lane, in feet)	10
Maximum Ascending Incline (percent)	10
Maximum Descending Incline (percent)	6

Source: Arup

During the development of the route options, minimum turning radius emerged as a critical design criterion, particularly in the terminal station areas. While a minimum 50-foot turning radius was assumed for this effort to accommodate the maximum number of potential system technologies, it was recognized during this process that the smaller radius permitted by some systems would allow for substantially different guideway design and location possibilities. Therefore it is emphasized that the focus of the options development effort was to generate a conceptual, non-vendor-specific alignment for feasibility analysis.

3.1.2 Station Criteria

For purposes of developing the routing options, two generic station footprints were assumed based on number of berths (3 or 6). The smaller stations were assumed (based on early demand calculations by Aerospace) to be located in the Airport parking lots and at off-Airport locations. The larger stations were assumed to be necessary for the terminal stations. Each station was assumed to include space for angled berths (though these could also accommodate linear berthing), queuing, potential ticketing, general circulation, and, for elevated stations, additional space allowance at either end for vertical circulation (stairs, escalators, and elevator). Table 2 summarizes these station criteria.

Table 2: Station Criteria

Criterion	Arup Assumption
Length of 6-Berth Elevated Station (feet)	180
Width of 6-Berth Elevated Station (feet)	50
Length of 3-Berth Elevated Station (feet)	90
Width of 3-Berth Elevated Station (feet)	50

Source: Arup

Network and station capacity modeling performed by Aerospace following the selection of the conceptual route indicated that the terminal stations required a higher capacity than the initial station criteria could accommodate. Later in the Feasibility Study, both the Arup and Aerospace teams developed and illustrated conceptual ideas for high-capacity terminal stations, shown in the Conceptual Design section (Section 4).

3.1.3 Maintenance Facility Criteria

The sizing of a maintenance facility is highly dependent upon numerous factors, including network operations, battery charging requirements (if battery operated), storage requirements, etc. The Arup square footage assumption reflects a concept of a two-level facility that houses 16 light maintenance bays, vehicle charging/storage area for up to 30 vehicles, control center, and miscellaneous facilities for staff and storage. The facility size is based on a fleet size of 300 vehicles, which was provided by Aerospace based on its network modeling. It is also assumed that the maintenance facility would have access to the mainline ATN guideway as well as to a surface access road.

3.2 Route Options Evaluation Criteria

Arup developed the following criteria in Table 3 to evaluate route options during the route development process. The criteria were helpful, even at a qualitative level, to differentiate between the many options being considered in the early stages of the process.

Table 3: Early Route Option Evaluation Criteria

Category	Description	Indicators
Constructability Risk	Constructability risks the ATN will be exposed to	Number of long spans, power lines, Airport architecture, disturbance to existing operations
Travel Time	Travel time between on-Airport ATN stations and off-Airport transit connections	Guideway length
Vertical Changes	Number of vertical changes involved in ATN trip	Number of times passengers must change levels to reach ATN stations, terminals, etc.
Walk Distance	Average additional walk distance or time introduced by ATN	Walk distance
Visual Impacts	Environmental risks the ATN will be exposed to	Visual impacts of stations and guideways
Land Use Compatibility	Potential ridership base due to proximity to off-Airport land uses	Disturbance to private property; availability of land
Capital Cost	Characteristics of the ATN alternative that influence capital cost	Number of bridge crossings, length of elevated vs. at grade segments, elevated vs. at grade stations

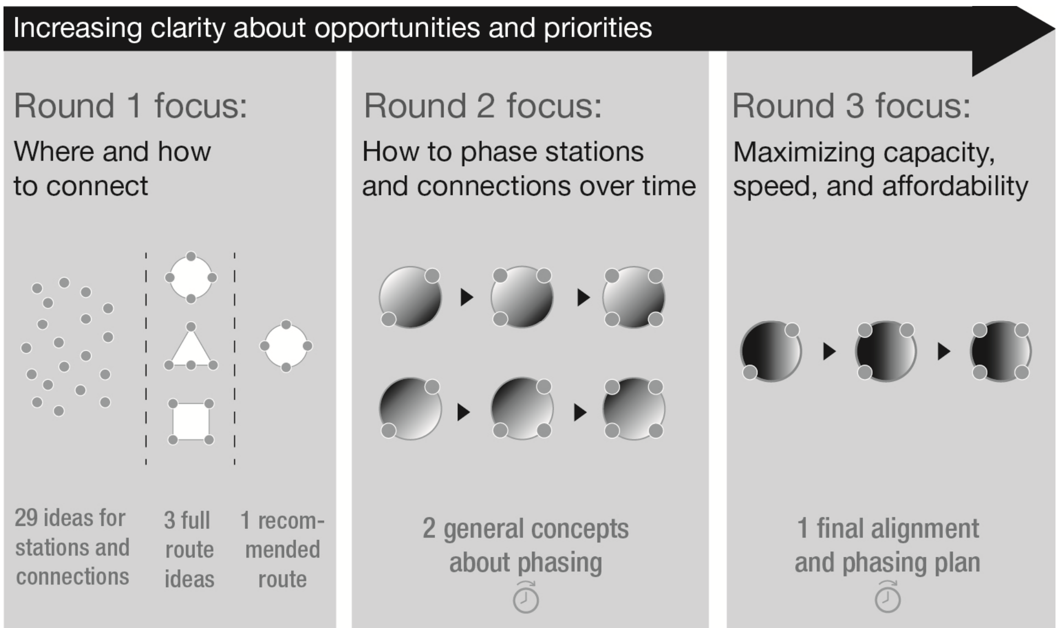
Source: Arup

As discussed below, the final round of route option development was primarily a refinement exercise, and the evaluation criteria above were not used.

3.3 Route Development Process

The conceptual route for the ATN was developed iteratively through three rounds of analysis and collaboration between Arup, the City, and Aerospace, as illustrated on Figure 3.

Figure 3: Overview of Route Development Process



Source: Arup

The first round of options sought to propose a minimum operable segment for an ATN system that serves Terminal A, Terminal B, and VTA Light Rail on North First Street. Routes differed in three key areas:

1. San José Airport terminal area station locations and routing;
2. North First Street Light Rail Stations;
3. Crossings of the Guadalupe River, US-101, Guadalupe Parkway (SR-87) and connection to North First Street.

The first round of analysis examined 19 station location options, 10 crossing and connection options, and a second-level screening examining three complete routes. The best-performing option had no long spans, the shortest overall route and consequently the shortest travel time, minimal private property impact, and one less major crossing than the other two full route ideas examined. Its primary drawback was that it had a more complicated intersection at Airport Parkway and Airport Boulevard.

The second round of analysis articulated two general concepts for how “interim” or low-capacity stations could be built near each terminal in early years of operation, followed by construction of high-capacity terminal area stations in an ultimate configuration. This was meant to accommodate the idea introduced by Aerospace that while the current ATN systems in operation were low-capacity systems, the ability to handle higher passenger demand would be developed and/or demonstrated over time. However, the City was not interested in building a low-capacity system that, for some unknown period, would have to be augmented by buses to meet the travel needs of Airport patrons traveling between Terminal A and ConRAC, the segment with the highest travel demand.

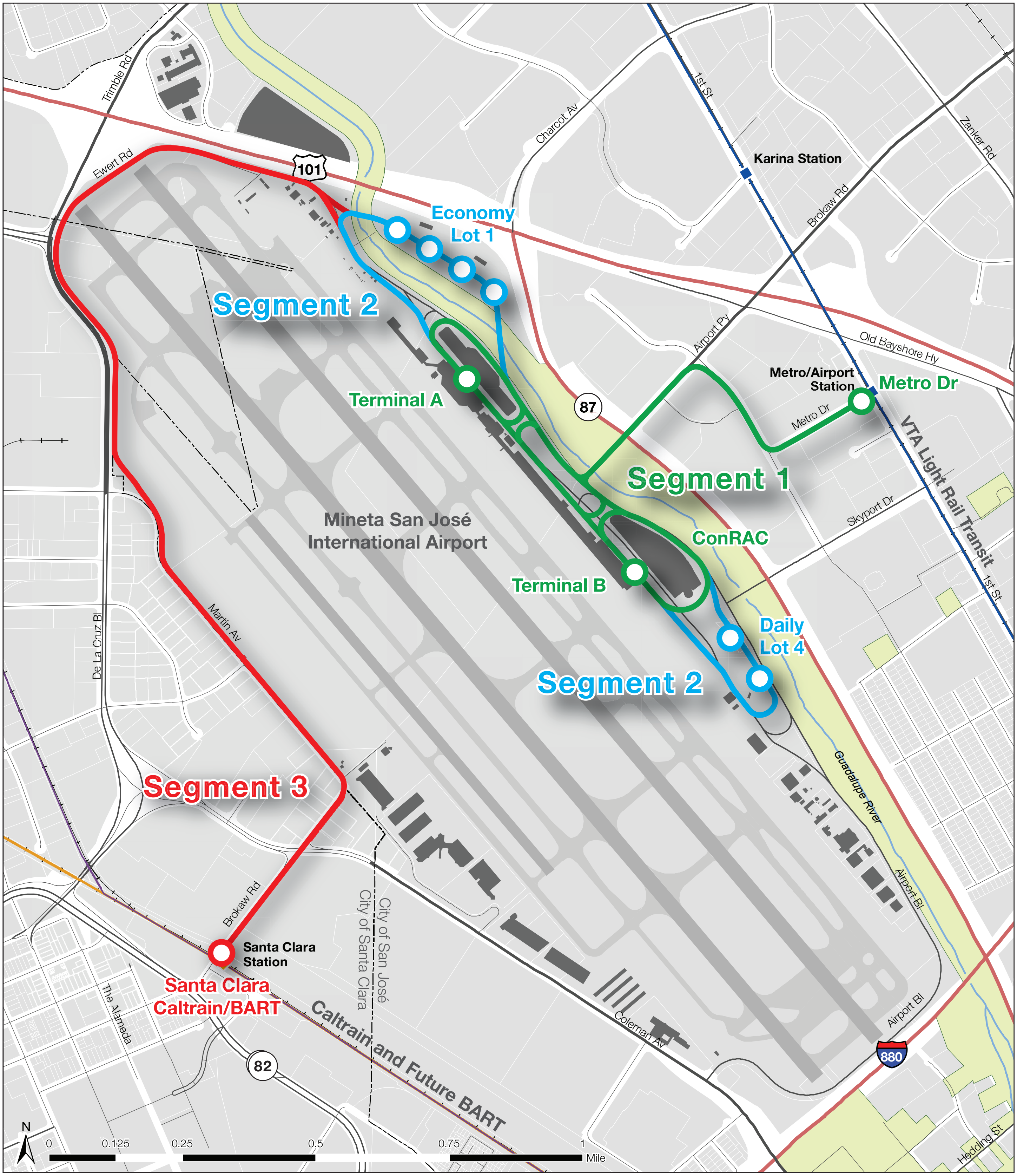
Faced with this challenge, the Project Team initiated a third round of analysis. Aerospace devised a solution that appeared to satisfy the demand between Terminal A and ConRAC. The strategy included high-capacity stations served by multi-vehicle platoons operating on an elevated, reversible guideway. Arup, in turn, developed a single alignment scenario that accommodated both low- and high-demand functions while seeking to maximize mainline travel speed. As part of the analysis, Arup identified issues that required further refinement, for example, the approach to high capacity service; operational assumptions for ATN stations; changes to existing roadway alignments; alignment of new bridge crossings; and phasing. Aerospace provided additional information to help address those issues, and Arup and Aerospace collaborated on refinements.

Arup's proposed changes sought to increase constructability/reduce potential cost and reduce impact to existing facilities/roadways while maximizing travel speeds on the guideway. Under the City's direction, Arup incorporated a final set of adjustments that resulted in Arup's Recommended Alignment, described below.

For more detailed descriptions of each stage of the options development process, please refer to Appendix A, Route Options Memos. These memos were written to help document the Project Team's thinking and decision-making as it went through the process.

3.4 Recommended Alignment

The ATN Recommended Alignment is 6.4 guideway miles long (10.3 track miles) and includes 10 stations (See Figure 4, Recommended Alignment). The alignment has three segments. The first segment is 2.7 miles long and links Airport Terminals A and B to Light Rail. The second segment, adding 1.3 miles, extends the ATN system to the on-Airport parking lots on the east side of the airfield. The third segment is 2.4 miles long and connects the Airport to the Santa Clara Caltrain/future BART station. Table 4 lists the stations included in the Recommended Alignment by segment. Design details and further considerations for each segment are described further below.



Legend

Segment 1 Recommended Alignment and Station

Segment 2 Recommended Alignment and Station

Segment 3 Recommended Alignment and Station

Figure 4
Recommended Alignment

San José ATN Feasibility Study

June 2012

Source

Arup 2012.

Table 4: Stations Included in the Recommended Alignment

Segment	Station	Notes
1	Terminal A	Terminal area high-capacity station.
1	Terminal B/ConRAC	Terminal area high-capacity station.
1	Metro Drive	Connects to VTA Metro/Airport Light Rail Station.
2	Economy Lot 1, Station 1	One of four stations in Economy Lot 1.
2	Economy Lot 1, Station 2	One of four stations in Economy Lot 1.
2	Economy Lot 1, Station 3	One of four stations in Economy Lot 1.
2	Economy Lot 1, Station 4	One of four stations in Economy Lot 1.
2	Daily Lot 4, Station 1	One of two stations in Daily Lot 4.
2	Daily Lot 4, Station 2	One of two stations in Daily Lot 4.
3	Santa Clara Station	Connects to Santa Clara Caltrain/BART station.

Source: Arup

3.4.1 Alignment Description: Segment One

The first segment would include a station serving the VTA Metro/Airport Light Rail Station at Metro Drive and stations at Terminals A and B. Each terminal station would be located in the median of Terminal Drive/Airport Boulevard between the terminal and its associated parking structure. Specialized ATN vehicle storage systems ("vehicle servers") located at or near each terminal station could supply a high volume of vehicles during peak times to serve passengers traveling in the direction of peak demand. The segment of guideway running between the two terminal stations could be a high-speed, reversible guideway to accommodate the changing directions of peak-period travel. Four turnbacks have also been designed into the first segment of the alignment in order to maximize connectivity between the stations. The alignment crosses the Guadalupe River at grade using the median of the existing Airport Parkway bridge to access the Metro Drive Station.

Operations for the vehicle servers were investigated by Aerospace. The ultimate design of the terminal-area stations will depend on the proprietary technology of the vendor and could vary substantially in size and operation. There appears to be adequate space upstream of the Terminal A station and downstream of the Terminal B/ConRAC station to allow for elevated vehicle storage areas. Vehicle storage could also potentially be provided by sidings parallel to mainline guideway. The additional costs for storage areas or sidings are not included in the cost estimate but are assumed to be minimal.

