Appendix A

Route Options Memos

A1 Recommended Routing Option 1 Memo

A2 Round 2 Options Comparison Memo

A3 Round 3 Options Memo (Revised)

A4 Recommended Alignment Memo

Memorandum

ARUP

To	Laura Stuchinsky Henry Servin Manuel Pineda	Date	June 3, 2011
Copies	Thomas Paige Everett L. Midkiff Austin Smith	Reference number	214704/GH
From	Gary Hsueh William Baumgardner	File reference	4-05
Subject	San José ATN Feasibility Study Recommended Routing Option 1		

Introduction

This memo summarizes Arup's recommendation for Routing Option 1, the first of three to be evaluated in Task 3 of the San José ATN Feasibility Study. First, a summary is presented of the recommended Option 1. Then the screening used to develop this option process is presented.

The objective of Option 1was to develop a minimum operable segment for an ATN system that serves Traminal A, Terminal B, and VTA light rail on N. 1st Street. Arup used a two-step screening process to develop the recommended option. In the first step, a large number of variations were considered for each of three physical areas:

1. San José Airport terminal area stations
2. N. 1st Street light rail stations
3. Crossings of the Guadalupe River, US-101, Guadalupe Parkway (SR-87) and connection to N. First Street

Out of this work, one terminal option and three N. 1st Street connection options were carried forward for comparative second level screening effort. The second step of screening merged the one terminal area option with three of the most promising crossing options to form three complete options. The results of this screening are shared at the end of this memo.

Recommendation

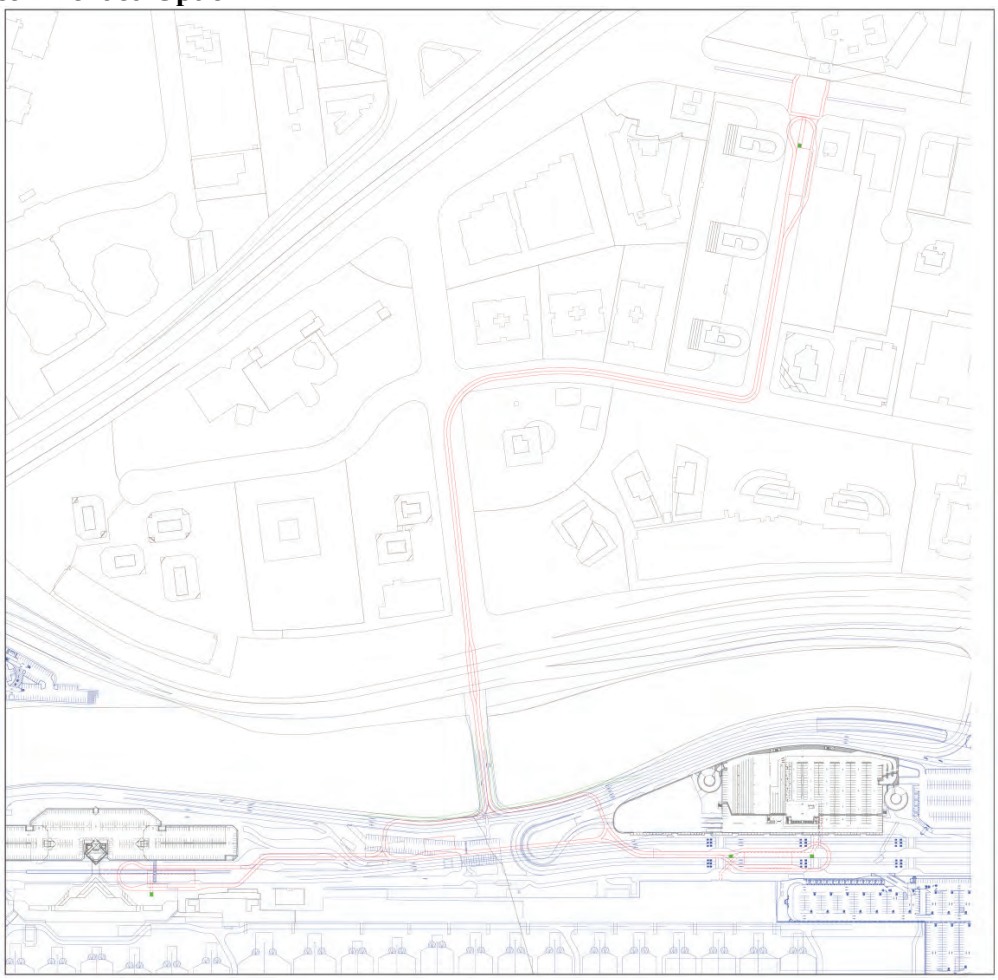
Arup recommends the following routing for Option 1:

- Three elevated stations, located:
  - Terminal A: in the median of Terminal Drive between Terminal A and Terminal A parking garage
  - Terminal B: in the median of Terminal Drive between Terminal B and ConRAC
  - VTA Light Rail: In the median of Metro Drive near North First Street and the Metro/Airport Light Rail Station
- The Terminal A platform/berths would be elevated at approximately a third-floor level, with a mezzanine level below at second-floor level that provides passenger access to the pedestrian bridge over Terminal Drive and directly to the ground-floor level inside the Terminal A building.

- The Terminal B platform/berths would also be elevated and have a mezzanine level below providing passenger access across Terminal Drive into both ConRAC and the Terminal B building, while also providing direct access to ground level in the median of Terminal Drive.
- The Metro/Airport LRT station would be elevated at second-floor level and provide vertical circulation down into the median of Metro Drive, at which point passengers would walk to either light rail platform.
- An elevated guideway connecting Terminal A, Terminal B, and Metro/Airport. It would be mostly elevated as it connects between Terminal A and Terminal B, and as it connects from the Airport terminal area to Metro/Airport station. The guideway would form a one-lane, one-way loop around the intersection of Airport Parkway and Airport Boulevard, allowing the guideway to descend to grade level to cross the Guadalupe River via the existing Airport Parkway bridge. The guideway would then cross under SR 87 in the median of Airport Parkway, then rise and cross over the eastbound lanes of Airport Parkway to cross over into the median of Technology Drive. Then the guideway would turn into the median of Metro Drive.

Figure 1 shows the Recommended Option 1. Refer to the attached Recommended Option 1 diagram for a larger version.

Figure 1. Recommended Option 1



Memorandum

Screening and Evaluation Criteria

Proposed evaluation criteria for Task 3 were previously presented in April. Criteria relevant to the screening of physical alignment of options are summarized in Table 1.

Table 1. Screening Criteria and Indicators

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	"Many" vertical changes or "Few"
Walk Distance	Average additional walk distance or time introduced by ATN	"Long" walk or "Short"
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

Design Criteria

Basic design criteria for the ATN guideway and stations were determined based on the information received from potential ATN vendors through the City of San José Request For Information process. The information provided by potential vendors was assembled and summarized by Aerospace, using the criteria provided by vendors who currently have operating systems or test tracks. During the development of the alignment options, minimum turning radius emerged as a critical design criterion, particularly in the station areas. A minimum 50' turning radius was assumed for this effort to cover the maximum number of potential vendors. However, the smaller radius allowable by some of the vendors would be highly desirable to provide the maximum flexibility and minimum footprint for the guideway design.

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First Level Screening

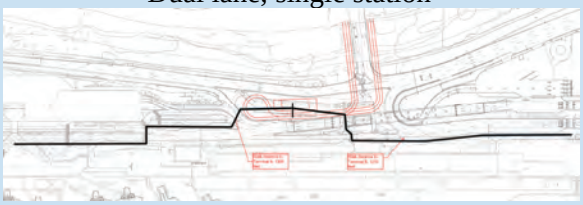
This section describes the first level of screening Arup performed. Arup initiated this step by dividing the study area into three principal areas of investigation:

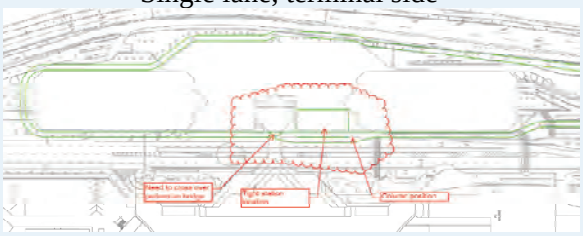
1. San José Airport terminal area stations
2. North First Street light rail stations
3. Crossings of the Guadalupe River, US-101, Guadalupe Parkway (SR-87), and connections to North First Street

Terminal Area

This includes potential station locations and guideway arrangements at Terminal A, Terminal B (also serving ConRAC), as well as a single-station idea to serve both terminals. Table 2 presents the ideas considered and the conclusions of the first level screening exercise.

Table 2. Terminal Area Station Options

Single Station Option	Conclusion
Dual lane, single station 	Requires passengers to walk too far (more than 1,200 feet) to terminal buildings. **Not carried forward.**

Terminal A Station Options	Conclusion
Single lane, at-grade linear station, terminal side	Changes to existing curb and passenger access too significant; does not allow for sawtooth ATN station configuration. **Not carried forward.**
Single lane, terminal side 	Pedestrian bridge is a large obstacle; tight station location on parking structure; insufficient space for columns. **Not carried forward.**

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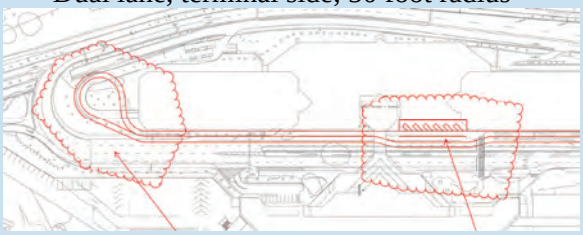
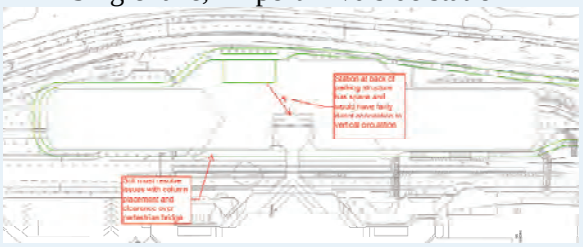
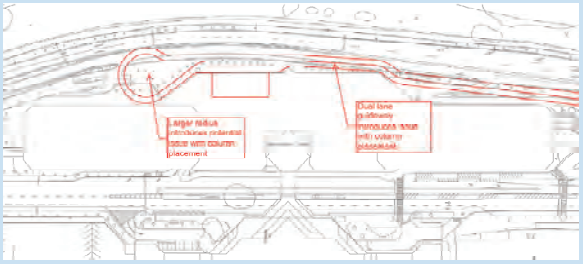
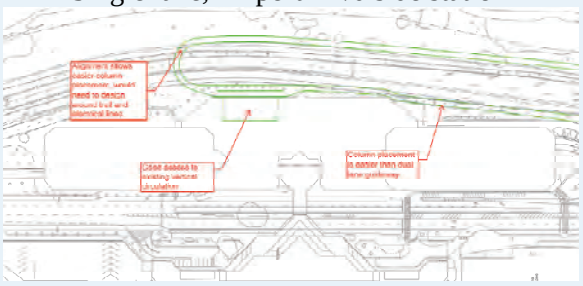
Terminal A Station Options	Conclusion
Dual lane, terminal side, 50 foot radius* 	Turnaround loop extends guideway too far (if terminal architecture not disturbed). **Not carried forward.**
Single lane, Airport Blvd side station 	Station at back of parking structure provides good access to existing vertical circulation, but encounters same issues as other options that have a guideway at the front of the parking garage. **Not carried forward.**
Dual lane, Airport Blvd side station, 50 foot radius* 	Potential problems with column placement. **Not carried forward.**
Single lane, Airport Blvd side station 	Better column placement than other options, but crosses Airport Blvd. **Not carried forward.**

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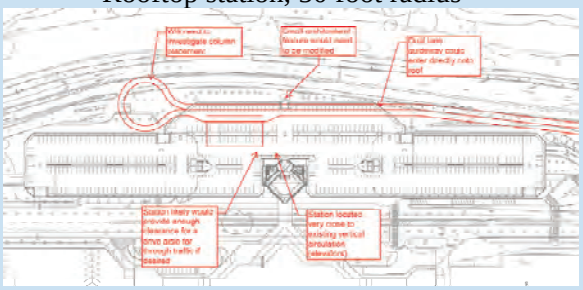
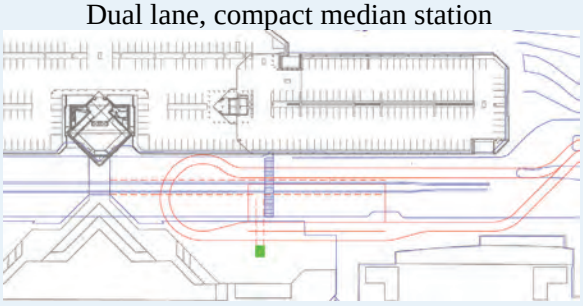
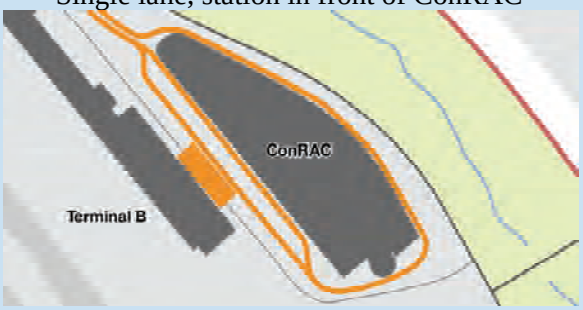
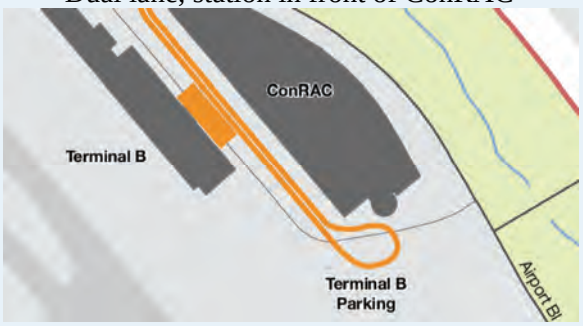
Terminal A Station Options	Conclusion
Rooftop station, 50 foot radius* 	Eliminates most problems with column placement by placing station and guideway completely within roofline of parking garage, but passengers required to go through garage (suboptimal experience). **Not carried forward.**
Dual lane, compact median station 	Maximizes passenger convenience with connections to pedestrian bridge and Terminal A building, at the expense of disruption to existing architecture. **Carried forward.**

* A 30 foot radius option was also investigated for this option

Terminal B Station Options	Conclusion
Single lane, station in front of ConRAC 	Column placement behind ConRAC requires significant changes to Airport Blvd. **Not carried forward.**
Dual lane, station in front of ConRAC 	Simple passenger access, but excessive guideway to accommodate turnaround loop. **Not carried forward.**

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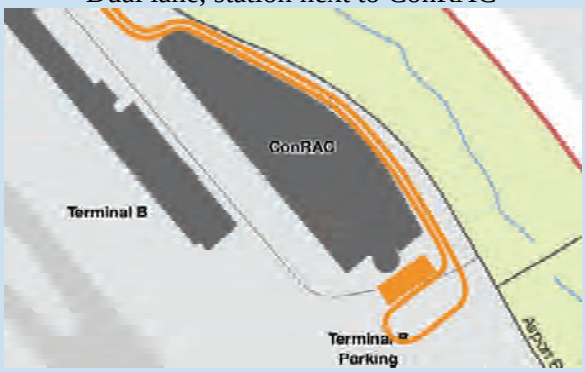
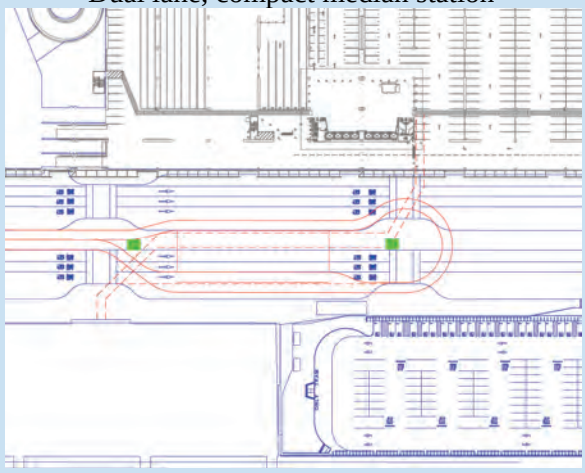
Terminal B Station Options	Conclusion
Dual lane, station next to ConRAC 	Station located far from Terminal B. **Not carried forward.**
Dual lane, rooftop station	Significant modifications required to ConRAC, and many vertical changes for passengers. **Not carried forward.**
Dual lane, compact median station 	Maximizes passenger convenience with same-level connections to ConRAC and Terminal B building, at the expense of disruption to existing buildings. **Carried forward.**

Memorandum

North First Street Light Rail Station Options

The LRT stations considered include Component Station, Karina Station, and Metro/Airport Station. Table 3 presents the ideas considered and the conclusions of the first level screening exercise.

Table 3. LRT Station Options

LRT Station Option	Conclusion
Component, ground level	Significant amounts of (private) vacant land available, resulting in flexibility for routing. Median of Component Drive not available (electrical towers). **Carried forward.**
Karina, ground level	Median station not feasible; this option would require some private property (parking lot). Fairly good access to North First intersection. Potential to work with property owner. **Carried forward.**
Metro/Airport, ground level	Would take a significant amount of private land and would impact existing driveways. **Not carried forward.**

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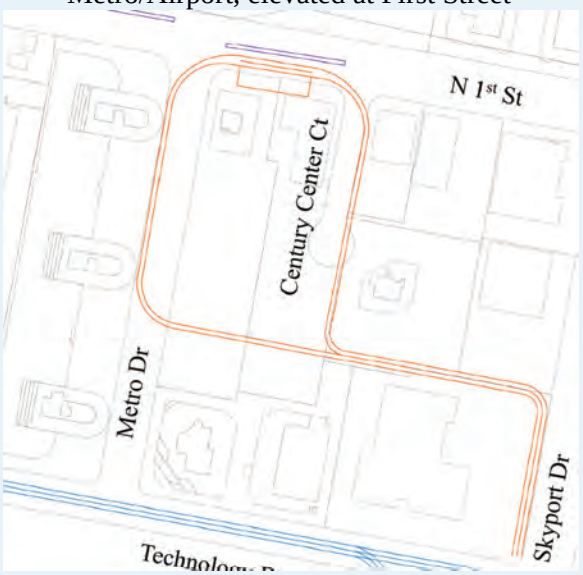
LRT Station Option	Conclusion
Metro/Airport, elevated at First Street 	Aesthetic impact and limited right-of-way on North First Street. Would traverse private property unnecessarily compared to median of Metro Drive. **Not carried forward.**
Metro/Airport, elevated in Metro Drive median	Requires least amount of private land amongst the Metro Drive options. Good access to North First intersection via median of Metro Drive. **Carried forward.**

It was noted that the vacant land surrounding the Component Station area would allow an ATN system to be better integrated into future development; for example, to reduce aesthetic impact of a dual guideway along North First Street, a single loop could instead encircle the development. It was also noted that the median of Component Drive was not available due to the presence of electrical towers, and therefore all ATN infrastructure in the immediate area would likely require crossing private property.

The three station options carried forward to second level screening were:

A. Component (at-grade)
B. Karina (at-grade)
C. Metro/Airport (elevated)

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Crossings and Connections

The routing across major obstacles to the LRT stations are largely dictated by the LRT station. Figure 2 shows the crossings and connections considered, and Table 4 presents the corresponding conclusions of the first level screening exercise.

Figure 2. Crossings and Connections Diagram

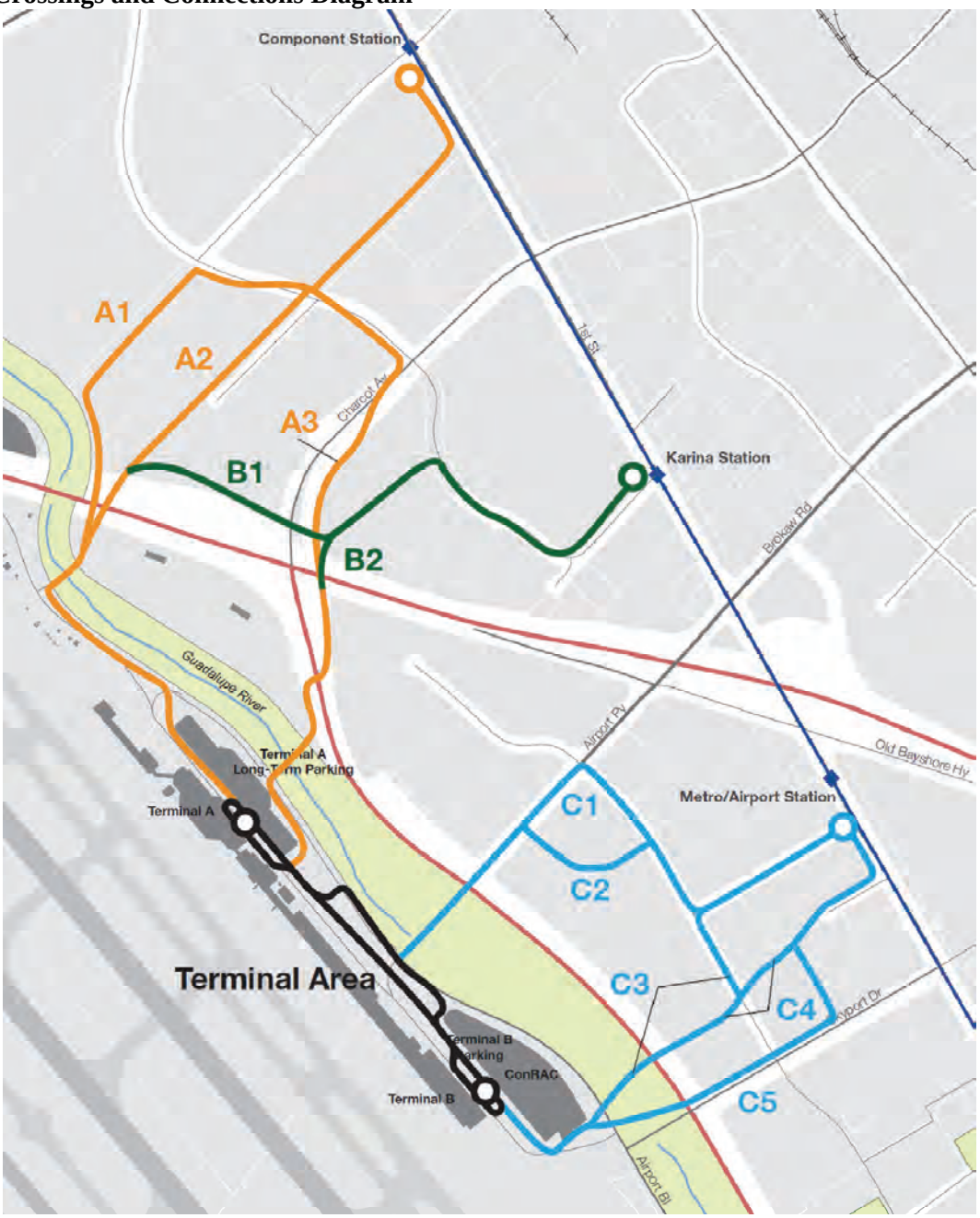

Table 4. Crossings and Connections Options

Crossing and Connection Option	Conclusion
A1 – Component via Green Island	Straightforward crossing over Guadalupe River and US-101. Some electrical lines will need to be relocated. **Not carried forward.**
A2 – Component via Green Island / Atmel Wy	Straightforward crossing over Guadalupe River and US-101. Straighter alignment than A1. **Carried forward.**
A3 – Component via SR 87	Requires two additional crossings over SR-87 compared to A1 and A2. **Not carried forward.**
B1 – Karina via Green Island	Longer distance than B2, but simpler. **Carried forward.**
B2 – Karina via SR 87	Shorter distance than B1, but requires an additional crossing over SR-87. **Not carried forward.**
C1 – Metro/Airport via Airport Pkwy	Crossing at Airport Parkway/Airport Boulevard allows at-grade crossing of Guadalupe River using existing bridge and allows guideway to cross under SR-87 without widening. Disrupts the least amount of private property. **Carried forward.**
C2 – Metro/Airport via Airport Pkwy / Private	Same as C1 but goes along a private drive with fountains in the median. **Not carried forward.**
C3 – Metro/Airport via North of Skyport	Crossing north of Skyport Drive requires long spans over both the river and SR-87. Also leads guideway directly into private property. **Not carried forward.**
C4 – Metro/Airport via APM Study Preferred Alignment	Crossing north of Skyport Drive requires long spans over both the river and SR-87. Alignment disrupts the most private property. **Not carried forward.**
C5 – Metro/Airport via Skyport	Crossing complicated by reconfigured intersection at Skyport Drive and still impacts private property. **Not carried forward.**

Memorandum

Second Level Screening

The three routes brought forward for the second level screening are shown in Figure 3. The terminal area is assumed to be a common element amongst all three routes.

Figure 3. Three Routes for Second Level Screening

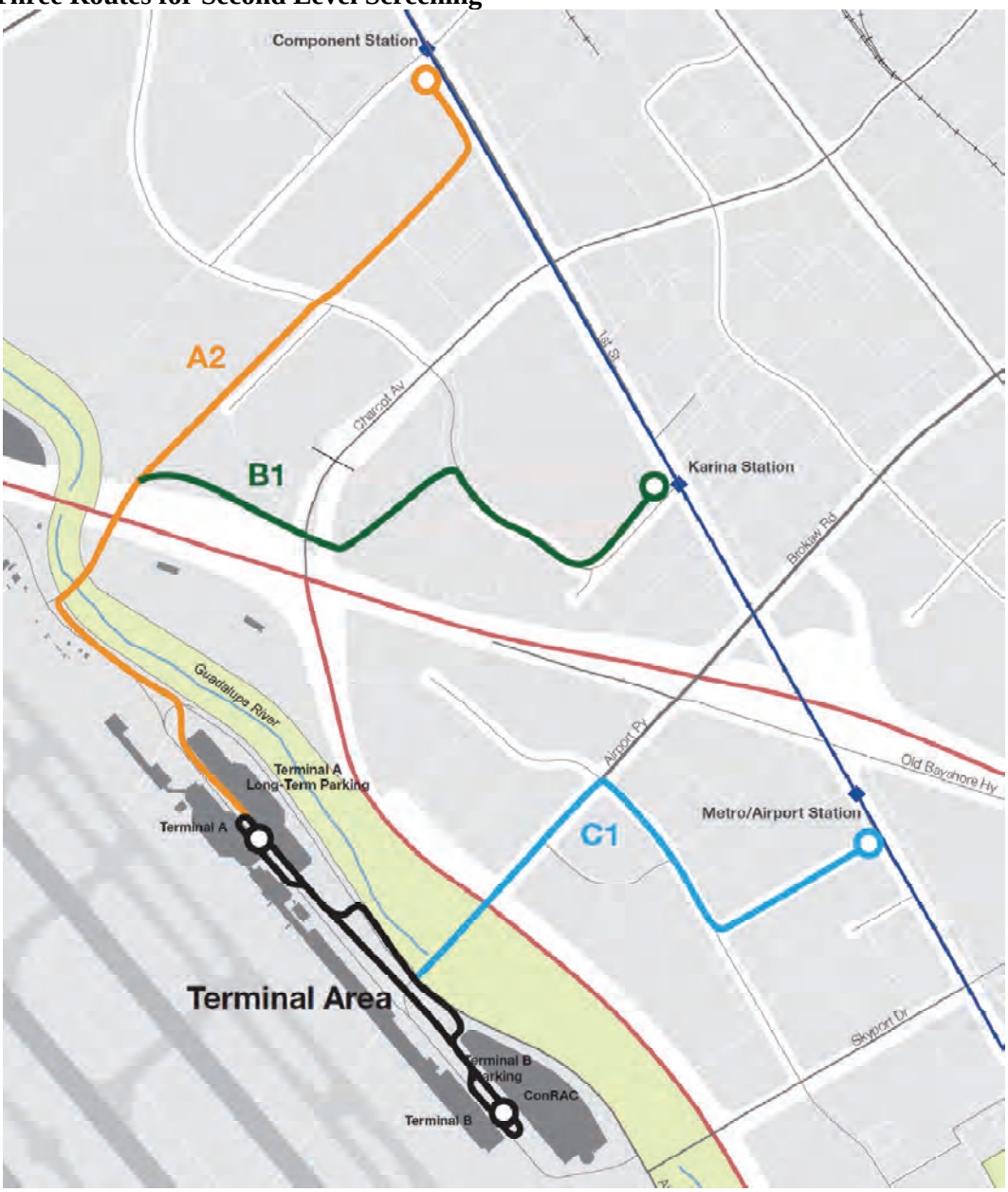

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Table 4 presents the results of screening the three routing options against the screening criteria described previously in Table 1. Table 4 includes findings common to all options (due primarily to the same assumptions for the terminal area) followed by differentiators.

