PHX Phoenix Sky Harbor International Airport

Comprehensive Asset Management Plan



Plan Adopted by the Phoenix City Council on June 11, 2019

The 2019 Phoenix Sky Harbor Comprehensive Asset Management Plan (CAMP) was prepared by the City of Phoenix Aviation Department and primary consultant Ricondo & Associates, Inc. Specialized consultants involved in the project included Kimley-Horn & Associates, Inc., PSM^2, C&S Engineers, and Trace Consulting, LLC. The goals and recommendations of CAMP were developed and guided by numerous stakeholders and this page is intended to recognize their contributions.

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PHX Phoenix Sky Harbor International Airport

Comprehensive Asset Management Plan

2019



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PHX RICONDO®

Introduction

The Comprehensive Asset Management Plan (CAMP) is a guide for managing and developing future facilities such as terminals, roadways, and aircraft aprons at Phoenix Sky Harbor International Airport (PHX).

The Federal Aviation Administration requires airport operators to maintain long-range plans for airport development so they can make cost-effective facility and land use decisions that reflect local goals. CAMP has resulted in an updated development plan that cost-effectively addresses aviation demand, enhances safety and security, increases operational efficiency, and preserves the flexibility to respond to evolving industry conditions and changing characteristics of Airport activity.

CAMP is the framework strategy for the long-term development of PHX. The preferred concept is not a rigid development program and decisions will be made as demand triggers are reached and opportunities arise. Specific development actions will reflect changing conditions, business climate, evolving demand characteristics, and other relevant factors. Prior to implementation, development actions would require further environmental review and projects would be funded from a variety of sources including federal and state grants, Airport funds, passenger facility charge revenue, and general airport revenue bonds. Improvement projects at PHX are not funded with taxpayer dollars.

To ensure a successful stakeholder-led planning process, CAMP promoted a high level of awareness which effectively balanced stakeholder input and interests.

Project committees and focus groups were formed and included individual citizens, elected officials, other city departments, state agencies, federal agencies, Airport users and tenants, special interest groups, and others. These stakeholders provided crucial information that helped guide the planning process and provided valuable feedback. The public was also provided the opportunity to learn about CAMP and engage in the planning process through public workshops held at key milestones during the project.

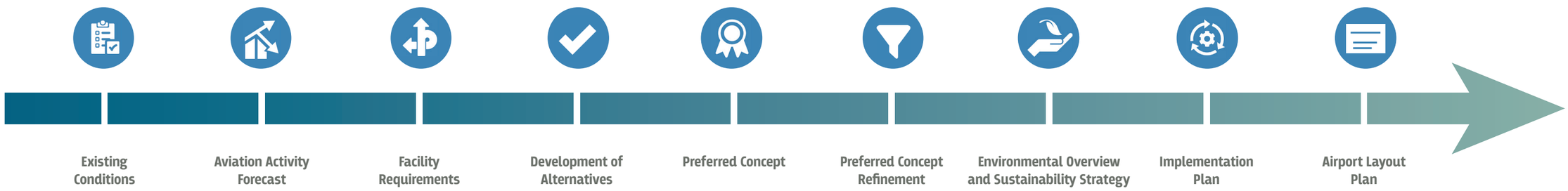


CAMP Process

The CAMP process began with an inventory of existing conditions including physical and operational characteristics of the Airport and its immediate environs. The inventory provided the basis for the facility requirements analyses later in the study. Aviation activity forecasts were developed for a 20-year planning horizon through 2037 and were reviewed and approved by the FAA. A base forecast and three forecast scenarios were developed to reflect reasonable conditions that could develop at the Airport over the planning horizon. The forecasts were used to establish future requirements for airfield, terminal/gates, transportation (roadways and parking), and support facilities, including cargo.

The future requirements for these Airport components were used to define alternatives. The alternatives for each component were evaluated, and the preferred alternative for each was integrated into an overall preferred concept. An environmental overview was produced to identify any issues to be resolved prior to implementation of the projects. Sustainability was integrated throughout the planning process and a strategy was prepared that suggests sustainability measures that can be integrated into the preferred concept.

An implementation plan, including timing and triggers for the various development components, and cost estimates were developed for subsequent use in financial planning. The preferred concept was depicted on the airport layout plan and submitted to the FAA for their review and approval.



Airport Growth and Usage



120,000 passengers on 1,200 aircraft arrive and depart per day

Airport covers 3,400 acres (5 sq mi)

More than 57,000 Airport jobs

Over 25,000 parking spaces

Over 800 tons of cargo moved per day

1920s

The Airport was originally developed by Scenic Airways with a single runway (existing Runway 7L-25R). The company collapsed on Black Friday (1928) and the Airport becomes the property of Acme Investment.

1930s

The City of Phoenix purchases the Airport from Acme Investments for $100,000.

1950s

Terminal 1 opens and serves American, Trans World, Frontier, and Western Airlines.

1960s

Terminal 2 opens with 19 gates (now 10 gates due to larger aircraft) for a cost of $2.7 million. PHX surpasses one million passengers per year.

1970s

Terminal 3 opens with adjacent parking garage and north/south concourses consisting of 23 gates. PHX surpasses 5 million passengers a year.

1990s

Terminal 4 opens in 1990 with 5 concourses and 44 gates as the Airport serves more than 20 million passengers per year. A fourth concourse added on the north side of the terminal.

2000s

An additional concourse is added on the south side of Terminal 4, a new 326-foot tall Airport Traffic Control Tower is constructed, and consolidated Rental Car Center opens.

2010s

PHX Sky Train opens and provides a connection between Terminal 3, Terminal 4, East Economy Parking, and the 44th Street/Washington Valley Metro Light Rail Station.

Forecast

To assess the ability of Airport facilities and evaluate the potential need for new or expanded facilities, aviation activity forecasts were developed for (1) enplaned airline passengers, (2) aircraft operations, and (3) cargo volume activity. The forecasts included a base forecast and three alternate forecast scenarios for passengers and aircraft operations and two alternate forecast scenarios for cargo volume. The forecasts were prepared in 2017 using 2016 data as the source for the baseline forecast. Actual data for 2017 has since been added to the charts below.

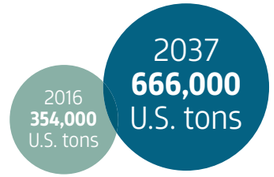
Passenger Forecasts

Annual passenger activity is estimated to grow by 25 percent over the next 10 years and by 55 percent by 2037 to nearly 68 million passengers.



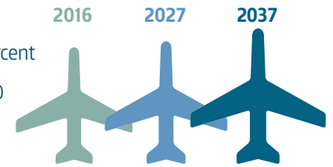
Cargo Volume Forecasts

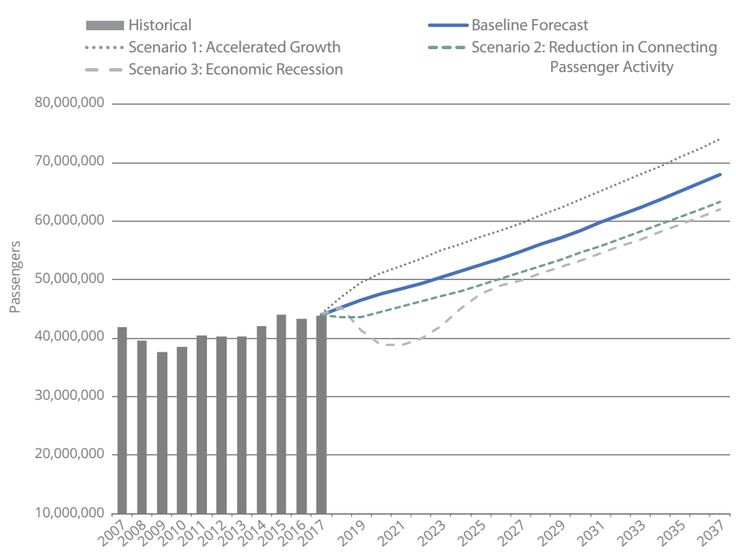
Cargo volume is forecast to increase from 354,000 U.S. tons in 2016 to 666,000 U.S. tons in 2037. Low and high cargo forecasts reflect varying growth rates in cargo activity, particularly e-commerce.