3.4.2 Alignment Description: Segment Two

The second segment adds connections to airport parking lots. To the north of Terminal A, two new bridges across the Guadalupe River would provide access to four stations within Economy Lot 1. To the south of Terminal B, two ATN stations are assumed to serve Daily Lot 4. An additional station could be accommodated at Hourly Lot 3, although Hourly Lot 3 is within walking distance of Terminal B and is therefore not assumed in the Recommended Alignment. A station could also be added to serve Daily Lot 6.

3.4.3 Alignment Description: Segment Three

The third segment would connect the ATN system to the Santa Clara Caltrain/future BART Station. From Economy Lot 1, the elevated guideway would descend to grade level along the Ewert Road right-of-way to avoid airplane operations and Airport height restrictions. Segments of the alignment would run elevated along Martin Avenue and in the median of Brokaw Road to near the site of the future Santa Clara BART Station.[2] A pedestrian overcrossing could provide access to the existing Caltrain station on the west side of the railroad tracks. This segment allows for future redevelopment of and access to the old parking lots on the west side of the airfield.

3.4.4 Opportunities for Expansion

The Recommended Alignment offers opportunities for expansion of the ATN network. For example, the network could be extended north, south, or east beyond the VTA Light Rail Station and to serve other locations in the North First Street Corridor; south along Airport Boulevard and perhaps under I-880 to reach Diridon Station; or west from Brokaw Road into Santa Clara.

In addition, infill stations could be provided along the Recommended Alignment. Between the Airport and VTA Light Rail, infill stations could be located along Technology Drive and Metro Drive within proximity of offices and hotels. On-Airport, additional stations serving Hourly Lot 5 and Daily Lot 6 could be provided on an interim basis before Terminal B is expanded to meet projected air passenger demand. Infill stations could also serve Airport cargo carriers, fixed-base operators, and west side development along Martin Avenue. The Recommended Alignment allows for the possibility of infill stations should conditions change or other opportunities be realized in the future.

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[2] The Project Team initially considered studying a tunnel option to connect the Airport to the Caltrain/future BART station. However, the practical difficulty of making significant elevation changes and executing wide turns in the tightly confined Airport terminal area, and very high cost to tunnel under the runways (as identified in previous APM reports), caused the City to dismiss consideration of this concept in this Feasibility Study.

4 Conceptual Station Design at Terminal B

Arup and its subconsultant WRNS Studio developed a conceptual design for the ATN station at Terminal B. Another concept was developed by Aerospace for the Terminal A station. These two efforts demonstrate a range of possibilities for how the ATN could be accommodated in the Airport terminal areas. This section outlines features and functional and aesthetic considerations for the station at Terminal B as accompanied by the included illustrations.

Figure 5 is a three-dimensional rendering of the broader context around Terminal B/ConRAC. The elevated ATN station is located in the median of southbound Airport Boulevard between Terminal B at the left and ConRAC on the right. The ATN guideway is shown in yellow approximating the alignment shown in Figure 4, Recommended Alignment. The guideway connects the Terminal B area to the parking lots south of ConRAC, to the VTA transit services at the Metro/Airport Light Rail Station, and to Terminal A and beyond.

Figure 6 is a close-in, three-dimensional rendering of the conceptual Terminal B ATN station looking east toward ConRAC. The rendering illustrates Terminal B passengers accessing the ATN station by crossing Airport Boulevard using the existing crosswalk and taking an escalator, elevator, or stairway up one level to the ATN platform. Passengers walking on to ConRAC can continue to cross Airport Boulevard as they do now. The station is arranged to offer easy access to the platform above while remaining permeable to through pedestrian traffic between ConRAC and Terminal B.

The ATN station would be naturally-ventilated, and the platform-level glass walls and the roof structure could support building-integrated photovoltaics (BIPV, e.g., flexible thin-film solar panels). The roof would be approximately 16 feet above the platform surface giving queuing passengers a light and open feel allowing views of the iconic Airport terminal architecture beyond. The guideways would be connected to the station at the platform berths, but otherwise would be offset from the station to allow light to reach the ground below. Aesthetics considerations, while not fully outlined at this stage, could include materials, colors, and shapes to blend or contrast with the styles of ConRAC or Terminal B. Additional station treatments could address landscaping and detailing in street furniture and fixtures as illustrated in this figure. The illustrations suggest branding opportunities appropriate to the airport location including use of Airport logos and signs. Because of the conceptual level of these illustrations, signage is not shown in these figures but should be assumed in complete station designs.

Figure 7 is another three-dimensional rendering looking toward ConRAC from the sidewalk in front of Terminal B. This view shows how the ATN station and guideway would be supported by columns in-line with the edge of the median. The station would be elevated approximately 17 feet above ground taking into account height clearance above traffic and maintaining a light and open feel at ground level between ConRAC and Terminal B.

Figure 8 is a plan view of the conceptual station roof level (top) and platform level (bottom). In this concept, the roof is curved to add visual interest and it extends over the guideway to provide shade. The platform supports four linear/in-line banks of five ATN vehicle berths at each bank, providing a capacity of 20 vehicles. Each bank is anticipated to function as an independent mini-station. Alternate platform configurations are possible. The platform berth area (for the 20 docked ATN vehicles) is shown to be approximately 155 feet long and 24 feet wide of usable platform space (excluding vehicles). Floor space accommodates queuing passengers, if any, and makes provisions for ticket and vending machines, information boards and multi-media station annunciators if needed.

The platform from elevator to elevator is approximately 400 feet long. This view shows how, in the platform berth area, there are a total of five ATN guideway lanes. Guideway 1 is a station access lane for the west side of the station, and it splits to Guideway 1a to serve Berths 11-20. Guideway 2 is a station access lane for the east side of the station, and it splits to Guideway 2a to serve Berths 1-10. Arriving vehicles would likely slow down on Guideways 1 and 2 to access the Terminal B station. Aerospace has proposed one potential method of operation in which vehicles could be configured to travel in virtual or physical tethered platoons. In this mode of operation, there is sufficient space in the station configuration for a 5-vehicle platoon to access Berths 6-10 independently from Berths 1-5. Similarly a 5-vehicle platoon can access Berths 16-20 independently from Berths 11-15.

Guideway 3 is a segregated, express/bypass lane on which through ATN vehicles from Terminal A can continue at relatively higher speeds to serve the parking lots south of ConRAC without slowing down in the vicinity of the station.

Figure 9 is a plan view of the conceptual station at ground level. The station is served by symmetrically-arranged escalators, elevators, and stairs that provide equal access to Terminal B and ConRAC. The arrangement of these features makes the station intuitive to navigate by passengers and easily visible to security personnel. The primary anticipated pedestrian trips to/from the Terminal B ATN station include the following:

- Air passengers using Terminal B would take ATN to or from VTA Light Rail, the Santa Clara transit hub, the Economy Lot, or the parking lots south of ConRAC. Passengers at Terminal B would be able to quickly access the ATN station by walking to the median using the existing crosswalk and then using the north set of escalators/elevator/stairs (left side of figure).
- Air passengers using ConRAC would take ATN to or from Terminal A after having rented or dropped off a rental car. These passengers would access the ATN station via the south crosswalk.

This view illustrates how the existing median could be narrowed slightly to accommodate the ground-level elements of the station as well as a new 6-foot-wide island located east of the median that would make provision for support columns for the guideway and station above. In this configuration, no traffic lanes would need to be removed – just shifted – and the median would retain curbside pick-up and drop-off functions.

Figure 10 shows longitudinal elevation (top) and cross-section (bottom) views of the conceptual ATN station. In the section view, the widths for various elements are shown, including the reconfigured median, new island for columns, and reconfigured traffic lanes.

Figure 11 provides detail for the conceptual single and dual guideway developed for the Feasibility Study. Given the many varieties of guideway and technology offered by ATN vendors, the assumed guideway proposes a flat surface that could support vehicles directly or could function as the supporting structure for a railbed. The illustrated design is not intended to support vehicles suspended from the guideway, but alternative designs could be equally configured for this station. The guideway width is based on a dynamic envelope analysis conducted by Aerospace of three major ATN vendors' vehicles and it includes width for an emergency walkway. The design live load assumes that vehicles can be accommodated bumper-to-bumper at upper-bound weight distributions. The typical section is 3 feet deep. The columns could be spaced at 80 foot intervals and could be 3 feet in diameter for a single guideway and 4 feet in diameter for a dual guideway. Below ground foundation shafts are assumed to be 5 feet wide for single guideway and 6 feet wide for dual guideway, with depths to 50 feet (this was assumed absent more detailed geotechnical information and is for illustrative purposes only).

Figure 5
Terminal B ATN Station Conceptual Illustration
3D Rendering - Area View

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Figure 6
Terminal B ATN Station Conceptual Illustration
3D Rendering - Station View 1

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Figure 7
Terminal B ATN Station Conceptual Illustration
3D Rendering - Station View 2

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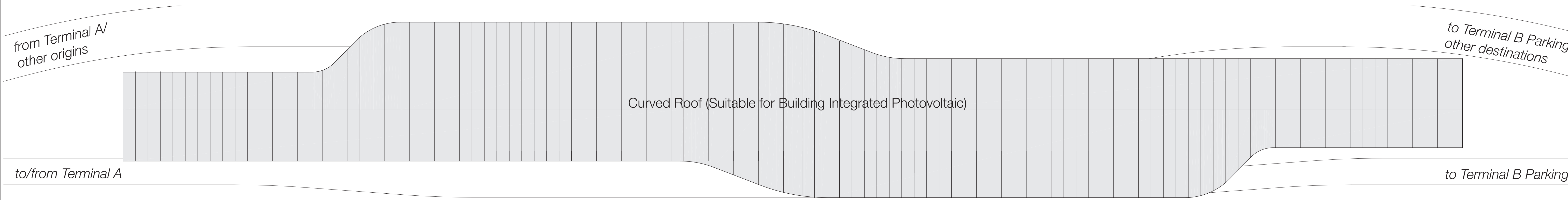
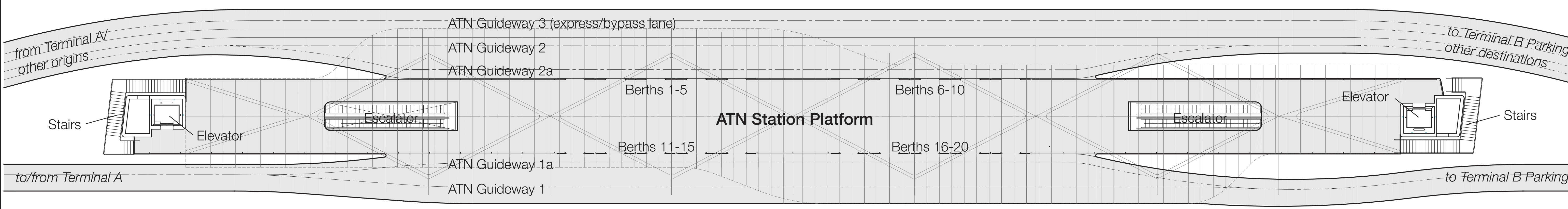


Terminal B ATN Station - Roof Level



Terminal B ATN Station - Platform Level (Elevated One Level Above Ground)

Figure 8
Terminal B ATN Station Conceptual Illustration
Plan View - Roof Level and Platform Level

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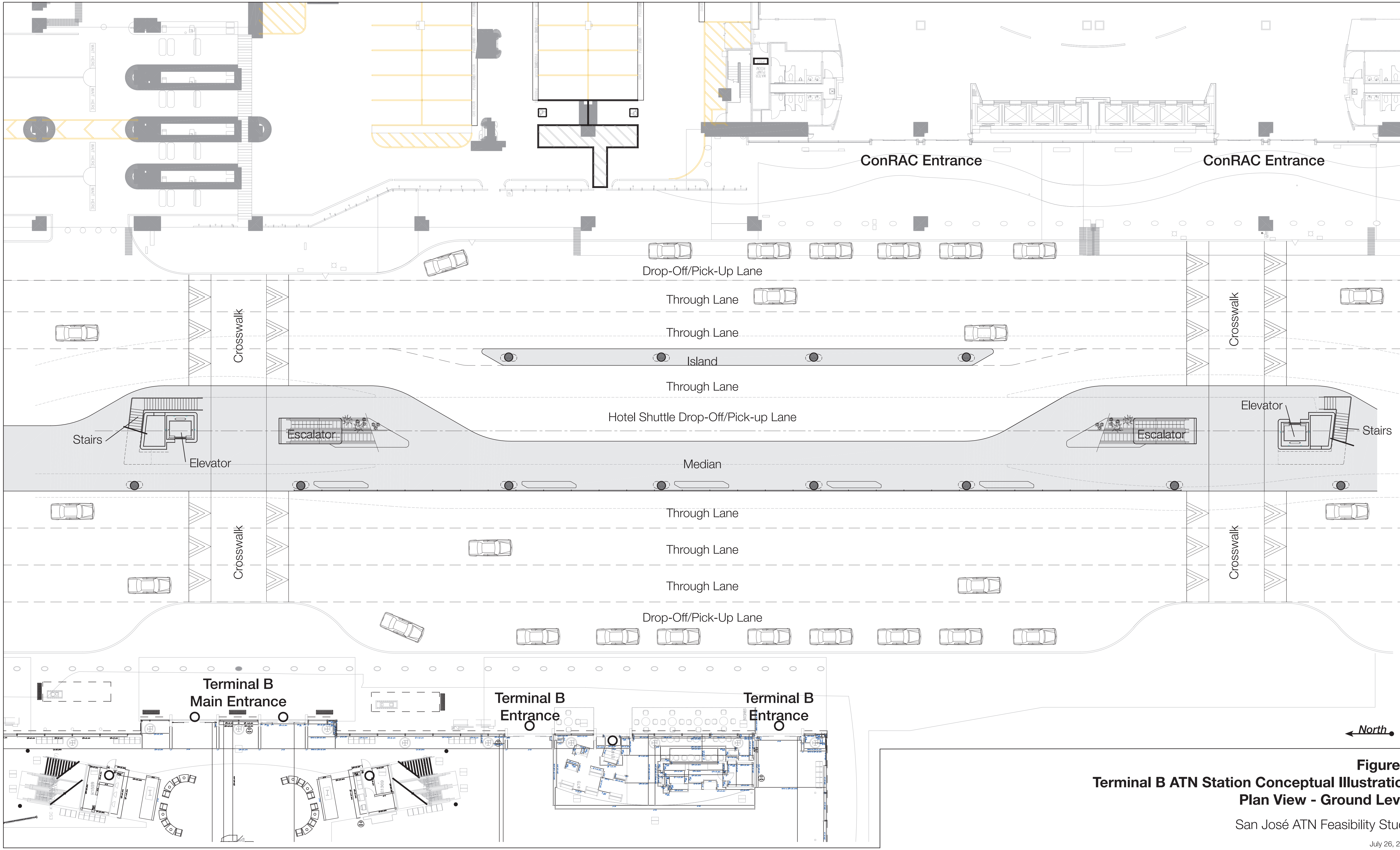