Table 4. Second Level Screening Results

Description			
Route #	**A2**	**B1**	**C1**
Short Name	**Component**	**Karina**	**Metro/Airport**
Description	Airport Terminals to Component LRT via Crossing A over 101; at-grade station	Airport Terminals to Karina LRT via Crossing B over 101; at-grade station	Airport Terminals to Metro/Airport via Airport Parkway; elevated station
Common Elements			
Vertical Changes	Few (<2)		
Walk Distance	Short (<200 feet); Would need to cross North 1st Street to get to LRT platforms		
Constructability Risk	Disruption in Terminal Drive median; modifications will be needed to Terminal A, Terminal A pedestrian bridge, ConRAC, Terminal B; On-Airport City employee parking lot will be disrupted		
Travel Time	0.5 miles between Terminal A and B		
Visual Impacts	2-story stations located above Terminal Dr.		
Differentiators			
Constructability Risk	1 span over river, power lines N of 101, addt'l disruption to Terminal A area	1 long span over river, power lines at Green Island	1 complicated rework of Airport Blvd., but then no long spans required
Travel Time	1.7 miles	1.75 miles	1.25 miles
Visual Impacts	Significant frontage on 1st St. Rest is fairly low profile	Elevated for the most part	Elevated for the most part
Land Use Compatibility	Private property req'd but mostly vacant; maint. facility readily accommodated	Requires private property for station, has land for maint. Facility	Minimal private property impact; maint. facility would need to be on-Airport
Capital Cost	2 major crossings, 1 mi elevated and 0.7 mi at-grade; at-grade station	2 major crossings, 1.5 mi elevated and 0.25 mi at-grade; at-grade station	1 major crossing, 1.15 mi elevated and 0.1 mi at-grade; elevated station
Summary	Longest route, greatest potential disruption to private property	Doable if can use eBay campus (high risk because probability unknown)	Shortest route, fewest major crossings, minimal private property affected

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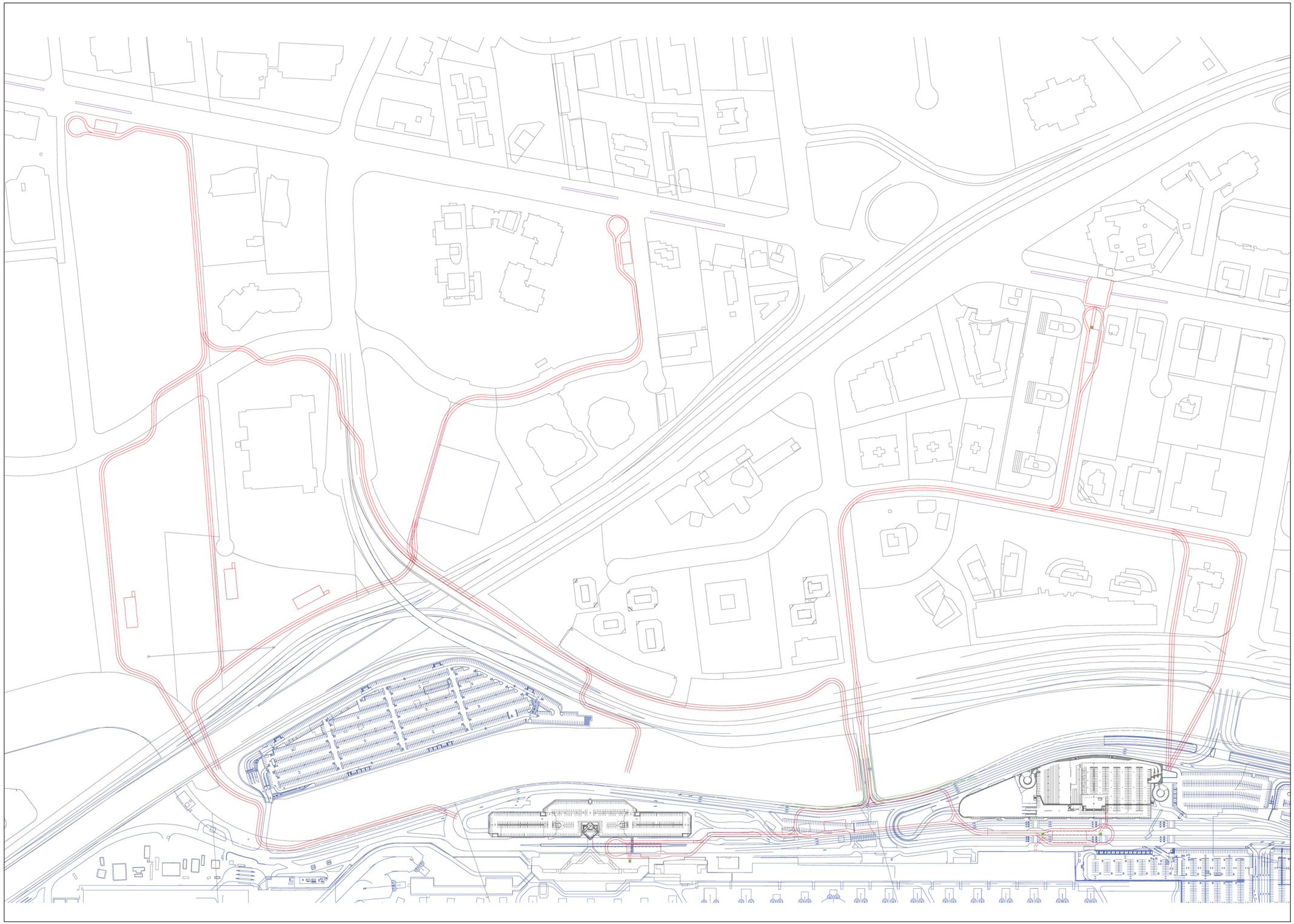
Conclusions
In terms of differentiators, the second level screening results indicate that, at least based on the selection criteria used, the Metro route (Route C) offers the most benefits over the other routes. The Metro route would have no long spans, would have the shortest overall route and consequently the shortest travel time, minimal private property impact, and one less major crossing involved. Its drawbacks are that it has a more complicated intersection at Airport Parkway and Airport Boulevard, and the maintenance facility would need to be located on Airport property.

Attachments
Options Development Diagram (11” x 17”)
Recommended Option 1 (11” x 17”)

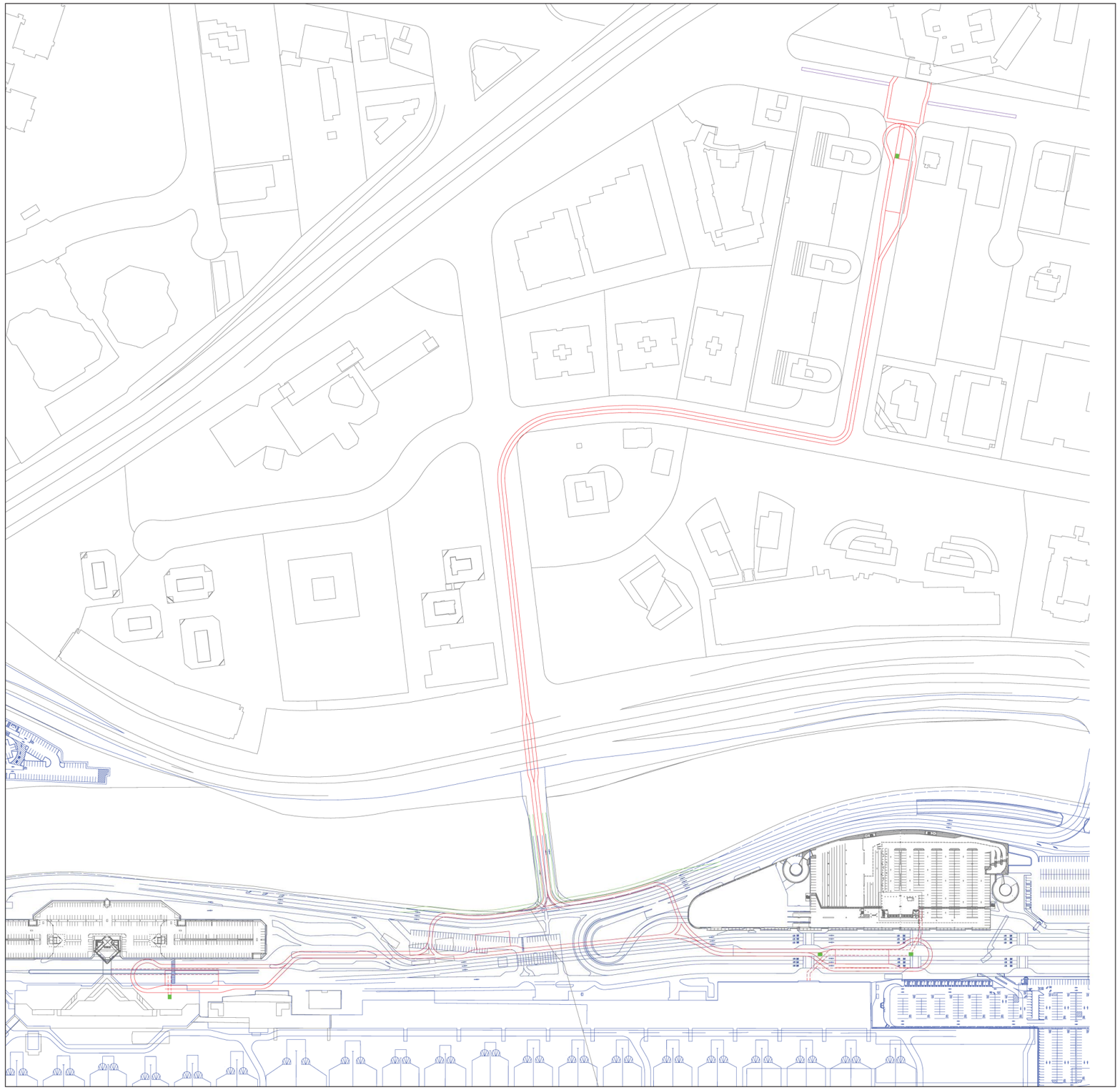


Options Development

San José ATN Feasibility Study

June 2, 2011

ARUP



Recommended Option 1

San José ATN Feasibility Study

June 2, 2011

ARUP

Memorandum

ARUP

To	Laura Stuchinsky Henry Servin Manuel Pineda	Date	August 30, 2011
Copies	Thomas Paige Everett L. Midkiff Austin Smith	Reference number	214704/GH
From	Gary Hsueh William Baumgardner	File reference	4-05
Subject	San José ATN Feasibility Study Round 2 Options Comparison		

This memo provides a comparison of the latest options ("Round 2") under consideration as part of Task 3, the physical routing options development process, of the San José ATN Feasibility Study.
This memo is organized into the following sections:

- Round 2 Option Development
- Questions for the City
- Option Narrative
- Design Criteria
- Screening and Evaluation Criteria
- Preliminary Screening of Round 2 Options
- Referenced Documents

Round 2 Option Development

The Round 2 options follow an initial investigative and options development effort by Arup and the Project Team. The earlier effort, carried out in Spring 2011, examined a range of ways to route an ATN system on Airport property and to connect the Airport to Valley Transportation Authority (VTA) Light Rail Transit (LRT) stations along North First Street. Please see the memo titled, "San José ATN Feasibility Study Recommended Routing Option 1" dated June 3, 2011 for a description of the two-stage screening process and sketches of the 19 station location options, 10 crossing and connection options, and three routes for second-level screening that were considered.

To develop the Round 2 options, the Project Team added the concept that the ATN development process would likely be staged over time to incorporate technological advances and increasing industry maturity. For example, an initial operating segment of the ATN would reasonably be expected to match currently-available systems (such as those that are now operating at Heathrow and Masdar), however future segments could be expected to meet higher levels of system demand and/or network complexity. This approach allows the Project Team to continue studying other aspects of the ATN while acknowledging that some gaps exist in the current technology. Please see the attached documents for more information about the Round 2 options:

- 2011 08 16 Workshop notes_Arup.pdf
- Round 2 Option Figures 2011 08 29.pdf

Memorandum

Questions for the City

The desired input from the City at this stage of options development involves the following questions:

1. Which Idea Family (presented below) should be finalized for evaluation?
2. In the selected Idea Family, which one of the three Stage 1 options should be evaluated?
3. What minor adjustments, if any, should be made to refine the selected Idea Family, and what indicators/issues should these adjustments address?
4. If Idea Family 1 is chosen, which Terminal A and Terminal B station options should be assumed?

Option Narrative

The following narrative discusses the options in reference to the attached Figures 1 through 10. The figures are organized according to two broad ideas, "Idea Family 1" and "Idea Family 2". Figures 1 through 6 address Idea Family 1. Figures 7 through 10 address Idea Family 2.

Idea Family 1

Figure 1. Base Scheme.

The base scheme is shown in red and consists of a loop guideway with two turnback loops, two interim location stations (each 6 berths long) and a maintenance facility located next to the Terminal B interim station. The guideway is elevated for the most part except for the segment on the east side of Airport Blvd., where it descends from either crossing over Airport Blvd. to grade level at Airport Parkway. This configuration allows for the eventual connection to the VTA Metro/Airport LRT station at North First Street.

Figure 2. Terminal A Interim Station Options

Two Terminal A Interim Station Options are presented. The first is an elevated station located over the current Terminal A Ground Transportation Center. Passengers collecting baggage in the Terminal A Parking Garage walk through the south wing of the garage as they do now and cross a bus lane to reach the station. Passengers leaving the ATN need to cross several crosswalks at grade to reach the Terminal A curb. In the future condition, the interim station could serve as an inline vehicle server for Terminal A, though vehicles would need to loop around on the mainline prior to arriving at the high-capacity station.

The second Terminal A Interim Station option is located over Terminal Drive (along with the aesthetic implications of the guideway). Compared to the first option, it is located closer to Terminal A and provides more direct connections (fewer crossings) to the Terminal A curb, while it would still require a crosswalk to the parking garage/baggage claim. The future condition demonstrates how the station and turnback loop are positioned to allow an additional 6-berth station and turnback loop to be constructed closer to Terminal A and how the interim station can be repurposed as an inline vehicle server.

Figure 3. Terminal B Interim Station Options

Three Terminal B Interim Station Options are presented. The first is a 6-berth elevated station located north of ConRAC. Passengers going to/from ConRAC and Terminal B cross a high pedestrian bridge to reach Terminal B curbside or ConRAC (via the median; there is insufficient space and safety concern for walking along the edge of ConRAC). In the future condition, the guideway can be extended to serve a high-capacity station located closer to Terminal B.

The second option is a 3-berth elevated station located immediately north of the main Terminal B building. It offers a direct connection to Terminal B and a closer walk to ConRAC (but still requires at-grade crossings). In the future condition, the guideway can also be extended down the median.

The third option is a 3-berth elevated station located south of Terminal B and across from ConRAC. It uses a portion of the parking lot to straddle one side of the roadway, providing a high degree of access to both Terminal B and ConRAC while minimizing visual impact directly in front of the Terminal B building. The station and infrastructure is situated such that in a future condition, extensions to Terminal B parking and even a high-capacity station can be built to connect to existing infrastructure.

Figure 4. Stage 1 Options

Three options are presented for extending the base scheme to meet the Project Team's definition of Stage 1. It is expected that one option would be selected for evaluation as Stage 1. It is assumed that all three options would then form the basis of Stage 2. Each option is shown in blue while the base scheme is unchanged and repeated in red.

The Economy Lot 1 option crosses the Guadalupe River and serves the lot with four elevated stations, replacing seven bus stops and eliminating the economy lot bus in its entirety (saving approximately $4 million annually).

The Terminal B Parking option connects the base scheme to the parking lots south of Terminal B via a dual-lane guideway and turnaround loop in the median of Airport Blvd. 3-berth stations situated in Lots 4, 5, and 6 collect passengers via a one-way loop. As shown, the primary benefit of this option is to ferry passengers from Daily Lot 4 to Terminal A in case Economy Lot 1 fills up, which is a role currently filled by the Airport inter-terminal rental car shuttle. In addition to saving a small amount of money by removing the Daily Lot 4 shuttle stop, this option could replace the Lot 5-6-Terminal B tram (saving approximately $420,000 annually), however, only the Interim Station Option 3 would do this effectively (the other options including the one shown requires an increase in passenger walking distance).

The VTA LRT option connects the base scheme to the VTA Metro/Airport LRT station at Metro Dr. and North First St. via a new elevated station located on Metro Dr. Potential savings would be gained by cutting or reducing service on the Airport Flyer, VTA Route 10 between the Airport and the LRT station.

Figure 5. Stage 2

This figure presents Stage 2 which is assumed to serve all three Stage 1 options (Economy Lot 1, VTA LRT, and Terminal B Parking). The station and routing variations associated with this idea family are included.

Figure 6. Stage 3

This figure presents Stage 3 which is assumed to add a connection to Santa Clara Caltrain/BART via Ewert Road (around the north end of the Airport) and two elevated high-capacity stations located close to Terminal A and Terminal B. These additional elements are shown in green. Also, the station and routing variations associated with this idea family are included.

Memorandum

Idea Family 2

Figure 7. Base Scheme

The base scheme is shown in red and consists of several elevated loops, two interim location stations (one 3 berths long and one 6 berths long) and a maintenance facility located next to the Terminal B interim station. Similar to Idea Family 1, the guideway is elevated for the most part except for the segment on the east side of Airport Blvd., where it descends to grade level at Airport Parkway. North of Airport Parkway, the guideway crosses Airport Boulevard and loops around to the north side of the Terminal A parking garage, where an interim station is located adjacent to the parking garage. Passengers traveling to Terminal A cross an elevated pedestrian bridge to Terminal A curbside. A new connection will be created to connect passengers with Terminal A baggage claim; passengers would not be able to walk along the edge of the parking garage.

Figure 8. Stage 1 Options

Three options are presented for extending the base scheme to meet the Project Team's definition of Stage 1. It is expected that one option would be selected for evaluation as Stage 1. It is assumed that all three options would then form the basis of Stage 2. Each option is shown in blue while the base scheme is unchanged and repeated in red.

The Economy Lot 1 option forms a one-way loop that crosses the Guadalupe River twice and serves the lot with four elevated stations, replacing seven bus stops and eliminating the economy lot bus in its entirety (saving approximately $4 million annually).

The Terminal B Parking option connects the base scheme to the parking lots south of Terminal B via a set of one-way loops that travel behind ConRAC along Airport Blvd. 3-berth stations situated in Lots 4, 5, and 6 collect passengers via a one-way loop. As with Idea Family 1, the primary benefit of this option is to ferry passengers from Daily Lot 4 to Terminal A in case Economy Lot 1 fills up, which is a role currently filled by the Airport inter-terminal rental car shuttle. In addition to saving a small amount of money by removing the Daily Lot 4 shuttle stop, this option could replace the Lot 5-6-Terminal B tram (saving approximately $420,000 annually), however, the location of the interim station requires an increase in passenger walking distance compared to the tram.

The VTA LRT option connects the base scheme to the VTA Metro/Airport LRT station at Metro Dr. and North First St. via a new elevated station located on Metro Dr. Potential savings would be gained by cutting or reducing service on the Airport Flyer, VTA Route 10 between the Airport and the LRT station.

Figure 9. Stage 2

This figure presents Stage 2 which is assumed to serve all three Stage 1 options (Economy Lot 1, VTA LRT, and Terminal B Parking).

Figure 10. Stage 3

This figure presents Stage 3 which is assumed to add a connection to Santa Clara Caltrain/BART via Ewert Road (around the north end of the Airport) and two elevated high-capacity stations located close to Terminal A and Terminal B. These additional elements are shown in green.

Memorandum

Design Criteria

Please refer to the "San José ATN Feasibility Study Design Criteria Summary" dated August 29, 2011 for a statement of the assumed design criteria used for the formulation of the options.

Screening and Evaluation Criteria

Evaluation criteria for Task 3 were previously presented in April 2011; see "ATN Arup Task 3 Eval Criteria 20110429_gh.xlsx." Criteria relevant to the screening of physical alignment of options are summarized in the table below.

Screening Criteria and Indicators

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	"Many" vertical changes or "Few"
Walk Distance	Average additional walk distance or time introduced by ATN	"Long" walk or "Short"
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

Memorandum

Preliminary Screening of Round 2 Options

The tables below presents a preliminary screening of the Round 2 options using the screening criteria and indicators presented previously. Stages 2 and 3 from Idea Family 1 are compared next to Stages 2 and 3 from Idea Family 2.

Description

Route #	Idea 1 Stage 2	Idea 1 Stage 3	Idea 2 Stage 2	Idea 2 Stage 3
Description	Low-capacity system serving Economy Lot 1, VTA LRT, and Terminal B Parking, with interim stations	High-capacity system serving Economy Lot 1, VTA LRT, Terminal B Parking, and Santa Clara	Low-capacity system serving Economy Lot 1, VTA LRT, and Terminal B Parking, with interim stations	High-capacity system serving Economy Lot 1, VTA LRT, Terminal B Parking, and Santa Clara

Indicators

Constructability Risk	1 long span; Power lines near Econ. Lot 1; Minor disturbance to existing structures	2 long spans; Power lines near Econ. Lot 1; Disturbance to Term. A; potential dist. to Term. B	2 long spans; Power lines near Econ. Lot 1; No disturbance to existing structures	2 long spans; Power lines near Econ. Lot 1; Disturbance to Term. A
Travel Time	Long distance between Term. B parking and Term. B interim station (except Station Option 3)	Relatively direct connections between destinations	Long distance between Term. B parking and Term. B interim station	Long distance between Term A and Santa Clara
Vertical Changes	2 vertical changes for all passengers	2 vertical changes for all passengers except 1 change at Term. A	2 vertical changes for all passengers	2 vertical changes for all passengers
Walk Distance*	Term. A: 630/850 feet (Opt 1) 430/560 feet (Opt 2) Term. B: 800/1280 feet (Opt 1) 390/870 feet (Opt 2) 530/300 feet (Opt 3)	Term. A: 200/260 feet Term. B: 540/300 ft (Opt 1&2) 175/310 feet (Opt 3)	Term. A: 885 feet (?)/750 feet Term. B: 800/1280 feet	Term. A: 550/415 feet Term. B: 540/300 feet
Visual Impacts	All elevated stations; guideway avoids Term. A area; guideway in front of Term. B	All elevated stations; high-capacity stations at Term. A and Term. B; plus guideway to Santa Clara	All elevated stations; guideway avoids Term. A area and Term. B area	All elevated stations; high-capacity station at Term. A; plus guideway to Santa Clara
Land Use Compatibility	Potential for connections between Airport and LRT	Potential connections between Airport, LRT, and Santa Clara	Potential for connections between Airport and LRT	Potential connections between Airport, LRT, and Santa Clara
Capital Cost	All elevated guideway and elevated stations; simple crossings	Same as Stage 2, except portion to Santa Clara may be partly at-grade	Same as Idea 1, except number of single-lane guideway segments increases cost	Same as Idea 1, except number of single-lane guideway segments increases cost

* Walk distances reported in destination pairs, in feet:
Terminal A: ATN station to Baggage Claim / ATN station to center of Terminal A
Terminal B: ATN station to center to Terminal B (1st crosswalk) / ATN station to ConRAC (2nd crosswalk)

Memorandum

Next Steps

Arup's recommended next steps for the options process are:

- Project Team discussion: Arup presents each option via teleconference; everyone discusses the options and preliminary evaluation
- City selects options for evaluation
- Arup finalizes options in preparation for evaluation; assembles demand data for Aerospace
- Arup and Aerospace perform evaluation of 3 options and document results
- Arup and Aerospace present results
- City determines that Task 3 is concluded

Referenced Documents

The following documents have been referenced in this memo:

- San José ATN Feasibility Study Recommended Routing Option 1, dated June 3, 2011
- Round 2 Option Figures 2011 08 29.pdf (attached)
- 2011 08 16 Workshop notes_Arup.pdf (attached)
- San José ATN Feasibility Study Design Criteria Summary, dated August 29, 2011 (attached)
- ATN Arup Task 3 Eval Criteria 20110429_gh.xlsx

Framework for Project Stages

	Technical Factors	Acquisition and Programmatic Factors
Stage 1 "Initial Operating Segment"	**"Low Capacity Loop or Shuttle"** **Capacity Limitations** • Link capacity (low) • Vehicle berthing capacity (low) • Passenger queuing length and processing rate (low) **Network Complexity** • Could be a Loop, "T" or Shuttle • No more than two different loops **Regulatory Issues/Compatibility** • Approvable in the short term • "APM-Light" model (conform to existing APM standards to the extent possible) **Verification** • Limit scale and complexity comparable to systems with test tracks or in operations (Heathrow, Masdar, Vectus) • Additional verification will be required **Manageability** • Sequence of technical challenges (manageable) • Size of challenges (manageable) **Vendor Lock-In** • Seek to maintain ability to change vendors in future stages • At the Feasibility/Planning stage, this affects key design criteria assumptions such as guideway width, minimum turning and station size • Set planning-level design criteria to be conservative in order to allow for multiple possible vendors **Expandability** • Needs to consider future configuration – expandable	**Minimum Connection Requirements** • Desirable, but not required, to serve LRT • Minimum 3 stations (must serve both terminals + additional destination **Operating Costs** • Minimize operating deficits • Seek to replace bus routes or shorten routes significantly and redirect bus operating expenditures to ATN • Ideally does not require additional operating subsidy (Note: actual ATN operating costs are unknown). **Customer Convenience** • Maximum 800 foot walk from terminal to ATN (we have heard that ideally, max 800 foot walk from airplane gate) • More important than aesthetics **Aesthetics** • Maximize visibility of existing Airport architecture • Minimize visual impact of ATN system elements

	Technical Factors	Acquisition and Programmatic Factors
Stage 2 "Expanded Airport System"	**Capacity Limitations** • Link capacity (low) • Vehicle berthing capacity (low) • Passenger queuing length and processing rate (low) **Network Complexity** • Could have multiple loops	**Minimum Connection Requirements** • Both terminals • N. First Street LRT • Multiple airport parking areas **Operating Costs** • Minimize operating deficits • Seek to replace bus routes or shorten routes significantly and redirect bus operating expenditures to ATN • Ideally does not require additional operating subsidy (Note: actual ATN operating costs are unknown).
Stage 3 "Full Project"	**Description:** • Full service, on-Airport public circulator with a connection to LRT and employee parking • Complex network with high capacity **Demonstrate:** • Flexibility of concept • Ability of industry to meet requirements and high demand • Product line – not one size fits all • Expandability • Stations able to handle high capacity	**Minimum Connection Requirements** • Both terminals • N. First Street LRT • Multiple airport parking areas • ConRAC • Santa Clara Caltrain/BART
Stage 4 "Vision"		**Additional Potential Destinations:** • Diridon Station • Remote HSR parking facilities • North San Jose • Intermediate stations • Sports arena • Future Terminal C

San José ATN Feasibility Study
Workshop Notes – Arup – August 16, 2011

Connectivity

	Terminal A	Terminal B	ConRAC	Economy Lot 1	Daily Lot 4	Hourly Lot 5	Daily Lot 6	N. First Light Rail	Santa Clara Caltrain/ BART
Stage 1 "Initial Operating Segment"	✓	✓	×	O	O	O	O	O	×
Stage 2 "Expanded Airport System"	✓	✓	×	✓	✓	O	O	✓	×
Stage 3 "Full Project"	✓	✓	✓	✓	✓	O	✓	✓	✓

Legend
✓ Must serve
× Will not serve
O Optional in this stage

Stage 1 Routing Notes

- Does not need to serve LRT or Caltrain connection in Stage 1
- No 2-station option, must serve both terminals
- Simple "T" (or "Y" – no advertised connection between Airport terminals or from ConRAC to Terminal A)
- Seek to serve parking lots to replace/reduce Airport shuttle costs
- Service to Economy Lot needs to stop at both terminals
- Minimal gain if replace internal tram serving Lots 5&6
- Station placement of this option minimizes disruption of construction of new stations in later options
- Stations built in this option may be later repurposed for additional ATN storage, expansion of maintenance, etc.
- Routing should allow expansion to Green Island, Santa Clara, Diridon/Downtown San Jose
- Potential integration of guideway inside Airport buildings, along edge of Terminal Drive
- Vehicle accumulators can range from automated "vehicle servers" that are part of larger structures, or can be simple sidings along the guideway
- Staying within airport property could simplify implementation
- Not connecting to LRT in Stage 1 may be less attractive to VTA

Memorandum

ARUP

To	Laura Stuchinsky Henry Servin	Date	August 29, 2011
Copies	Thomas Paige Everett L. Midkiff William Baumgardner Austin Smith	Reference number	214704/GH
From	Gary Hsueh	File reference	4-05
Subject	San José ATN Feasibility Study Design Criteria Summary		

This memo contains a summary of the design criteria Arup used to develop the ATN physical routing options throughout Task 3 of the feasibility study. Basic design criteria for the ATN were formed on the basis of the information received from potential ATN vendors through the City of San José Request For Information process. The information provided by potential vendors was assembled and summarized by the Aerospace Corporation.