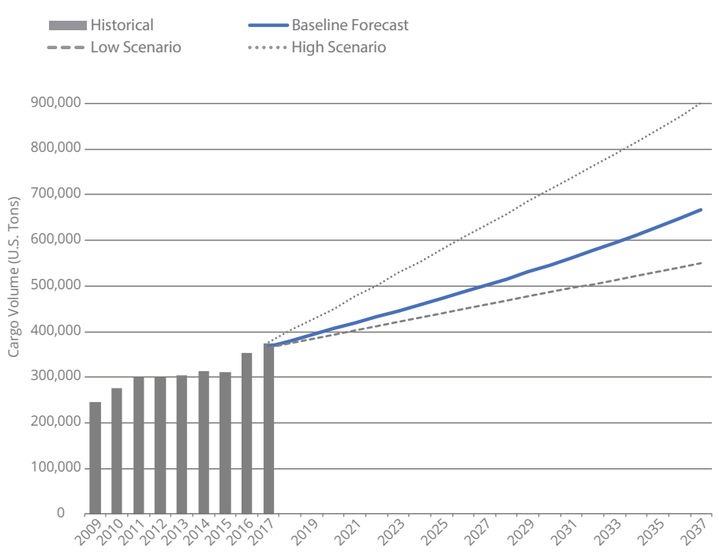


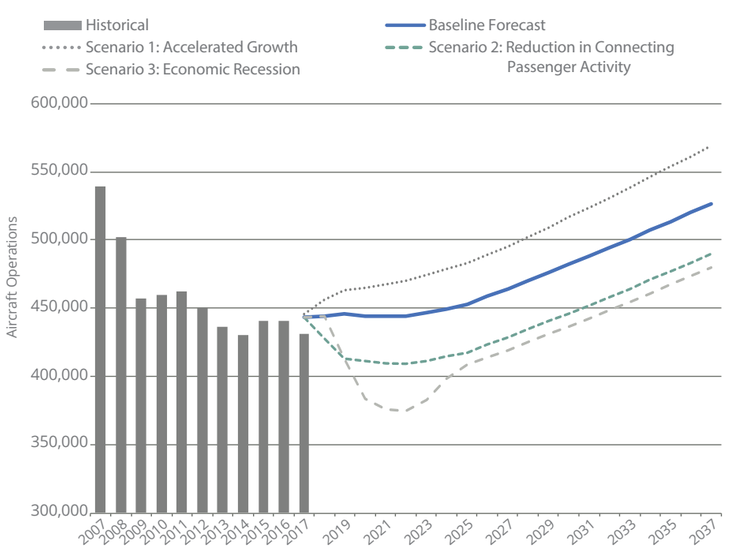
Aircraft Operations Forecasts

Aircraft operations are forecast to grow by 5 percent over the next 10 years and by approximately 20 percent by 2037.









In addition to the baseline forecast, three additional scenarios, a high forecast scenario and two low forecast scenarios, were developed to estimate the possible variation in passenger related activity resulting from changes in the socioeconomic and competitive environment assumed in the baseline forecast.

Scenario 1: Accelerated growth scenario where population and economic activity would grow at a faster rate between 2017 and 2023, with the growth rate peaking in 2020 and returning to baseline levels of year-over-year growth from 2024 to 2037.

Scenario 2: Connecting passenger traffic is reduced as capacity is realigned across airline networks. The capacity reduction would begin early in the forecast period and result in connecting passenger volume decreasing by approximately 13 percent compared to the baseline forecast.

Scenario 3: Weakened economic activity would drive a decrease in passenger volume and aircraft operations. An economic recession was assumed to begin in 2019 driving year-over-year decreases in passenger activity through 2021. Growth would resume in 2022 and traffic would increase at an accelerated rate through 2026, mimicking the patterns of the 2008 recession and subsequent recovery.

PHX RICONDO®

Existing Facilities

This map depicts the airfield, terminal, landside, support, and miscellaneous facilities at the Airport at the beginning of CAMP in 2017.

A Airfield

A-1. Runway 8-26
A-2. Runway 7L-25R
A-3. Runway 7R-25L

L Landside Transportation

L-1. Rental Car Center
L-2. Terminal 2 Parking Garage
L-3. Terminal 3 Parking Garage
L-4. Terminal 4 Parking Garage
L-5. West Economy Parking
L-6. East Economy Parking
L-7. Cell Phone Lots
L-8. Employee Parking
L-9. Taxi/Transportation Network Company Staging

S Support

S-1. West Cargo Complex
S-2. Facilities & Services
S-3. South Cargo Complex
S-4. Airport Operations Center
S-5. Corporate Office Building
S-6. Aviation Fuel Tanks
S-7. Mesa Airlines Maintenance
S-8. American Airlines Maintenance
S-9. Southwest Airlines Maintenance
S-10. Aircraft Rescue & Fire Fighting Stations
S-11. Airport Traffic Control Tower
S-12. North General Aviation Hangars/Offices
S-13. South General Aviation Hangars/Offices

T Terminals

T-2. Terminal 2
T-3. Terminal 3
T-4. Terminal 4

M Miscellaneous

M-1. Arizona Air National Guard Complex
M-2. Honeywell Industrial Complex



Planned Airport Facilities

At the beginning of CAMP in 2017, the Airport was in the planning, design, or construction phase of several significant development projects. These facilities are described below and were incorporated in CAMP.

A Airfield

A-1 + A-2. Crossfield Taxiways V and U
Two crossfield taxiways are planned to connect Runway 7L and Runway 8. Implementation of these taxiways would require the relocation of Facilities & Services and West Cargo Complex.

S Support

S-1. Southwest Airlines Maintenance Expansion
Southwest Airlines is doubling the size of its aircraft maintenance hangar and adding space for other maintenance services.

T Terminal Projects

T-2. Demolition of Terminal 2
Terminal 2 has reached the end of its useful life. Once the Terminal 3 Modernization Program and Terminal 4 Concourse S1 are complete, Terminal 2 will be demolished. As part of the demolition project, the Paul Coze Mural in Terminal 2 will be relocated.

T-3. Terminal 3 Modernization
The first milestone for the Terminal 3 Modernization Program was reached in December 2016, when the western portion of the terminal processor was completed. The completely reconstructed Terminal 3 South Concourse opened to passengers in January 2018. The North Concourse and eastern portion of the Terminal 3 processor improvements are anticipated to be complete in 2020. Enhancements include more baggage handling capacity, additional ticket counter and baggage claim, and additional aircraft gates.

T-4. Terminal 4 Concourse S1
Terminal 4 Concourse S1 is a new eight-gate concourse currently in the design phase.

L Landside Transportation

L-1. PHX Sky Train Stage 2
Stage 2 of the PHX Sky Train project involves extending the existing line from the Terminal 3 station 2.5 miles to the Rental Car Center (L-2). This $700 million project will be funded using airline Passenger Facility Charge and rental car Customer Facility Charge revenues. This project impacts several existing Airport facilities, including the West Economy Parking, Ground Transportation Staging Lot, a FedEx leasehold, and Gate 1 at Terminal 2.

L-2. Rental Car Center Station

L-3. West Ground Transportation Center Station

L-4. Future Terminal Station





Facility Requirements

The relationship between demand for and capacity of the functional components of an airport is complex. Numerous factors affect how efficiently a certain level of demand can be processed within the capacity of a facility. Furthermore, the level of service that is acceptable varies by user, facility, and stakeholder. The relationship between demand and capacity was explored in the requirements analysis, and the ability of existing facilities to accommodate future demand was assessed. Facility requirements were developed based on stakeholder input, tenant interviews, industry benchmarking, and planning guidance developed by the following:

- Federal Aviation Administration
- Transportation Security Administration
- U.S. Customs and Border Protection
- International Air Transport Association
- Airport Cooperative Research Program
- Airports Council International – North America

As part of the stakeholder involvement process, several key issues were identified and considered in the study.