Figure 9
Terminal B ATN Station Conceptual Illustration
Plan View - Ground Level

San José ATN Feasibility Study

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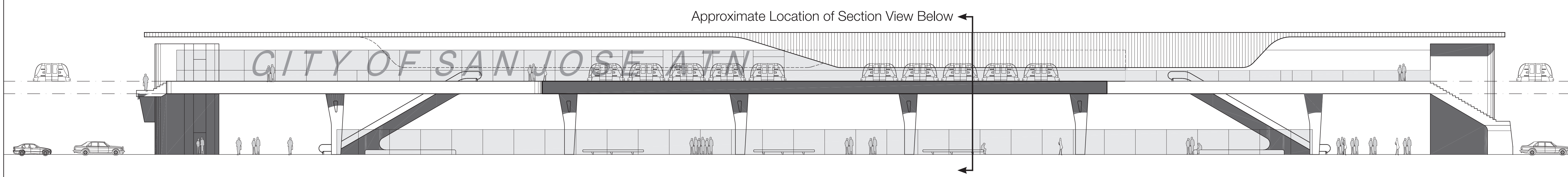
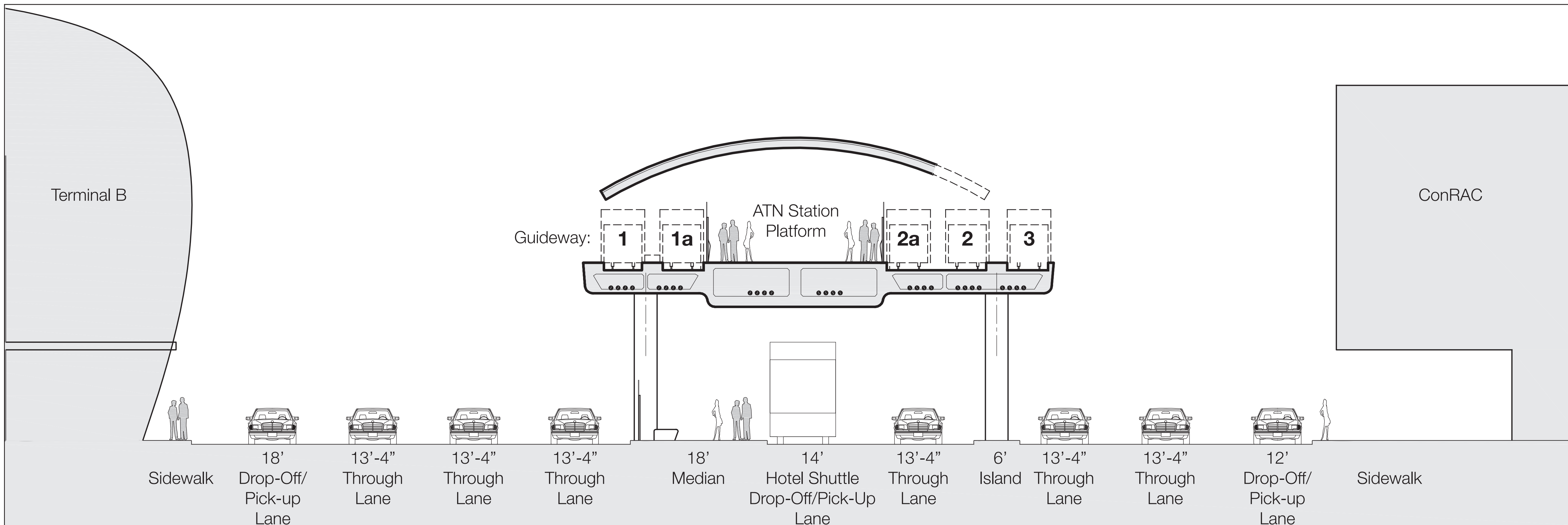


Terminal B ATN Station - Elevation Looking East Toward ConRAC



Terminal B ATN Station - Section Looking North Toward Terminal A

Figure 10
Terminal B ATN Station Conceptual Illustration
Elevation and Section

San José ATN Feasibility Study

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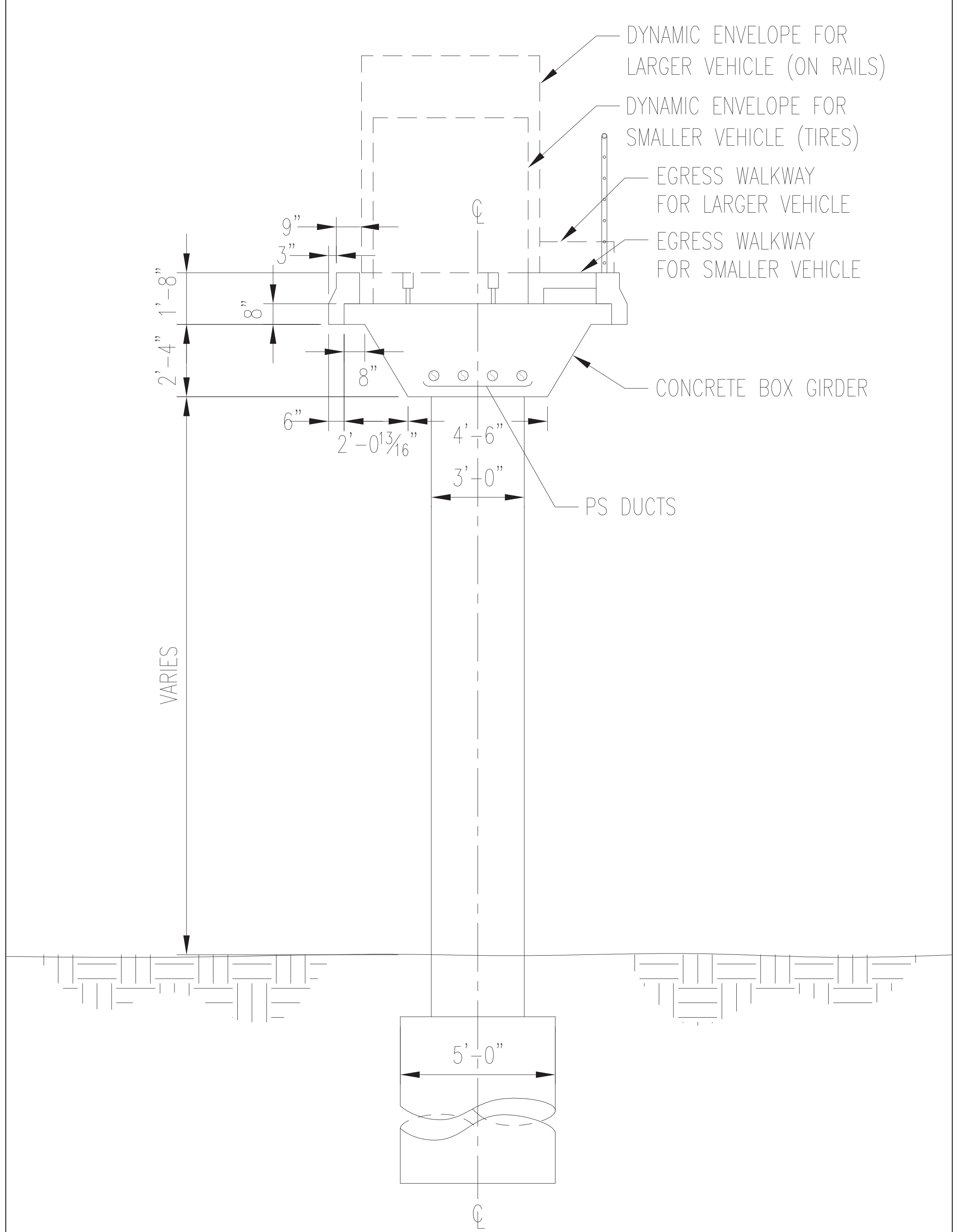
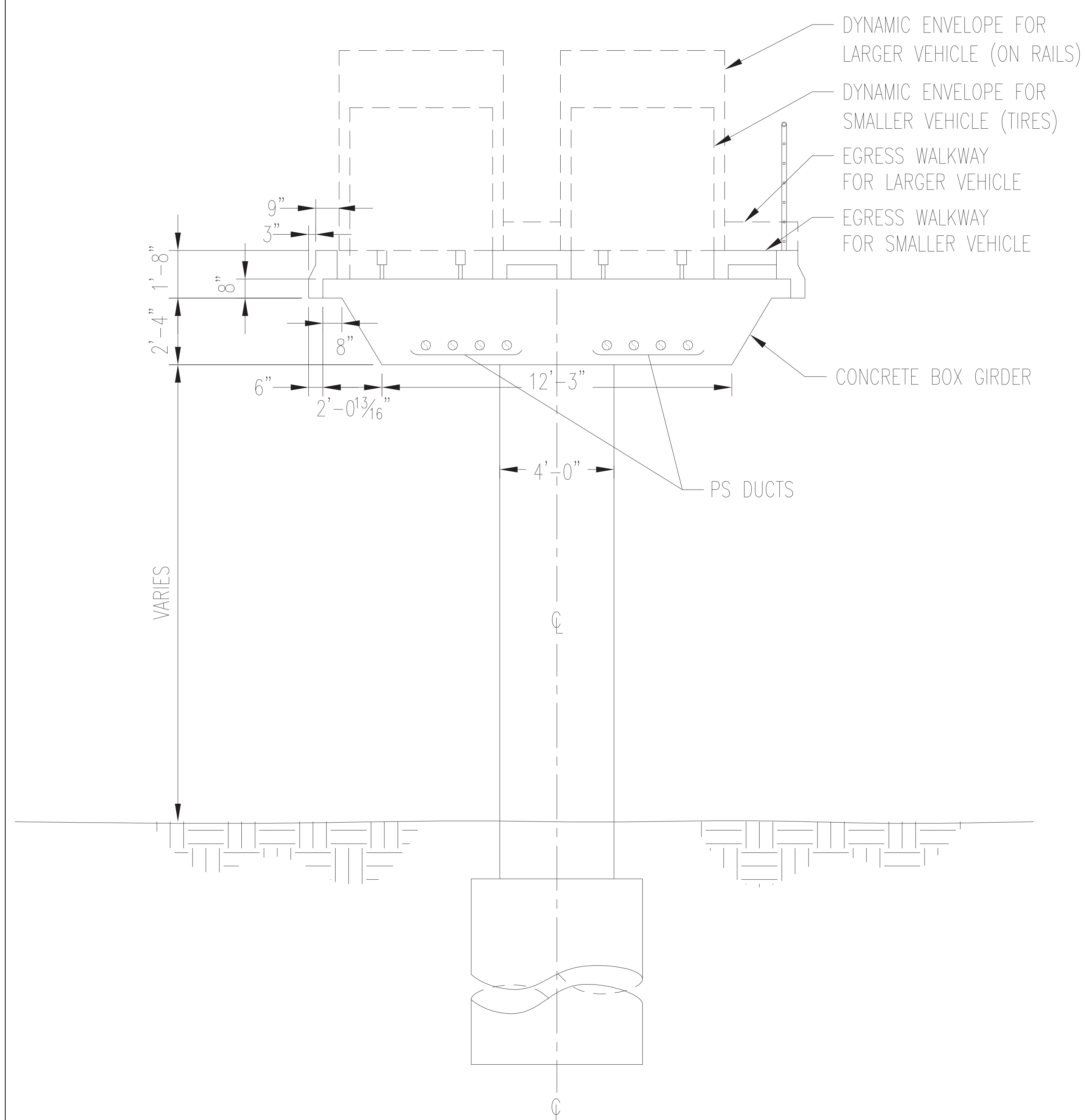


Conceptual Single Guideway Section



Conceptual Dual Guideway Section

Figure 11
Conceptual Guideway Sections

San José ATN Feasibility Study

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5 Demand Forecasts

Arup, along with subconsultant Cambridge Systematics, examined Norman Y. Mineta San José Airport user characteristics, future trends, projected air passenger demand, and travel times, in order to estimate potential demand for an ATN serving the Airport.

5.1 Categories of Potential ATN Passengers

For purposes of the ATN Feasibility Study, the ATN was assumed to serve the airport central terminal area, parking facilities and rail transit connections. It would thus primarily serve people traveling to and from the Airport. Airport-related users of the ATN would likely include commercial air passengers and their "meeters and greeters" and employees working at the Airport in the terminal areas. The ATN would also provide a non-stop transit link for passengers traveling between Caltrain and Light Rail. The potential demand from these passengers is included in the Feasibility Study demand estimates.

Some potential ATN passenger categories are excluded from the ATN Feasibility Study demand estimates. These include general aviation customers at the Airport, employees working at the Airport but outside the terminal areas, home-based work trips originating near the Airport, and trip capture between hypothetical infill stations located off-Airport.

General aviation consists of small privately-owned aircraft ranging in size from piston-powered airplanes to corporate jets. Operations are low-volume; users do not use the central terminal area; and users are unlikely to make connections to public transportation.

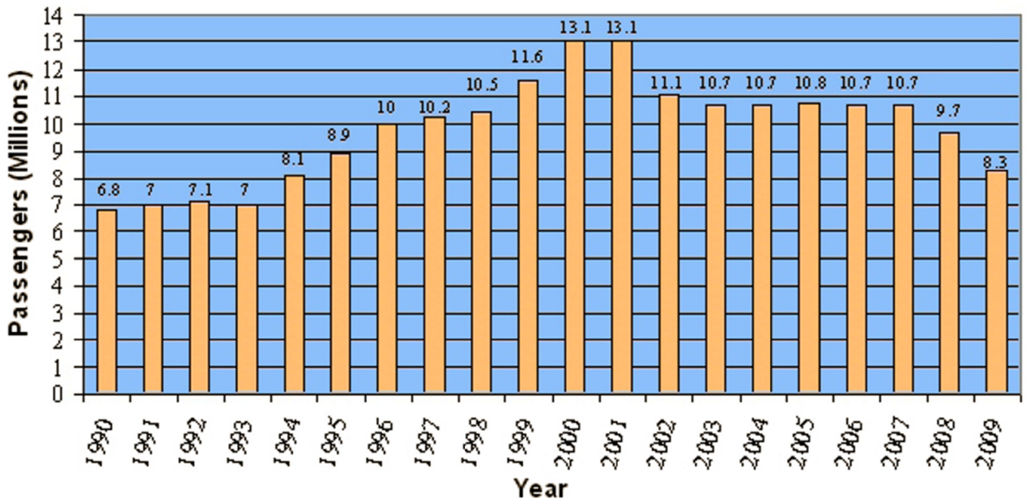
Employees are concentrated in the terminal areas whereas employees working at general aviation, cargo, and fixed-base operator (FBO) facilities are scattered in various locations around the Airport and employment density is low at each.