Guideway Criteria

Guideway criteria were based generally on dimensions provided by three leading PRT manufacturers – ULTra, Vectus, and 2getthere. The subsequent RFI process conducted by the City in early 2011, and follow-up conversations held directly with the vendors, confirms that the assumed design criteria are reasonable at this early stage of analysis. The assumption for guideway width is conservative due to uncertainty in the application of regulatory requirements to the ATN in California. The table below includes relevant criteria supplied by the PRT manufacturers.

Criterion	Arup Assumption	2getthere	ULTra	Vectus
Minimum Radius of Curvature (feet)	**50**	18	16.4	49.2
Cross-Section Width per Guideway Lane, including Walkways (per lane, in feet)	**12**	10	7	7 plus walkway
Maximum Ascending Incline (percent)	**10**	10	20	100
Maximum Descending Incline (percent)	**6**	10	6.3	100

Station Criteria

Station criteria were based generally on Arup's experience with ULTra at London Heathrow Airport and with Arup's general transit station design experience. The station is assumed to include space for angled berths (pull-in, back-out operation), queuing space, ticketing and circulation space, and for elevated stations, additional space allowance at either end for vertical circulation (stairs, escalators, and elevator). In August 2011, the Project

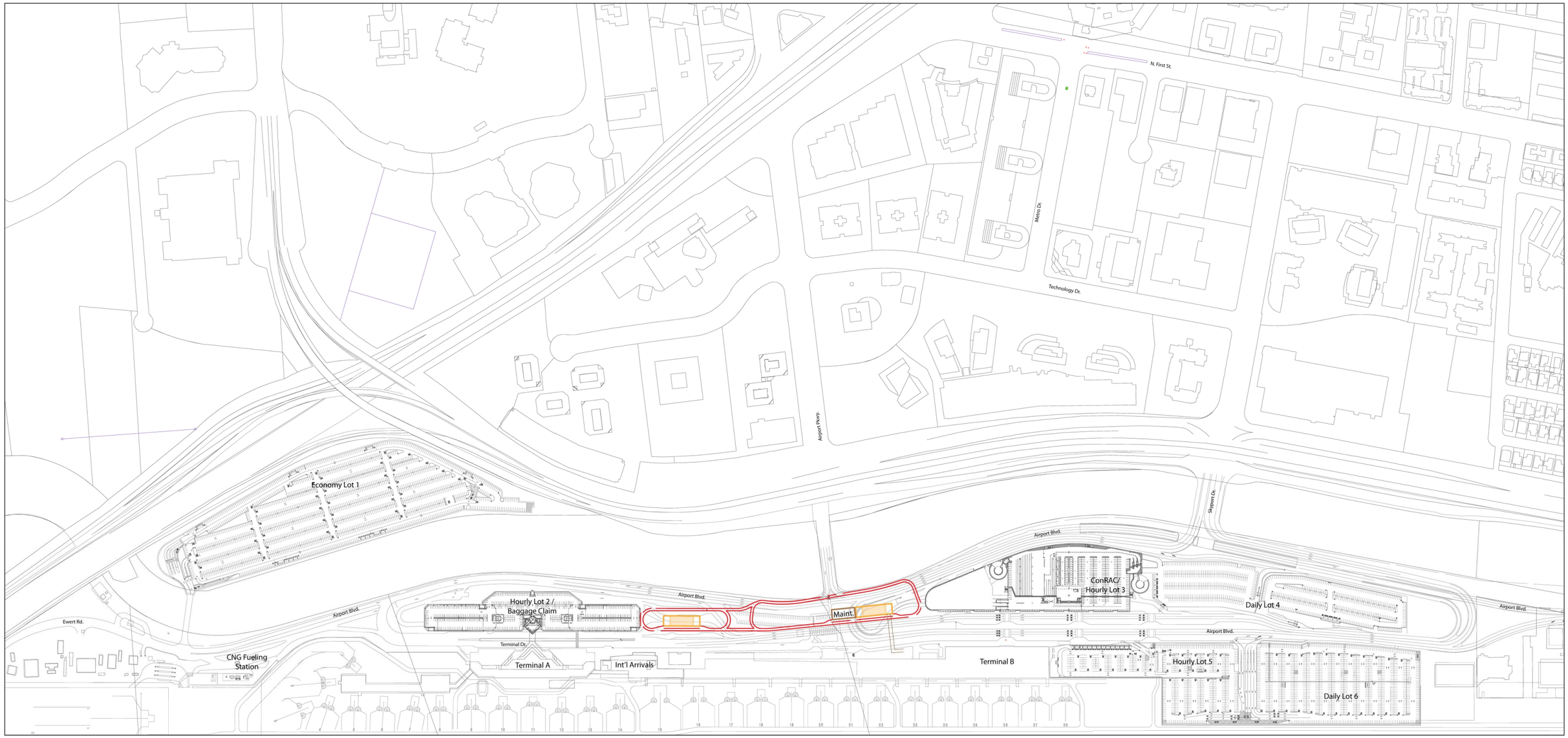
Team introduced the concept of a smaller, interim station that could be built similarly to existing precedent systems. Arup's assumption for that type of station is represented as a 3-berth station with half the length as a 6-berth station.

Criterion	Arup Assumption
Length of 6-Berth Elevated Station (feet)	**180**
Width of 6-Berth Elevated Station (feet)	**50**
Length of 6-Berth At-Grade Station (feet)	**115**
Width of 6-Berth At-Grade Station (feet)	**50**
Length of 3-Berth Elevated Station (feet)	**90**
Width of 3-Berth Elevated Station (feet)	**50**

Maintenance Facility Criteria

Arup's discussions with PRT vendors indicated that the sizing of a maintenance facility is highly dependent upon numerous factors including vehicle count, guideway length, and operational characteristics of the service. Some vendors noted that storage can be accommodated at ATN stations and possibly at other storage points along the guideway. Arup has assumed a concept of a two-three-level facility that houses light maintenance bays, vehicle charging/storage area for up to 30 vehicles, control center, and miscellaneous facilities for staff and storage. It is assumed that the maintenance facility has access to the mainline ATN guideway as well as to a surface access road.

Criterion	Arup Assumption
Facility Length (feet)	**160**
Facility Width (feet)	**60**



Notes:

1. The base scheme shown here is intended to be constructed in combination with one of the Stage 1 options shown on the following sheet.
2. Small gaps in the alignment indicate locations of tie-ins of guideway from future phases.

Figure 1
Idea Family 1
Base Scheme

San José ATN Feasibility Study

August 26, 2011

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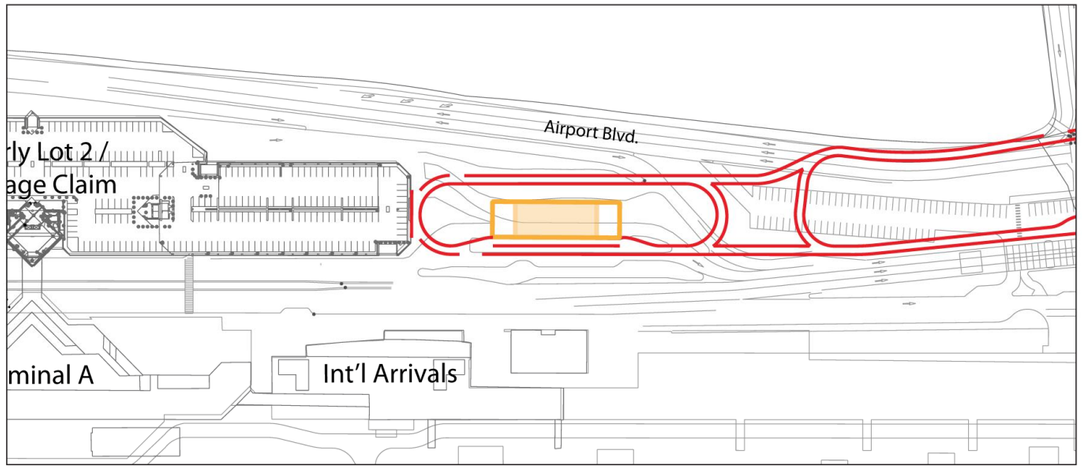
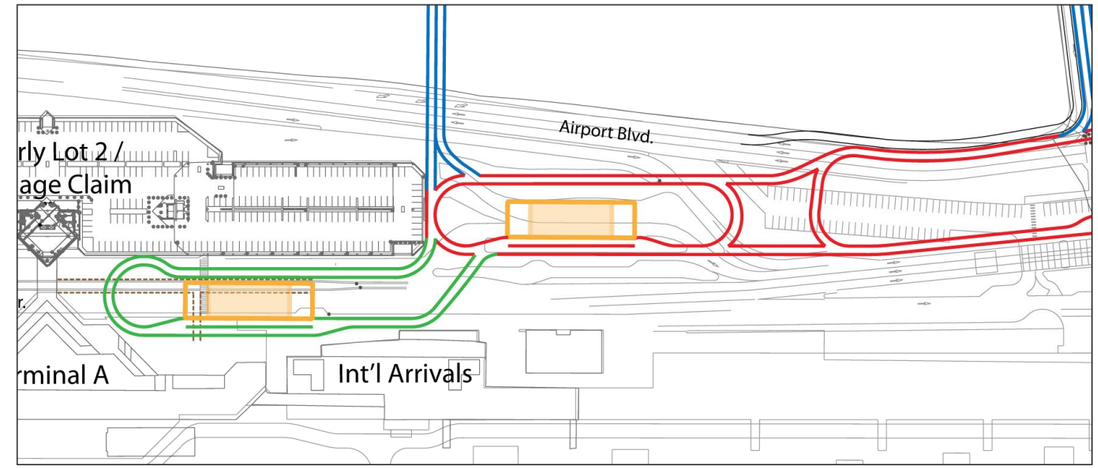
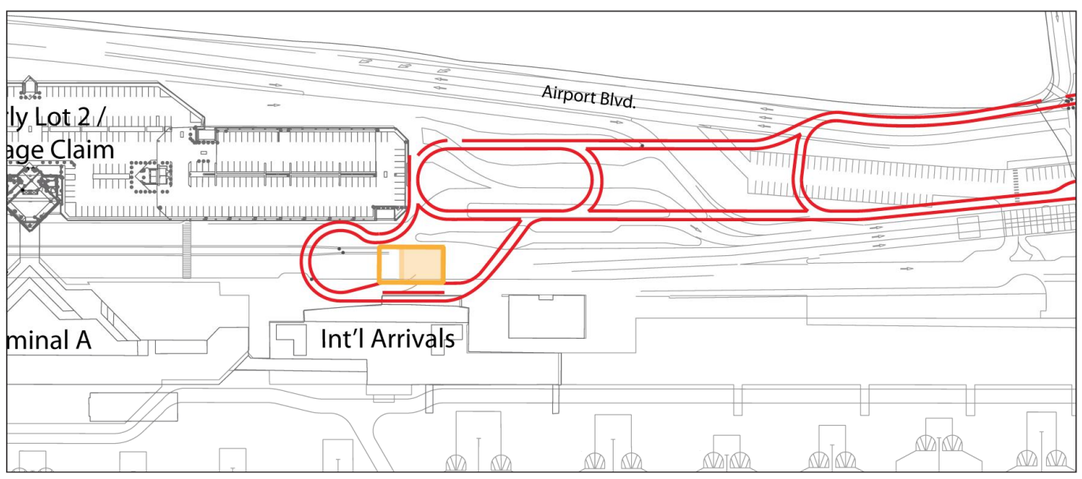
Terminal A Interim Station Options

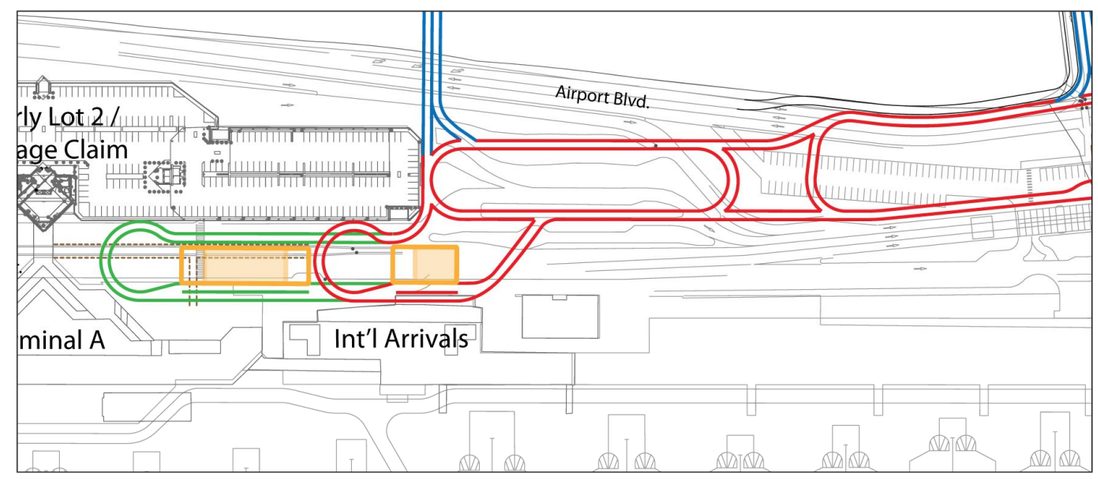
Terminal A Station Options Showing High-Capacity Station





Option 1





Option 2

Figure 2
Idea Family 1
Terminal A Interim Station Options

San José ATN Feasibility Study

August 26, 2011

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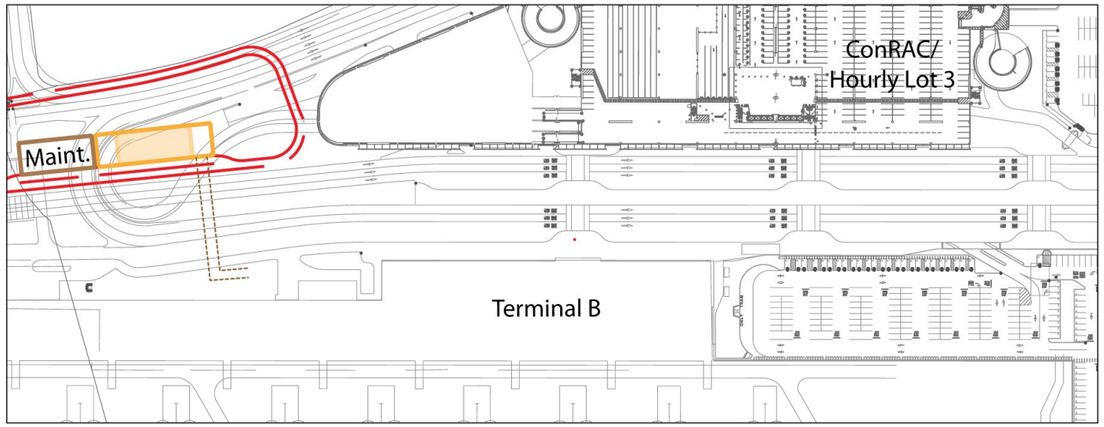
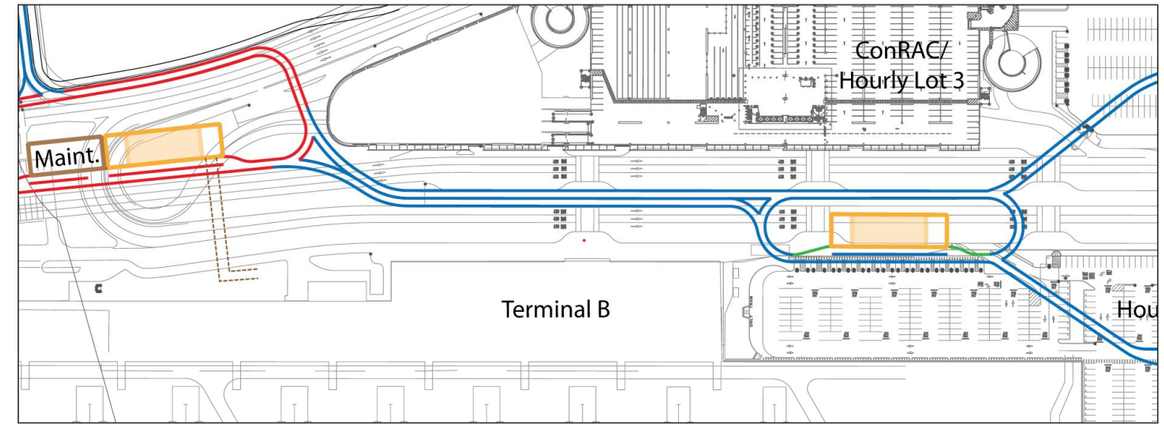
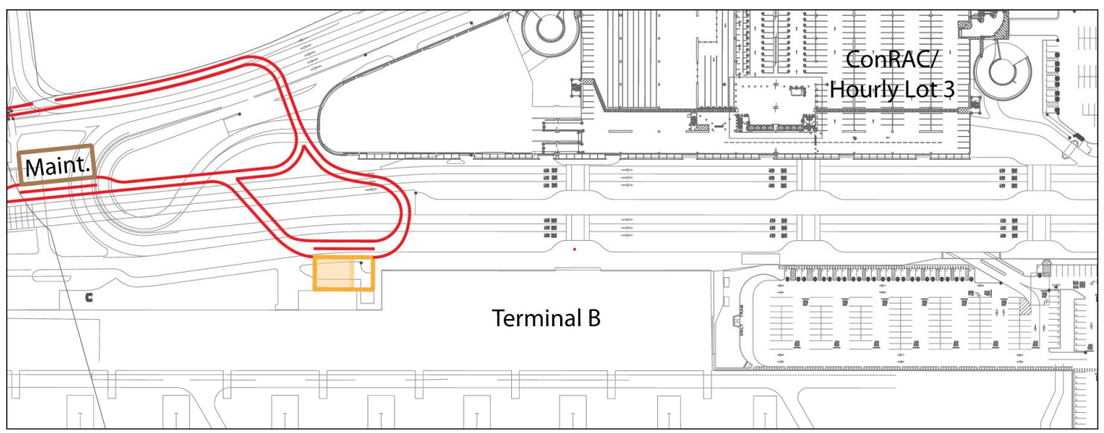
Terminal B Interim Station Options

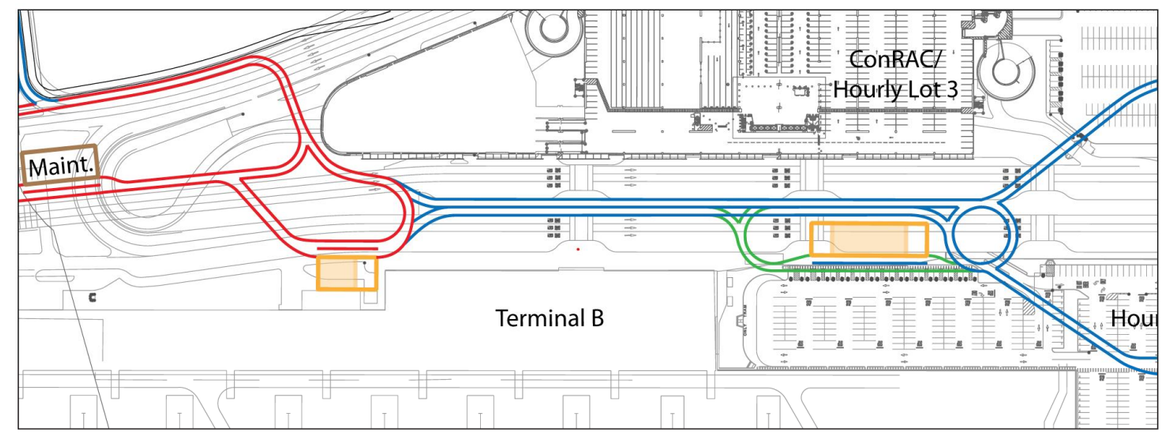
Terminal B Station Options Showing High-Capacity Station



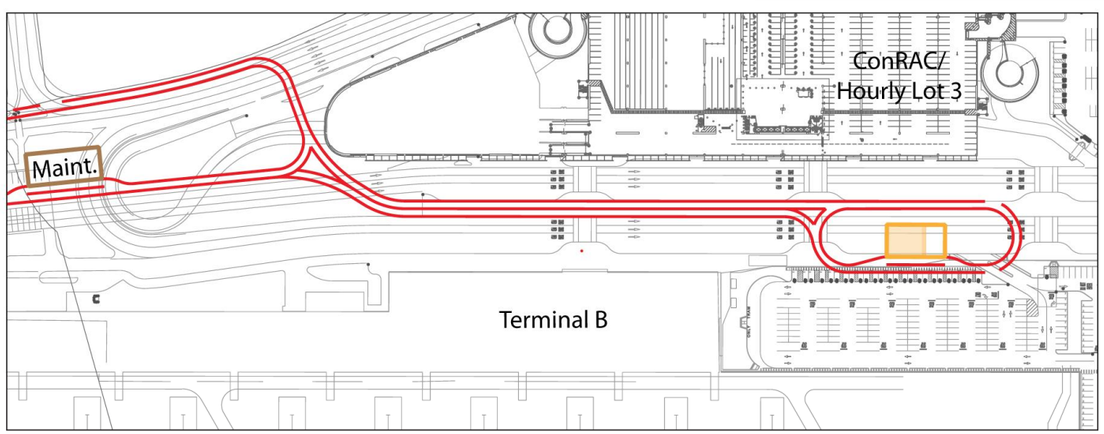


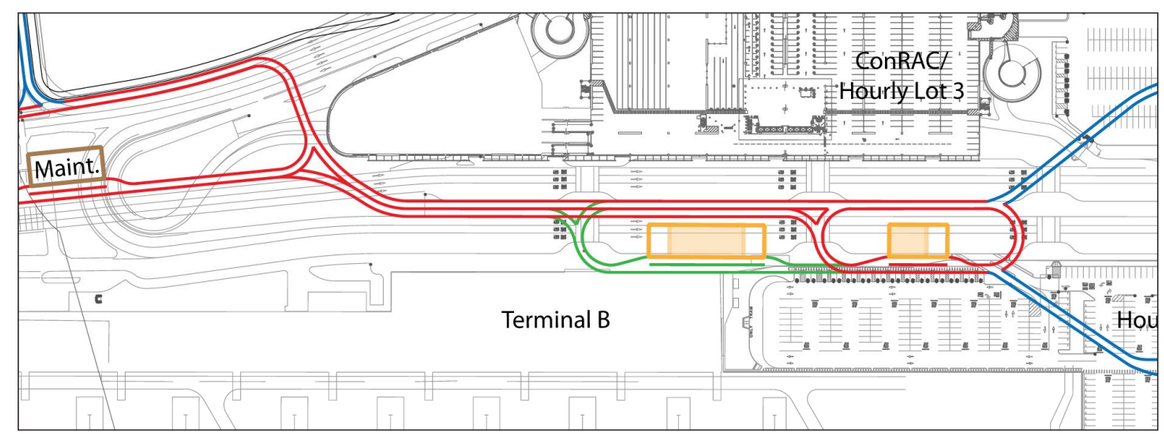
Option 1





Option 2





Option 3

Figure 3
Idea Family 1
Terminal B Interim Station Options

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August 26, 2011

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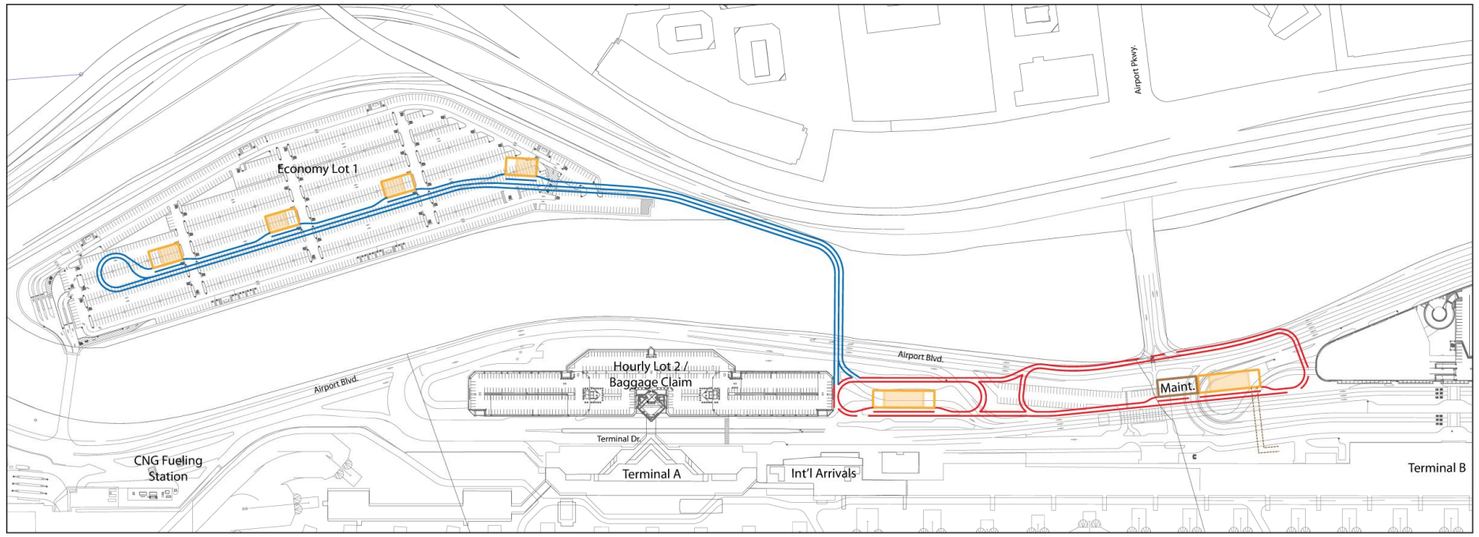
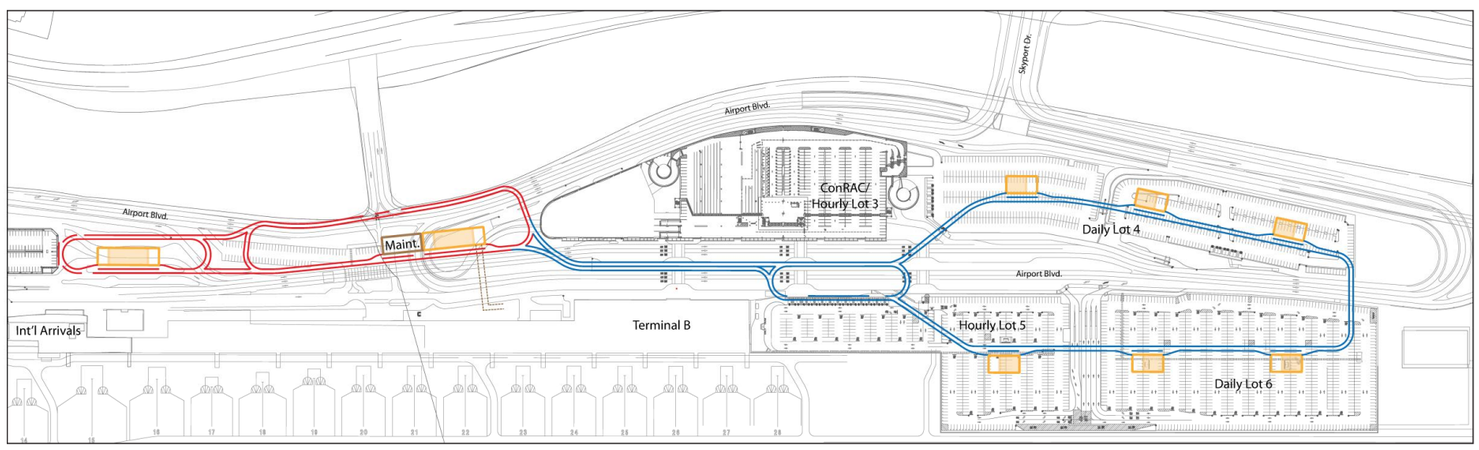
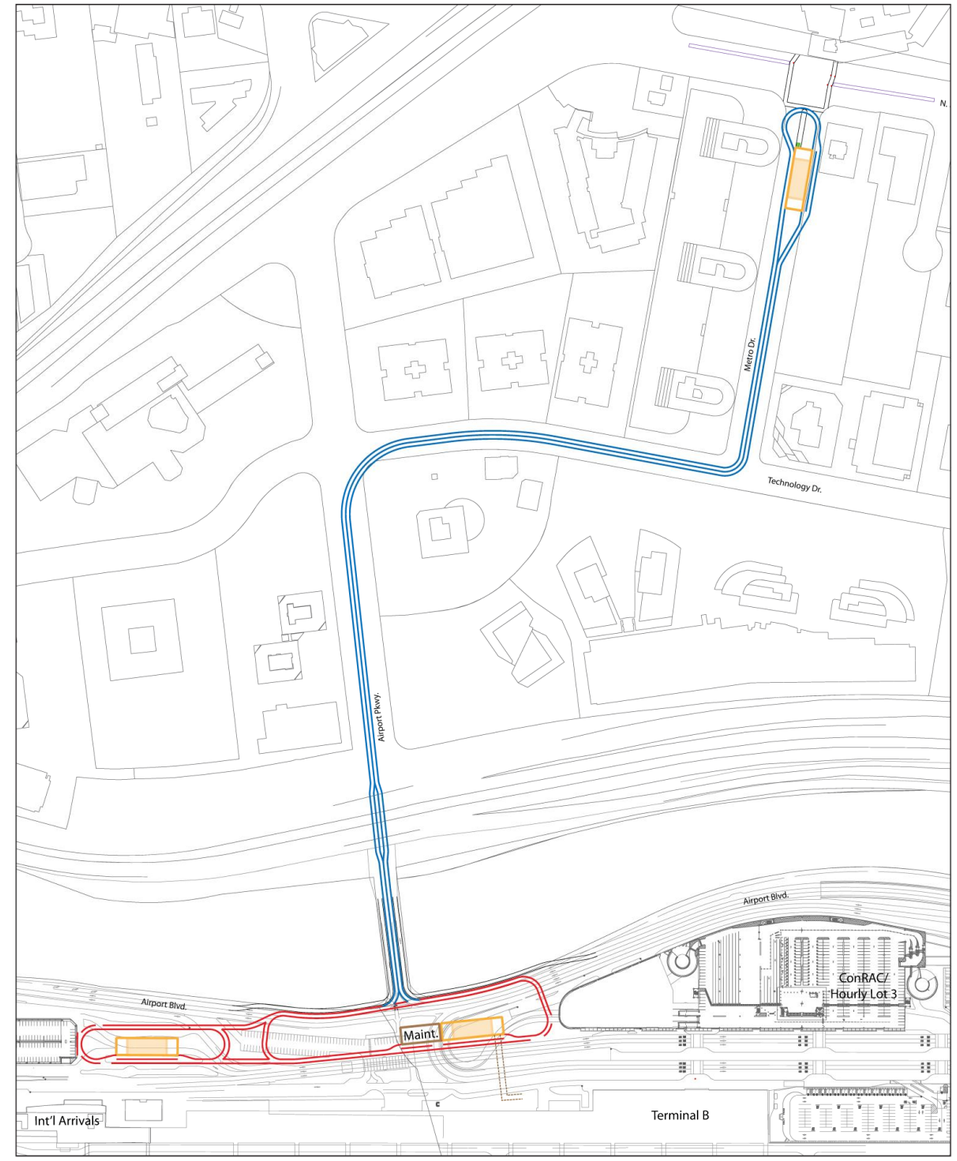