Airfield

- Provide additional aprons for aircraft parking overnight
- Identify areas for ground support equipment storage
- Create an implementation plan for crossfield Taxiways V and U
- Balance aircraft parking locations to reduce aircraft congestion on crossfield Taxiways T, S, and R

Passenger Experience

- Reduce terminal complexity
- Create secure connections between terminals
- Alleviate holdroom congestion
- Provide additional gate capacity and capability

Sustainability and Community

- Increase efficiency and redundancy of existing and planned Airport facilities
- Address idle vehicles in cell phone lots and around terminal curbs
- Address alternative energy sources and decrease Airport environmental impacts
- Develop community-friendly expansion and mitigate community traffic impacts
- Prepare surrounding roadways for the Airport's future development and to help local business and neighborhoods thrive

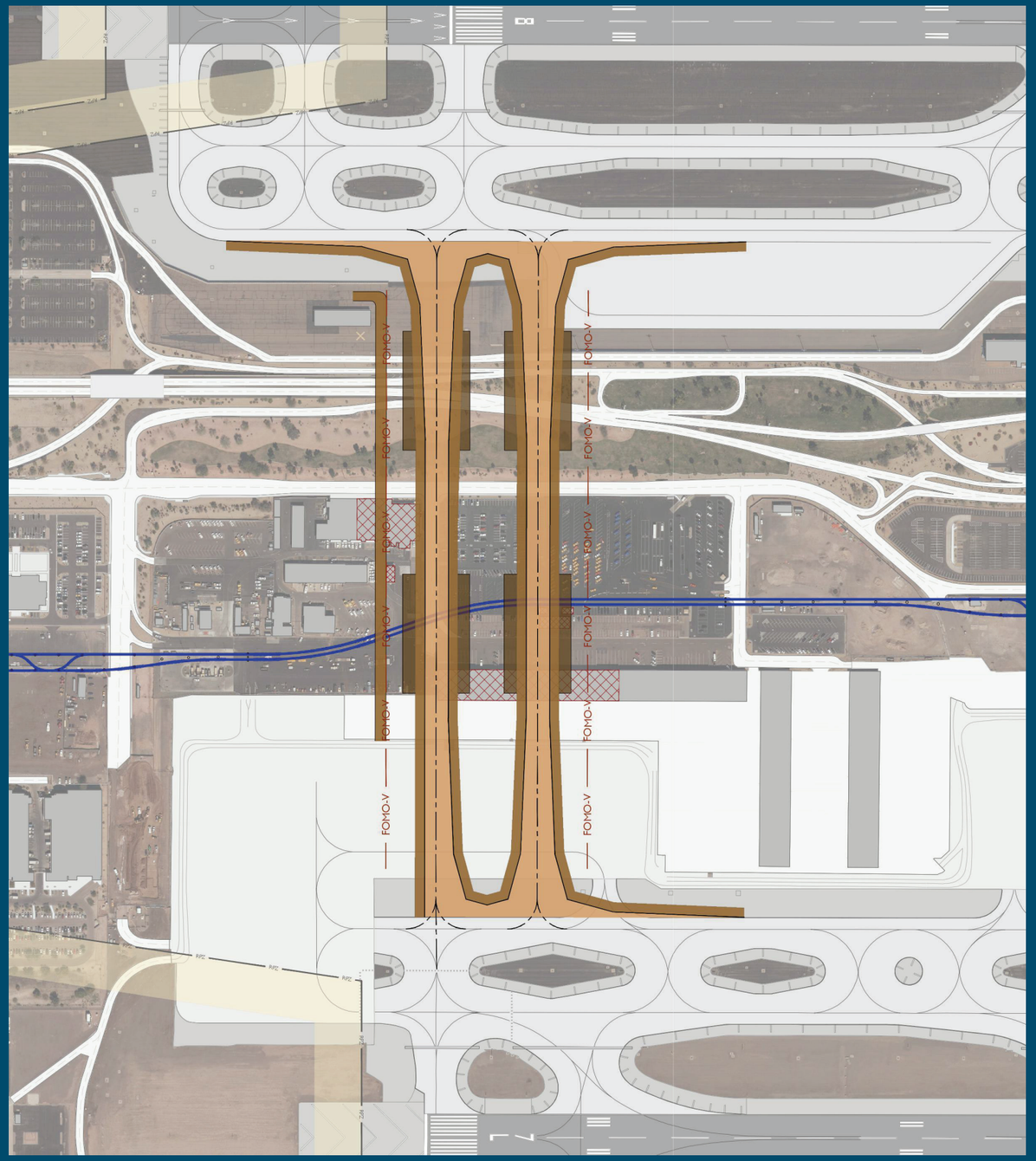
Land Use

- Optimize use of existing Airport lands
- Identify highest and best use of land north of Airport
- Determine which developments should be considered in and around the Airport

Airfield

The three existing runways at the Airport provide sufficient capacity to meet demand through Planning Activity Level (PAL) 3, which is equivalent to approximately 68 million annual passengers (MAP). The number of peak hour and annual operations should not exceed calculated capacities for the airfield.

A new set of crossfield taxiways located in the west airfield that connect the ends of Runway 7L and Runway 8 are planned. These taxiways would provide air traffic control with greater flexibility to maneuver aircraft throughout the airfield and the ability to better sequence aircraft for departure. These crossfield taxiways also reduce overall average taxi distances and travel times while reducing congestion along north and south concourses.



Terminal

Terminal and concourse requirements were categorized into three terminal groups: Terminal 3, Terminal 4-North, and Terminal 4-South, assuming that airlines operating in Terminal 2 would relocate to Terminal 3 when Terminal 2 is closed. The table below identifies capacity deficiencies for each PAL for gates, holdroom area, and each terminal function.

The Terminal 3 Modernization Program provides sufficient gate and holdroom area capacity through PAL 2 with some modifications to gate parking positions and minor expansion of holdroom areas by PAL 3. For Terminal 4-South, the opening of the Concourse S1 provides sufficient holdroom area through PAL 2. By PAL 3, Terminal 4-South will require additional holdroom space. The existing gates areas for Terminal 4-North are deficient in holdroom area and this continues through PAL 3 as the number of gates required increases.

The table below provides an assessment of the anticipated performance of various terminal components for each PAL. Assuming that airlines stay in their existing locations, most of the functional areas in the terminals have sufficient capacity through PAL 1. Some of the functional areas need additional capacity to accommodate demand in PAL 2. There would need to be significant improvements and expansion of most functional areas by PAL 3, indicating a need for terminal expansion.

	TERMINAL COMPONENT	PAL 1 (49 MAP)	PAL 2 (55 MAP)	PAL 3 (68 MAP)
Terminal 3	Total Gates Required	27	27	29
	Additional Holdroom Required (sq ft)	0	0	1,409
	Check-in			
	Security			
	Checked Bag Screening			
	Outbound Baggage Make-up			
	Domestic Bag Claim			
Terminal 4 - South	Total Gates Required	24	25	32
	Additional Holdroom Required (sq ft)	2,309	5,139	16,419
	Check-in			
	Security			
	Checked Bag Screening			
	Outbound Baggage Make-up			
	Domestic Bag Claim			
Terminal 4 - North	Total Gates Required	61	62	64
	Additional Holdroom Required (sq ft)	50,366	64,616	87,826
	Check-in			
	Security			
	Checked Bag Screening			
	Outbound Baggage Make-up			
	Domestic Bag Claim			
	International Arrivals			

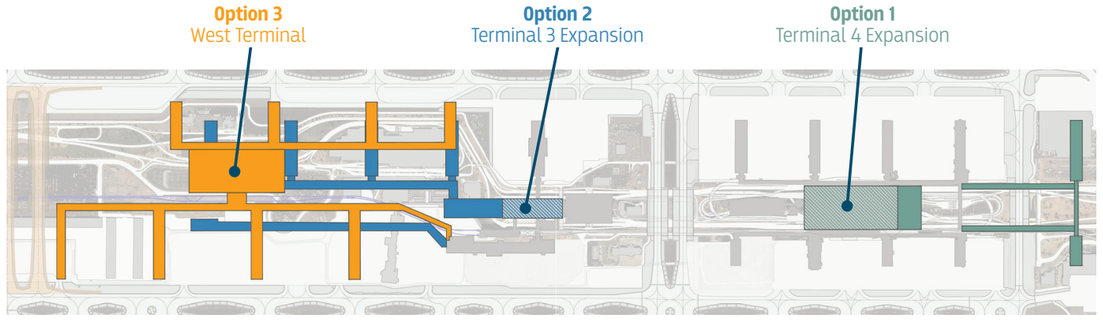
LEGEND
Sufficient
Marginal
Deficient

To address gate, holdroom, and terminal needs, three options were analyzed for overall terminal facility expansion:

- **Terminal 4 Expansion:** Gate facilities placed over existing airline maintenance facilities and expansion of the terminal processor resulting in the relocation of roadways and vertical parking access.
- **Terminal 3 Expansion:** Terminal 3 processor extension and placement of gates to the west which would require a reconfiguration of the recently modernized facility.
- **West Terminal:** New terminal facility located west of Terminal 3 accommodating north and south pier concourses and utilizing the planned PHX Sky Train station.