A preliminary analysis examined planned land uses on parcels within walking distance from Light Rail, Caltrain, and a hypothetical network of intermediate ATN stations to the west and east of the Airport. This analysis found the likely demand for intermediate ATN stations to be relatively low (between 20 and 100 riders a day). Please see the Alternative Revenue Sources Memo in Appendix C for more information about this analysis.

5.1.1 Airport Passengers

The Airport's passenger volume has held steady at approximately 8.3 million commercial air passengers annually for the past three years (2009 through 2011), after declining from a high of 13.1 million passengers in 2000 and 2001. The Airport Master Plan projects air passenger demand will reach 17.6 million passengers by the year 2027 (Annual Status Report on the Airport Master Plan, March 2012). The basis for the projection is explained in the Airport's Summary of Aviation Demand Forecasts[3]. Figure 12 shows historical annual air passenger volume.

Figure 12: San José Airport Historical Annual Air Passenger Volume



Source: SJC Master Plan Update EIR 8th Addendum (Feb 2010).

According to a 2005 Airport user intercept survey, 48% of air passengers are business travelers and 52% are leisure travelers.[4]

In terms of the seasonal variation of passenger volume at the Airport, average months are March, April, and October. February has the lowest volume on average while June, July, and August are markedly higher. Table 5 displays the amount of variation by month from the average of all months.

Table 5: Seasonal Variation at SJIA, Percent Change from the Monthly Average

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
-10%	-15%	0%	-1%	3%	9%	10%	11%	-2%	-1%	-3%	-2%

Source: San José International Airport, 2012

Analysis of the Association of Bay Area Governments (ABAG) regional projections ("ABAG") and those of the City of San José's General Plan buildout ("Scenario 6")[5] indicated that growth in air passenger trips to/from the Airport is primarily concentrated in Santa Clara County. While growth in air passenger demand is also apparent in Alameda, San Mateo, and San Francisco Counties, growth in these areas occurs from a fairly small base. The major implication for this trend is that airport passenger demand is expected to represent a significant market that can potentially be captured on transit.

[3] Summary of Aviation Demand Forecasts, Ricondo & Associates, July 2009.
[4] Norman Y. Mineta San José International Airport Customer Opinion Survey, Evans/McDonough Company, 2005.
[5] Both data sets provided by the City of San José Department of Transportation, 2011.

5.1.2 Airport Employees

The employee profile in 2005 was as follows: Transportation Security Administration, 29%; airline ground personnel, 29%; City of San José, 16%; vendors, 9%; airline flight crew, 4%; and 13% other.[6] In 2010, according to Airport staff, approximately 350 employees were employed directly by the City of San José. Future employee travel demand is assumed to increase linearly with air passenger demand.

5.1.3 Transit Passengers

The VTA Flyer served an average of 1,100 weekday trips in 2010[7]. According to VTA's 2006 Comprehensive Operations Analysis, approximately half of VTA Flyer trips were to or from the Airport; the remaining half consisted of a mix of direct trips between VTA and Caltrain stations and intermediate stops excluding the Airport terminals. This included boardings from the employee parking lot on the west side of the airfield, which was relocated to the Terminal A parking garage in 2011. The VTA Flyer route was also changed from a northern alignment to a southern alignment, though ridership was steady at approximately 1,200 weekday trips in April 2012.[8]

Other notable routes serving Santa Clara Station include Route 22 with 15,300 average weekday trips in 2010 and Route 522 with 6,100 average weekday trips. The entire Light Rail system averaged 31,300 weekday trips in 2010.[9] Caltrain daily boardings and alightings at Santa Clara Station numbered approximately 1,400 in 2009,[10] and are projected to reach 5,500 by 2030.[11]

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[6] Norman Y. Mineta San José International Airport Customer Opinion Survey, Evans/McDonough Company, 2005.
[7] Summary of Route Statistics, VTA, dated January 2011.
[8] VTA automatic passenger count data for the month of April 2012.
[9] Summary of Route Statistics, VTA, dated January 2011.
[10] Peninsula Corridor Joint Powers Board, 2009.
[11] 2030 Caltrain ridership model run, Peninsula Corridor Joint Powers Board, 2009.

5.2 Airport Access Mode Split

The proportion of trips made to and from the Airport in 2005 is shown in Table 6.

Table 6: Airport Access Mode Split

Mode of Transportation	Passengers	Greeters	Employees	All People
Private Car – Drove Alone	20%	92%	71%	40%
Private Car – Rode with Others	39%	1%	11%	28%
Rental Car	24%	1%	0%	17%
Taxi/Shuttle	12%	1%	4%	4%
Public Transportation	0%	1%	11%	1%

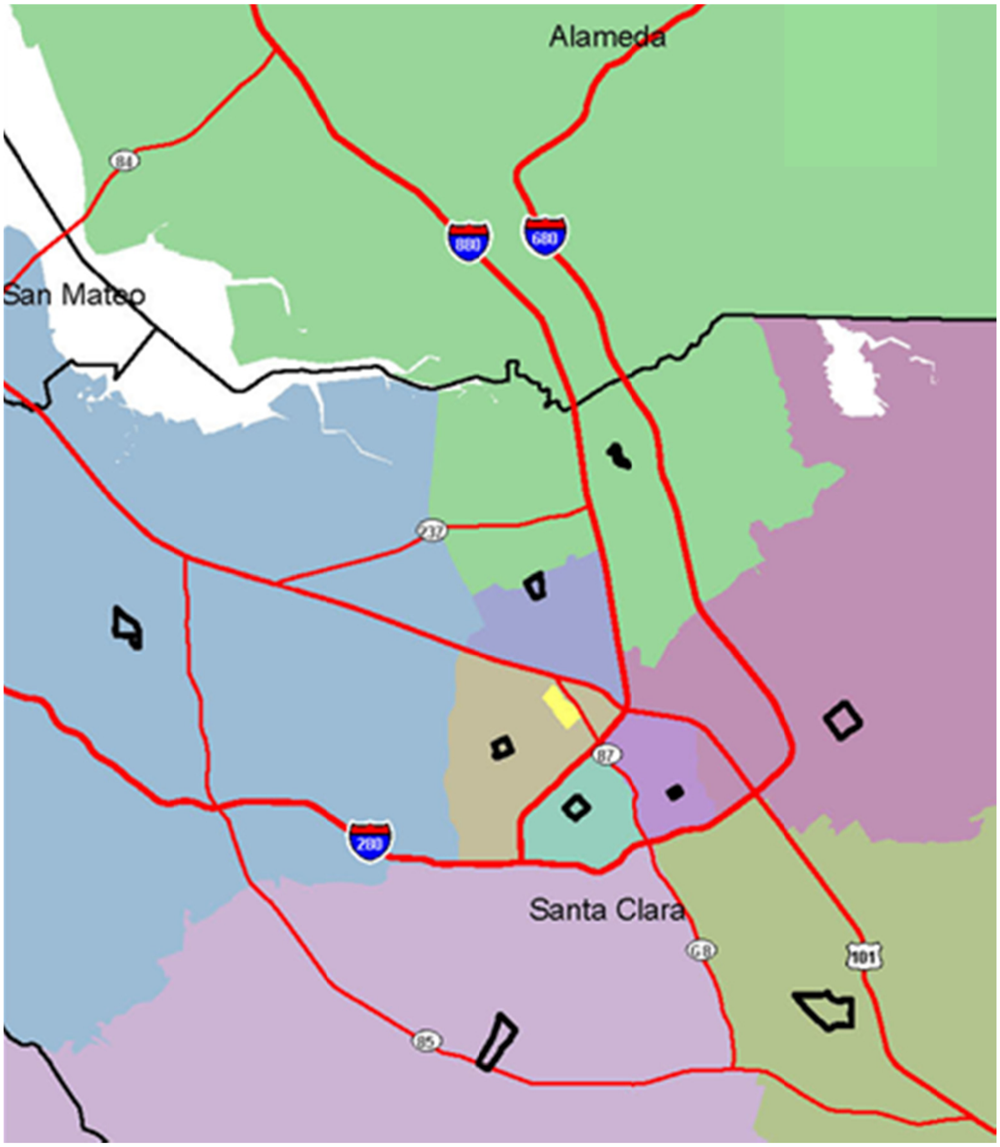
Source: Evans/McDonough Company, 2005.

As indicated in Table 6, the use of public transit by air passengers is minimal. In contrast, approximately 11 percent of Airport employee trips to the Airport are made by transit. Seventy-one percent of employees drive to work.

5.3 Comparative Travel Time Analysis

Cambridge Systematics conducted a travel time analysis comparing representative trips made by car and by existing transit systems. Nine sample locations were selected for analysis based on relative distance from the Airport and geographic catchment area. The locations considered to be closer to the Airport included: Inner Southwest Santa Clara; Central Santa Clara; North San José; and Greater Downtown San José. Locations that were farther included: North Santa Clara and East Bay; Southwest Santa Clara; West Santa Clara and Peninsula; South San José; and East Santa Clara. These locations are shown on Figure 13 below. The Airport is shown in yellow.

Figure 13: Representative Trip Origins for Comparative Travel Time Analysis



Source: Cambridge Systematics, 2011.

Table 7 shows the sample travel times by car and existing transit (without ATN). Transit trips are generally considered competitive if the transit trip is less than twice as long as a car trip (the transit to car time ratio is less than 2).

Table 7: Comparative Travel Times by Car and Transit

Representative Trip to Airport	Car Trip (minutes)	Transit Trip (minutes)	Transit to Car Time Ratio
Inner Southwest Santa Clara	14	36	2.5
Central Santa Clara	15	32	2.1
North San José	16	34	2.1
Greater Downtown San José	16	33	2.0
North Santa Clara and East Bay	21	78	3.8
Southwest Santa Clara	20	73	3.6
West Santa Clara and Peninsula	24	63	2.6
South San José	21	57	2.7
East Santa Clara	20	67	3.3

Source: Cambridge Systematics, 2011.

The analysis indicates that transit is more competitive for trips that originate closer to the Airport, but that transit trips originating further away are not competitive with autos. The low 1 percent air passenger transit access mode share supports this observation.

With the ATN system, overall transit travel time would decrease modestly. The VTA Flyer scheduled travel time from the Metro/Airport Station to Terminal A is 5 minutes, and from Terminal B to Santa Clara Station it is 10 minutes. With ATN, the trip from Metro/Airport Station to Terminal A could be less than 3 minutes, and 6 minutes from Terminal B to Santa Clara Station. Perhaps more importantly, ATN would also reduce wait time, to which passengers are more sensitive than travel time. Headways on the VTA Flyer are approximately 15 minutes, so average wait time would be 7.5 minutes, whereas ATN could provide a level of service of less than 1 minute.

However, as an on-airport system, the benefits of ATN are just one part of the overall transit trip, and resulting transit to car time ratios are still generally uncompetitive. For this reason, the ATN system under consideration is not assumed to drive a measurable change in Airport access mode share towards transit.

5.4 ATN Demand Forecasts

Demand forecasts were based primarily on existing and future airport activity, because air passengers and airport employees would make up the vast majority of potential ATN riders. Transit passenger demand between VTA Light Rail on North First Street and Caltrain at Santa Clara was also estimated.

Arup used two methods to estimate ATN demand. Preliminary estimates were generated by utilizing the City's travel demand model. Later, Arup used the Airport's flight schedule as a basis. The latter method was used to generate the final daily and peak hour demand forecasts for the San José ATN Feasibility Study.

5.4.1 Preliminary Daily ATN Demand

Arup and Cambridge Systematics prepared preliminary demand estimates in February and March 2011 based on the City's travel model which forecasted travel to a horizon year of 2030. The estimates were used to illustrate differences in demand between four early routing ideas. The estimates were also shared with Aerospace for input into Aerospace's initial ATN network models.

The key travel trips of relevance to designing an ATN system were identified using Measure A objectives and a review of other trips that could be served by a potential ATN system. To quantify the trip estimates, total demand from each terminal was based on the City's model baseline and checked against annual air passengers in 2009.The total demand was split between air passengers and employees based on the information gathered in the 2005 intercept surveys.

Off-Airport trips included travel to/from VTA and Caltrain. Key on-Airport trips included travel between Terminal A and ConRAC, which was driven by rental car pickup and return activity, and travel to/from the various Airport parking lots.

Please refer to the Preliminary Travel Demand Memo in Appendix B for more information about this method.

One notable methodological issue that became apparent in examining the travel model is that the Airport is represented as a single node on the model transportation network. Further, the model is already coded to include an Automated People Mover, building upon previous studies conducted in 2001/2002, and consequently very low travel times and headways are assumed in the model between Light Rail and the Airport.

5.4.2 Daily ATN Demand

The preliminary demand estimates were sufficient for comparison of the early routing ideas and input into the preliminary network analysis. Arup refined the methodology in September 2011 to include the Airport flight schedule for estimation of both daily and peak hour demand.

Arup vetted a series of assumptions with the Project Team and Airport staff. Assumptions included average airplane load factor, transfer rates within terminals, balance between terminals, departure and arrival temporal profiles, air passenger demand forecasts, and key trips between destinations.

These assumptions were used to estimate year 2011 daily air passenger trip volumes at the terminal curbsides (all curbside trips, including travel to/from parking lots, ConRAC, VTA Light Rail, Caltrain, and other off-Airport locations) excluding internal terminal transfers). This total trip volume was checked against the City's travel model baseline and the Airport's annual air passenger volume in 2011 (8.3 million passengers).[12] Next, Airport shuttle ridership data, combined with key trip assumptions, was used to estimate the proportion of transit trips compared to the daily trip volume for each origin and destination. Previous estimates for VTA Light Rail and Caltrain ridership to/from the terminals, and between VTA and Caltrain, were brought forward. Employee demand was estimated using parking and shuttle data, as non-City employee parking had been consolidated into the Terminal A parking garage in summer 2011. The resulting tabulation for daily ATN demand in 2011 is shown in Table 8.