Economy Lot 1



Terminal B Parking (Lots 4, 5, & 6)



VTA LRT

Figure 4
Idea Family 1
Stage 1 Options

San José ATN Feasibility Study

August 26, 2011

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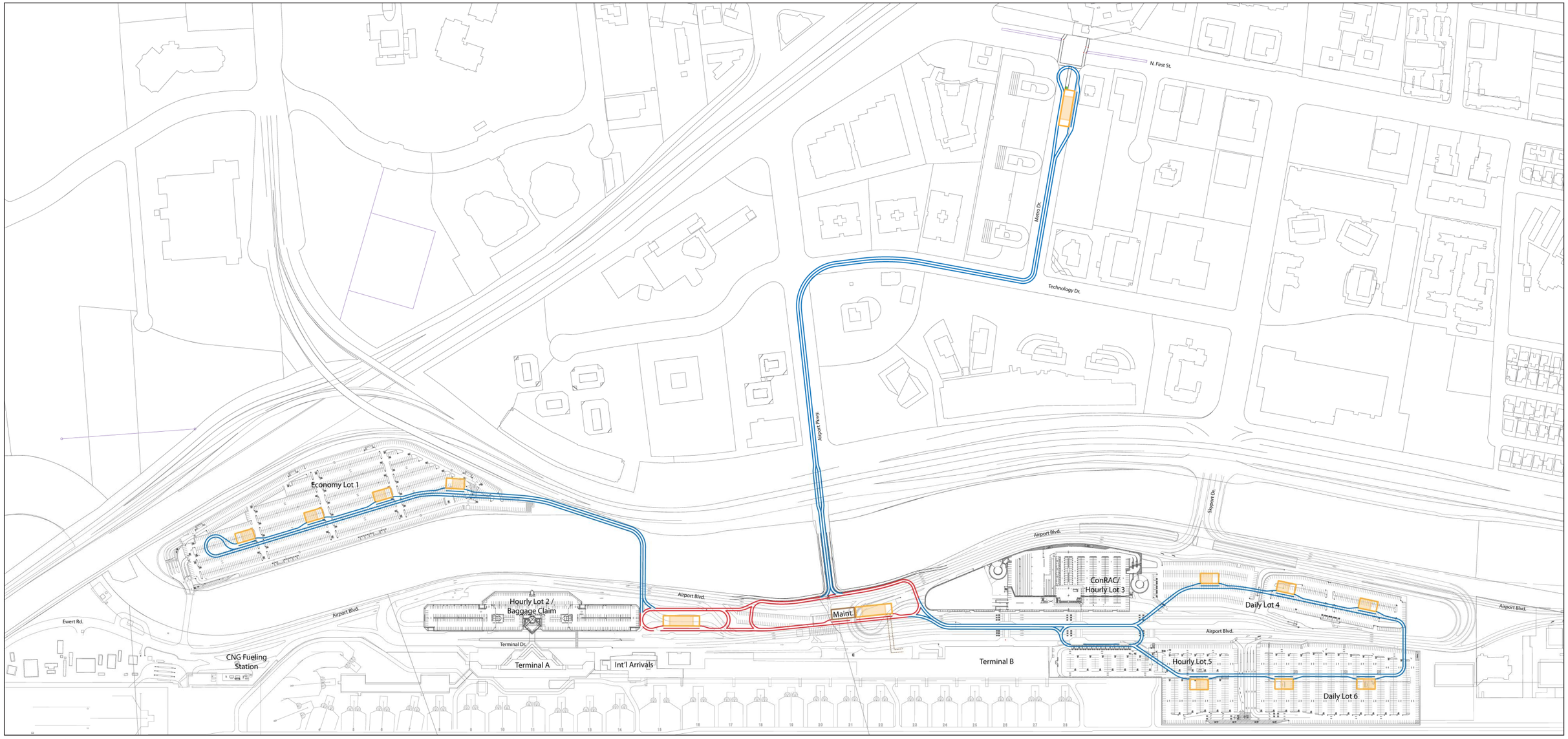
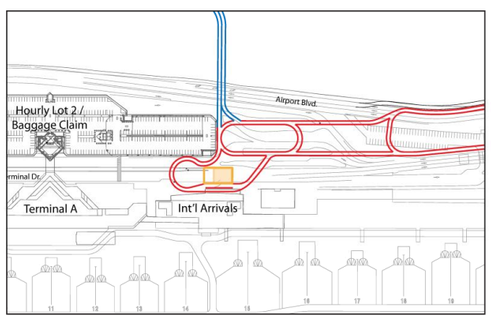
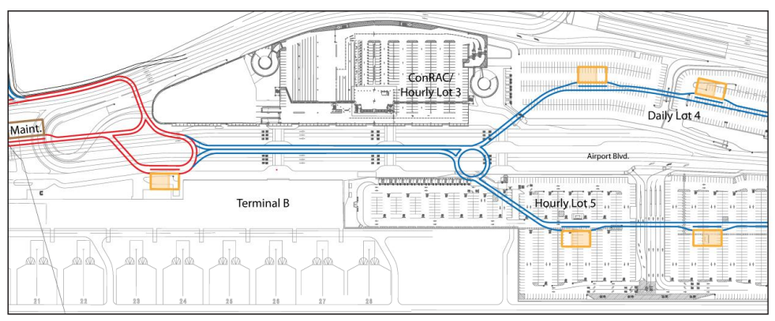
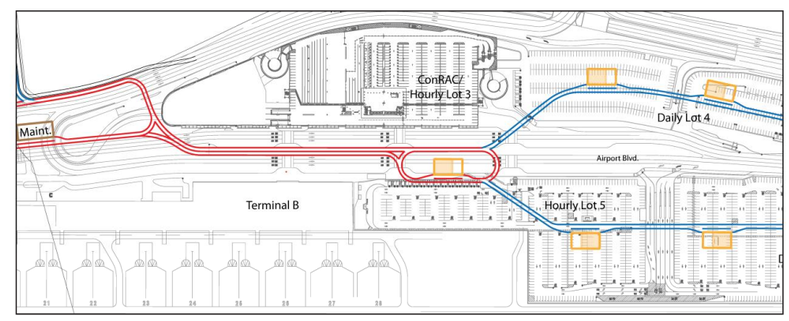


Stage 2 serving Economy Lot 1, VTA LRT, and Terminal B Parking







Station and Routing Variations

Figure 5
Idea Family 1
Stage 2

San José ATN Feasibility Study

August 26, 2011

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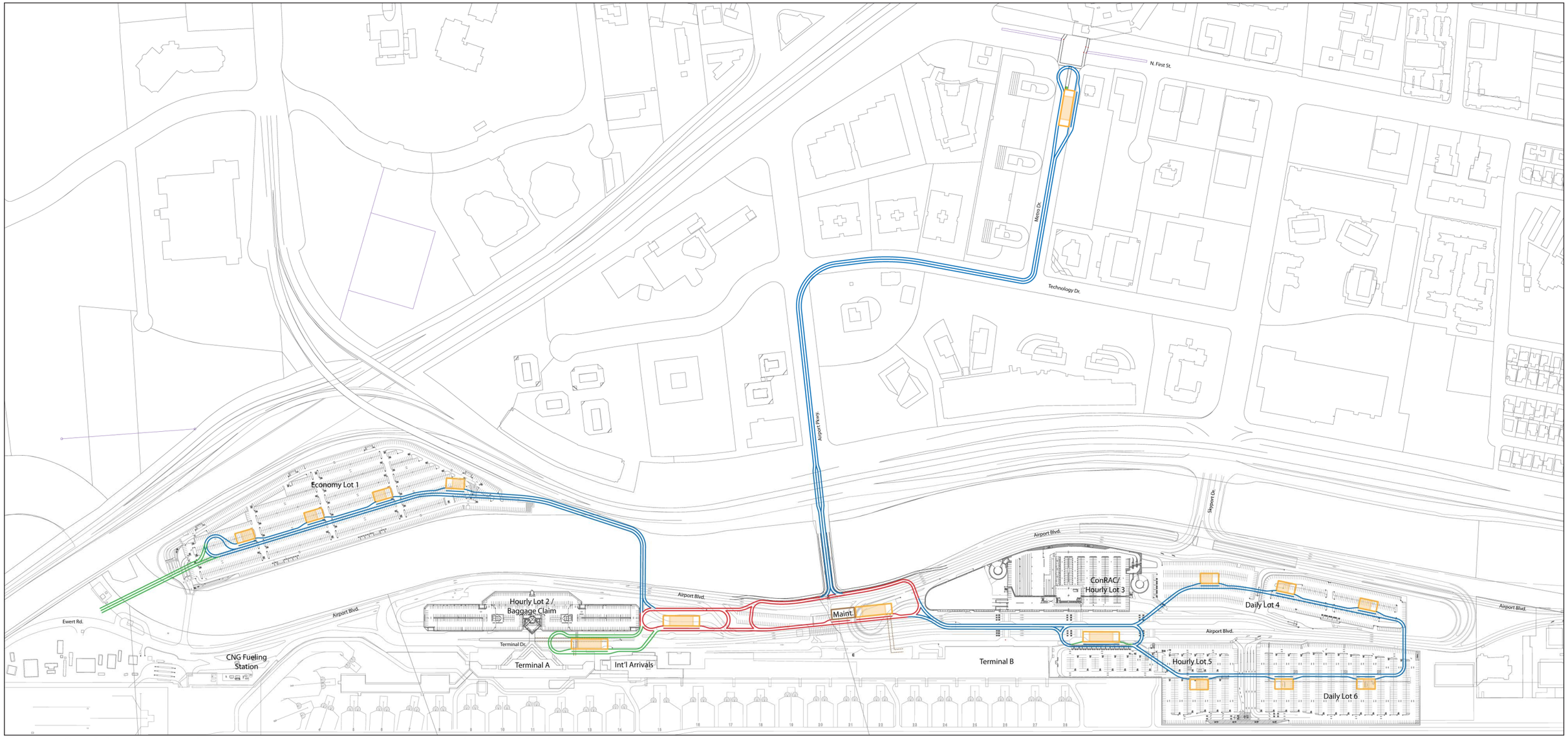
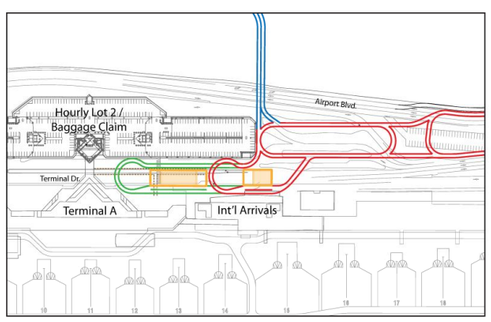
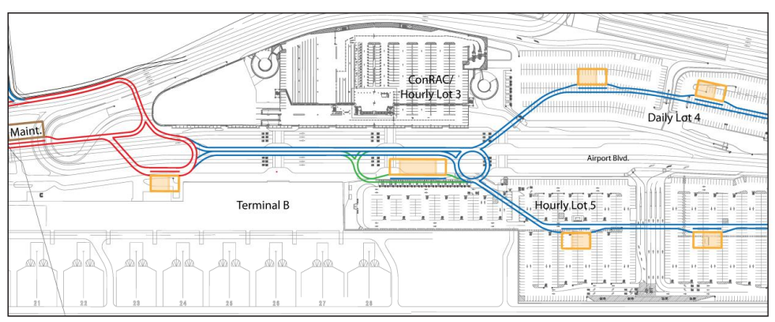
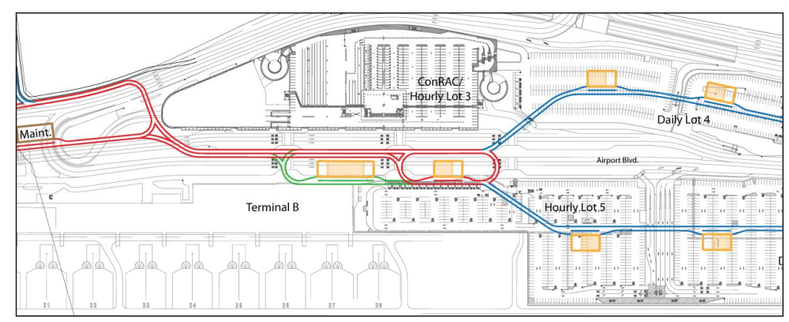


Stage 3 with connection to Santa Clara Station and with High-Capacity Stations







Station and Routing Variations

Figure 6
Idea Family 1
Stage 3

San José ATN Feasibility Study

August 26, 2011

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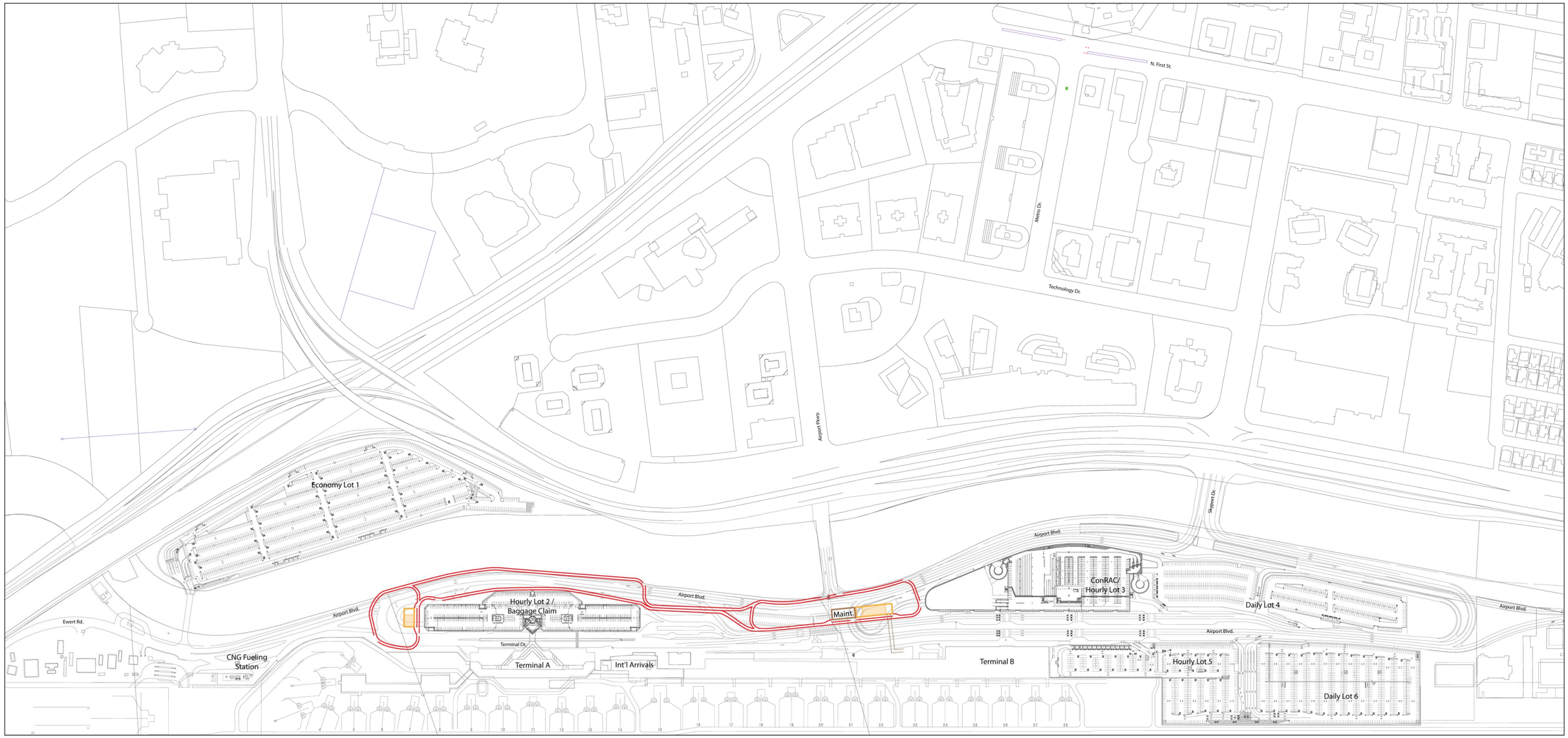


Notes:

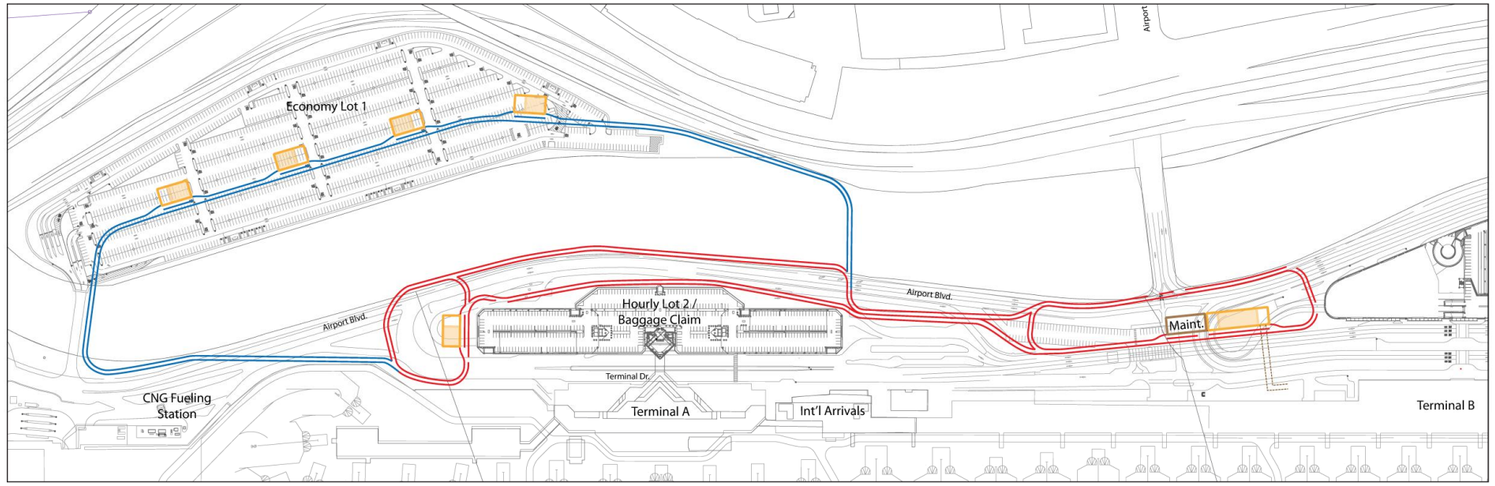
1. The base scheme shown here is intended to be constructed in combination with one of the Stage 1 options shown on the following sheet.
2. Small gaps in the alignment indicate locations of tie-ins of guideway from future phases.

Figure 7
Idea Family 2
Base Scheme

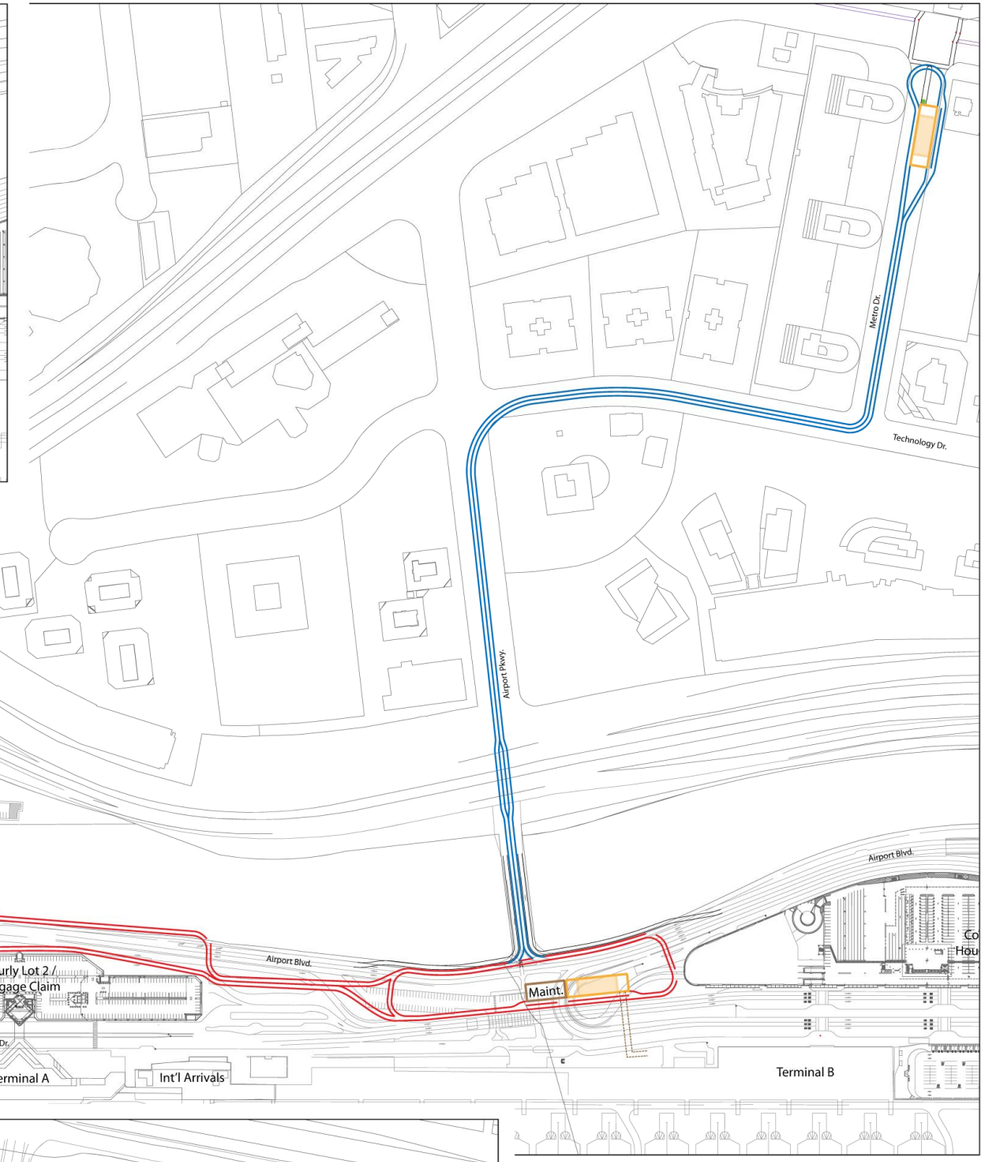
San José ATN Feasibility Study

August 26, 2011

ARUP



Economy Lot 1



VTA LRT

Terminal B Parking (Lots 4, 5, & 6)

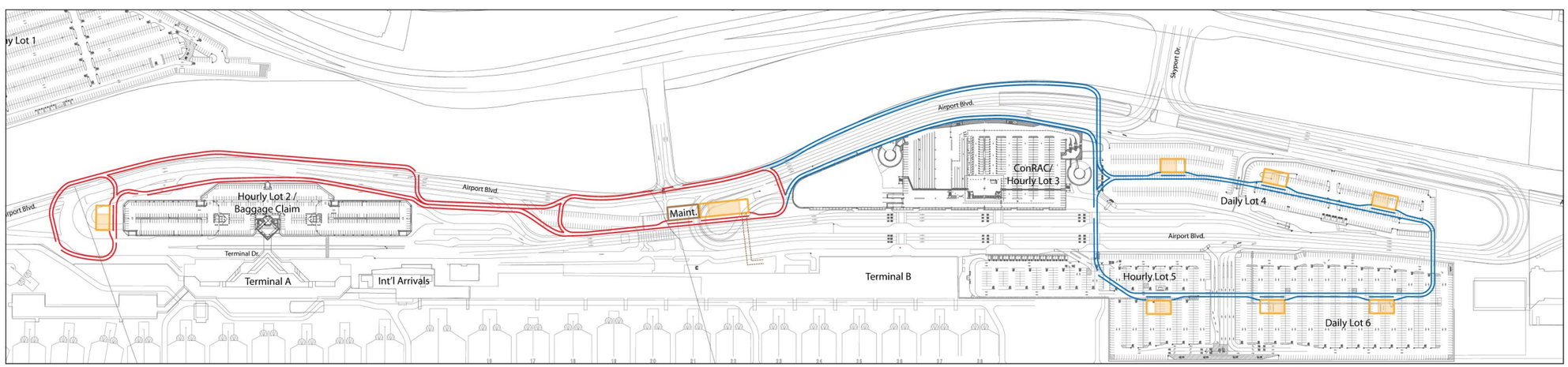
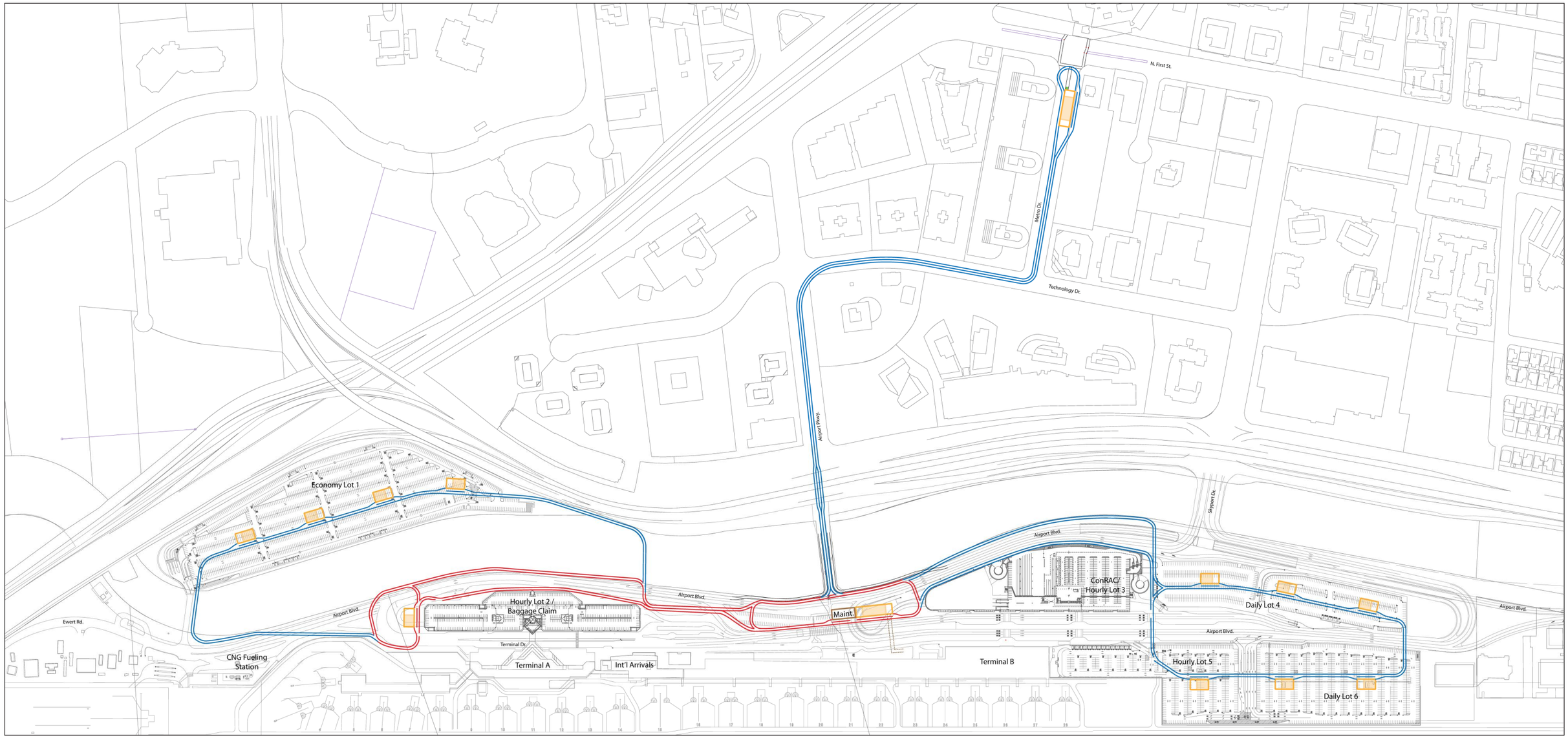