Ultimately, a West Terminal development is preferred due to the ability to accommodate gate and terminal expansion beyond PAL 3 while not interfering with the operation of existing terminals and concourses. The West Terminal is also preferred largely due to cost, construction challenges, and decrease in passenger level of service associated with the expansion of Terminal 3 or Terminal 4. The terminal plan includes a north pier concourse and a secure passenger connection located between Terminals 3 and 4. Secure passenger connections are also planned between Terminal 3 and the future West Terminal on both the north and south sets of pier concourses. These passenger connections increase operational flexibility by allowing gates to be served by more than one terminal.





Preferred Terminal Concept

T-1 West Terminal

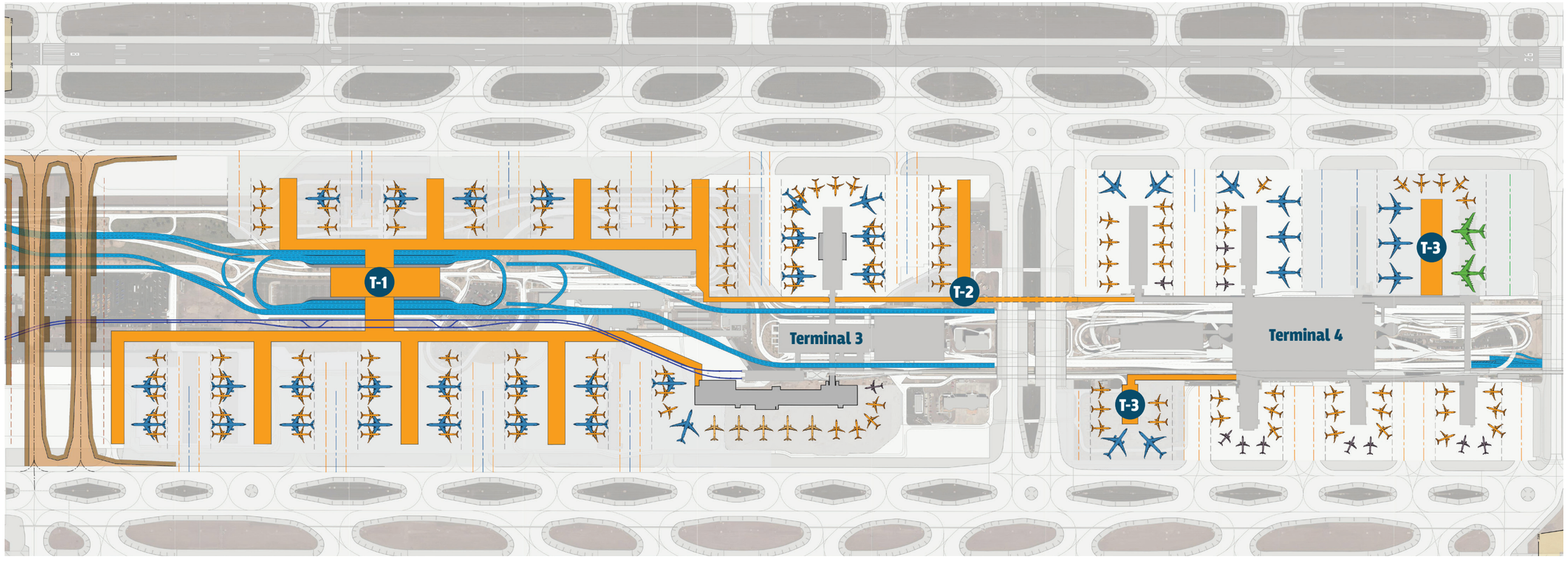
The West Terminal provides a centralized passenger processor connected to north and south concourse piers that can accommodate up to 62 aircraft. Both the north and south concourses would have a secure connection to Terminal 3. The West Terminal is planned to be configured with dual-level roadways on both sides (similar to Terminal 4). This terminal would have a station for the PHX Sky Train.

T-2 Terminal 3 North Concourse 2 and Terminal 3-Terminal 4 Connector

A concourse providing six narrowbody gates located between Terminal 3 and Terminal 4 would accommodate near-term gate demand. The new concourse would include a passenger connector that allows it be used by passengers in Terminal 3 or Terminal 4.

T-3 Concourse S1 and International Concourse

Terminal 4 gate improvements include the planned Concourse S1 and an international concourse to replace Concourses N3 and N4. This new concourse would better accommodate widebody aircraft by providing dual taxiway/taxilanes on each side. Expanded holdroom and concessions areas and facilities for processing international arriving passengers would be incorporated to increase capacity and provide a better passenger experience.



Transportation

Transportation facilities at the Airport include access roads, parking, rental car facilities, and facilities associated with commercial vehicles (taxicabs, limousines, transportation network companies, off-Airport parking shuttles, and hotel courtesy vehicles). The following describes the key issues, challenges, and requirements for transportation facilities.

R Rental Car Access

Access to the Rental Car Center on eastbound Interstate 10 requires drivers to exit the freeway before the Airport exit at the Washington/Jefferson Street off-ramp, cross the light rail and Washington/Jefferson Street intersections at grade, cross over the freight railroad, and then make a right turn on Sky Harbor Circle North which then leads to the RCC. Similarly drivers leaving the RCC and heading back toward downtown Phoenix on westbound Interstate 10 must navigate a complicated route to get back to the Interstate 10 on-ramp at Washington/Jefferson Street. A more direct route to/from the RCC would save time and ease driver anxiety for those not familiar with the local access roads near the Airport.

W West Access

Access to Sky Harbor Boulevard and the terminal core from Interstate 17 and westbound Interstate 10 requires drivers to exit the freeway system at Buckeye Road, head west to Copperhead Drive and make a left turn before merging on to Sky Harbor Boulevard. Currently this route only causes a few minutes of delay for customers that want to access the terminal area, but in the future there will be significantly more traffic near the West Ground Transportation Center. All other routes to the Airport from the regional freeway system on both the east and west sides have direct ramp access that flow onto Sky Harbor Boulevard.

T Terminal Curbs

Terminal curb congestion was analyzed for existing conditions and PALs 1, 2, and 3. If the West Terminal is not constructed, in order to maintain an acceptable level of service by PAL 3, there is an anticipated need for an additional 30 feet, 50 feet, and 220 feet of two-lane curbing space at Terminal 3 South Inner, Terminal 4 North Departures, and Terminal 4 South Departures curbfronts, respectively. In addition to curbfront length, demand for one additional through lane is required for Terminal 3 North Outer, Terminal 3 South Inner, and Terminal 3 South Outer curbfronts and for the Terminal 4 Departure South curbfront.