ATN demand in 2030[13] was estimated by factoring up the 2011 total daily trip volumes and applying mode split and terminal balance assumptions to each origin and destination. The growth factor was selected using the travel demand model and was checked against the Airport's projected growth in annual air passenger demand. The Airport access mode split was assumed to be the same as in 2011. The terminal balance, or level of air passenger activity at Terminal A vs. Terminal B, was assumed to shift from 40% Terminal A / 60% Terminal B in 2011 to 50% / 50% by 2030. The tabulation for daily ATN demand in 2030 is shown in Table 9.

The total daily ATN demand is estimated to be 5,780 trips in 2011 and 14,160 trips in 2030.

[12] The February 2011 flight schedule was used as the starting point for Arup's terminal passenger model. As shown in Table 5 in Section 5.1.1, the month of February has the lowest level of passenger activity. However, the model primarily used non-seasonal assumptions. Consequently the modeled demand is approximately 3% higher than the Airport's recorded average monthly volume in 2011, indicating a slightly conservative estimated demand.
[13] The planning horizon for the Feasibility Study is 2030, consistent with the City's travel demand model horizon year. Air passenger forecasts are based on the Airport's 2027 Master Plan.

Table 8: 2011 ATN Demand, Daily

	Term A	Term B/ ConRAC	Economy Lot	Daily Lot 4	VTA	Santa Clara	Total ATN Origins
Term A/GTC		1,470	250	80	85	85	**1,970**
Term B/ConRAC	1,470		400	120	125	125	**2,240**
Economy Lot	250	400		0	0	0	**650**
Daily Lot 4	80	120	0		0	0	**200**
VTA	85	125	0	0		150	**360**
Santa Clara	85	125	0	0	150		**360**
Total ATN Destinations	**1,970**	**2,240**	**650**	**200**	**360**	**360**	**5,780**

Source: Arup

Table 9: 2030 ATN Demand, Daily

	Term A	Term B/ ConRAC	Economy Lot	Daily Lot 4	VTA	Santa Clara	Total ATN Origins
Term A/GTC		3,960	690	220	235	235	**5,340**
Term B/ConRAC	3,960		735	220	230	230	**5,375**
Economy Lot	690	735		0	0	0	**1,425**
Daily Lot 4	220	220	0		0	0	**440**
VTA	235	230	0	0		325	**790**
Santa Clara	235	230	0	0	325		**790**
Total ATN Destinations	**5,340**	**5,375**	**1,425**	**440**	**790**	**790**	**14,160**

Source: Arup

Notes:
ConRAC = Consolidated Rent-a-Car facility, located across the street from Terminal B.
VTA = Metro/Airport Light Rail Station, located on North First Street at Metro Drive.

For more detail and documentation, please see the following:

- San José ATN Feasibility Study Preliminary Travel Demand Memo in Appendix B;
- San José ATN Feasibility Study Airport Passenger Demand Analysis in Appendix B;
- San José ATN Feasibility Study Round 3 Options Memo (Revised) in Appendix A; and
- O-D Matrix in Appendix B.

5.4.3 Peak Hour ATN Demand

To estimate peak hour demand, Arup used the February 2011 weekday flight schedule and the assumptions listed previously (Section 5.4.2) to create a temporal profile of arriving and departing passengers at each terminal on an average day. This was used in conjunction with the refined daily demand estimates to estimate peak hour demand for 2011 and 2030.

Three critical peak hour scenarios of interest were defined: 1) the hour of greatest demand throughout the ATN system; 2) the hour of greatest demand in both directions between Terminal A and ConRAC; and 3) the hour of greatest demand in one direction between Terminal A and ConRAC.

The peak hour was determined to be the same for scenarios 1 and 2, which was 11:45 a.m. to 12:45 p.m. The peak hour for scenario 3 was determined to be 8 to 9 a.m. The 2011 peak hour demand for each scenario is provided in Tables 10 and 11. The 2030 peak hour demand for each scenario is provided in Tables 12 and 13.

Table 10: 2011 ATN Peak Hour Demand, 11:45 a.m.-12:45 p.m.

2011	Term A	Term B/ ConRAC	Economy Lot	Daily Lot 4	VTA	Santa Clara	Total ATN Origins
Term A/GTC		**190**	30	10	10	10	**250**
Term B/ConRAC	**85**		30	10	10	10	**145**
Economy Lot	10	25		0	0	0	**35**
Daily Lot 4	5	5	0		0	0	**10**
VTA	5	10	0	0		25	**40**
Santa Clara	5	10	0	0	25		**40**
Total ATN Destinations	**110**	**240**	**60**	**20**	**45**	**45**	**520**

Source: Arup

Table 11: 2011 ATN Peak Hour Demand, 8-9 a.m.

2011	Term A	Term B/ ConRAC	Economy Lot	Daily Lot 4	VTA	Santa Clara	Total ATN Origins
Term A/GTC		55	5	0	0	0	**60**
Term B/ConRAC	**190**		20	5	5	5	**225**
Economy Lot	30	30		0	0	0	**60**
Daily Lot 4	10	10	0		0	0	**20**
VTA	10	10	0	0		25	**45**
Santa Clara	10	10	0	0	25		**45**
Total ATN Destinations	**250**	**115**	**25**	**5**	**30**	**30**	**455**

Source: Arup

Table 12: 2030 ATN Peak Hour Demand, 11:45 a.m.-12:45 p.m.

2030	Term A	Term B/ ConRAC	Economy Lot	Daily Lot 4	VTA	Santa Clara	Total ATN Origins
Term A/GTC		**505**	85	30	30	30	**680**
Term B/ConRAC	**225**		50	15	15	15	**320**
Economy Lot	35	45		0	0	0	**80**
Daily Lot 4	10	15	0		0	0	**25**
VTA	10	15	0	0		50	**75**
Santa Clara	10	15	0	0	50		**75**
Total ATN Destinations	**290**	**595**	**135**	**45**	**95**	**95**	**1,255**

Source: Arup

Table 13: 2030 ATN Peak Hour Demand, 8-9 a.m.

2030	Term A	Term B/ ConRAC	Economy Lot	Daily Lot 4	VTA	Santa Clara	Total ATN Origins
Term A/GTC		145	20	5	5	5	**180**
Term B/ConRAC	**505**		40	10	10	10	**575**
Economy Lot	85	55		0	0	0	**140**
Daily Lot 4	30	15	0		0	0	**45**
VTA	30	20	0	0		50	**100**
Santa Clara	30	20	0	0	50		**100**
Total ATN Destinations	**680**	**255**	**60**	**15**	**65**	**65**	**1,140**

Source: Arup

5.4.4 Other Potential Sources of Demand

Although not analyzed in this study, several additional markets could potentially be served by an ATN, including:

- Connections between the Airport and existing Diridon Station public transit (Caltrain, Capitol Corridor, ACE Commuter Rail, VTA Light Rail & Bus).
- Connections between the Airport and future High Speed Rail.
- Connections between High Speed Rail and existing or future long-term parking lots and rental car facilities.
- Connections between the Airport and the Diridon Station area and Downtown San José.

6 Costs and Revenues

6.1 Capital Costs

Arup developed a capital cost estimate for the ATN system as input into the Preliminary Business Case summarized in Chapter 8 and detailed in Appendix E, Preliminary Business Case Report. Costs are expressed in 2012 dollars. Arup classifies the cost estimate at a Level 5 Rough Order of Magnitude, meaning it is at the most conceptual and least detailed level of cost estimating. On this scale, Level 1 represents a detailed, construction-ready estimate with relatively low contingency while Level 5 is the most conceptual level of estimate and includes the highest levels of contingency. The Feasibility Study is technology-neutral, analyzing feasibility on the basis of the widest track requirements, largest minimum turn radii, and heaviest vehicles. Tradeoffs have also been made in the alignment development process to favor larger turn radii to support higher operational speeds, with consequently higher costs. In future phases of study and design, the cost estimate would be refined, and contingencies likely reduced, as more detail is made available. For example, if a vendor is chosen then the costs can be focused on a much more specific set of system requirements and technology characteristics.

The cost estimate reports costs for the three alignment segments described in Section 3.4.

The capital cost estimate is comprised of three primary elements: base costs; indirect costs and related elemental contingency; and categorical risk contingency.

The base capital cost components include the following: guideway (single-track, double-track, and triple-track); minor stations (parking lot, VTA, and Caltrain stations); major stations (terminal stations); a maintenance facility; general allowances for utility relocations and small subcontracted work; control system (proportion of base construction cost); and vehicles (based on assumed unit cost and fleet size).

Indirect costs and other additions include: contractor indirect costs; contractor overhead and profit; design engineering; project insurance; tax; bond; and an elemental risk contingency. The elemental risk contingency is intended to cover unexpected cost increases in labor, equipment, materials, design, sub-consultants, overhead, and/or profit.

Finally, categorical risks are included in the capital cost estimate. Categorical risks refer to external risks specific to a project, some of which can be quantified as more information about the project is gathered. Some categorical risks cannot be quantified. Examples that can be quantified over time include risks due to design (including emerging technological development), construction, operations, site conditions, and regulatory codes/standards. Examples of risks that cannot be quantified include political, legislative, and funding changes. The process used to identify and quantify categorical risks is described in the Preliminary Business Case in Section 8.4.3.

The ATN total capital cost estimate is reported in Table 14 by risk scenario and by segment. Percentile risk indicates the level of confidence in the estimated cost. The 30th percentile scenario reflects the view generally taken by construction builders and implies a 70% chance that the costs will be higher than the value presented. The 80th percentile scenario reflects the view generally taken by the Federal Transit Administration (FTA) and implies a 20% chance that the costs will be higher than the value presented. The 95th percentile scenario reflects the view generally taken by lenders and implies a 5% chance that the costs will be higher than the value presented.

Table 14: ATN Capital Cost Estimate

Cost Scenario (inclusive of Base Cost, Elemental Risk, and Categorical Risk)	Capital Cost by Segment (2012 $, Million)			Total Capital Cost (2012 $, Million)
	Segment 1	Segment 2	Segment 3	
Scenario 1: 30th Percentile	263	107	167	**537**
Scenario 2: 80th Percentile	371	152	235	**758**
Scenario 3: 95th Percentile	445	182	282	**909**

Source: Arup

Please see the Basis of Capex Estimate in Appendix C for more detail about the capital cost estimate.

6.2 Operating and Maintenance Costs

Arup's operating and maintenance cost estimate for the ATN system was used as input for the Preliminary Business Case. Costs are expressed in 2012 dollars. As with the capital cost estimate, the operating and maintenance cost estimate is reported for each of the three Project segments.

Operating and maintenance cost components include the following: staffing; maintenance; periodic renewals; and energy use. Staffing costs are based on a "bottoms up" approach that applies California labor rates to an assumed organizational structure. Maintenance needs are based on length of track, number of berths, and number of vehicles. Periodic renewals include vehicle replacement over the assumed 30-year operating period, as well as periodic information system replacements and guideway inspections. Energy usage is calculated using Arup experience on other projects.

The ATN total operating and maintenance cost estimate is reported in Table 15 by risk scenario. The scenarios vary by amount of assumed elemental risk contingency. The elemental risk contingency is intended to cover unexpected cost increases in labor, equipment, operation, overhead, and/or profit.

Table 15: ATN Operating and Maintenance Cost Estimate

Cost Scenario (for all Segments and inclusive of Base Cost and Elemental Risk)	Total Annual Operating Cost (2012 $, Million)
Scenario 1: 8% Contingency	11
Scenario 2: 24% Contingency	13
Scenario 3: 35% Contingency	14

Source: Arup

Please see the Basis of Opex Estimate in Appendix C for more detail about the operating and maintenance cost estimate.

6.3 Potential Revenue Sources

The City has stated that it does not intend for the ATN to compete with other regionally-prioritized transportation projects that would be eligible for traditional federal capital funding programs, or other major regional and state funding programs. Such projects currently include the BART extension to San José and electrification of the Caltrain corridor. A summary of potential operating revenue sources is presented below.

The primary revenue source assumed for the ATN is the savings in bus operating costs realized from the Airport budget as a result of discontinuing shuttle bus services to and within the Airport. This is discussed in more detail in Chapter 8, Preliminary Business Case and in Appendix E, the Preliminary Business Case Report.

The other potential operating revenue sources examined by Arup include fares, parking, adjacent development (e.g., Airport-serving hotels and businesses), sales taxes, and advertising. Each of these potential sources are compared below in Table 16 and discussed following Table 16. In summary, parking and advertising revenues are included in the financial feasibility analysis. While these revenues are included in the analysis, the City Council would need to take action to allocate any of these potential revenues to the ATN Project.

Please see the Alternative Revenue Sources Memo and the Potential Advertising Revenue Memo in Appendix C for more detailed discussion of each potential source.

Table 16: Potential ATN Operating Revenue Sources

Potential Revenue Source	Assumption in the San José ATN Feasibility Study	Notes
Fare Revenue	Not included	The ATN is required to provide free transportation connecting Airport terminal/parking lots with Caltrain and VTA train stations. Fares might be reasonably collected for direct trips between Santa Clara Caltrain and VTA Metro/Airport Stations, but these represent a small portion of likely trips.
Parking Revenue	Included	Parking revenues increased after the London-Heathrow Terminal 5 ATN began service, even after rates were raised. Further market study comparing San José to Heathrow may be justified.
Revenue from Adjacent Development	Not included	Early analysis indicated low potential ridership for non-Airport trips. Possibility for more in-depth analysis related to hotel shuttles, demonstration of benefit, and potential for TMA formation.
Sales Tax Revenue	Not included	Challenging environment to raise additional taxes to support ATN in the foreseeable future.
Advertising Revenue	Included	Advertising revenue of $500,000 per year based on precedents examined.

Source: Arup

6.3.1 Fare Revenue

The "Airport Master Plan Air Resources Board Certification Status Report for 2011" made free transportation connecting Airport terminal/parking lots and Caltrain/VTA train stations a condition of continued certification. The ATN would meet this condition. Trips for which fares might be reasonably collected would only be direct trips between the Santa Clara Caltrain and VTA Metro/Airport Stations. Such trips represent only approximately 5% of system total daily passenger trips, so those trips are also assumed to be free.

Given that fare collection equipment and a fare media system would need to be provided, charging for ATN use carries additional capital and operating costs for equipment, media, and software integration and maintenance, including potential integration with the Bay Area's Clipper smart transit fare card. This also introduces a level of complexity for travelers.

However, the connection between Santa Clara Caltrain and VTA Metro/Airport Station is a regional link. Although the two services meet at Diridon Station further south, there is a significant time penalty to make the transfer and travel through downtown San Jose via Light Rail. Therefore, passengers may be willing to pay for the convenience of traveling between Santa Clara Caltrain and VTA Metro/Airport Stations.