Figure 8
Idea Family 2
Stage 1 Options

San José ATN Feasibility Study

August 26, 2011

ARUP



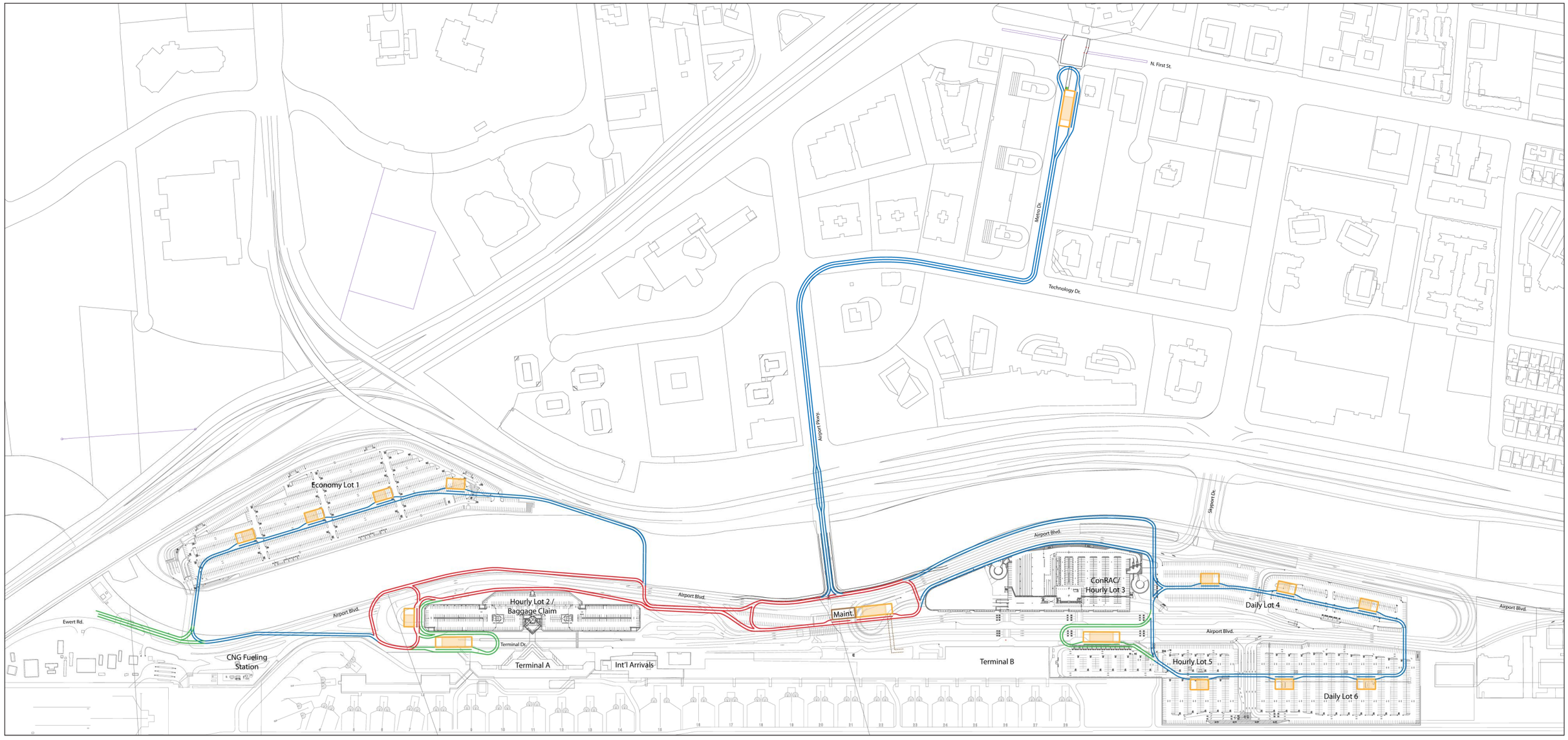
Stage 2 serving Economy Lot 1, VTA LRT, and Terminal B Parking

Figure 9
Idea Family 2
Stage 2

San José ATN Feasibility Study

August 26, 2011

ARUP



Stage 3 with connection to Santa Clara Station and with High-Capacity Stations

Figure 10
Idea Family 2
Stage 3

San José ATN Feasibility Study

August 26, 2011

ARUP

Memorandum

ARUP

To	Laura Stuchinsky Henry Servin	Date	September 27, 2011
Copies	Thomas Paige Austin Smith	Reference number	214704/GH
From	Gary Hsueh William Baumgardner	File reference	4-05
Subject	San José ATN Feasibility Study Round 3 Options Memo (Revised)		

This memo describes the first version of the "Round 3 Option" under consideration as part of Task 3, the physical routing options development process, of the San José Automated Transit Network (ATN) Feasibility Study. This memo is organized into the following sections:

- Description of the Round 3 Option: as developed to date
- Geometric Measurements: provided for Aerospace
- Terminal Area O-D Matrix: provided for Aerospace

Description of the Round 3 Option

The Round 3 Option incorporates concepts from previous rounds of options development, while it is focused on serving the high-demand scenario between Terminals A and B, and maximizing mainline travel speed (using the larger horizontal radius curves). The modification to the system architecture was driven by Aerospace to address the high-demand issue not resolved in the previous options. For a more comprehensive discussion of previous options development, please refer to the San José ATN Feasibility Study Round 2 Options Comparison, dated August 30, 2011.

Some aspects of the Round 3 option are still under development, and in the interest of moving the process forward, this memo highlights some of the assumptions made, issues to be resolved, and outstanding actions we suggest for the Project Team (City, Aerospace, Arup).

We anticipate that the Round 3 Option will continue to evolve as a response to Aerospace's network modeling and further developments in the high-capacity station concept, with a targeted final date of October 24, 2011. Arup will generate a final drawing for the Option and then evaluate the alignment according to the City's criteria.

Key Issues of the Round 3 Option

This section summarizes the key issues Arup has identified with the Round 3 Option. The issues are discussed in more detail in the following section. We recommend that the Project Team discuss/resolve these issues to further develop and finalize the option.

- Approach to providing high-capacity service
  - Requirement for capabilities beyond current technological ability.

    - Specific solution proposed that may not be deliverable by vendors.
- High-capacity station dimensions and operation
    - Needed in order to determine physical feasibility.
- Two stations at each terminal
    - Can both low-capacity and high-capacity functions be housed in the same station structure; tradeoff includes convenience/simplicity for passengers; question about phasing.
- Operation of and assumptions for low-capacity station at Terminal B
    - How to handle return vehicles.
- Transition across Airport Blvd. behind ConRAC
    - A slower speed guideway is likely needed.
- Design speed of new bridges over Guadalupe River
    - Necessitates long span north of Airport Parkway.
    - Necessitates two bridges near north end of Economy Lot 1
- Phasing of the option needs to be resolved
    - How the system is built incrementally
    - Maximizing cost savings by replacing bus operations

General Description of the Alignment

Terminal A and Terminal B

It is assumed that an elevated, high-capacity ATN station would be located above or very close to the Terminal A pedestrian bridge, providing convenient access to Terminal A and the Terminal A parking garage (where baggage claim is also located). The high-capacity station with an integrated "vehicle server", as described by Aerospace, would provide multi-vehicle chains of ATN vehicles along a reversible elevated guideway to/from ConRAC. This would accommodate the demand between Terminal A and ConRAC. The reversible guideway lane is assumed to be completely segregated from the other, adjacent elevated guideway lane. The low capacity guideway lane would have junctions to allow vehicles to switch from the high capacity lane to turn off to serve Economy Lot 1, VTA light rail, Santa Clara, and to receive vehicles coming from VTA light rail to Terminal B. It may also accommodate vehicles coming from Daily Lot 4 and circling back to Terminal B, as well as through trips from Economy Lot 1 and Santa Clara. The reversible lane is assumed to terminate at the elevated Terminal B high-capacity station. The Terminal B station would be located in the middle median island between Terminal B and ConRAC (between the first and second crosswalks). As drawn, with minimal turns and several large straight sections, the reversible lane appears able to accommodate speeds of 50 mph if the vehicles can achieve this speed while ensuring adequate passenger comfort.

Potential Issues:

- The requirement for high-capacity stations and high-capacity operations exceed the current capabilities of any potential ATN system/technology vendor. While understanding that some kind of option needs to be selected for evaluation, the requirement to provide a high-capacity system is highly significant for the project. (For example, it is possible that the feasibility study may deem this to be theoretically feasible, but it is unknown if it can be delivered by vendors.)
- As currently developed, this option uses an unconventional, yet specific approach to providing high capacity: simultaneous docking of multi-vehicle chains combined with a reversible guideway and fed by an automated vehicle storage system. Because this approach has not yet been implemented, it would be prudent to identify other approaches to providing adequate capacity (e.g. a dual guideway with two vehicle groups in shuttle operation, and/or larger vehicles).

- The high-capacity station / integrated vehicle server concept should be refined to the extent that a height, width, and depth can be identified to confirm that it can physically fit in the desired locations. Further, it would be desirable to the have a better understanding of how the station will operate. It is assumed that Aerospace will provide drawings to illustrate the concept.
- Passenger access from the Terminal A high-capacity station to baggage claim will need to be examined after the station concept is refined. Previous concepts included the use of an intermediate mezzanine level that would serve most passenger circulation and access functions while the ATN platforms/berths would be located one level above.
- A Terminal A low-capacity station is assumed to be located immediately to the north of the high-capacity station. Given the traffic flow along Terminal Drive at this location, the vehicle server function for the low-capacity station may need to be located above ground. Height requirements do not appear to be a limiting factor (see Figure 2 of the July 2011 Existing Conditions Memo); however, a tradeoff may be additional aesthetic impact. From a passenger convenience perspective, having the two station functions co-located/served by a common pathway or vertical circulation would be preferred.
- If the reversible guideway lane is allowed to mix with traffic from the adjacent lane, then additional safeguards (physical or systemic) may be needed to ensure that collisions are prevented.

South of Terminal B / Daily Lot 4

An elevated low-capacity station is envisioned to be located south of the high-capacity Terminal B ATN station. Vehicles returning from the VTA light rail station or Economy Lot 1 could pass by the high-capacity station and stop/unload at the low-capacity station. Vehicles could travel from the low-capacity station to VTA light rail or Economy Lot 1 via a 19-mph curved elevated segment immediately south of ConRAC.

The low-capacity station would also send and receive vehicles to two elevated ATN stations serving Daily Lot 4 via a one-way elevated loop. It is not known currently how the station would handle returning vehicles, but some possible options would be to use vehicles that are reversible, or the station could have a turntable to allow returning vehicles to unload passengers, turn around, and be sent out again on the loop. The outbound segment would allow a speed of 50 mph but vehicles would need to slow to approximately 15 mph for the curve into the the stations in Daily Lot 4. After passing through the straight station zone, in which a combined acceleration/deceleration lane serves both stations, vehicles could return at 25 mph to the low-capacity station.

Potential Issues:

- As discussed above, the low-capacity station as drawn does not have a turnaround loop. If this proves infeasible to assume, then alternate approaches will need to be examined, for example, vehicles from Daily Lot 4 may need to go past Airport Parkway to turn around to return to Terminal B.
- The alignment does not traverse through Daily Lot 6 in consideration of the Airport's future terminal development plans should air passenger traffic rise. The result is a fairly tight curve as the alignment returns to serve Daily Lot 4 stations, resulting in slow (15 mph) speeds on the curve.

From Daily Lot 4 through Airport Parkway / VTA Light Rail

From the Daily Lot 4 stations, vehicles would also have the option to go directly to Economy Lot 1 or Terminal A via a high-speed (50+ mph), one-lane, elevated segment along the east edge of ConRAC. After the guideway crosses over Airport Boulevard, it would splitinto two segments.

One segment is straight and elevated, allowing vehicles to continue at speed to Economy Lot 1 and to Terminal A. The other segment would descend to grade level to the median of the existing Airport Parkway bridge, cross

the Guadalupe River and continue under SR 87/Guadalupe Parkway. After it crosses under SR 87, the dual guideway would rise in elevation and continue along Airport Parkway, then turn onto Technology Drive, then onto Metro Drive to terminate with a loop at the elevated Metro Drive ATN station. On the return from VTA, the guideway would rise from grade at the Airport Parkway bridge to meet up with the elevated bypass segment. A 15-mph turnback loop allows vehicles from VTA to reach Terminal B.

Potential Issues:

- The alignment shown behind ConRAC is illustrative. The issues that have previously been discussed by the Project Team include an inability to reduce the number of traffic lanes in the area behind ConRAC, the presence of the high-voltage electrical lines and towers, the limited space for columns along the base of ConRAC, and potential interference with the façade artwork above. The assumption is that one guideway lane can be cantilevered out from the ground at the base of ConRAC, but additional study will ultimately be required to see whether the long spans crossing Airport Boulevard are feasible as shown, as curved guideways without intermediate supporting columns require substantial support at the ends.
- The use of the existing Airport Parkway bridge is a major design benefit that avoids the need to cross the Guadalupe River and SR 87 with new, tall long-span bridges but the assumed alignment would entail two small radius horizontal curves (one in each direction) that would require significantly reduced vehicle speed at the intersection. One outstanding issue is to resolve how through vehicles can traverse through the area at higher speeds.
- The VTA alignment was drawn using the previous criteria of minimum 50 foot radius. A higher-speed curve may be possible at the intersection of Technology Drive and Metro Drive.
- The Metro Drive ATN station has not been changed from previous options.

Economy Lot 1 to Terminal A

North of the Airport Parkway intersection, the elevated guideway would split. One lane would allows high-speed operation along the back of the Terminal A garage to a point where it turns back at 18 mph to reach the Terminal A high-capacity station.The other lane would cross the Guadalupe River via a new, architecturally significant long-span bridge that would allow vehicles to travel at 40 mph. Once in Economy Lot 1, the guideway would split into a mainline and a combined acceleration/deceleration lane serving all four elevated Economy Lot ATN stations. Leaving Economy Lot 1 via a one-way loop, the guideway would split. One lane would continue to Santa Clara at high speed, while the other returns to Terminal A via a 20-mph curve. Both lanes would require new bridge structures over the Guadalupe River. After crossing the river, the sweeping elevated curve segments back to Terminal A allow 40-mph operation to the Terminal A high-capacity station.

Potential Issues:

- In order to maximize speeds, a long-span bridge (500 feet or more) is assumed to cross the Guadalupe River to Economy Lot 1. While this offers the opportunity for a signature bridge to be designed, it also would be much more costly (by approximately 3 times) than a bridge of the same length with shorter spans. In order to avoid disturbing the river channel, then the footing for a long-span bridge would need to be located near the east bank, as there is insufficient space for a 30’ by 30’ footing (preliminary estimate) on the west bank. The tower height, assuming a single-pier cable-stayed bridge, would be roughly 270 feet above grade. This height would exceed the maximum flight contours in this area of 160-177 feet above grade. The high-voltage power lines may also be an obstacle, depending on the exact location of the bridge.

- An additional bridge at the north end of Economy Lot 1 is necessitated by maximizing the size of the sweeping return curve to Terminal A, which splits the guideway before crossing the Guadalupe River. Alternatively, the segment continuing to Santa Clara could be adjusted to form a tighter "T", but at the expense of reduced speed.
- Both bridges at the north end of Economy Lot 1 cross the Guadalupe River at a more straight-on angle than the other Economy Lot bridge, but the span distance is still approximately 200 feet, which would typically be built with at least temporary piers in the river channel.

Santa Clara Segment

From Economy Lot 1, the elevated guideway would descend to grade level along the current Ewert Road right-of-way around the north end of the airfield. Several straight segments would offer opportunities for high-speed travel; curves generally allow 30-mph or greater speeds. Past the vicinity of the blast protection fences along Ewert Road, the dual ATN guideway would rise to go over and around the old parking lots on the west side of the airfield to Martin Avenue, allowing the Airport to maximize the footprint of future redevelopment of the parking lots. The guideway would maintain 35 mph design speed through curves at the beginning of Martin Avenue, after which the guideway continues straight along Martin Avenue. At the end of Martin Avenue, the guideway would make a sharper 20-mph curve to the south edge of Brokaw Road, where it would proceed west over private property, cross the Coleman Avenue/Brokaw Road intersection, and end at an elevated station with turnback loop at the current end of Brokaw Road near the future Santa Clara BART station. A pedestrian overcrossing could provide access to the existing Caltrain station on the other side of the railroad tracks.

Potential Issues:

- It is assumed that Ewert Road will be converted to Airport internal use only, potentially replacing/merging with the airside access road. Other transportation functions include the ATN guideway, and bike lanes or a multi-use path.
- Along the north side of the airfield, there are two narrower areas where Ewert Road will need to be removed or narrowed in order to accommodate the dual at-grade ATN guideway. A further level of study is required in these areas to determine feasibility.
- The ATN avoids Memorial Cross Park, which is believed to be the original site of Mission Santa Clara.
- The FAA Ground Radar Facility at the end of Martin Avenue presents a special risk because of the combination of its proximity to the edge of Martin Avenue and to-be-researched system shielding / interference / minimum setback requirements. Henry Servin indicates that the original APM study was given a requirement to stay "at least 150 feet away from the antennas' predominant wave spread to avoid compromising the radar waves."
- Brokaw Road is narrow down to Coleman Avenue, and both sides of the street are lined with local-scale utility poles. Alignment options for the elevated ATN guideway include locating columns on private property on either side of the street, or creating a median for support columns that would likely require removing public parking from at least one side of the street. It is currently assumed that the alignment will traverse private property along the south side of Brokaw, and that the existing utility lines along that side of Brokaw would be undergrounded, as well as those at the intersection of Brokaw and Coleman Avenue. West of Coleman Avenue, there are more opportunities for redevelopment of existing parcels (notably the FMC site) along Brokaw Road. The ATN guideway is shown aligned with the center of Brokaw Road, and an elevated terminus station is assumed, pending more defined plans for redevelopment.

Phasing

The Project Team has not yet determined the staging for this option, especially for Stages 1 and 2 (Stage 3 is assumed to include all elements discussed in the memo and shown in the figures). Some of the issues involved in the determination include the following:

- Potential operating cost savings from replacing the Airport shuttle buses (there are multiple choices depending on parking lots served)
- Potential operating cost savings from replacing the Airport Flyer/VTA Route 10 (partially or fully)
- Potential ridership vs. operating cost (operating cost per passenger mile) and other performance metrics
- Low-speed operation (proven by current technology) vs. high-speed operation
- Low-capacity operation (proven by current technology) vs. high-capacity operation
- Configuration of low-capacity stations (those in use in existing systems vs. new designs)
- Reserving sufficient space for high-capacity stations and additional guideway while accommodating low-capacity operation
- Low-capacity service between Terminal A and ConRAC, vs. no service (but the network function still requires the guideway between those points)
- Public expectations of the extent of a Stage 1 and Stage 2 system

Geometric Measurements

The attached Figures 1 through 11 illustrate the alignment currently envisioned for the Round 3 Option. Arup has measured each segment of the alignment, providing radius of curvature, distance, and elevation change.

Figures 3 through 11 contain specific dimensions, except elevation changes as noted below. The locations of elevation changes are shown on Figures 5, 7, and 9. A site topographic map showing 5-foot index contours is attached as Figure 12, which demonstrates that the site increases in elevation gradually from north to south.

Elevation Changes of ATN Round 3 Option

#	Location/Description	Elevation Change	Assumed Slope	Length
0	Elevated sections are generally assumed to be at 20 feet above grade; almost all guideway is elevated except as noted below	Varies	0%	Varies
1	Descent from northbound elevated mainline along Airport Blvd. to grade at Airport Parkway bridge	20 feet	-6%	333 feet
2	Ascent from Airport Parkway bridge at grade to northbound elevated mainline	20 feet	6%	333 feet
3	Ascent from elevated mainline along Terminal Drive to Terminal A high-capacity station	15 feet	6%	250 feet
4	Descent from Terminal A high-capacity station to elevated mainline	15 feet	-4%	375 feet
5	Descent from elevated mainline at Ewert Road to grade	20 feet	-6%	333 feet
6	Ascent from grade level at Ewert Road to elevated mainline	20 feet	6%	333 feet

Memorandum

Terminal Area O-D Matrix

Airport staff (Bob Lockhart) provided shuttle daily boarding data for the month of August, by route and by time. Arup aggregated the data to generate average daily shuttle boardings by route. Arup then updated the origin-destination matrix from the Existing Conditions Report (July 2011) to reflect the addition of Daily Lot 4 south of Terminal B, as well as checking the Economy Lot estimates against the shuttle data. The revised O-D matrix is presented below.

Origin-Destination Matrix – Daily Trips Potentially Served by ATN						
	Economy Lot	**Terminal A**	**GTC**	**Terminal B**	**ConRAC**	**Daily Lot 4**
Economy Lot		250	0	400	0	0
Terminal A	0		0	150	170	0
GTC	250	0		0	1150	80
Terminal B	400	0	0		0	120
ConRAC	0	1150	0	0		0
Daily Lot 4	0	80	0	120	0	

Notes

The matrix above is based on current shuttle data. Estimates for future design years should be factored up accordingly.

The demand from the terminal areas to VTA and Santa Clara Caltrain are not expected to change from the numbers previously reported in the Existing Conditions Memo – for the existing condition, 170 trips total between Terminal A and VTA; 170 trips total between Terminal A and Caltrain; 250 trips total between Terminal B and VTA; 250 trips total between Terminal B and Caltrain; and 300 trips total between Caltrain and VTA.

The trips are not balanced. On average, there appear to be approximately 300 more trips made per day from Terminal A to Terminal B/ConRAC. The Airport offered several potential explanations for the imbalance, with the first reason perhaps contributing the most to the imbalance:

- Employees park at employee parking in A (there are regularly more than 300 vehicles per shift); they take the shuttle to B, but walk back through B to get back to their parking space.
- People arriving by plane at A take the shuttle to ConRAC to rent a car, then drop off their car elsewhere (e.g., San Francisco)(1-way trip).
- People park in the Terminal A garage because the Terminal B garage is full; take the shuttle to B to fly out; then on their return trip when they arrive at B, they walk back through B to get to their parking space.

Anecdotally, Daily Lot 4 had about 50-70 cars parked on a given day in August compared to a capacity of 400 vehicles. The shuttle operator recorded no boardings in August at Daily Lot 4. The Airport thought that was reasonable, concluding that people likely walk to Terminal B rather than wait for a shuttle, given that cars parked in the lot are always observed to be parked close to Terminal B. This, plus the fact that Economy Lot 1 does not yet currently fill to capacity, indicates that Daily Lot 4 does not yet operate as the Airport has expected it to – as

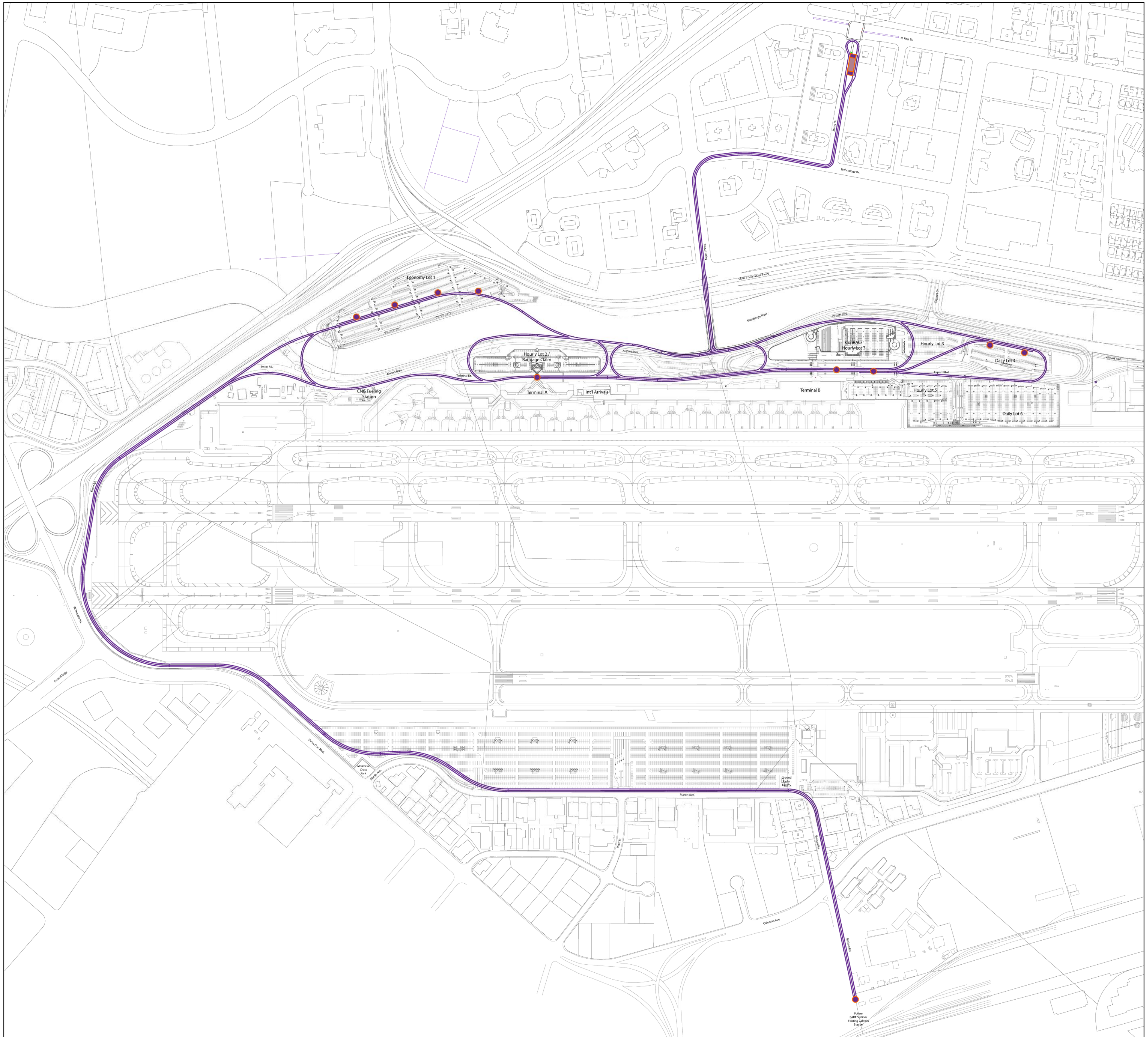
an overflow for the Economy Lot. However, for purposes of this study, the O-D matrix reflects a *maximum* daily demand for Daily Lot 4, using the assumptions described below.

Peak period demand has not been calculated, but it would be expected to follow previous demand patterns that were estimated using the Airport's current flight schedule. The previous peak demand estimates are discussed in the San José ATN Feasibility Study Airport Passenger Demand Analysis, dated April 29, 2011.