C Cut-through Traffic

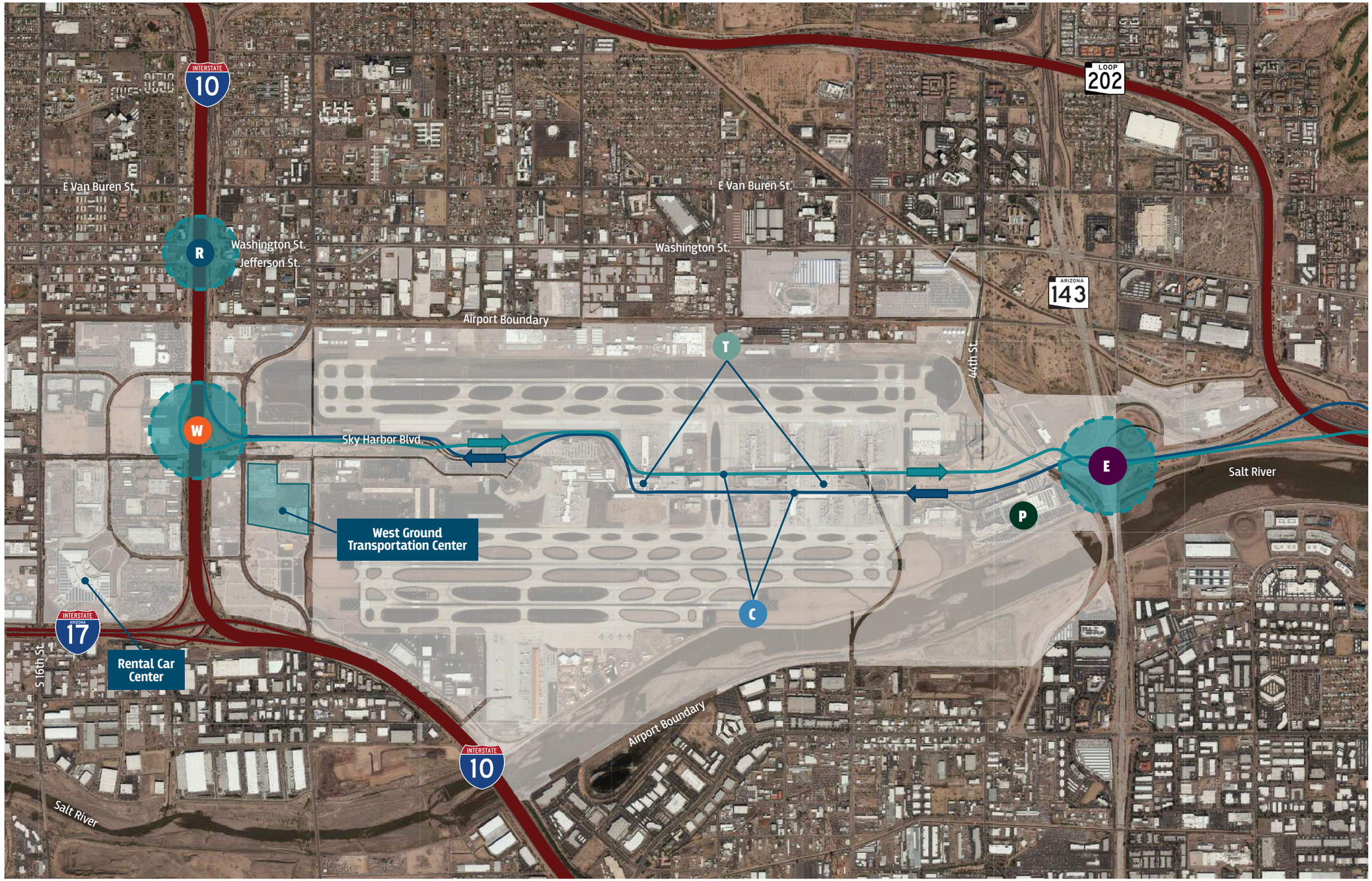
Vehicle traffic delays on surrounding Airport roadways (Interstate 10 and State Route 202) have resulted in a trend of commuters using Sky Harbor Boulevard to bypass the congestion – especially during morning and evening weekday peak hours. This additional traffic creates unnecessary demands on Sky Harbor Boulevard, reducing the roadway level of service, and increasing on-Airport traffic congestion.

E East Access

All routes to the terminal core converge onto westbound Sky Harbor Boulevard within a short distance east of Terminal 4. These routes include westbound State Route 202, northbound and southbound State Route 143, northbound and southbound 44th Street, and the ramp from 42nd Street that serves the East Economy Parking Lot. This causes excessive merging, weaving, driver confusion, traffic congestion, and safety concerns as drivers attempt to jockey for position to be in their correct lane. At busy times of the day there can be significant backups on Sky Harbor Boulevard Drivers need more time and distance to get in the correct lane assignments for Terminal 4 Arrivals, Terminal 4 Departures, or Terminals 2 and 3.

P Parking

An additional 4,400 public and 600 employee parking spaces will be needed by PAL 3. Due to the uncertainty of future travel modes with Transportation Network Companies, autonomous vehicles, and the West GTC currently in development, specific locations for vehicle parking development were not identified. It is recommended that the Airport preserve undeveloped or re-developable parcels near the terminals and roadways that could be utilized for vehicle parking until demand clarifies the amount of space that will be needed in the future.


INTERSTATE
10
LOOP
202
ARIZONA
143
INTERSTATE
17
E Van Buren St.
Washington St.
Jefferson St.
Airport Boundary
44th St
Sky Harbor Blvd.
West Ground
Transportation Center
Rental Car
Center
S 16th St.
Salt River
R
W
T
C
P
E

Transportation

Several improvements are identified for west roadway access, including a security plaza to reduce cut-through traffic and removal and addition of on-and-off ramps and roadways to provude more direct access to the Rental Car Center, West Ground Transportation Center, and Sky Harbor Boulevard.

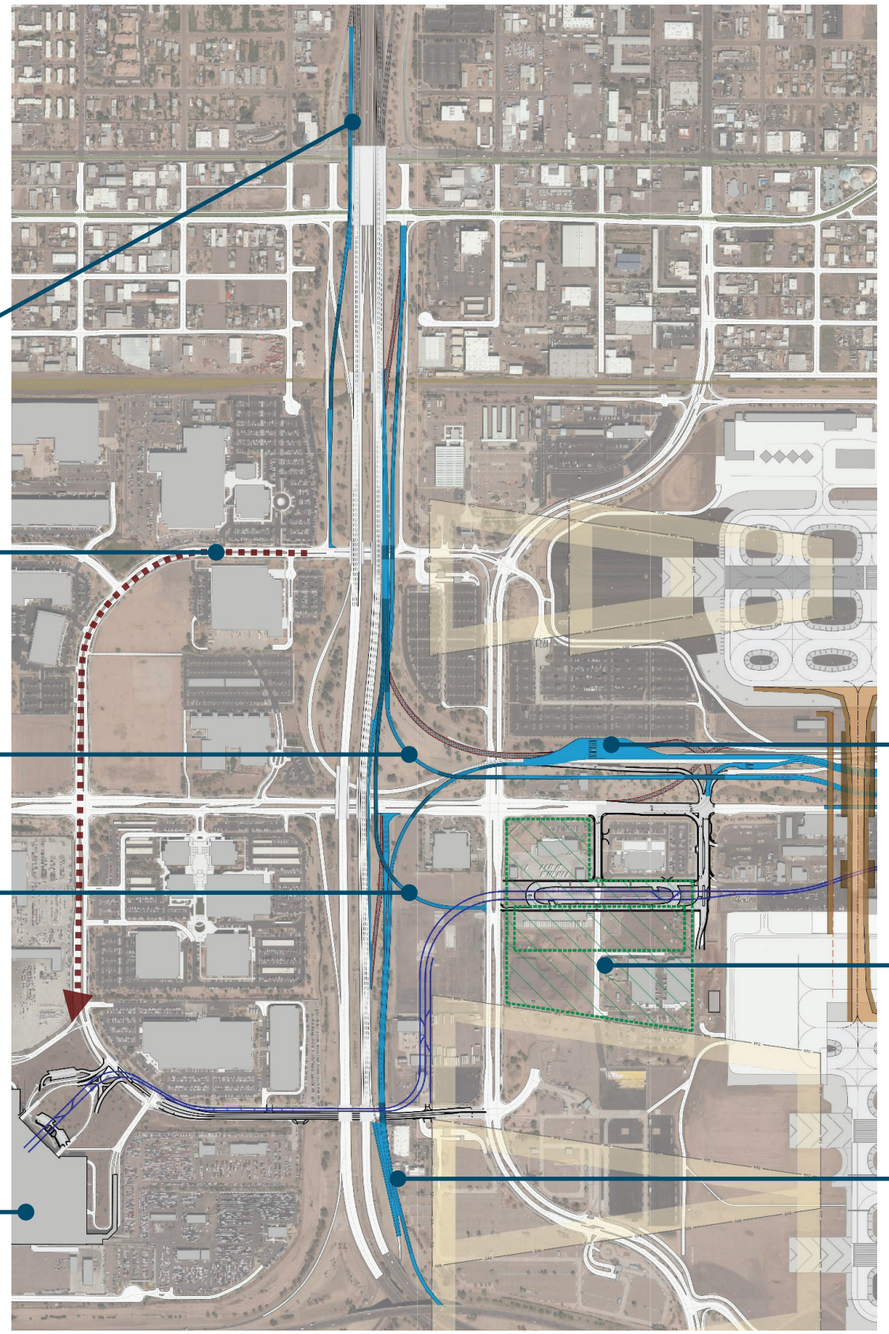
Improved Rental Car Center Access
A bypass exit from Interstate 10 over Washington Street and Jefferson Street intersections to improve connectivity to the Rental Car Center.