6.3.2 Parking Revenue

Preliminary data from the ATN operation at London-Heathrow Airport Terminal 5 indicates a 10 percent at increase in revenues from two business-class surface parking lots served by ATN since commencement of ATN service. The Airport operator (BAA) saw usage grow even after it increased rates at the surface lots. Given the similarity of the passenger profile (high business travel), and the Airport's location in Silicon Valley, a modest one-time increase in parking revenue seems justified. However, further study is warranted to determine the level of increase more precisely. For the purposes of this study, the Project Team assumed a one-time increase of 10% (with no parking rate increase), and subsequent annual increase of 1.5% linked to airport passenger growth.

6.3.3 Revenue from Adjacent Development

A preliminary analysis examined planned land uses on parcels within walking distance from VTA LRT, Caltrain, and a hypothetical[14] network of intermediate ATN stations to the west and east of the Airport. This analysis found the likely demand for intermediate ATN stations to be relatively low (on the order of dozens or hundreds of riders a day), and thus not likely to drive developers to help fund an ATN.

Similarly, a preliminary analysis examined demand for ATN service from hotels and other local area businesses. In theory, these businesses could find it in their interests to help cover ATN operating costs. However, the magnitude of support from hotels for ATN is questionable and needs further study. The low-cost, door-to-door shuttle services that most hotels in the area provide to their guests minimize passenger walk distances, compared to an ATN, and have wider coverage than a potential ATN system. These shuttles also provide some hotels with a competitive advantage over others based on the quality of the shuttle service (such as responsiveness to traveler demand, proximity to Terminal entrances, and so on), such that those hotels may not support a shared airport service of any kind.

Further research is recommended to confirm attitudes and commitments of Airport-serving businesses. In the meantime, revenue from adjacent development has not been assumed in the Preliminary Business Case.

[14] The hypothetical ATN stations were placed with the intent of capturing as much development as possible except for avoiding the Rosemary Gardens residential neighborhood immediately east of the Airport, which has in the past objected to the Airport APM.

6.3.4 Sales Tax Revenue

The City of San José could consider promoting a local sales tax measure to help fund ATN operations, or it could lobby VTA to include ATN on future county sales tax measures. A very strong political effort would be needed to convince local taxpayers to pay for ATN, considering the current economic climate, the fact that Santa Clara County already has sales tax measures in place for transportation, and larger regional projects need significant capital and operating funds. While this funding source does not seem likely in the near future, it may be worth revisiting as the trend of increasing local funding for transportation continues. At this time, sales tax revenue has not been assumed in the Preliminary Business Case.

6.3.5 Advertising Revenue

Due to the innovative nature of an ATN, several methods were used to gauge potential advertising revenue for the ATN at the San Jose International Airport. Several estimating methods are described in “Transit Cooperative Research Program Synthesis 51: Transit Advertising Sales Agreements,” 2004. These methods include estimating revenue based on: a percentage of total operating funds; passenger trips; and fleet size. Arup used recent, local transit agency data to calculate potential revenue according to each method.

Based on the assumed characteristics of the ATN project and analysis of the estimating methods, an advertising revenue of $500,000 per year seems to be reasonably supported. This estimate should be refined to reflect more ATN-specific characteristics if available in the future. Please see the Potential Advertising Revenue Memo in Appendix C for a more detailed discussion.

7 Environmental Issues and Strategy

Arup and subconsultant David J. Powers & Associates analyzed potential environmental issues related to the ATN Recommended Alignment. These are described below, followed by a potential approach for environmental clearance, which would be required for constructing and operating an ATN.

The project is subject to the requirements of the California Environmental Quality Act (CEQA). The project may also be subject to the National Environmental Policy Act (NEPA), if federal funding is used to support the project. Other environmental permits and approvals may also be required to implement an ATN, depending on the location of the alignment.

Please see the San José ATN Feasibility Study Environmental Issues and Strategy Memo in Appendix D for more detailed discussion.

7.1 Environmental Opportunities and Constraints Analysis

In general, impacts from the ATN system will fall into two broad categories: the direct impacts from construction of the footprint of the ATN (i.e., the guideway, stations, maintenance facility, etc.) and indirect impacts such as traffic, noise, vibration, air quality, and visual.

7.1.1 Direct Impacts

Direct impact categories used by CEQA were reviewed for likely issues. Impacts are not likely to be significant for the following categories: Land Use; Flooding; Cultural Resources; Hazardous Materials; and Temporary/Construction. All direct impacts can likely be mitigated by standard measures for these categories.

Biological impacts will not be significant except at the two new crossings of the Guadalupe River. Such impacts can be minimized by adjusting the alignments of the crossings to pass through the existing gaps between large trees on the riverbanks, designing the structures to avoid any piers in the low-flow channel of the riverbanks, and utilizing precast construction methods to avoid realigning the low-flow portion of the channel. Any remaining impacts can be mitigated to a less-than-significant level through of replacement habitat creation.

7.1.2 Indirect Impacts

Indirect impact categories used by CEQA were reviewed for likely issues. Overall, there are no indirect impacts that are likely to be significant, including in the following categories: Traffic; Noise and Vibration; Air Quality; Visual and Aesthetic Considerations. To the extent that the ATN will reduce vehicle trips on area roadways, the traffic and air quality impacts could be beneficial. While vibrations and visual intrusions are likely to occur, they would likely be at levels below the applicable thresholds of significance.

7.2 Environmental Strategy

There are a number of options that the City will need to consider when the environmental review process for the ATN is undertaken. These options fall into three categories of consideration that are detailed below.

- Preparing an environmental document on the entire ATN project versus preparing a separate environmental document for each phase of the project;
- Preparing a CEQA analysis only, versus a combined NEPA/CEQA analysis; and
- Determining the level of environmental review to pursue.

7.2.1 Entire Project Versus Phased Project

Conducting the environmental review for the project in phases is a possible approach for the ATN system, as the first segment identified in the Recommended Alignment Memo would have independent utility by connecting on-Airport destination to each other and to the VTA LRT station. However, it may not be especially helpful to break the review into phases, as the other Project segments do not seem to introduce new or greater impacts or controversial aspects compared to the first segment. Preparing an environmental document on the entire ATN project would have several benefits, among which are avoiding multiple review and approval cycles and reducing review costs later in the Project.

7.2.2 CEQA Versus NEPA/CEQA

All projects in California require compliance with CEQA. In addition, projects that require federal approvals or projects that utilize federal funding require compliance with NEPA. NEPA compliance may be desired by a local agency because it accelerates the approval process in the event that federal funding becomes available later, and it can make the project rank higher for funding as it is viewed as being closer to "shovel ready."

7.2.3 Level of Environmental Review

Environmental clearance is obtained through one of the following three levels of environmental review, which are roughly equivalent between CEQA and NEPA.

Table 17: CEQA and NEPA Levels of Environmental Review

Type/Magnitude of Potential Project Effects	CEQA Terminology	NEPA Terminology
Small projects that can be readily deemed as having no potential for resulting in significant environmental effects	Categorical Exemption (CE)	Categorical Exclusion (CE)
Projects that may/will result in significant environmental effects but mitigation for such effects is proposed	Initial Study → Negative Declaration (IS/ND)	Environmental Assessment → Finding of No Significant Impact (EA/FONSI)
Projects that will likely result in significant environmental effects and projects that are controversial on environmental grounds	Environmental Impact Report (EIR)	Environmental Impact Statement (EIS)

Source: David J. Powers & Associates

7.2.4 Environmental Conclusions

Based on the preliminary analysis completed to date, it is highly probable that the ATN project will not result in any significant unmitigated environmental effects. Mitigation is potentially needed for biological impacts and temporary/construction-related impacts, but mitigations would be available to reduce impacts to a less-than-significant level. Further, the nature of the project is one that is unlikely to be controversial on environmental grounds. In fact, many community groups, residents, and businesses have long been advocating for improved transit access between the Airport and the nearby rail systems.

7.2.5 Environmental Recommendations

If the project moves forward, it is suggested that the City proceed with the preparation of an Initial Study (IS) leading to the adoption of a Negative Declaration (ND) to comply with CEQA (an ND may include mitigations and in that case is sometimes called a Mitigated Negative Declaration, or MND). Similarly, if NEPA compliance is required or desired, an Environmental Assessment (EA) leading to a Finding of No Significant Impact (FONSI) is suggested. For simplicity, cost-effectiveness, and an expedited review process, a combined IS/EA, which is a common practice, is recommended.

Future issues for the City to decide include: the City’s approach to phased environmental analysis versus analysis of the complete Project; to what extent will the City influence the design of the final alignment to minimize and avoid impacts; and, consequently, whether it will be necessary to pursue additional permits for project implementation.

8 Preliminary Business Case

8.1 Introduction

The purpose of the Preliminary Business Case is to support the City's decision-making process on whether to move forward to the next stage of the Project (i.e., detailed planning, engineering, technology assessment, and procurement, etc.) and, if so, to determine the range of viable project development options. This study presents a high-level cost comparison of the ATN to other modes of transportation.

There are several ATNs in operation worldwide. In 2011, three systems commenced operations at London Heathrow Airport, in Masdar City (Abu Dhabi), and at Rovisco Pais Hospital (Portugal) and another was under construction in Suncheon, South Korea. At this time the ATN technology has not been fully deployed on the scale required for the San José application. Current ATN systems serve several low-volume stations in a linear or "WYE" configuration. The San José application would consist of 10 stations, two of which are high-volume, and are connected via a network that allows passengers to travel nonstop to any point within the network. Therefore, the technology requires further development to demonstrate its ability to deliver the passenger-carrying capacity required for the network of stations contemplated for this Project.

This chapter provides summary information that is described more fully in Appendix E, the Preliminary Business Case Report.

8.2 Evaluation Methodology

The Preliminary Business Case uses quantitative and qualitative methods to evaluate the Project's feasibility from a funding perspective. The quantitative assessment was undertaken as a "funding gap" analysis recognizing that a more complete financial analysis will be undertaken during the next stage of the Project's development.

In the context of this report, the funding gap is the difference between project costs and the revenues currently available to fund the construction and operations of the Project. A risk-adjusted cash flow model was built to estimate a range of the funding gap. The funding gap range was developed using three scenarios considering different risk confidence levels and sensitivities.

The qualitative assessment evaluated five characteristics of the Project that were considered key to deliver the Project but were not quantitatively measurable (Project Delivery Objectives). These included (1) the compliance with Measure A funding requirements, (2) the affordability compared to alternative systems, (3) the minimization of overall uncertainty, (4) the maximization of "equity of use" and (5) maximization of revenue potential without compromising the "equity of use".

Finally, Arup evaluated potential strategies to develop the Project from initial feasibility to commencement of operations and identified the areas to focus on at the next stage of the Project's development.

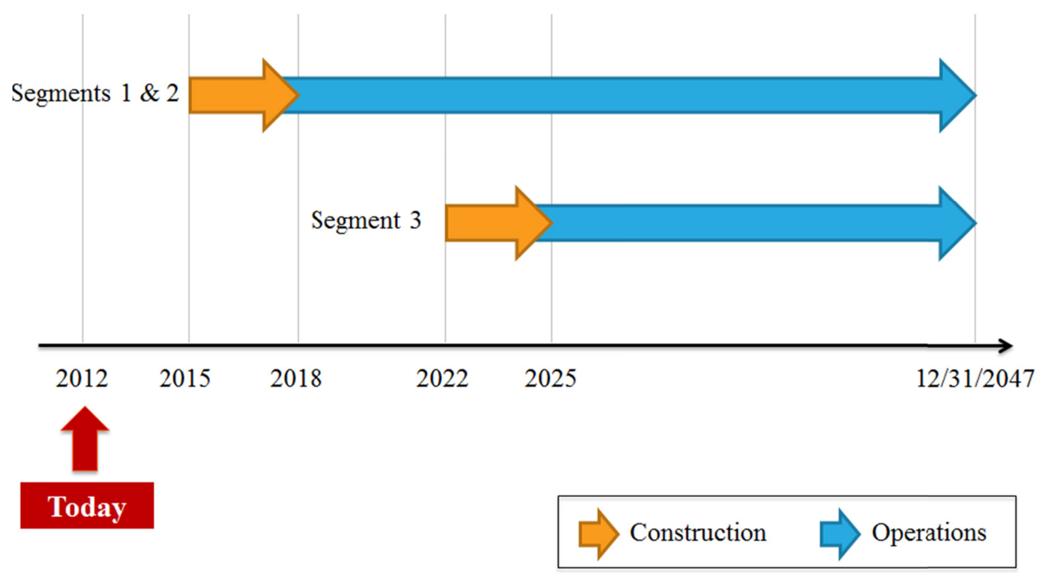
8.2.1 Quantitative Evaluation Methodology

For the purpose of this analysis, the following Project timeline was assumed:

- The Project would start construction in 2015, after a 3-year development and procurement period starting in 2012.
- The overall Project forecast would then last 33 years, which accounts for a 3-year initial construction period and a 30-year operation period.
- Segments 1 (2.7 miles long) and 2 (1.3 miles long) would be built together between 2015 and 2018. They would begin operations in 2018 and continue operations through the end of 2047.
- Construction of Segment 3 (2.4 miles long) would begin in 2023. Despite longer guideways, it would only take 2 years to complete (i.e., 1 year less than Segments 1 and 2) due to the simpler layout. Operations would begin in 2025 to coincide with commencement of BART service to Santa Clara Station.
- Operating costs and revenues would continue up until the end of 2047. However, it is probably that the system's operations would continue beyond that date.

Figure 14 illustrates the timeline assumptions for the purpose of this analysis.

Figure 14: Project Timeline



Source: Arup
Note: An operating period of 30 years has been assumed for this analysis (i.e., 2018–2047) to account for at least one full cycle of vehicle replacement for all three segments.

The Project consists of a 6.4 linear mile alignment with elevated concrete structures and 10 stations. Arup developed baseline cost estimates for the construction and operation of the Project. These estimates are based on benchmark data and project-specific bottom-up analysis.

In line with industry best practices, Arup assessed Project risks for the likelihood of occurrence and potential cost or schedule impact. Three scenarios were simulated, each defined by different confidence levels: the Optimistic Case, the Most Likely Case, and the Pessimistic Case.

In collaboration with the City, Arup identified potential revenues from the following sources to support the operations and maintenance of the Project:

- Annual Airport operations budget savings from the discontinuation of the current Airport shuttle bus services that would be completely replaced by the ATN services (“Bus Savings”);
- Incremental parking revenue associated with the increased demand for the ATN system; and
- Advertisement on the ATN system.

At this time, the City has not identified funding sources to support the construction of the Project.

For the revenue estimates it was considered appropriate to use sensitivities applied on the Bus Savings component of the potential revenue sources listed above.