Assumptions and Issues

The following assumptions and issues related to the O-D matrix are noted below.

- The same number of people travel between Economy Lot 1 and Terminal A/GTC (the trips are balanced).
- The same number of people travel between Economy Lot 1 and Terminal B/ConRAC (the trips are balanced).
- People getting on at Terminal A travel to Terminal B or ConRAC.
- People getting on at GTC (near Terminal A) travel to Economy Lot 1, ConRAC, or Daily Lot 4.
- People getting on at Terminal B travel to Economy Lot 1 or Daily Lot 4.
- People getting on at ConRAC travel to Terminal A.
- The demand split for Economy Lot 1 and Daily Lot 4 is assumed to be 40% Terminal A and 60% Terminal B, which is how current air passenger traffic is divided between the terminals.
- The demand for Daily Lot 4 assumes that the lot is filled to capacity every day (400 vehicles), and that half the lot turns over every day (average parking duration of 2 days per vehicle, shorter than Economy Lot 1). Thus it is assumed that 200 trips come from and 200 trips go to the lot every day.
- The average length of stay per vehicle in Economy Lot 1 is calculated at 2.6 days per car. This assumes that the lot is filled to capacity of 1671 vehicles every day, that there is one person per car, and is based on average daily shuttle ridership of 639 throughout the month of August. Several factors could alter this calculation:
    - If the lot is not filled to capacity (anecdotally it actually does not fill completely every day, but a better number could not be established), then given the same shuttle ridership, the average stay would be shorter.
    - If there is more than one person per car on average, and given the same shuttle ridership, then the average stay would be longer.
- Parking data will help validate some of the above assumptions, particularly in terms of parking occupancy that would better inform the average stay per vehicle.
- Only a travel survey will generate origin-destination information.



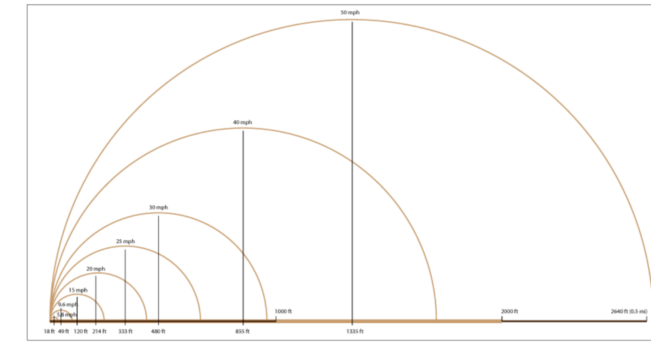


Figure 1
Round 3 Option
Overview

San José ATN Feasibility Study

September 22, 2011

ARUP

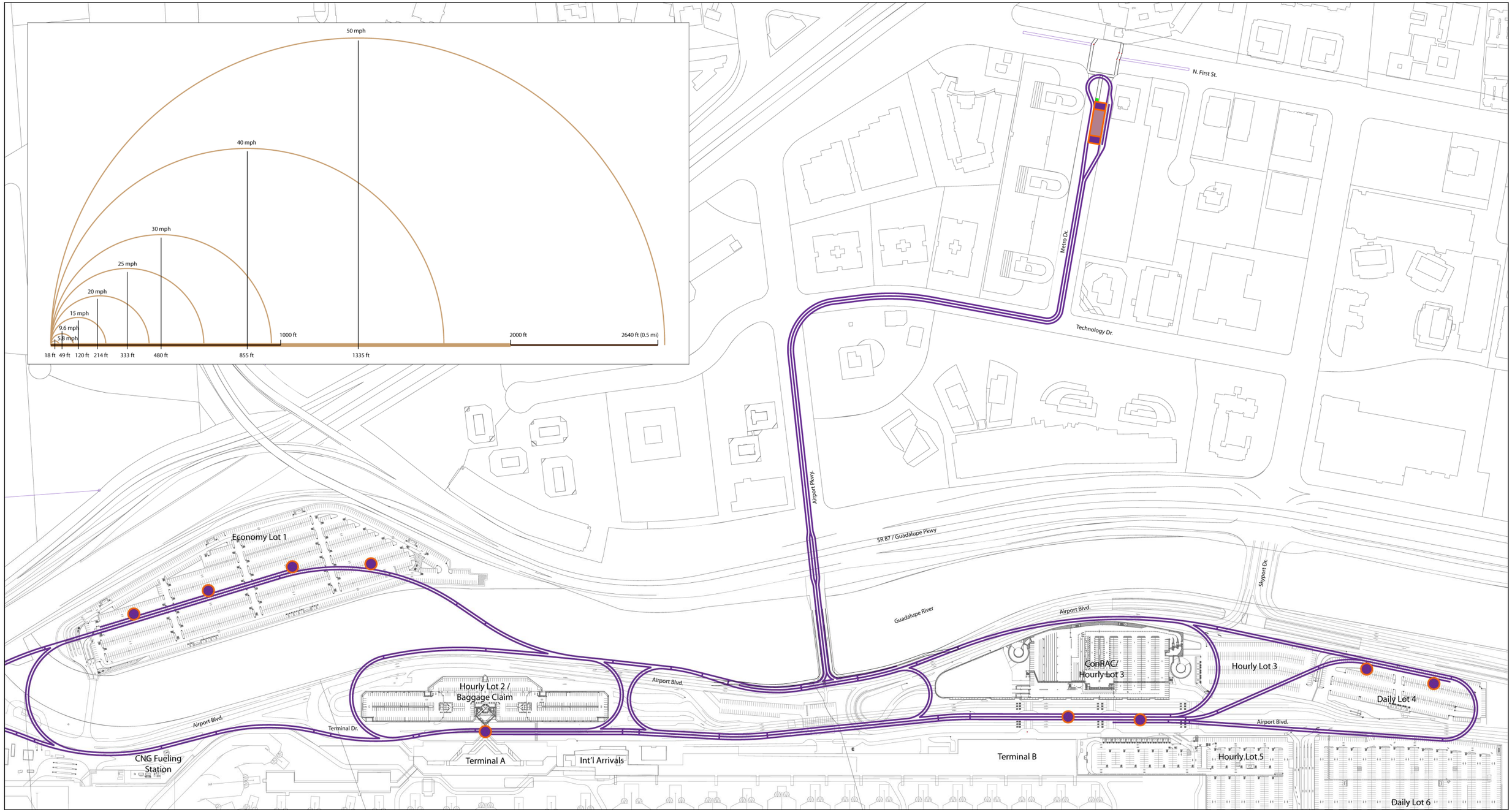


Figure 2
Round 3 Option
Terminal Area Overview

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September 22, 2011

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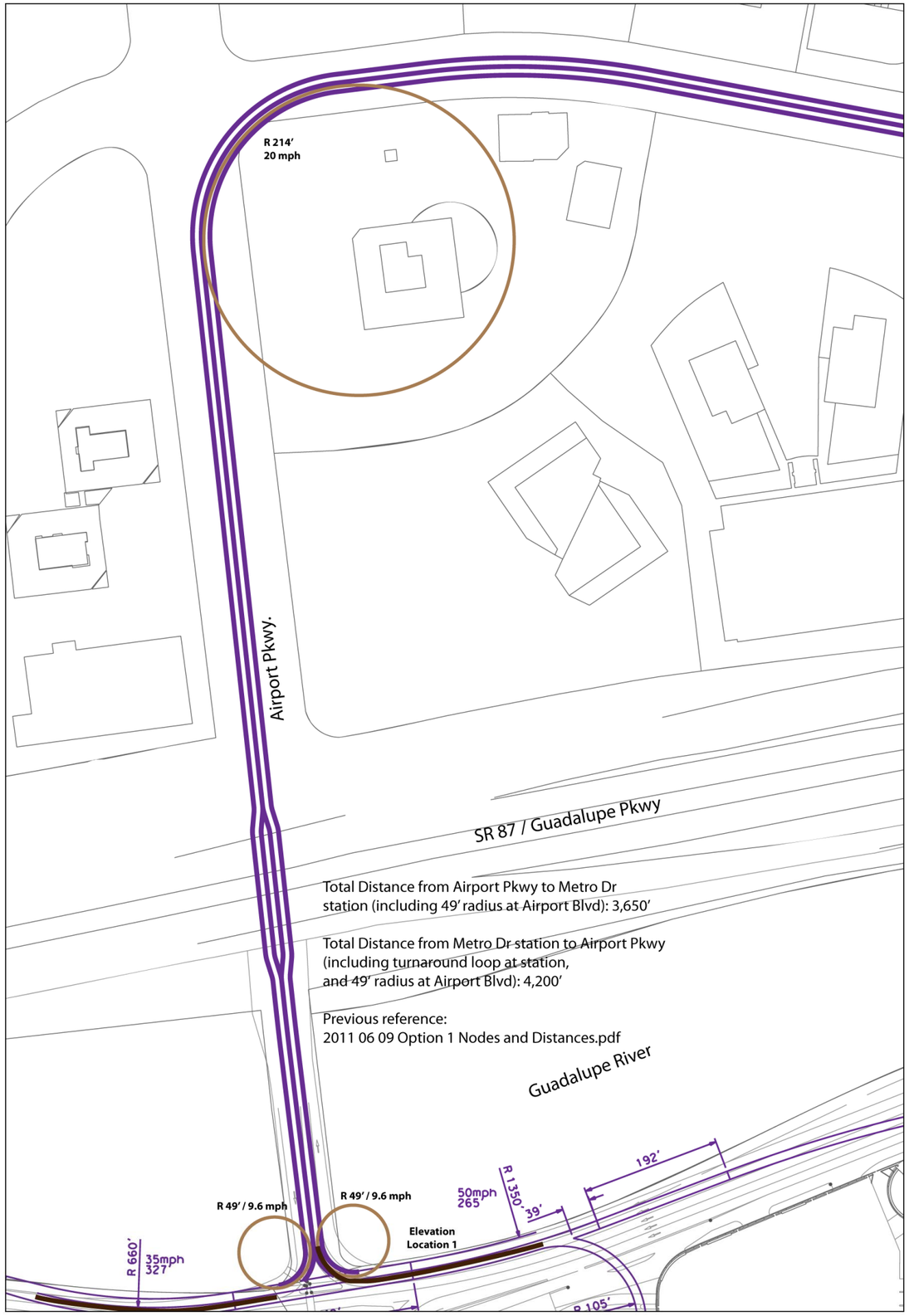

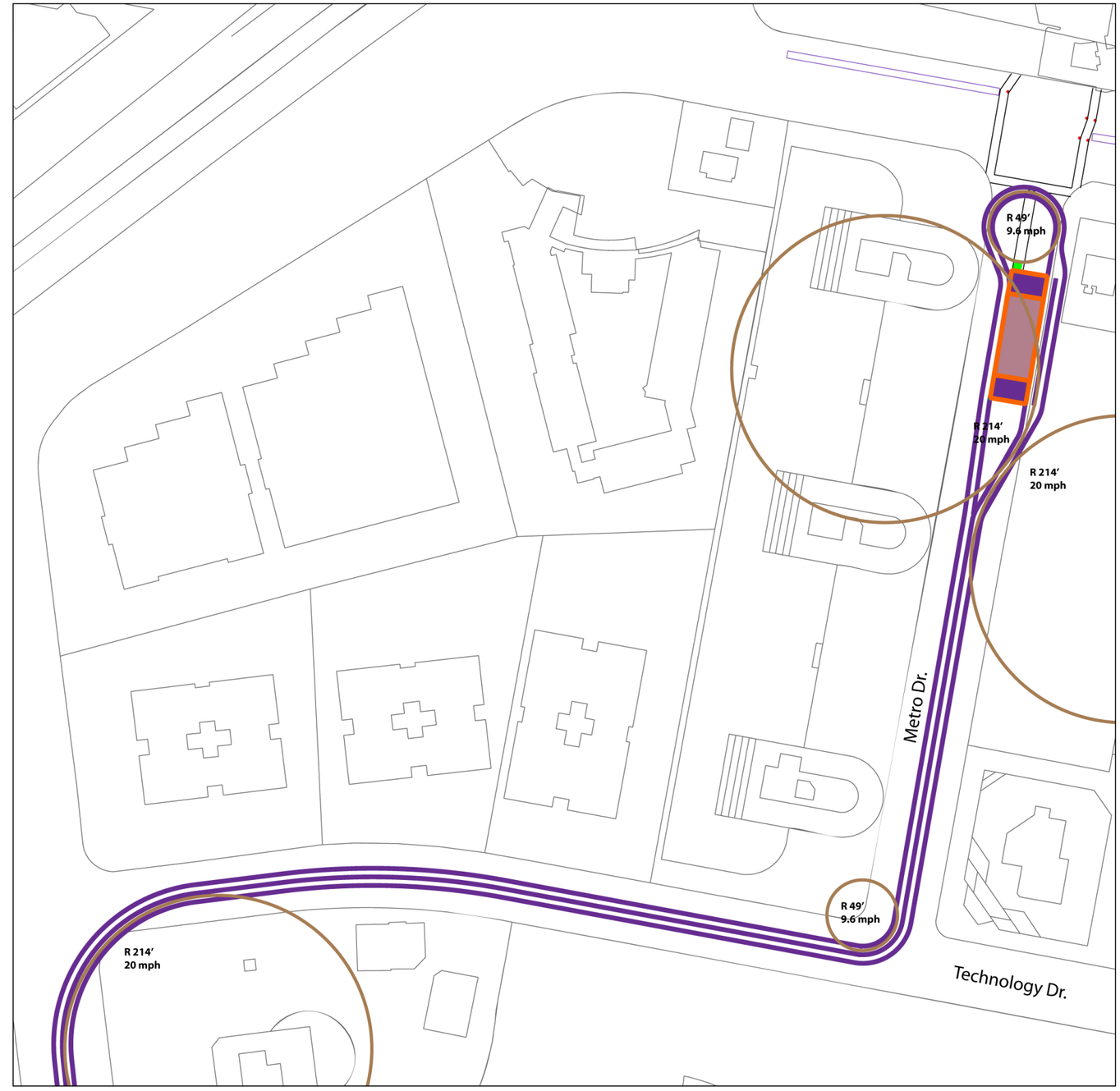

Figure 3
Round 3 Option
VTA Segment Dimensions

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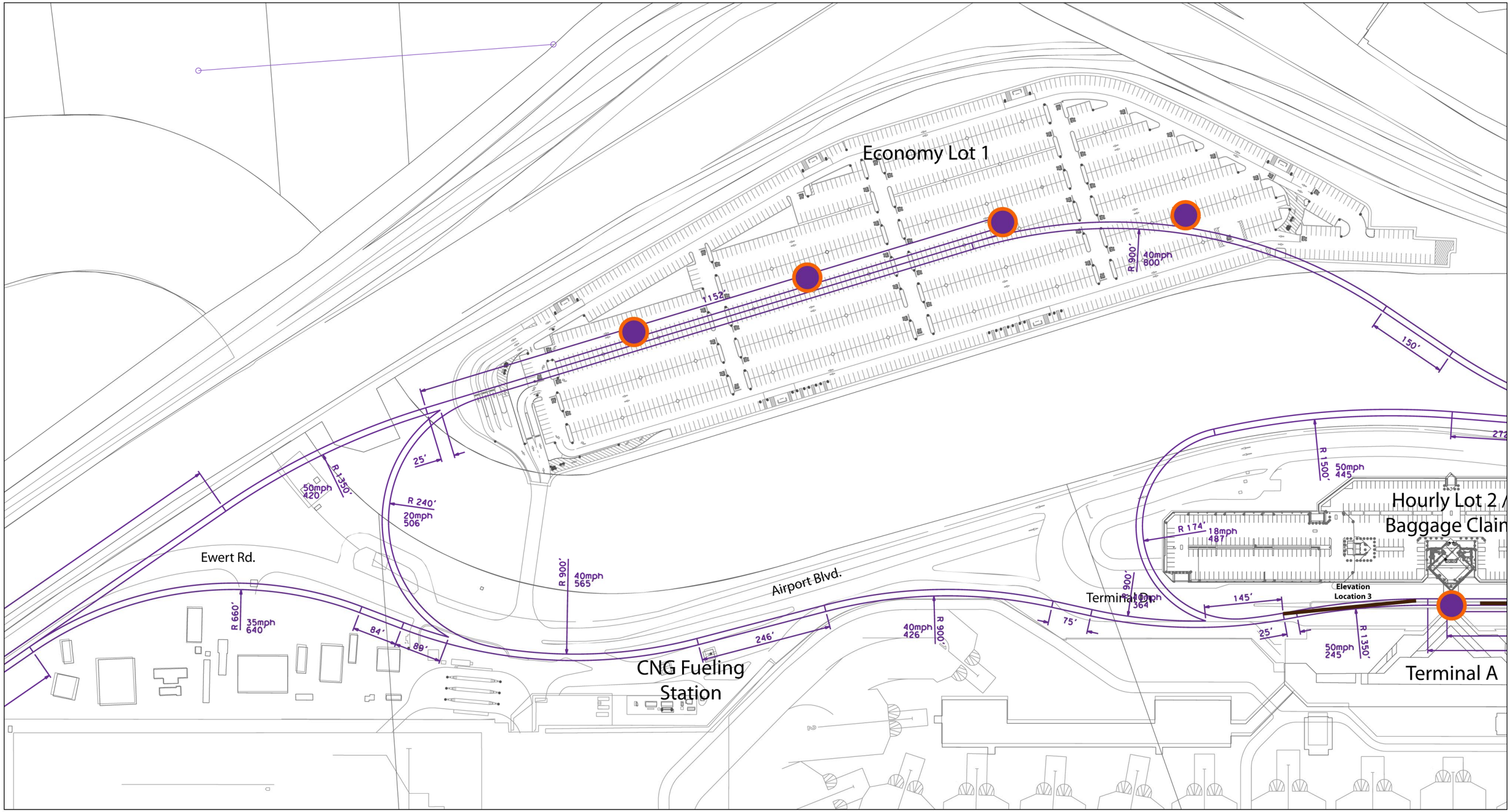

Figure 4
Round 3 Option
Economy Lot 1 Area Dimensions

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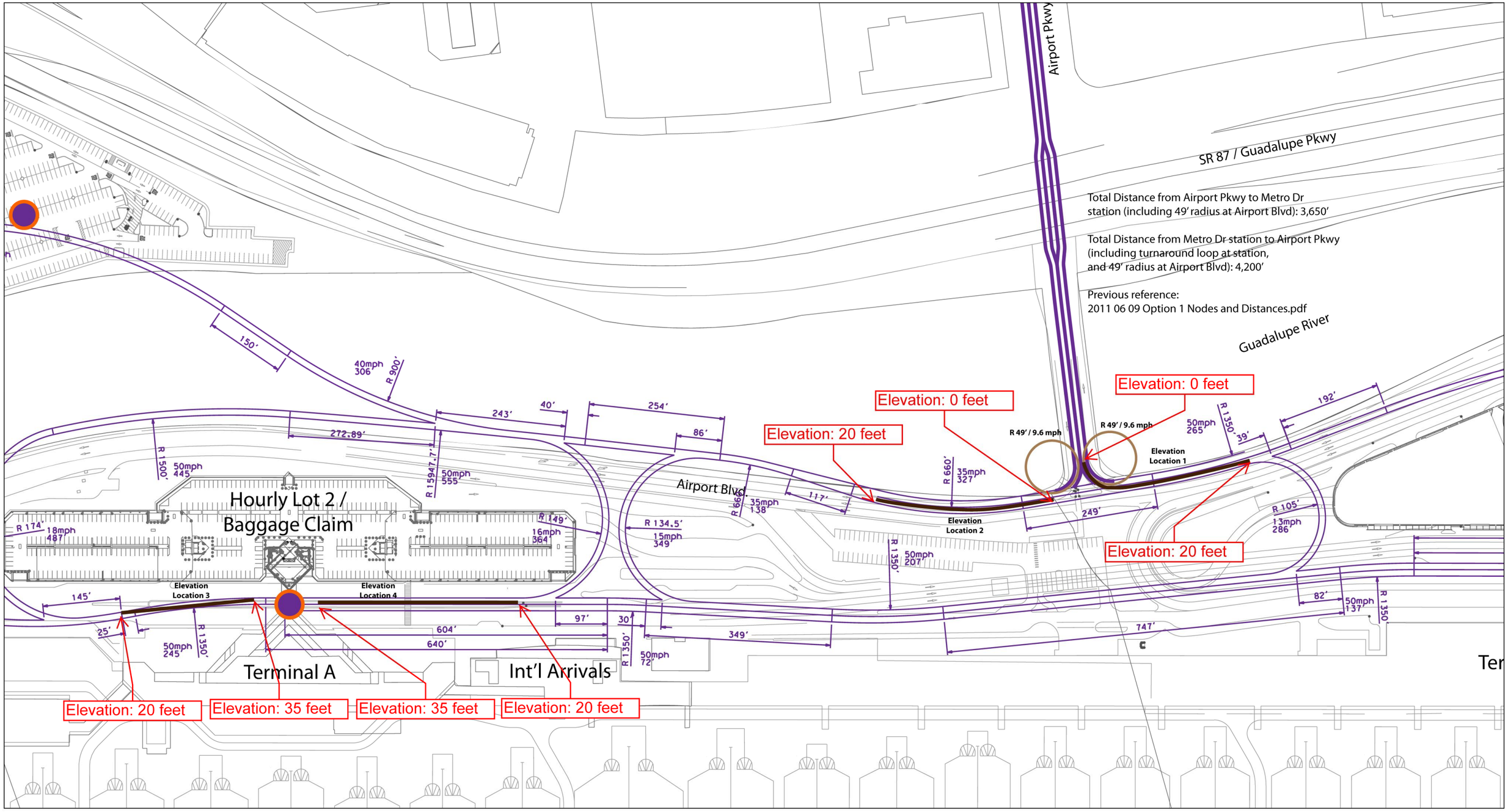

Figure 5
Round 3 Option
Terminal A / Airport Parkway Area Dimensions

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September 22, 2011

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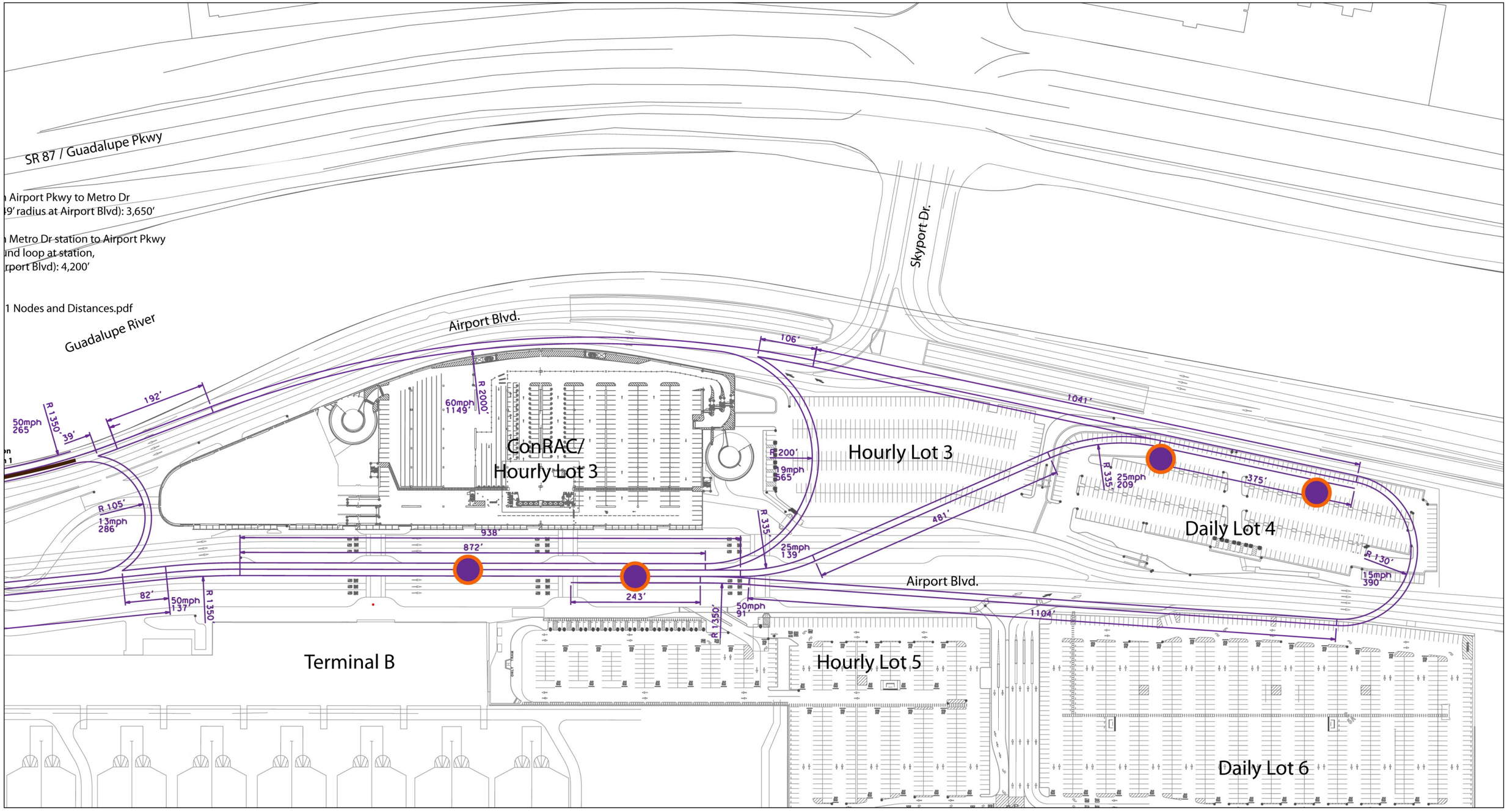

Figure 6
Round 3 Option
Terminal B / Daily Lot 4 Area Dimensions

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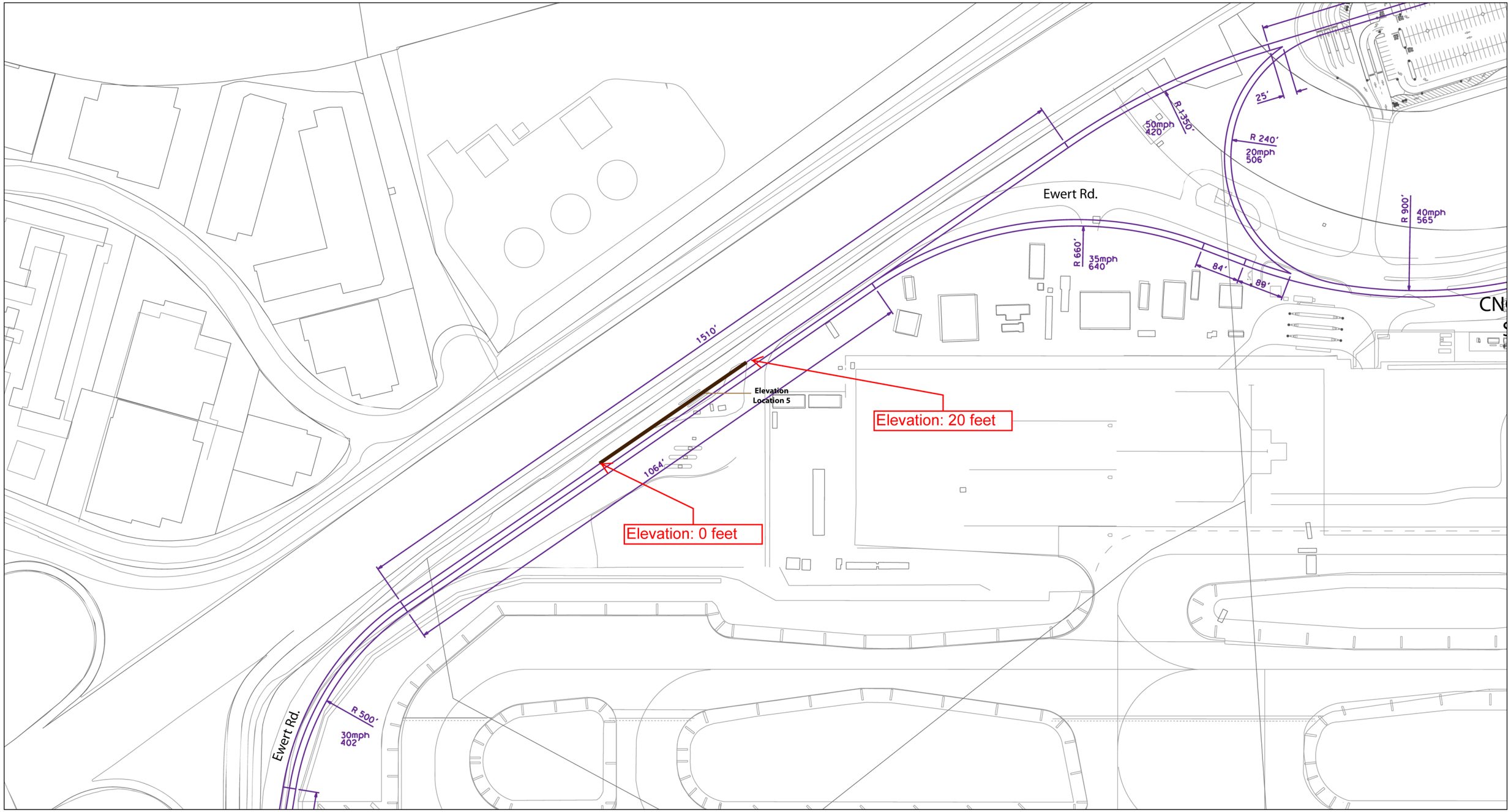