Rental Car Center Access

Airport Exit Improvements
Airport exit is shifted south of Airport entrance to allow for inbound security plaza and extended Interstate 10 merge distance.

West Ground Transportation Center and Rental Car Center Exit to Interstate 10
Entrance ramp provides access to Interstate 10 directly from 24th Street to reduce congestion near Buckeye Road.

Rental Car Center



West Roadway Access

Security Plaza
Reduces cut-through traffic from the west.

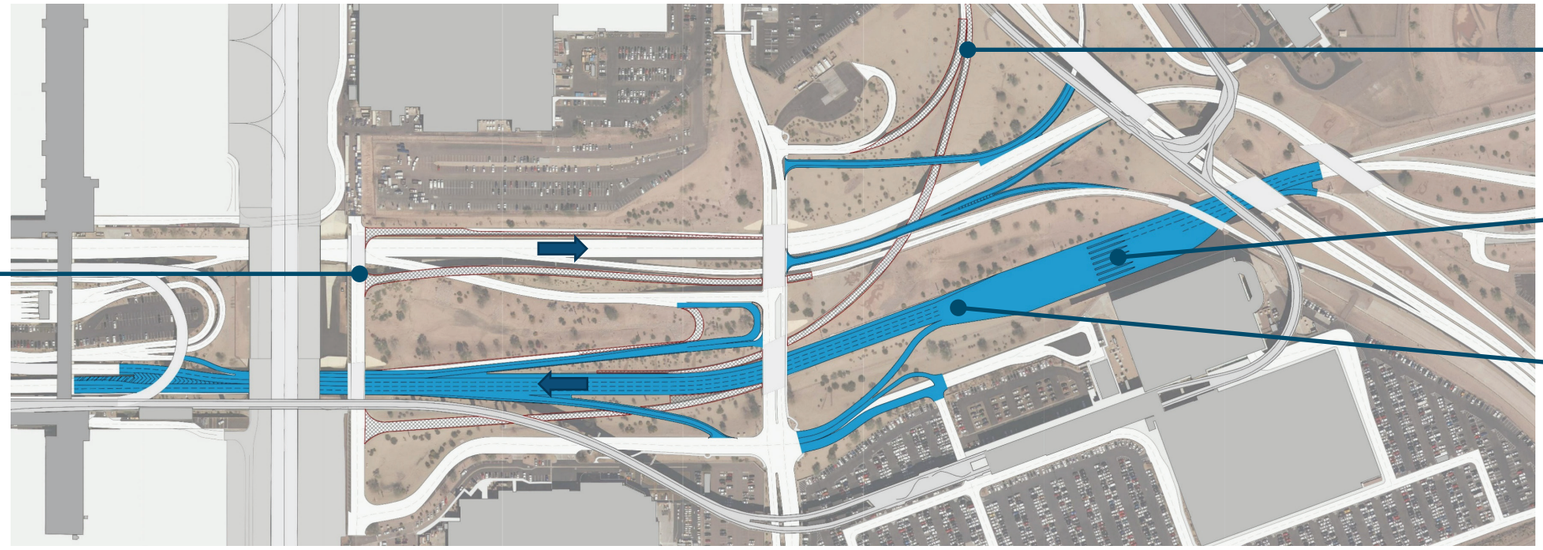
West Ground Transportation Center
Facility with parking garage, vehicle curb, and PHX Sky Train station provides access to terminals and opportunitites to reduce demand on terminal curbsides.

Interstate 10 Improvements
Capacity improvements to Interstate 10 by mitigating the merge/weave conflicts at the Buckeye Road exit, Jefferson Street exit, and the Airport on-ramp to Interstate 10.

Transportation

Improvements are also identified for east roadway access, including a security plaza, removal of 44th Street access, and reconfiguration of on- and off-ramps and roadways to reduce congestion and enhance safety. Sky Harbor Boulevard will be reconfigured to accommodate the West Terminal and eliminate the sharp curve west of Terminal 3.

East Roadway Access



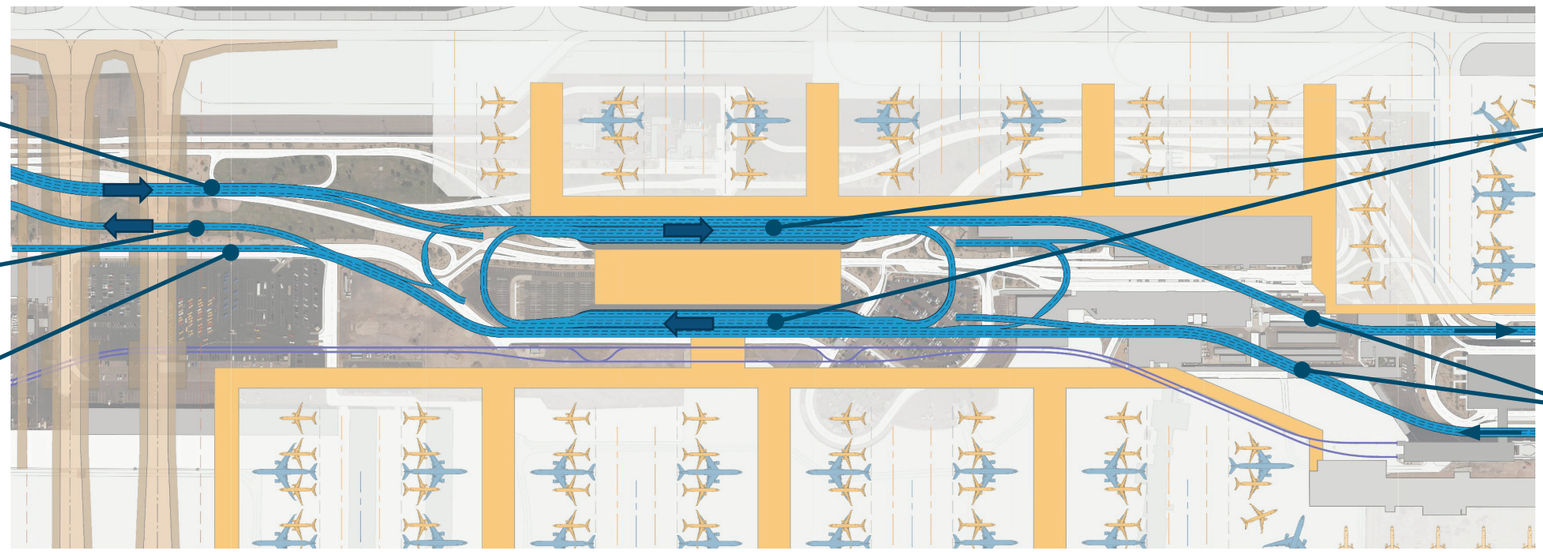
Conversion of 41st Street to Airside Road
With 42nd Street roadway improvements, 41st Street will no longer be required for public access and roadway can be used as secured airside road between the north and south airfields.

Remove 44th Street Access from the North
Eliminates merge/weave congestion at Terminal 4.

Security Plaza
Reduces cut-through traffic from the east.

East Access Improvments
Enhanced access and wayfinding including improved access to/from the East Economy Lot to reduce weaving and congestion.