Table 18 below provides a summary of the assumptions used in the three scenarios. Discussions with the City indicated that the Most Likely Case was the scenario that best aligned with the City’s cost and risk preferences and therefore would be the basis for Arup’s conclusions and recommendations.

Table 18: Scenario Definition

Scenario	Description	Assumptions
Optimistic Case	Reflects the view generally taken by construction builders and implies a 70% chance that the costs will be higher than the value presented	Risk-adjusted construction costs @ 30th percentile Risk-adjusted operating costs @ 30th percentile Bus Savings sensitivity @ +25%
Most Likely Case	Reflects the view generally taken by the Federal Transit Administration (FTA) and implies a 20% chance that the costs will be higher than the value presented	Risk-adjusted construction costs @ 80th percentile Risk-adjusted operating costs @ 80th percentile No Bus Savings sensitivity
Pessimistic Case	Reflects the view generally taken by lenders and implies a 5% chance that the costs will be higher than the value presented	Risk-adjusted construction costs @ 95th percentile Risk-adjusted operating costs @ 95th percentile Bus Savings sensitivity @ -25%

Source: Arup

Finally, in order to estimate a funding gap range, a cash flow model was created for each scenario, comparing the Year-of-Expenditure (YOE) (i.e., indexed) risk-adjusted construction, operations and maintenance costs with forecasted revenues over the assumed 33-year life of the Project.

8.2.2 Qualitative Evaluation Methodology

In collaboration with the City, Arup identified a number of overarching delivery objectives for the Project grouped into four main areas: technology, procurement, transportation, and funding/financing.

Working with the City five Project Delivery Objectives were prioritized and evaluation criteria were defined for each of these in order to assess the Project.

Table 19 summarizes the Project Delivery Objectives and related evaluation criteria.

Table 19: Project Delivery Objectives and Evaluation Criteria

Project Delivery Objectives	Evaluation Criteria
1. Be compliant with VTA and Measure A funding requirements	• The Project should fulfill the Measure A requirement to build a people mover rail connection between the Airport and the VTA, Caltrain, and BART systems.
2. Be affordable when compared to alternative systems	• Ongoing operations and maintenance costs should be comparable to or less than the costs of operating existing shuttle bus services. • Construction costs should be comparable to or less than the APM option previously considered.
3. Minimize overall Project uncertainty (e.g., technology, regulatory approvals)	• The Project risk profile should be at a level acceptable to the City and there should be no apparent "fatal flaws." (1)
4. Maximize access and "equity of use" (e.g., for economically disadvantaged groups and Airport staff)	• The Project should not collect fares from the general public or Airport staff.
5. Maximize revenue potential without compromising access and "equity of use"	• All viable commercial revenue sources, other than fares, should be considered.

Source: Arup

Note: (1) A "fatal flaw" is a technical or financial factor that would rule out proceeding with the Project to the next level of evaluation. A technical fatal flaw may involve the ATN technology, the Project's physical context, alignment or ridership. A financial fatal flaw may involve the City's affordability limit with regards to operations and maintenance costs and construction costs. An absence of apparent fatal flaw at this stage is not a recommendation to proceed but rather an absence of evidence that would bar the Project from proceeding to the next level of evaluation.

8.3 Evaluation Results

8.3.1 Quantitative Evaluation

8.3.1.1 Funding Gap Analysis

The results of the funding gap analysis are summarized in **Table** 20**: Quantitative Assessment Summary (YOE Dollars)** and include the effect of inflation from 2012 to 2047 (i.e., YOE dollars).

The funding gap assessment differentiates between the construction and operation period of the Project. This is because potential restrictions exist for different sources of funds. Federal grants may only be used for construction projects while savings generated from discontinued shuttle bus services may only be used for operating the Project.

Based on the Most Likely Case, which best reflects the City's cost and risk preferences, the results indicate that:

(1) The funding identified for the Project's operations (i.e., bus savings) is greater than the estimated operations and maintenance costs (i.e., there is no funding shortfall during operations).[16]

(2) A significant construction funding gap would need to be overcome to build the project given that no capital funding has been committed yet.

Table 20: Quantitative Assessment Summary (YOE Dollars)[(1)]

	Optimistic Case (YOE $, Million)	Most Likely Case (YOE $, Million)	Pessimistic Case (YOE $, Million)
Average Annual Operations Funding Surplus/ (Gap)	9	1	(6)
Construction Funding Surplus / (Gap) [(2)]	(747)	(1,019)	(1,205)

Source: Arup

Notes:

[(1)] The assumed base date is January 1, 2012 for indexation purposes.

[(2)] This analysis does not include possible private financing costs as it assumes that construction will be funded by public sources (local, state and federal). As noted elsewhere in the report, the option to use private financing as part of a possible project development and procurement strategy will be considered in future studies.

8.3.1.2 Transportation Mode Comparison

As shown in Table 21, Arup has also conducted a high-level cost comparison of the ATN system with shuttle buses and Automated People Mover (APM) modes of transportation. The APM option was previously considered by the City under a separate study by another consultant team. The APM comparison in this study represents the route that was the most analogous to the ATN route. Please see Arup's memorandum titled "San José ATN Feasibility Study Cost Comparison Methodology" in Appendix C, which provides further details on how the APM risk-adjusted costs were derived.

This comparison shows that there is no apparent financial fatal flaw with the Project since the ATN system, based on the Most Likely Case, meets Project Delivery Objective 2 of affordability by offering:

- Operations and maintenance costs that are comparable to the cost of operating existing shuttle bus services
- Construction costs that are lower than the APM option.

[16] Subsequent to the preliminary business case analysis, the Airport reduced its shuttle bus budget for FY 2012-2013. If the City were to move forward with this project at some time in the future, all potential revenue sources would be reevaluated at that time.

In addition, the ATN system offers improved passenger experience and level of service.

Table 21: ATN, Shuttle Buses, and APM Cost Comparison in 2012 Dollars

Mode	Risk-Adjusted Construction Costs (2012 $, Million)	Annual Operations and Maintenance Base Costs (2012 $, Million)	Comments
ATN System	758 [2]	10	• Waiting time generally less than 1 minute • On-demand point-to-point travel • Reduced walking distance due to 10 passenger stations • Passenger experience: Excellent e.g. improved wait time, travel time, comfort, point-to-point service
Shuttle Buses	N/A	10	• Longer travel times for Airport shuttle buses and VTA Flyer Line 10 • Longer headways [5] for VTA Flyer Line 10 (15-20 minutes) • Stops at all stations
Airport People Mover [3]	967 [4]	Estimates not available for comparison purposes [1]	• Passenger experience: Good, but service limited to half the locations of the ATN or shuttle bus services • Headway [5] 2 minutes on routes between the terminal stations and 4 minutes on routes to Caltrain and VTA • Stops at 5 passenger stations and would not serve Lot 4 Daily Parking

Source: Arup, Airport FY 2011-12 budget, San Jose International Airport APM Projects Conceptual Cost Estimate (September 2001)

Notes:

(1) Operations and maintenance cost were not available from previous studies.

(2) Most Likely Case, expressed in 2012 dollars (note that Table 20: Quantitative Assessment Summary (YOE Dollars) costs are expressed in YOE dollars)

(3) An underground option was explored in 2001, which assumed free transfer of tunnel boring machines from the BART extension project. The route used for comparison here is based on the alignment around the Northern end of the airfield and does not use tunnel boring machines.

(4) Includes 40% categorical risk contingency, which is significantly less than the ATN categorical risk contingency (based on the Most Likely Case, 134%). This is due to the fact that the APM is a proven technology with a track record and regulatory approval in the United States. Please see the

APM Cost Comparison Methodology Memo in Appendix C for more information about the adjustments made to the 2001 cost estimate to compare APM with ATN.
(5) Headway is defined as the interval time between vehicles.

8.3.2 Qualitative Evaluation

Based on the evaluation of the City's Project Delivery Objectives summarized in Table 22, in order to proceed with the next stage of the Project as it is currently planned, the priority should be to reduce the Project uncertainty to an acceptable level for the City and prepare an adequate funding plan to address the funding gap identified. At that point a financing and procurement method assessment can be made.

Table 22: Qualitative Assessment Summary

Project Delivery Objectives	Evaluation Criteria	Evaluation Results
1. Be compliant with VTA and Measure A funding requirements	▪ The Project should fulfill the Measure A requirement to build an automated rail connection between the Airport and the VTA, Caltrain, and BART systems.	Objective met: ▪ The Project achieves VTA criteria to date.
2. Be affordable when compared to alternative systems	▪ Ongoing operations and maintenance costs should be comparable to or less than the costs of operating existing shuttle bus services. ▪ Construction costs should be comparable to or less than the APM option previously considered.	Objective met: ▪ The Project achieves both criteria within reasonable range. (See section 1.5.1 Quantitative Results above).
3. Minimize overall Project uncertainty (e.g., technology, regulatory approvals)	▪ The Project risk profile should be at a level acceptable to the City and there should be no apparent fatal flaws.	Objective not met: ▪ There are no apparent fatal flaws. ▪ The ATN technology requires further development (1) ▪ The cost and schedule risk analysis conducted in this study conservatively estimates the technology and project-specific risks identified for the Project at this point of development of the ATN technology.

Project Delivery Objectives	Evaluation Criteria	Evaluation Results
4. Maximize access and "equity of use" (e.g., for economically disadvantaged groups and Airport staff)	▪ The Project should not collect fares from the general public or Airport staff.	Objective met: ▪ The Network provides direct connection to public transit; no fares assumed for users.
5. Maximize revenue potential without compromising access and "equity of use"	▪ All viable commercial revenue sources, other than fares, should be considered.	Objective met: ▪ No fares assumed, but all viable alternative revenue sources have been considered (e.g., advertising).

Source: Arup
Note:(1) As per Aerospace's report titled "Automated Transit Network Feasibility Evaluation – San José Mineta International Airport" dated August 7, 2012.

8.4 Evaluation Assumptions and Analysis

8.4.1 Base Costs

Arup used benchmark data and project-specific bottom-up analysis to develop preliminary life-cycle costs, consisting of construction, operation, maintenance, and renewal costs.

The base costs for the Project Segments have been estimated in 2012 dollars prior to the risk adjustments. Note that the base costs should not be used for budgetary or planning purposes. Only the total risk-adjusted figures, presented in Section 8.4.3 below, should be used for that purpose. Table 23 below provides a summary of the base costs, which are detailed in the Rough Order of Magnitude Cost Estimate in Appendix C.

Table 23: Base Costs Summary – Not for Budgetary or Planning Purposes

Base Costs	2012 $, Million
Construction Base Costs (Total – All Segments)	280
Development Base Costs (Total – All Segments)	70
Operations and Maintenance Base Costs (Annual – All Segments)	10

Source: Arup

8.4.2 Revenues

In order to fulfill the two Project Delivery Objectives, of (1) maximizing access to the Airport and (2) providing "equity of use," the City recommended that the

Project not collect fares from the general public or Airport staff. This approach is in line with other international benchmarks.

The primary source of Project revenues considered at this time are the Bus Savings defined as the savings from the Airport's operating budget as a result of discontinuing the shuttle bus services at the Airport and the VTA Flyer Line 10 since those services would be replaced by the ATN service. This budget includes all vehicle, fuel, staff and overhead costs. The shuttle bus budget was assumed to increase annually by 1.50% per annum between 2012 and 2027 to account for the forecasted growth in Airport passengers. However, the City Council would need to take action to dedicate the Bus Savings to the Airport ATN Project. If it chose otherwise, the ATN Project revenues assumptions would need to be altered.

Empirical evidence obtained at other airports around the world show that an improved passenger experience traveling from remote parking lots to airport terminals results in high utilization of the parking lots (i.e., increased demand). Arup has assumed that all of the incremental revenue from the car-parking lots connected to the ATN will be dedicated to fund the ongoing operations of the ATN system. In addition, Arup has estimated that the increase in parking revenue will be approximately equal to 10% of the current annual revenue at the car-parking lots served by the ATN.

This source of revenue is assumed to commence in the second year of operation. This ramp-up period is in line with Airport expectations and benchmarking data. Thereafter, this revenue is index-linked to the Airport passenger growth forecast (i.e., 1.50% per annum).

In line with the benchmarking analysis performed in Section 6.3.5, advertisement revenue has been assumed to commence in the third year of operations (i.e., 2020). This would allow sufficient time for the Project to establish market confidence with the system's reliability and ensure increased passenger-service quality and brand recognition.

This revenue has been assumed to increase year-on-year from 2020 by approximately $70,000 (2012 dollars) per annum up to a maximum amount of $0.5 million (2012 dollars) in the second year of operation of Segment 3 (i.e., 2026). Thereafter, this revenue is capped at $0.5 million (2012 dollars) per annum.

As discussed in Section 6.3, other revenue sources (e.g., revenue from adjacent developments) were considered, but these sources were not deemed to be commercially viable at this stage of the analysis.

Table 24 below provides a summary of the estimated revenues primarily considered to support the operation and maintenance of the Project.

Table 24: Revenues Summary

Revenues	Annual Revenues (2012 $)
Bus Savings	• Total for all Project Segments: $9 million o Segments 1 and 2: $8 million o Segment 3: $1 million • 2012–2027: 1.50% increase per annum (1)
Other Revenues – Additional Parking Revenue dedicated to the ATN project	• 2019: $1.2 million • 2020–2027: 1.50% increase per annum
Other Revenues – Advertisement Revenue	• 2020–2025: $70,000 increase per annum up to a cap of $0.5 million per annum • 2026–thereafter: capped at $0.5 million per annum

Source: Arup

Note: (1) The Airport expects a 1.50% annual increase in budget for shuttle buses between 2012 and 2027. To account for this, bus savings have also been increased by 1.50% per annum between 2012 and 2018, commencement year of operations.

8.4.3 Risk Analysis

The objective of the risk analysis was to determine the total expected costs based on Project-specific knowledge. The Project-specific risk analysis was conducted using a number of industry best-practice methods, such as Monte Carlo simulation of key risks, risk workshops with the Project team, discussions with industry/supplier experts and construction practitioners, and incorporation of experience from precedent projects.

For the purposes of this risk analysis, the construction method assumed was a Design–Build approach. This was assumed given the technical complexity and specialist expertise required to build the Project, and market precedents of comparable projects.

The risk contingencies, summarized in Table 25 along with risk-adjusted costs, are within the expected benchmark range for a project of this complexity, technology track record, and level of design development detail.