Figure 7
Round 3 Option
North Airfield Area Dimensions

San José ATN Feasibility Study

September 22, 2011

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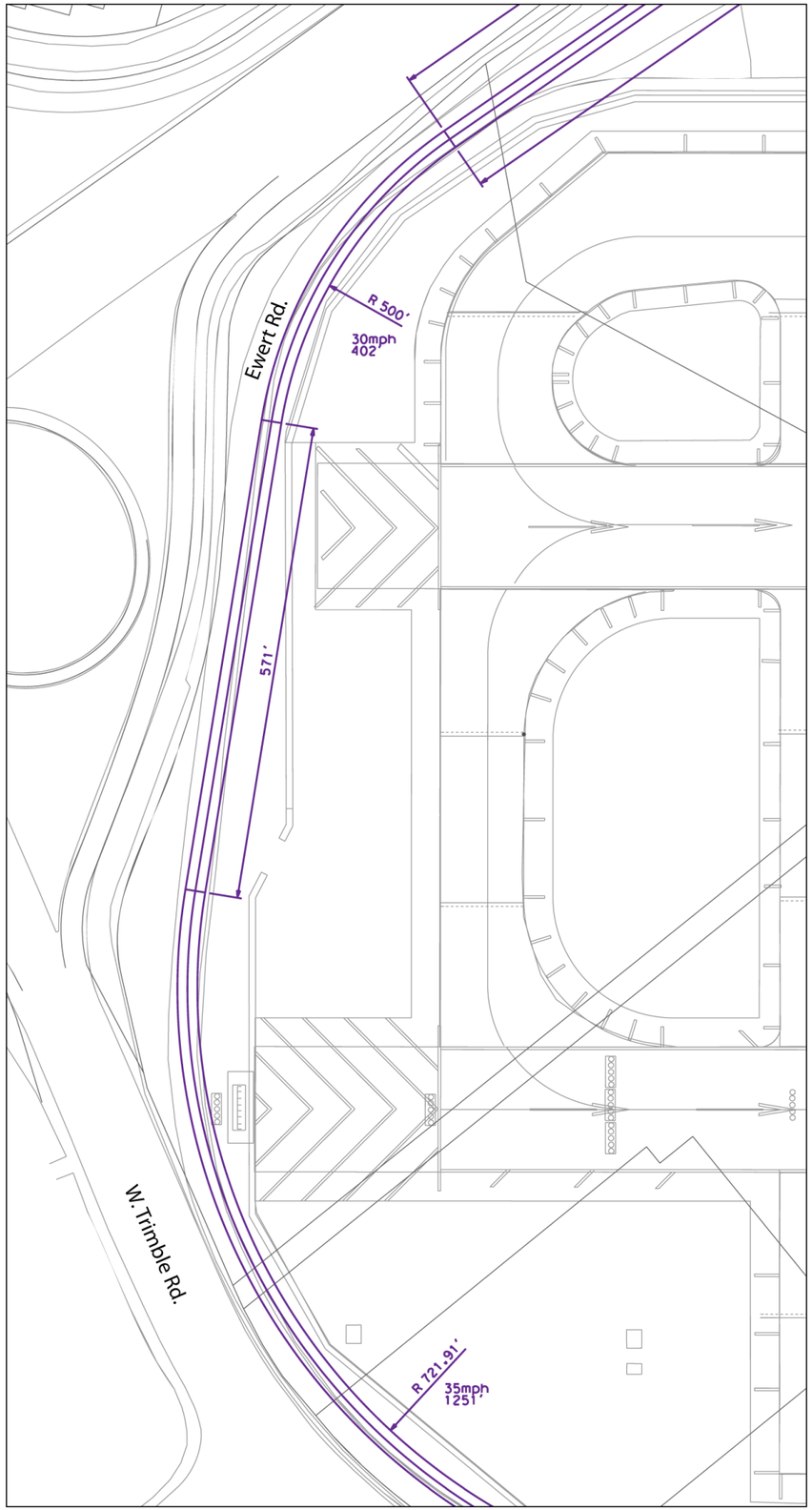

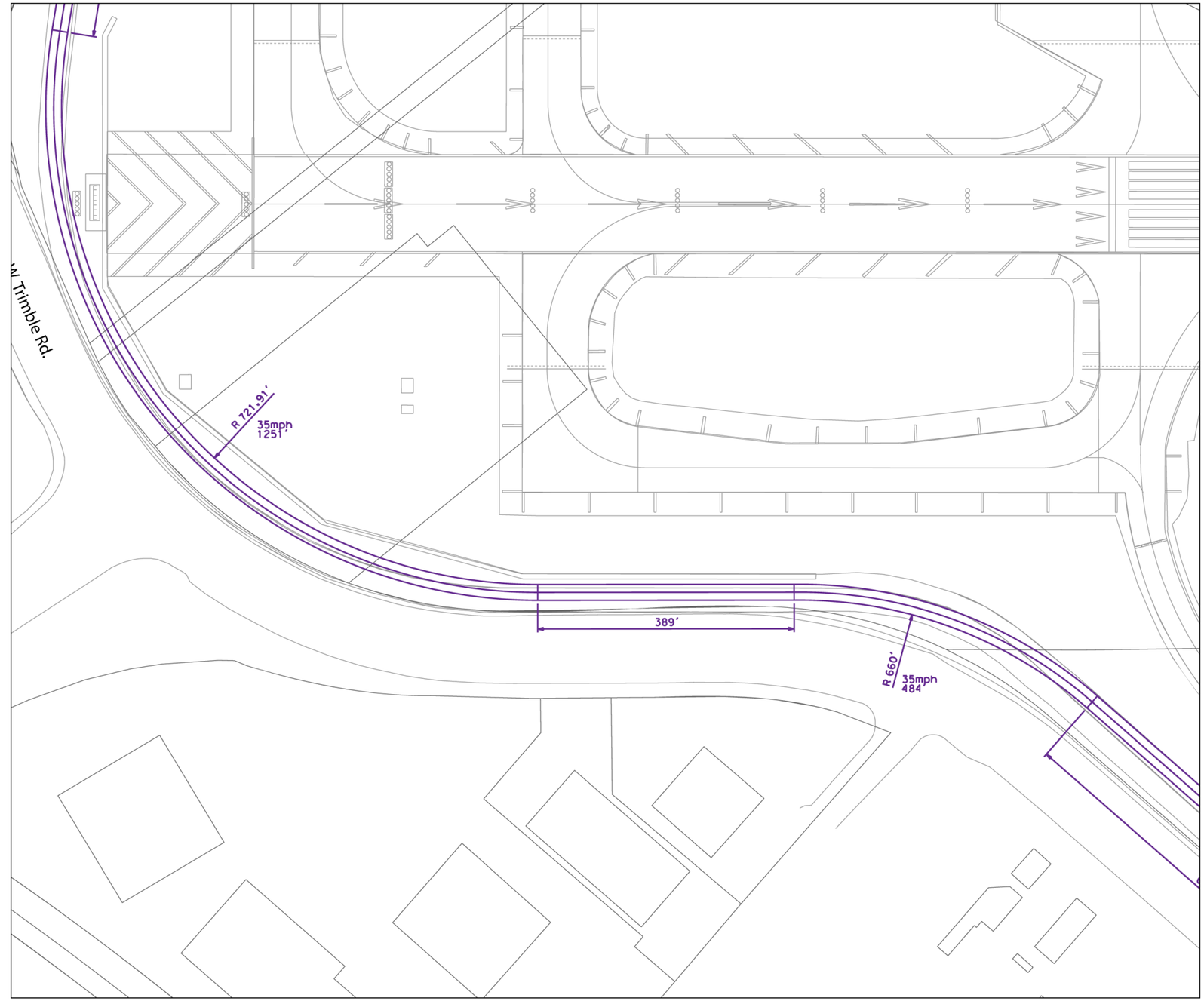

Figure 8
Round 3 Option
North Airfield Area Dimensions, cont.

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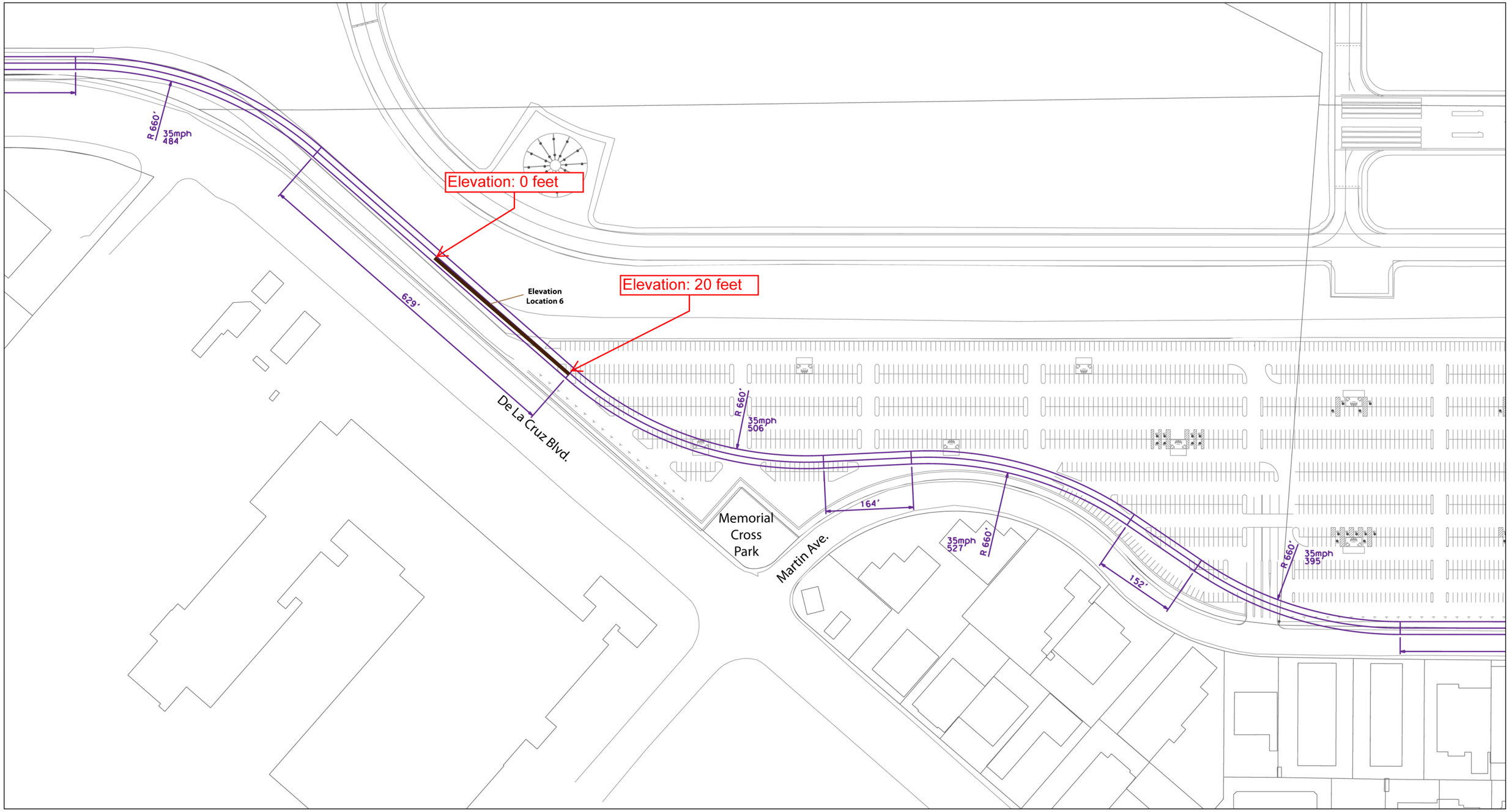

Figure 9
Round 3 Option
De La Cruz / Martin Ave Area Dimensions

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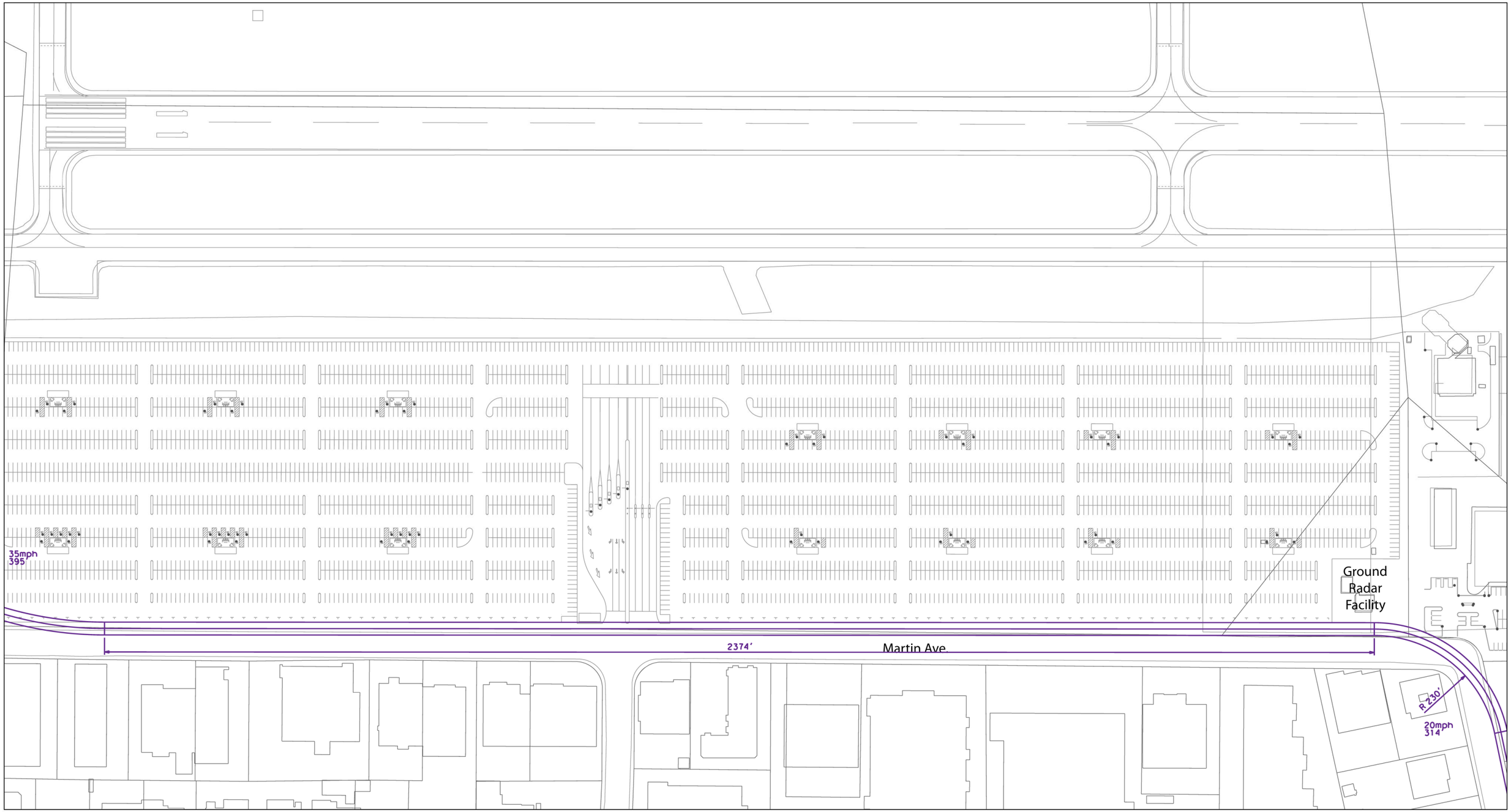

Figure 10
Round 3 Option
Martin Ave Area Dimensions

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September 22, 2011

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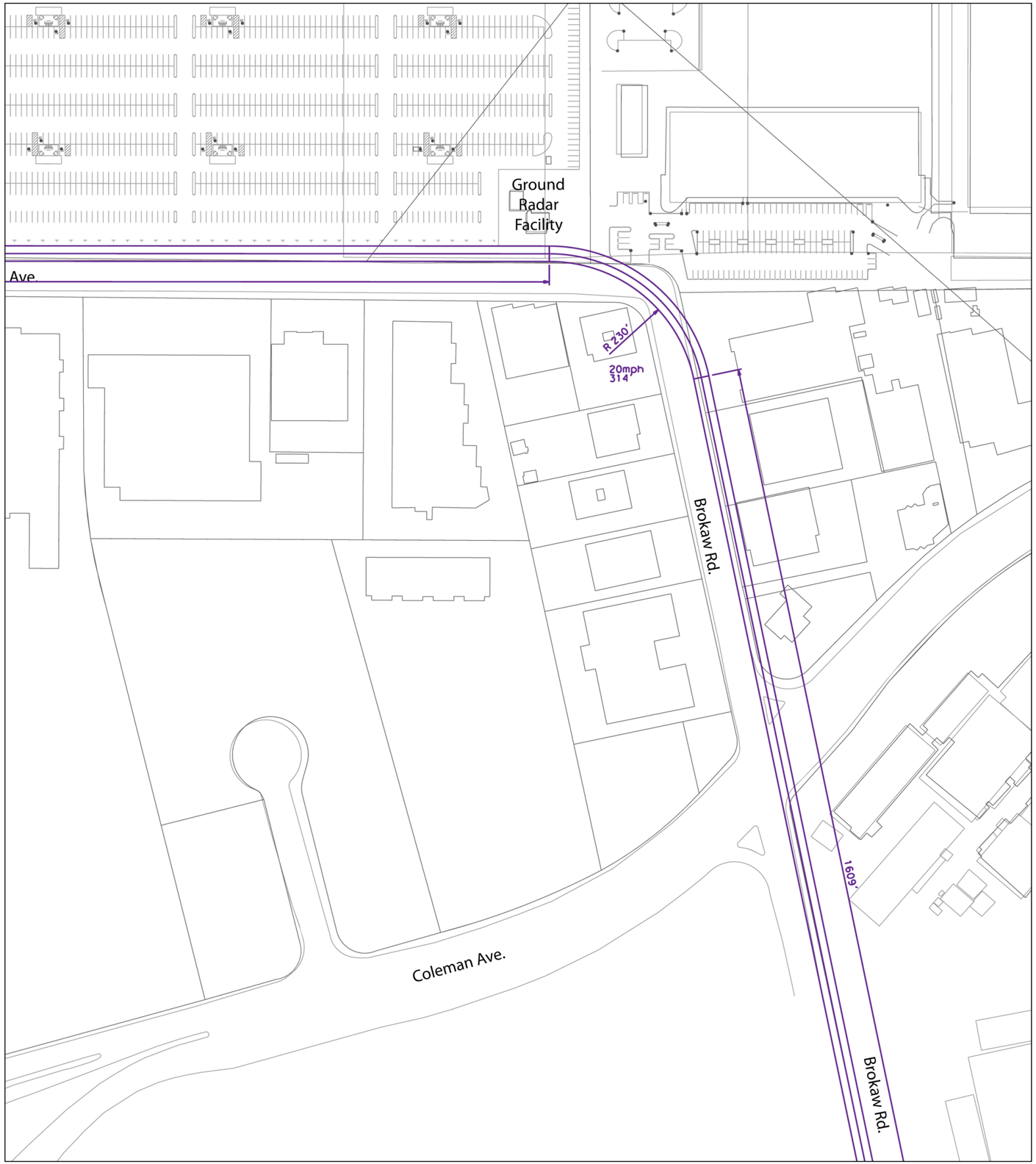

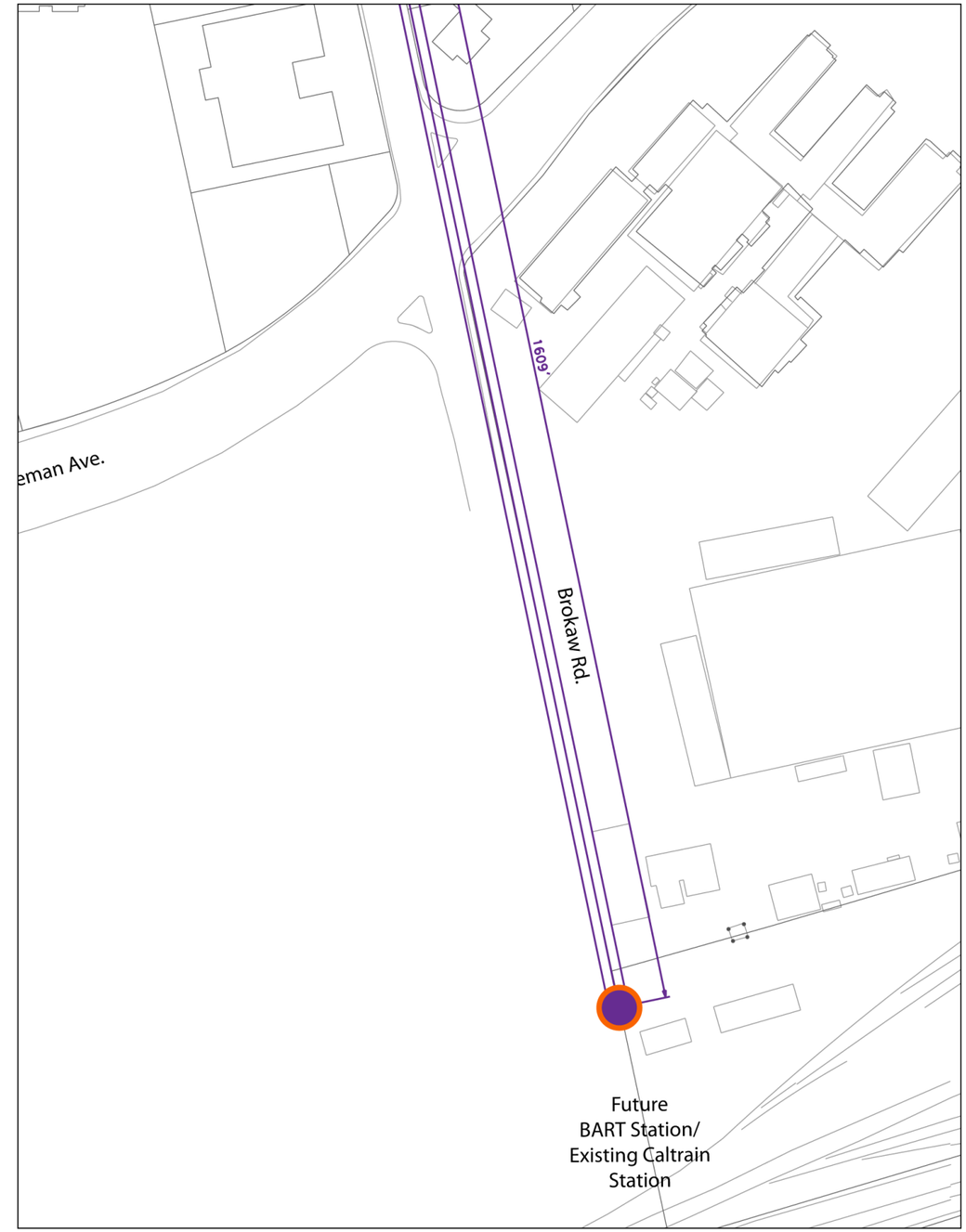

Figure 11
Round 3 Option
Brokaw Rd Area Dimensions

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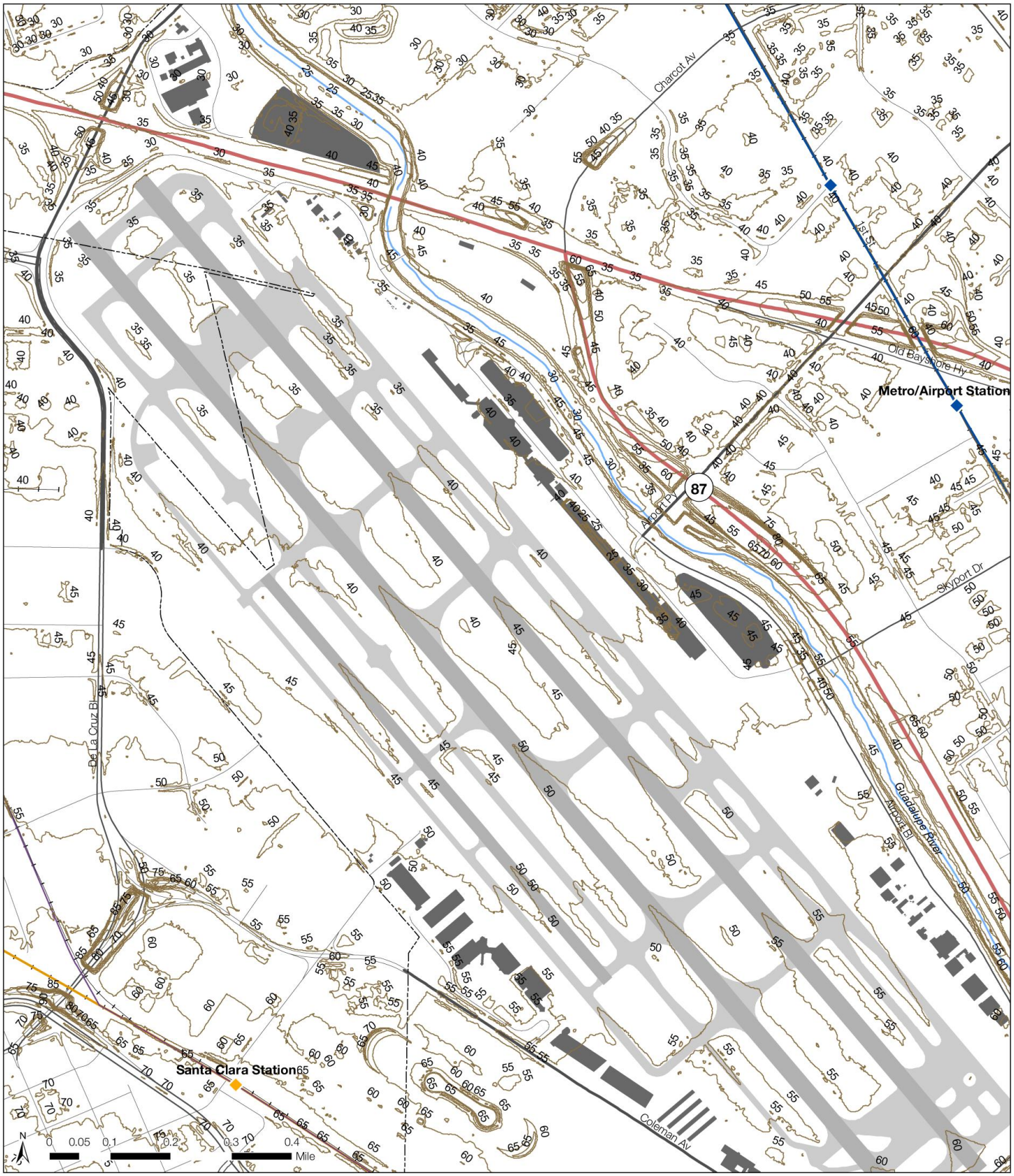


Legend

City Boundary

Transit Routes

Rapid Rail

Light Rail

Commuter Rail

Creek or River

Figure 12
Base Map with 5-foot Contours

San José ATN Feasibility Study

September 22, 2011

ARUP

Memorandum

ARUP

To	Laura Stuchinsky, Henry Servin	Date	June 21, 2012
Copies	Austin Smith	Reference number	214704
From	Gary Hsueh William Baumgardner	File reference	4-05
Subject	San José ATN Feasibility Study Recommended Alignment		

This memo describes the Recommended Alignment for the San José Automated Transit Network (ATN) Feasibility Study. The Recommended Alignment represents the culmination of several previous rounds of options development and reflects several refinements made to the Round 3 Option that immediately preceded it. The Round 3 Option was documented in the San José ATN Feasibility Study Round 3 Options Memo (Revised) dated September 27, 2011.