West Terminal Roadways



West Airport Entrance

West Airport Exit

Buckeye Road Access

Dual Level West Terminal Curbs
Curbs in similar alignment to existing Terminal 4 with outer bypass lanes.

Sky Harbor Boulevard Realignment

Support Facilities

Requirements

The graphic below identifies the various support facilities and the land required to accommodate demand associated with PAL 3. The graphic also identifies facility siting needs and potential interdependencies.

Concept

The Arizona Air National Guard (AZANG) currently accommodates 8 KC-135 Stratotanker aircraft on their existing apron. The AZANG has interest in basing 12 new generation KC-46A aircraft that are longer, wider, and have a taller tail. The existing apron is not able to accommodate these aircraft due to surfaces associated with the south runway. The concept for the south area includes expansion of AZANG and general aviation facilities into the existing South Cargo Complex. The South Cargo Complex would be relocated to a new north cargo area. The West Cargo Complex houses all-cargo and passenger airline cargo facilities and would be relocated to the north area to accommodate Taxiways U and V and the West Terminal and associated concourses. The consolidation of cargo facilities on the north side allows for greater facility efficiency and the ability to accommodate future cargo demand.

To utilize the north area of the Airport for cargo and an aero support complex, the Union Pacific Railroad along the north side of the Airport would be placed in a trench extending from Interstate 10 to South 44th Street. This trench would provide the ability to stage trains and allow the Airport to access and utilize land north of the railroad. This rail trench would also remove at-grade roadway crossings throughout the area and most notably at 24th Street.

Cargo facilities are planned to extend west from 34th Street with dual taxilanes providing airfield access to the area. An additional taxilane would be constructed near existing 27th Street. The North Aero Support Complex would be located east of 36th Street and accommodate the relocation of the Facilities & Services Lot, passenger airline cargo, and airline ground support equipment storage and maintenance facilities, as well as off-airport and new airport facilities such as in-flight catering and a Centralized Receiving and Distribution Center. Operations, Police, and Facilities & Services administration functions would be located near the West GTC. Airport Administration functions would be expanded in this area as needed.

Support Facilities and PAL 3 Requirements

Support Facility	Integrated Cargo	All-Cargo	Fixed Based Operator	General Aviation	Airline Maintenance	Operations/ Police	Facilities & Services	Centralized Receiving & Distribution Center	In-flight Catering Services	Passenger Airline Cargo	Airline Ground Support Equipment	Aero-Industrial/ Aerospace
PAL 3 Required (High Growth)	59 Acres (66 Acres)	22 Acres (49 Acres)	8 Acres	6 Acres	7 Acres	6 Acres	13 Acres	6 Acres	7 Acres	8 Acres (9 Acres)	3 Acres	65 Acres

Facility Siting Needs/Interdependency

- Airfield Taxiway Access
- Co-location Efficiencies
- Co-location Efficiencies
- Landside and Airside Roadway Access
- Airfield Roadway Access
- Combined Site Space and Operational Efficiencies
- Near Terminal Core/Sky Harbor Boulevard/ PHX Sky Train Access
- Storage/Screening Collaboration
- Consolidated Support Campus / Aero Support Complex

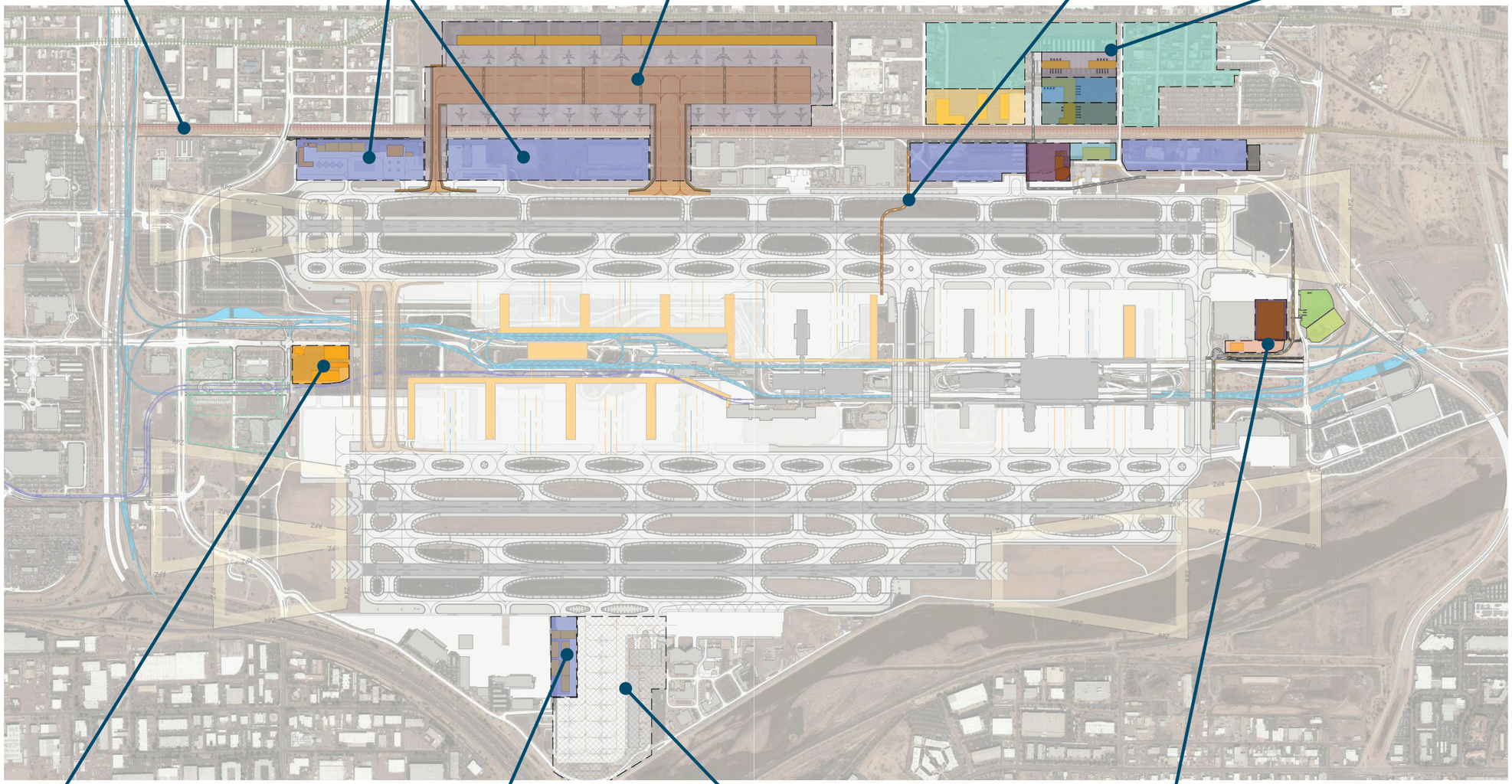
Union Pacific Railroad Trench
Placement of the Union Pacific Railroad in a 30-foot deep trench to allow an airfield connection to north cargo and support facilities and provide an overpass for roadway crossings, most notably 24th Street.

Aero Business/General Aviation
Areas south of the Union Pacific Railroad trench to accommodate aviation needs, such as special event aircraft parking and aviation services companies.

North Cargo Facility
To accommodate relocation of the South Cargo and West Cargo facilities and provide future expansion capability, a consolidated north cargo facility is planned. Development in this area requires placing the Union Pacific Railroad in a trench to allow taxiway and secure roadway access to the airfield.

Vehicle Service Road Tunnel
A secure roadway tunnel below the airfield to provide a direct vehicle connection between the North Aero Support Complex and the terminal core.

North Aero Support Complex
Co-location of support facilities displaced by terminal and taxiways development and allows for future growth and sharing of screening and distribution functions.



Operations/Police/Administration
Relocation of the operations and police facilities displaced by the West Terminal and concourses. Facility would have access to Sky Harbor Boulevard, the airfield, and future PHX Sky Train West GTC Station.

Fixed Based Operator
Executive hangar growth utilizing a portion of the South Cargo ramp adjacent to existing Fixed Base Operators.