Table 25: Risk-Adjusted Costs – All Segments

Scenario	Optimistic Case (2012 $, Million)	Most Likely Case (2012 $, Million)	Pessimistic Case (2012 $, Million)
Confidence Range (1)	*30th Percentile*	*80th Percentile*	*95th Percentile*
Total Risk-Adjusted Construction Costs	537	758	909
Total Risk-Adjusted Annual Operations and Maintenance Base Costs	11	13	14
Construction risk (2)	66%	134%	181%
Operations and maintenance risk (3)	8%	24%	35%

Source: Arup
Notes:
(1) 80th Percentile Confidence Range means an 80% probability the values in Table 25 will not be exceeded

(2) This is calculated as Categorical Risk / (Total Base Cost + Elemental Risk ($324 million))
(3) This is calculated as (Elemental Risk + Categorical Risk) / Annual Base Costs ($10 million)

Based on the Most Likely Case, the results include a significant risk contingency (134%) when compared to other fixed guideway transportation systems which have a longer track record of commercial operations and longer track record of obtaining regulatory approvals in the United States. For example, the APM project identified in

Table 21 includes a 40% risk contingency. The cost and schedule risk analysis conducted in this study conservatively estimates the technology and project-specific risks identified for the Project at this point of development of the ATN technology. It is critical for the City to set up a process to manage all of the identified Project risks and communicate these expectations to the appropriate stakeholders. Proactively addressing these risks and implementing mitigation strategies will reduce uncertainty and total expected Project costs. To achieve this objective, the City should implement a detailed risk-management process with the objective of reducing or mitigating the potential outcomes of the risks.

Engaging effectively with the industry will also be critical to understand better the key Project risks and the market's ability to manage these. As the Project proceeds the risk analysis performed to date can become the basis for the evaluation and development of a preferred procurement method and the commercial agreements with the private sector appropriate for that method.

8.5 Preliminary Business Case Conclusions and Recommendations

As explained in section 8.2.1, the conclusions and recommendations of the Preliminary Business Case are based on the Most Likely Case, which best reflects the City's cost and risk preferences.

8.5.1 Conclusions

The quantitative and qualitative assessments have demonstrated that there is no apparent fatal flaw with the Project. In this context, it is important to consider that the quantitative cost and risk analysis conducted in this study have conservatively estimated the technology and Project-specific risks at this point of development of the ATN technology. In particular, the following conclusions can be drawn:

- The Project is self-sustaining during operations and generates an average annual operating surplus of $1 million (YOE dollars) relative to the potential revenue sources considered in this study. However, with no capital funding committed or identified for the Project to date, a $1 billion (YOE dollars) construction funding gap would have to be overcome to build it. The City should prepare a robust Project funding plan to address this gap in construction funding.
- When compared to alternative modes of transportation systems, there is merit to explore the Project as a viable alternative because the estimates are that it has lower construction costs than the previously considered APM project, in addition to offering improved connectivity (i.e., twice as many passenger stations), passenger experience, and level of service.
- As shown in Table 22 above, the Project meets four of the City's five Project Delivery Objectives (Project Delivery Objectives 1, 2, 4, 5) and there are no apparent technical (i.e., technology, physical context, alignment, ridership) or financial (i.e., breach of the City's affordability limit) fatal flaws. An absence of apparent fatal flaw at this stage is not a recommendation to proceed but rather an absence of evidence that would bar the Project from proceeding to the next level of evaluation.
- As per Aerospace's report titled "Automated Transit network Feasibility Evaluation – San José Mineta International Airport" and dated August 7, 2012, the ATN technology requires further development to demonstrate its ability to deliver the passenger-carrying capacity required for the network of stations contemplated for this Project.
- The uncertainty levels are within the expected benchmark range for a project of this complexity, technology track record, and level of design development; but inherent in any project are unrecognized risks, which may change the expected results. As the Project is further developed these uncertainties can be further mitigated and the contingency levels reduced.

During the next stage of the Project Arup recommends that the City focus its effort to address the following key Project development tasks that are considered critical for its success:

1. Demonstrate readiness of the ATN technology to meet the Project's specific requirements.
2. Engage the ATN technology industry's availability and ability to deliver.
3. As the technology is further developed, identify strategies to optimize the Project costs and mitigate risks and uncertainties.
4. Prepare a robust capital funding plan.
5. Develop a plan to resolve regulatory, environmental, and stakeholder approvals.

Arup has identified possible development options in Section 8.5.2 to address these key Project development tasks.

8.5.2 Recommendations

8.5.2.1 Project Development Options

In order to develop the Project further, Arup has considered four possible development options. These options are strategies to address the first four key Project development tasks identified above. The last Project development task (i.e., regulatory, environmental, and stakeholder approvals) is outside the scope of this report, but Arup recognizes this should be addressed in parallel. It will have a critical impact on the schedule for delivering the Project and gaining the appropriate level of political/public support.

For analysis purposes, each of the following development options has been considered independently, but in practice, they may have shared components:

- Option 1: The ATN industry leads the market with research and development, plus the experience gained from delivering other projects around the world (i.e., the City waits for the market to mature).
- Option 2: The City and any other collaborating agencies, leads a research and development program.
- Option 3: The City and any other collaborating agencies, and the ATN industry collaborate with shared costs and benefits. Note that this option has two sub-options, namely, Option 3A – "Preferred Supplier" and Option 3B – "Industry Collaboration".
- Option 4: The City prepares an RFP for a "starter project" that can be delivered with the current technology and industry delivery capabilities.

Please see Appendix E, the Preliminary Business Case Report, for a more detailed description of these options.

8.5.2.2 Project Development Recommendation

Following several Project team workshops with the City, Arup evaluated the relative merits of each development option. Arup recommends Option 3A – "Preferred Supplier" in order to address the Project development tasks identified.

The Project is a transportation project with significant innovation of technology and type of service it provides. There are no standard approaches for development and procurement for delivering the Project. As identified above, this Project will involve a significant amount of development, requiring a creative approach to deliver it successfully.

The key aspect of the recommended approach is to engage industry effectively in order to advance the Project feasibility. This approach would allow a "client" and "supplier" to focus on a particular project in order to advance the understanding of technology readiness and the industry's delivery capabilities.

In addition, this approach would demonstrate commitment and willingness to succeed on both sides. Based on our discussions during the Request for Information process (2011), the ATN industry is willing to engage in collaborative efforts, within commercially feasible limits, in order to advance the technology.

The primary benefits of this option are the ability to maintain a constructive and collaborative engagement with the Preferred Supplier, while respecting intellectual property rights and / or commercially sensitive information. The Preferred Supplier approach should lead to more efficient progress and incorporate innovation early in the process. The benefits of pursuing the recommended Option 3A – "Preferred Supplier" development option are summarized follows:

- Leadership: Show strong leadership by engaging with industry early to attract and incentivize progress, and advance the schedule to achieve a "first mover" advantage.
- Project goals: Establish clear expectations by defining the outline Project requirements and identify clear Project goals.
- Industry understanding: Establish a comprehensive industry understanding by sharing the key findings to solicit constructive feedback, innovative ideas, identify any fatal flaws, and better understand and validate the industry expertise and capability.
- Right partnership: Identify the right partnership and relationships by openly communicating and engaging with prequalified suppliers (e.g., selection based on capabilities, experience, financial standing/capability, key personnel, approach, and Project understanding).
- Mutual goals: Define mutual goals by creating the appropriate attitudes and incentives in order to engage industry innovation and reduce the Project uncertainty. The City should create a "win-win" scenario. This could involve a shared cost "co-development" agreement with clear decision-making / acceptance criteria.

- Maintain competition: Maintain control of a fair, competitive, and transparent procurement process. The City should seek objective results with sufficient flexibility to maintain control of a competitive procurement process. With a "co-development" agreement cost sharing provisions could be adopted on an "open book" basis. In addition, the City could establish an "option to re-bid" the final delivery contract, once the feasibility determination stage has been reached. This will allow alternative suppliers to bring wider industry experience and knowledge to bid the Project, if necessary. In addition the City would include appropriate "off- ramps" in the co-development agreement to ensure competitive tension is maintained with the Preferred Supplier. At the end of the development process (i.e., the point at which the Project has been determined feasible for procurement), the City would start a new procurement process to complete the design, construction and operation of the Project.

The recommended next steps are summarized in Section 9.3.

9 Conclusions and Next Steps

Based on the analyses performed by Arup and its subconsultants for the San José ATN Feasibility Study, Arup has drawn the conclusions and next steps below.

9.1 Overall Conclusions

The following are Arup's primary, high-level conclusions for the San José ATN Feasibility Study.

- The Recommended Alignment demonstrates that at least one conceptual route is feasible given the physical constraints of the study area and the required connections of the ATN.
- The Recommended Alignment would link Terminal A, Terminal B, ConRAC, airport parking lots, VTA Light Rail on N. First Street and Caltrain/future BART at Santa Clara Station. Other destinations may be served using infill stations or by extending the network.
- ATN passenger trips between Terminal A and Terminal B/ConRAC would be highly directional and would experience sharp peaks in demand. Demand on the rest of the network is relatively low.
- The ATN system would be anticipated to serve approximately 6,000 passengers per day under year 2011 airport demand, and 14,000 passengers per day under year 2030 airport demand.
- The Project meets four of the City's five Project Delivery Objectives (Project Delivery Objectives 1, 2, 4, 5) and there are no apparent technical (i.e., technology, physical context, alignment, ridership) or financial (i.e., breach of the City's affordability limit) fatal flaws. An absence of apparent fatal flaw at this stage is not a recommendation to proceed but rather an absence of evidence that would bar the Project from proceeding to the next level of evaluation.
- The Project is self-sustaining during operations and generates an average annual operating surplus of $1 million (YOE dollars) relative to the potential revenue sources considered in this study.
- With no capital funding committed or identified for the Project to date, a $1 billion (YOE dollars) construction funding gap would have to be overcome to build it.
- The project risks associated for implementing the ATN are higher than they would be for an Automated People Mover or bus transit project, particularly in the areas of technological and regulatory risk.
- The estimated capital cost of the ATN, including appropriate levels of contingency, is less than the cost of the APM system that was planned for the Airport.

- The estimated operating cost of the ATN is comparable to the savings that would be achieved by discontinuing the VTA Flyer and Airport shuttle operations.
- The ATN could offer a higher quality passenger experience than the existing VTA Flyer and shuttle buses by providing minimal waiting time, direct point-to-point service and a private riding experience.

9.1.1 Secondary Conclusions

Arup offers the following additional conclusions.

- The Recommended Alignment is intended to achieve a balance between increasing constructability, lowering potential cost, and maximizing travel speed on the guideway. Other alignments may also be feasible and will offer different tradeoffs.
- The Recommended Alignment is intended as a vendor-neutral reference to be used for planning purposes. The ultimate alignment will need to be further refined and optimized, in accordance with the technical specifications of the select vendor.
- ATN offers the potential for significant travel time savings compared to the VTA Flyer and shuttle bus services it would replace.
- In the context of the regional transportation network, trips to the Airport using a combination of ATN and existing rail transit would likely remain relatively uncompetitive compared to corresponding trips made by auto.
- Fare revenue opportunities for the Project are limited. The Airport has a mandate to provide free transit service as a condition of the State Air Board's certification of the Airport Master Plan.
- The Project, as conceived, would likely not result in significant environmental effects that are not able to be mitigated.
- As per Aerospace's report titled "Automated Transit network Feasibility Evaluation – San José Mineta International Airport" and dated August 7, 2012, As per Aerospace's report, the ATN technology requires further development to demonstrate its ability to deliver the passenger-carrying capacity required for the network of stations contemplated for this Project.
- The cost and schedule risk analysis conducted in this study conservatively estimates the technology and project-specific risks identified for the Project at this point of development of the ATN technology. The uncertainty levels are within the expected benchmark range for a project of this complexity, technology track record, and level of design development; but inherent in any project are unrecognized risks, which may change the expected results. As the Project is further developed these uncertainties can be further mitigated and the contingency levels reduced.

9.2 Major Project Risks

9.2.1 Technology Risk

Preliminary reports from Aerospace indicate that the ATN application would challenge the demonstrated technological capability of the systems in operation today. These challenges are detailed in the Aerospace Final Report. Issues cited by Aerospace include:

- Ensuring the system can provide sufficient network capacity to serve the relatively highly directional peak hour demand at the Airport;
- Ensuring the system can provide sufficient station loading/unloading capacity at the Airport terminal stations; and
- Constructing and operating a system on a scale larger than has been previously demonstrated for this technology.

9.2.2 Regulatory Risk

The ATN project would need to obtain regulatory approvals for a form of public transportation that has not be previously been implemented in the United States and California. The new regulatory pathway will need to simultaneously meet public safety goals and allow flexibility of innovation and improvement. The timeline for obtaining regulatory approvals, the level of effort required and the funding sources for the regulatory process are unknown. More detail on this is included in the Aerospace Final Report.

9.2.3 Physical and Environmental Risks

This initial effort indicates that the ATN Recommended Alignment is physically feasible and that the project is not likely to result in negative, unmitigatible environmental effects. However, environmental, infrastructure and constructability considerations will need to be analyzed in further detail to ensure guideway and station that blend safe function, protection of natural resources, maintenance of airport operations, and aesthetic compatibility with the existing context.

9.3 Next Steps

The following is an outline of recommended next steps in order to further develop the Project as necessary to decide on the most appropriate implementation strategy.

Project Delivery/Leadership

- Set up the dedicated City Project-delivery team with appropriate leadership, management, and governance resources.
- Determine the decision-making protocol.

- Establish and maintain political leadership and support at local, state and federal levels.

Partnerships/Stakeholders

- Leverage valuable partner relationships to develop the Project (e.g., ATN vendors, local industry, state and federal agencies).
- Consider engaging stakeholders with Memorandums of Understanding, etc.
- Determine the public outreach/communication protocol.

Technology

- Engage with industry and adopt a suitable path forward to test/prove/demonstrate technology.
- Prepare "bankable" risk profile (e.g., identified development options),

Approvals/Regulatory

- Solicit input from regulators on applicable codes/standards.
- Prepare to implement environmental clearance process including commissioning topical environmental studies.
- Define project approval process (e.g., approval agencies, legislative approval, etc.).

Costs/Risks

- Define minimum Project performance requirements.
- Advance level of design detail and refine costs/risk estimates.
- Define acceptable level of overall affordability (i.e., construction costs, and operations and maintenance costs).
- Implement Project risk-management strategies.
- Define acceptable risk-tolerance level.

Funding

- Identify a stable, predictable funding plan for short-, medium-, and long-term goals with level of commitments and timing of availability.

Financing/Tax/Insurance

- Consider alternative procurement strategies and evaluate which one is best suited for the City using a Value for Money comparative analysis (e.g., Design–Build, Design–Build–Finance, and Design–Build–Finance–Operate–Maintain, etc.).
- Explore private sector appetite for procurement methods that rely on transfer of risks to the private sector and the use of private financing.