1 Description of the Recommended Alignment

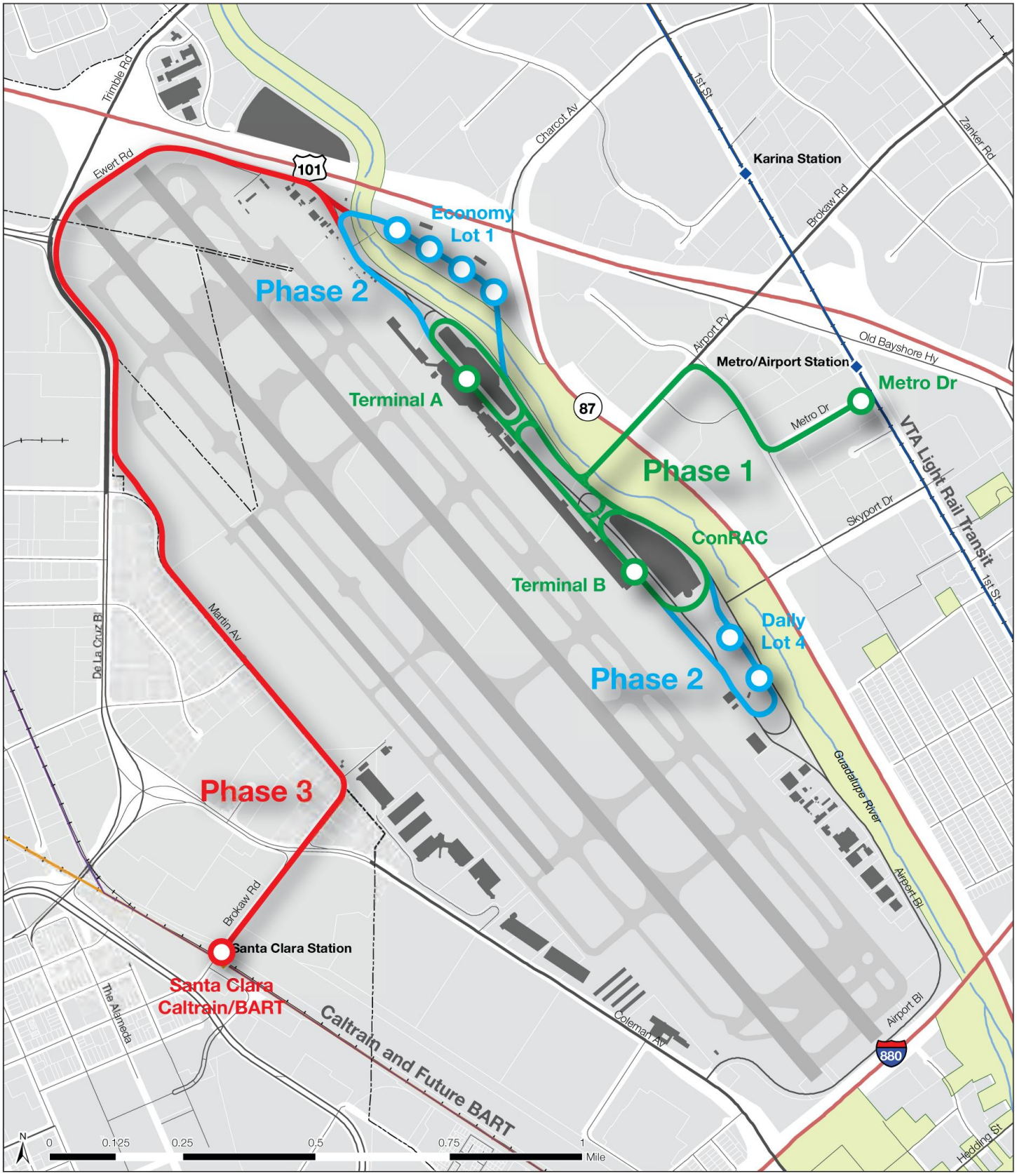
Overview

The ATN Recommended Alignment consists of a 6.4-mile, 10-station system connecting the Mineta San José International Airport to the VTA Metro/Airport light rail station and the Santa Clara Caltrain/future BART station as well as interconnecting points within the Airport: Terminal A and its parking garage, Terminal B and ConRAC (Consolidated Rent-A-Car) garage, Economy Lot 1 (the surface parking lot north of Terminal A), and the surface lot south of Terminal B (Daily Lot 4).

The sections below describe the ATN Recommended Alignment in more detail. Please refer to Figures 1 and 2.

Terminal A and Terminal B/ConRAC

It is assumed that an elevated, high-capacity ATN station would be located above or very close to the Terminal A pedestrian bridge, providing convenient access to Terminal A and the Terminal A parking garage (where baggage claim is also located). A similar elevated, high-capacity ATN station would be located in the median of Airport Blvd. between Terminal B and ConRAC. Each high-capacity station would feature a nearby “vehicle server”, as described by The Aerospace Corporation (Aerospace), which would offer the capacity to quickly provide multi-vehicle chains of ATN vehicles and/or allow for a “source-sink” mode of operation along a dedicated, reversible elevated guideway between Terminal A and ConRAC. This is intended to accommodate the relatively high directional demand between Terminal A and ConRAC during peak hours. The adjacent low capacity guideway lane would



Legend

- Phase 1 Recommended Alignment and Station
- Phase 2 Recommended Alignment and Station
- Phase 3 Recommended Alignment and Station

Source

Arup 2012.

Figure 1
Recommended Alignment

San José ATN Feasibility Study

June 2012

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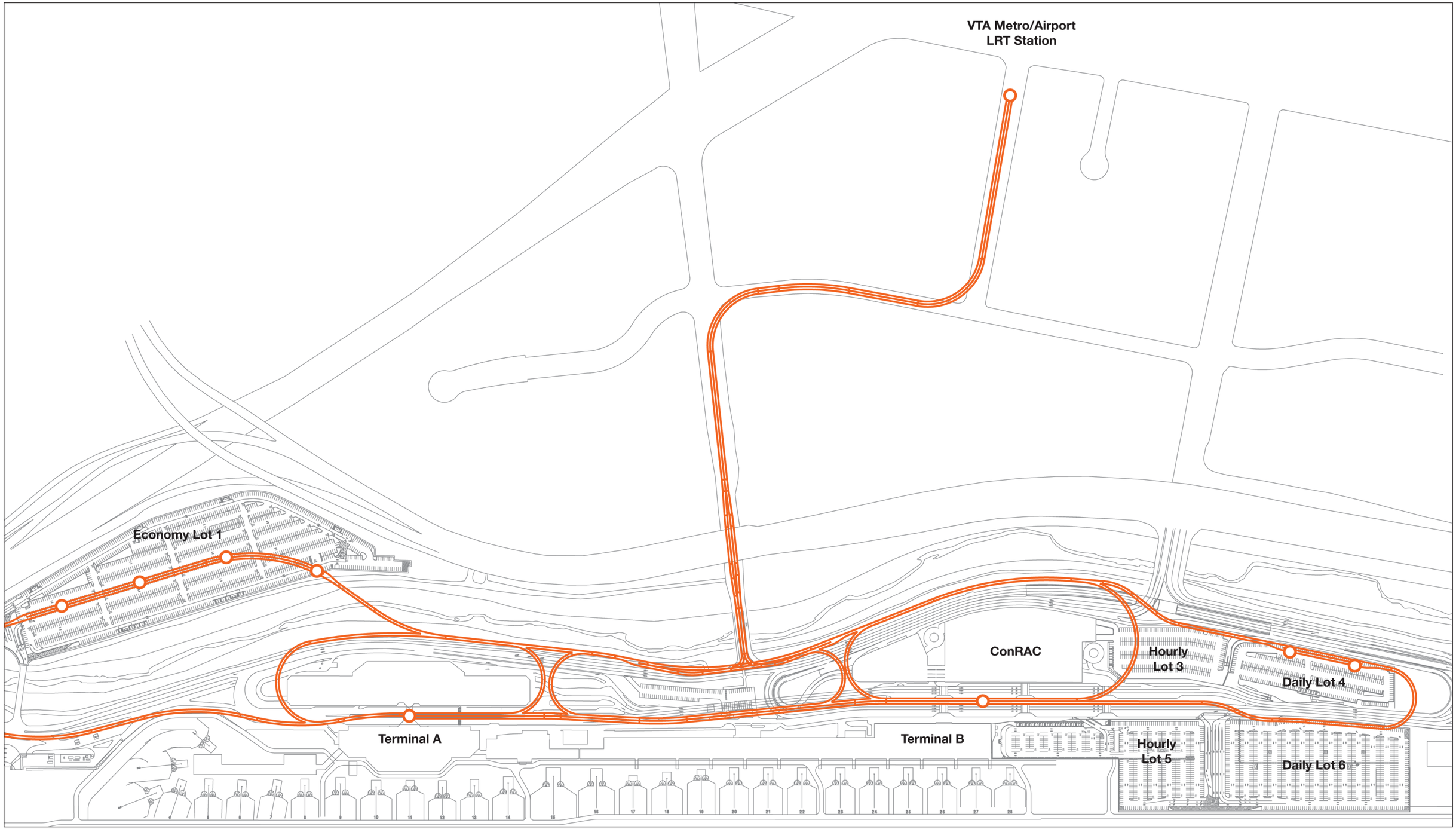

Legend

Recommended Alignment and Station

Source

Arup, 2012.

Figure 2
Recommended Alignment
Terminal Area Detail

San José ATN Feasibility Study

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have junctions to allow vehicles to turn off to serve Economy Lot 1, VTA light rail, Santa Clara Caltrain, and to receive vehicles coming from those destinations as well as from Daily Lot 4. The reversible lane is assumed to terminate at the elevated Terminal B high-capacity station. With minimal turns and several long straight sections, the reversible lane would be able to support high-speed operation.

South of Terminal B

Two ATN stations are assumed to serve Daily Lot 4, south of ConRAC. 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. Similarly, an additional station could also be located to serve Daily Lot 6, which is due south of Hourly Lot 5 and Terminal B, but the ATN station is not assumed in the Recommended Alignment for two reasons. First, both Lots 5 and 6 are served by a relatively inexpensive in-lot shuttle service that brings passengers to and from Terminal B. An ATN station may not be attractive because of travel time to Terminal B. Secondly, the Airport ultimately plans to remove Lots 5 and 6 when increases in air traffic require expansion of Terminal B. In that case, the entrance to Terminal B is not likely to change and an ATN station serving Lot 6 would become extraneous.

From Daily Lot 4 through Airport Parkway / VTA Light Rail

From the Daily Lot 4 stations, vehicles would cross over Airport Blvd. and continue northbound on a high-speed elevated segment parallel to the Guadalupe River. Vehicles could return to Terminal B, go to Economy Lot 1, or go to Terminal A.

As the guideway approaches Airport Parkway near the north end of ConRAC, it would split into two segments. One segment is straight and elevated, allowing vehicles to continue at speed to Economy Lot 1 and to Terminal A. The other segment would descend to grade level to the median of the existing Airport Parkway bridge, cross the Guadalupe River and continue under SR 87/Guadalupe Parkway. After it crosses under SR 87, the dual guideway would rise in profile and continue elevated along Airport Parkway, then turn onto Technology Drive, then onto Metro Drive to terminate with a loop at the elevated Metro Drive ATN station. On the return from the VTA station, the guideway would rise from grade after crossing the Airport Parkway bridge to meet the elevated bypass segment. A 15-mph turnback loop would allow vehicles from VTA to reach Terminal B without continuing around the Terminal A garage.

Economy Lot 1 to Terminal A

North of the Airport Parkway intersection, the elevated guideway would split. One lane would allow high-speed operation along the back (east side) of the Terminal A garage and return to the Terminal A station. The other lane would cross the Guadalupe River into Economy Lot 1. After crossing the river, the lane would split into a mainline and a combined acceleration/deceleration lane serving all four elevated Economy Lot ATN stations. The lanes would merge at the north end of Economy Lot 1 and cross the Guadalupe River via a new bridge. After crossing the river, the guideway would split. One lane would continue to Santa Clara at high speed, while the other would return to Terminal A. After

crossing the river, the sweeping elevated curve segments back to Terminal A allow up to 40-mph operation to the Terminal A high-capacity station.

Santa Clara Segment

From Economy Lot 1, the elevated guideway would descend to grade level along the current Ewert Road right-of-way around the north end of the airfield to avoid airplane operations and Airport height restrictions. Several straight segments would offer opportunities for high-speed travel; curves generally allow 30-mph or greater speeds. Past the end of the runways along Ewert Road, the dual ATN guideway would rise to go over and around the old parking lots on the west side of the airfield to Martin Avenue, allowing the Airport to maximize the footprint of and allow access to future redevelopment of the parking lots. The guideway would maintain 35 mph design speed through curves at the beginning of Martin Avenue, after which the guideway continues straight along Martin Avenue. At the end of Martin Avenue, the guideway would make a 20-mph curve to the median of Brokaw Road, where it would proceed west, cross the Coleman Avenue/Brokaw Road intersection, and end at an elevated station with a turnback loop at the current end of Brokaw Road near the future Santa Clara BART station. A pedestrian overcrossing could provide access to the existing Caltrain station on the other side of the railroad tracks.

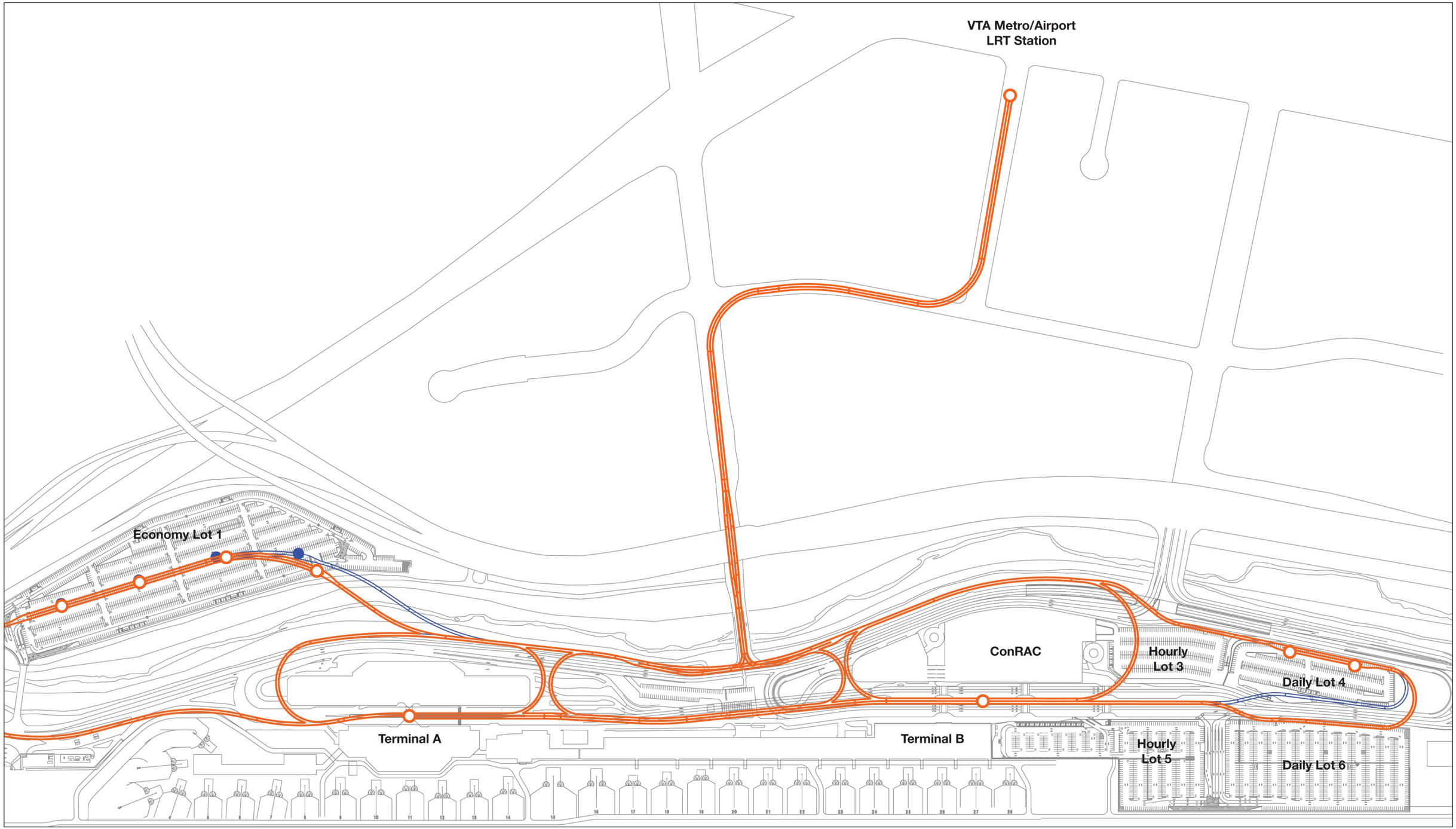
2 Phasing

The alignment is segmented into three phases. The first phase is 2.2 miles long and links Airport Terminals A and B to Light Rail. The second phase, adding 1.8 miles, extends the ATN system to the on-Airport parking lots on the east side of the airfield. The third phase is 2.4 miles long and connects the Airport to the Santa Clara Caltrain/BART station.

3 Changes Resulting in the Recommended Alignment

The overall focus of the Recommended Alignment is on maximizing mainline travel speed using large horizontal radius curves where possible, similar to the intent of the Round 3 Option. The modifications made to the Round 3 Option are intended to resolve constructability issues and minimize impact to existing facilities/roadways, with the benefit of reducing potential cost, while maximizing travel speeds on the guideway. Please see Figure 3, which is a diagram comparing the Recommended Alignment to the Round 3 Option. The Recommended Alignment reflects the following changes compared to the Round 3 Option:

- Modified the alignment at the north end of the Economy Lot (near US-101) to reduce the number of new crossings of the Guadalupe River from two to one;
- Modified the alignment crossing the Guadalupe River east of the Terminal A parking garage to increase the distance between merge and diverge points;
- Refinements to the alignment in the vicinity of the “VTA WYE” crossing (crossing over the Guadalupe River using the existing Airport Parkway bridge) to clarify merge/diverge points and segments of guideway for deceleration and acceleration;
- Increased the radius of the curve at Metro Dr. and Technology Dr. to allow for faster vehicle travel speeds;



Legend

- Recommended Alignment and Station
- Round 3 Option Alignment and Station

Source

Arup, 2012.

Figure 3
Comparison Between Recommended Alignment and Round 3 Option Alignment
San José ATN Feasibility Study
June 2012

ARUP

- Added a turnback loop immediately north of ConRAC so that vehicles from parking lots south of ConRAC can return to Terminal B more quickly and avoid commingling with vehicles traveling to the VTA station from Terminal A;
- Modified the alignment south and east of ConRAC to reduce disruption to the roadway alignment along northbound and southbound segments of Airport Boulevard;
- Removed the direct link from Daily Lot 4 (south of ConRAC) to the Terminal B station to reduce the footprint across the parking lot (to accommodate future expansion to structured parking) and so that the Terminal B station would not have to handle reverse-direction vehicles; and
- Indicated potential station location serving Daily Lot 6 (south of Terminal B).

For a discussion of previous options development, please refer to the San José ATN Feasibility Study Round 2 Options Comparison, dated August 30, 2011.

4 Responses to the Key Issues of the Round 3 Option

This section summarizes the key issues Arup previously identified with the Round 3 Option and documents how the issues were addressed by the Project Team.

- Issue in the Round 3 Option: The requirement for high-capacity stations and high-capacity operations exceed the current, demonstrated capabilities of any current ATN system/technology vendor. While understanding that some kind of option needs to be selected for evaluation, the requirement to provide a high-capacity system is highly significant for the project.
  Response in the Recommended Alignment: High-capacity stations and operations are assumed. Allowances for these have been included based on input from Aerospace.

- Issue in the Round 3 Option: As directed by Aerospace, this option uses an unconventional, yet specific approach to providing high capacity: simultaneous docking of multi-vehicle chains combined with a reversible guideway and fed by an automated vehicle storage system. Because this approach has not yet been proven, it would be prudent to identify other approaches to providing adequate capacity (e.g. a dual guideway with two vehicle groups in shuttle operation, and/or larger vehicles).
  Response in the Recommended Alignment: Other modes of operation are being investigated by Aerospace. The ultimate design to the high-capacity stations may depend on the proprietary technology of the vendor and could substantially alter the size and operation of the Terminal A and Terminal B/ConRAC stations.

- Issue in the Round 3 Option: The high-capacity station / integrated vehicle server concept as defined by Aerospace should be refined to the extent that a height, width, and depth can be identified to confirm that it can physically fit in the desired locations. Further, it would be desirable to have a better understanding of how the station will operate. It is assumed that Aerospace will provide drawings to illustrate the concept.
  Response in the Recommended Alignment: Aerospace has provided conceptual drawings illustrating two sets of single-vehicle-wide, vertical vehicle elevators connecting from elevated platform level to underground storage in the median of Terminal Dr. in front of Terminal A. Because this configuration entails removing one traffic lane and isolating another between the two elevators, from a transportation perspective this severely limits the traffic operations of Terminal Dr. Therefore, that specific configuration has not been assumed in the Arup Recommended Alignment. However, 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.

- Issue in the Round 3 Option: Passenger access from the Terminal A high-capacity station to baggage claim will need to be examined after the station concept is refined. Previous concepts included the use of an intermediate mezzanine level that would serve most passenger circulation and access functions while the ATN platforms/berths would be located one level above.
  Response in the Recommended Alignment: The high-capacity station concept will need to be refined in subsequent phases of planning and design. A placeholder footprint based on input from The Aerospace Corporation, assuming 20 berths arranged in four blocks of 5 berths each, has been assumed in the cost estimates.

- Issue in the Round 3 Option: A Terminal A low-capacity station was assumed to be located immediately to the north of the high-capacity station. Given the traffic flow along Terminal Drive at this location, the vehicle server function for the low-capacity station may need to be located above ground. Height requirements do not appear to be a limiting factor (see Figure 2 of the July 2011 Existing Conditions Memo); however, a tradeoff may be additional aesthetic impact. From a passenger convenience perspective, having the two station functions co-located/served by a common pathway or vertical circulation would be preferred.
  Response in the Recommended Alignment: The concept of low-capacity stations is no longer assumed in the Recommended Alignment, due to the City's desire to connect Terminals A and B to the VTA station from the outset of ATN system operation. Each terminal station is assumed to serve both low- and high-capacity functions.

- Issue in the Round 3 Option: If the reversible guideway lane is allowed to mix with traffic from the adjacent lane, then additional safeguards (physical or systemic) may be needed to ensure that collisions are prevented.
  Response in the Recommended Alignment: It is assumed that such safeguards are in place, although the concept has not been refined to elaborate at that level of detail.

- Issue in the Round 3 Option: As discussed above, the low-capacity station as drawn does not have a turnaround loop. If this proves infeasible to assume, then alternate approaches will need to be examined, for example, vehicles from Daily Lot 4 may need to go past Airport Parkway to turn around to return to Terminal B.
  Response in the Recommended Alignment: A turnback loop has been added to the alignment immediately north of ConRAC to allow vehicles from Daily Lot 4 to return to Terminal B without passing through the VTA WYE past Airport Parkway.

- Issue in the Round 3 Option: The alignment does not traverse through Daily Lot 6 in consideration of the Airport's future terminal development plans should air passenger traffic rise. The result is a fairly tight curve as the alignment returns to serve Daily Lot 4 stations, resulting in slow (15 mph) speeds on the curve.
  Response in the Recommended Alignment: Vehicle speed will continue to be limited as the alignment crosses southbound Airport Blvd. in the approach to the southernmost station serving Daily Lot 4.

- Issue in the Round 3 Option: The alignment shown behind ConRAC is illustrative. The issues that have previously been discussed by the Project Team include an inability to reduce the number of traffic lanes in the area behind ConRAC, the presence of the high-voltage electrical lines and towers, the limited space for columns along the base of ConRAC, and potential interference with the façade artwork above. The assumption is that one guideway lane can be cantilevered out from the ground at the base of ConRAC.
  Response in the Recommended Alignment: Further investigation indicates that an alignment on the east side of northbound Airport Blvd., rather than along the base of ConRAC, is more practical. By introducing a crossing over Airport Blvd. further south, the revised alignment eliminates conflict with ConRAC, allows for minimal changes to the existing roadway, and avoids the overhead electrical lines. A potential limitation is the span distance across Airport Blvd., which dictates the angle of the guideway overcrossing.

- Issue in the Round 3 Option: The use of the existing Airport Parkway bridge is a major design benefit that avoids the need to cross the Guadalupe River and SR 87 with new, tall long-span bridges but the assumed alignment would entail two small radius horizontal curves (one in each direction) that would require significantly reduced vehicle speed at the intersection. One outstanding issue is to resolve how through vehicles can traverse through the area at higher speeds.
  Response in the Recommended Alignment: The alignment concept in this area has been refined such that the through segment will allow high-speed operation, while there will be additional guideway to allow vehicles traveling towards the VTA station to branch off, decelerate, and descend onto the Airport Parkway bridge at-grade.

- Issue in the Round 3 Option: The VTA alignment was drawn using the previous criteria of minimum 50 foot radius. A higher-speed curve may be possible at the intersection of Technology Drive and Metro Drive.
  Response in the Recommended Alignment: The radius of the curve at this intersection has been increased to allow for higher vehicle travel speeds. Note that the revised alignment traverses a corner of private property, which would need to be acquired, or the alignment can be further refined to stay within the public right-of-way.

- Issue in the Round 3 Option: In order to maximize speeds, a long-span bridge (500 feet or more) is assumed to cross the Guadalupe River to Economy Lot 1. While this offers the opportunity for a signature bridge to be designed, it also would be much more costly (by approximately 3 times) than a bridge with shorter spans.
  Response in the Recommended Alignment: Closer inspection of the crossing sites indicates that a signature, long-span bridge is not necessary and that the assumed typical span of 80 feet is likely sufficient to cross the Guadalupe River. This assumes that columns can be placed in the river bed but outside of the low-flow (water present year-round) river channel.

- Issue in the Round 3 Option: An additional bridge at the north end of Economy Lot 1 is necessitated by maximizing the size of the sweeping return curve to Terminal A, which splits the guideway before crossing the Guadalupe River. Alternatively, the segment continuing to Santa Clara could be adjusted to form a tighter “WYE”, but at the expense of reduced speed.
  Response in the Recommended Alignment: Further concept design has resulted in a tighter “WYE”, but preliminary analysis indicates that impact to travel time is only on the order of seconds. The alignment now avoids crossing over the detention basin adjacent to US 101 and the Guadalupe River.

- Issue in the Round 3 Option: Both bridges at the north end of Economy Lot 1 cross the Guadalupe River at a more straight-on angle than the other Economy Lot bridge, but the span distance is still approximately 200 feet, which would typically be built with at least temporary piers in the river channel.
  Response in the Recommended Alignment: Closer inspection of the crossing sites indicates that the assumed typical span of 80 feet is likely sufficient to cross the Guadalupe River. This assumes that columns can be placed in the river bed but outside of the low-flow river channel. Additionally, the alignment has been refined to require one new crossing in this location rather than two.

- Issue in the Round 3 Option: It is assumed that Ewert Road will be converted to Airport internal use only, potentially replacing/merging with the airside access road. Other transportation functions include the ATN guideway, and bike lanes or a multi-use path. Along the north side of the airfield, there are two narrower areas where Ewert Road will need to be removed or narrowed in order to accommodate the dual at-grade ATN guideway. A further level of study is required in these areas to determine feasibility.
  Response in the Recommended Alignment: Further design work will be required in subsequent planning and design phases to ensure that all transportation functions, including differentiation between public access, ATN, and airfield functions, can be accommodated.

- Issue in the Round 3 Option: The FAA Ground Radar Facility at the end of Martin Avenue presents a special risk because of the combination of its proximity to the edge of Martin Avenue and potential system shielding / interference / minimum setback requirements. Henry Servin indicates that the original APM study was given a requirement to stay "at least 150 feet away from the antennas' predominant wave spread to avoid compromising the radar waves."
  Response in the Recommended Alignment: The proximity to the Ground Radar Facility remains a project risk. There are alternate alignments in the vicinity should the facility require the same setback; however it is unclear at this stage whether the same requirements will be imposed upon the ATN technology. Further research will be required in subsequent planning and design phases to resolve this issue.

- Issue in the Round 3 Option: Brokaw Road is narrow between Martin Ave. and Coleman Ave., and both sides of the street are lined with local-scale utility poles. Alignment options for the elevated ATN guideway include locating columns on private property on either side of the street, or creating a median for support columns that would likely require removing public parking from at least one side of the street.
  Response in the Recommended Alignment: The question of right-of-way along Brokaw Rd. will need to be further examined in subsequent planning and design phases. To minimize disruption to private property, the alignment is assumed to occupy the median of Brokaw Rd.

- Issue in the Round 3 Option: Phasing of the option needs to be resolved.
  Response in the Recommended Alignment: The Project Team chose a phasing scheme for the ATN for the purposes of analysis.