Arizona Air National Guard
The AZANG is pursuing basing 12 KC-46A aircraft requiring additional space beyond their current leasehold and site space for additional facilities. This growth displaces the current South Cargo Complex.

Airline Support Facility Optimization
Relocation of support facilities for the construction of the Terminal 3 North Concourse 2. Includes realignment of an airside service road and security gate while accommodating maintenance hangar facility expansion.

Short-Range Development Plan: 0 to 10 Years

Projects are listed below in the order of construction in their category based on demand triggers. The anticipated time frame for the start of construction is identified for each project assuming a base year of 2019.

A Airfield

0-3 Yrs

A-1. Crossfield Taxiway V

Taxiway to provide air traffic control with greater flexibility and reduce overall average taxi distance.

0-10 Yrs

A-2. Airfield Improvements

Various taxiway improvements to increase airfield efficiency and enhance safety for aircraft operations.

L Landside

5-10 Yrs

L-1. West Access Improvements

Roadway connection improvements to Interstate 10 and Interstate 17, including a west security plaza.

L-2. East Access Improvements

Roadway connection improvements for Terminal 4 traffic weaving and an east security plaza.

L-3. Rental Car Access Improvements

More direct access to the Rental Car Center from eastbound Interstate 10 to bypass Washington Street and Jefferson Street.

0 to 10 Years Total Phase Cost: $2,277M

Select Project Costs:
S-2. Union Pacific Railroad Trench: $441M
T-2. Terminal 4 Concourse S1: $310M
T-3. Terminal 3 North Concourse 2: $178M
T-4. Terminal 3-Terminal 4 Connector: $194M
S-5. North Cargo: $263M
T-5. Concourse WS4: $361M

**Rough Order of Magnitude cost estimates do not include future cost escalation*

T Terminal

0-3 Yrs

T-1. Apron Hardstands

Utilization of the west apron area for remote bus gates served from Terminal 3 or Terminal 4 to provide near-term additional gates.

3-5 Yrs

T-2. Terminal 4 Concourse S1

An eight-gate concourse (or five narrowbody and two widebody) serving Terminal 4 airlines.

T-3. Terminal 3 North Concourse 2

A six-gate narrowbody concourse for Terminal 4 or Terminal 3 airlines. Initially the concourse can function as a bus-gate facility.

5-10 Yrs

T-4. Terminal 3-Terminal 4 Connector

A passenger tunnel and corridor connecting the Terminal 3 North Concourse 2 to Terminal 3 and Terminal 4. Connector allows for utilization of gates by either terminal while providing a secure connection between terminals. Project includes a tunnel for airside vehicles to eliminate vehicle crossings on Taxiways S and T.

T-5. Concourse WS4

The first phase of the West Terminal concourses would be an extension of the existing Terminal 3 South Terminal, allowing for ten gates (or 4 widebody and 2 narrowbody).

S Support

0-3 Yrs

S-1. C-Point Relocation

Relocation of the American Airlines cargo facility and vehicle gate located west of the Terminal 3 North Concourse to the existing American Airlines Maintenance Hangar to allow for the construction of Terminal 3 North Concourse 2.

0-5 Yrs

S-2. Union Pacific Railroad Trench

Trench the existing railroad to allow for Airport expansion to the north.

S-3. Facilities & Services Lot Relocation

5-10 Yrs

Relocation of the existing Facility & Services Lot to the North Aero Support Complex to allow for crossfield Taxiway V and the Operations/Police/Administration facility.

S-4. Operations/Police/Administration

Relocation of the Operations and Police and growth of administration support functions to allow for realignment of Sky Harbor Boulevard and construction of the West Terminal.

S-5. North Cargo

Relocation of existing West Cargo and South Cargo facilities.

S-6. Fixed Based Operator

Expansion of Fixed Based Operator facilities near existing operations.

M Miscellaneous

0-10 Yrs

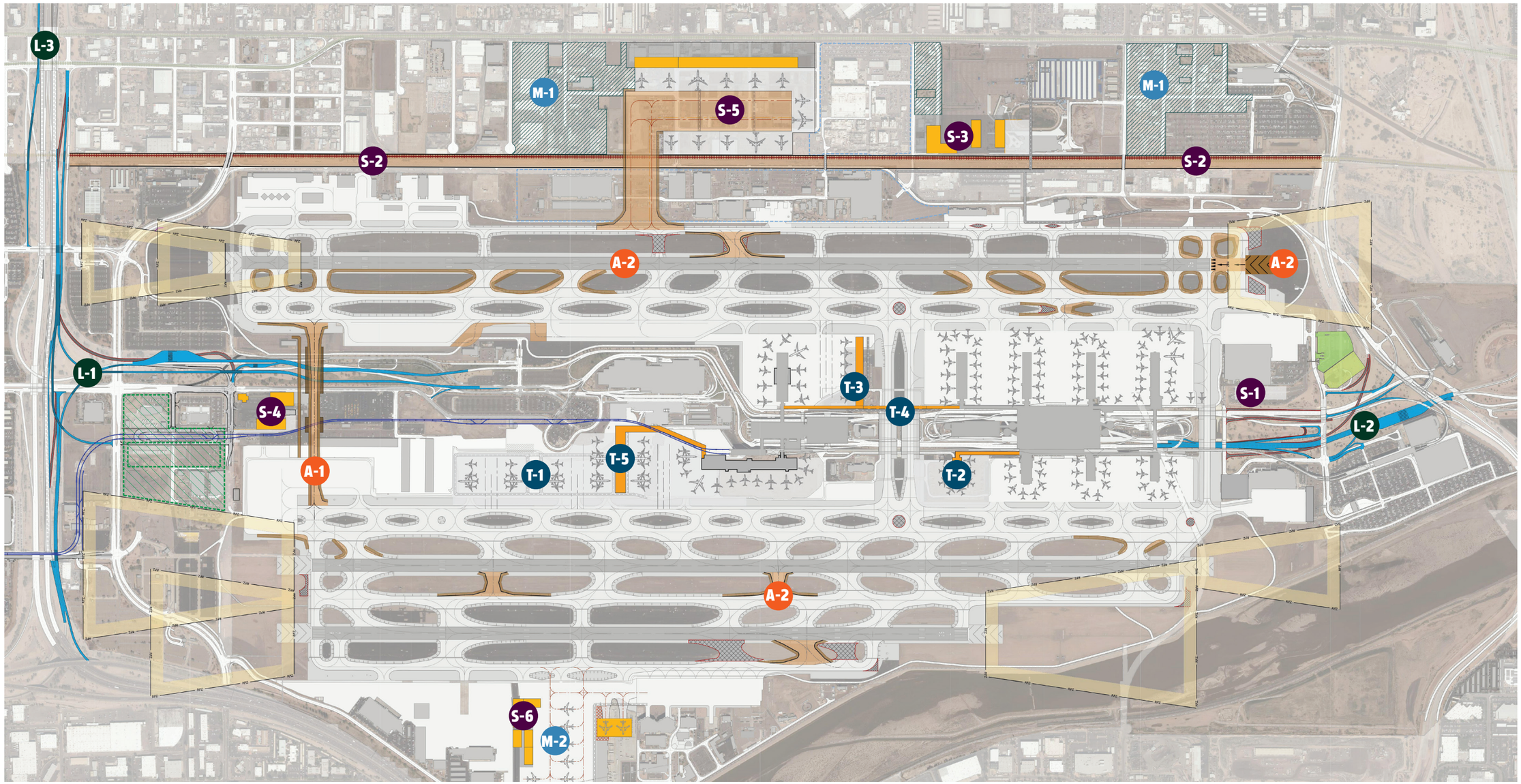
M-1. Land Acquisition Areas

Continual purchasing of land between Washington Street and the Union Pacific Railroad trench for future Airport expansion.

5-10 Yrs

M-2. Arizona Air National Guard Expansion

Displacement of the South Cargo Complex to allow for the AZANG to accomodate larger KC-46A aircraft. The existing South Cargo building would be re-purposed by the AZANG.


L-3
M-1
S-5
S-3
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A-2
A-2
L-1
S-4
T-3
T-4
S-1
L-2
A-1
T-1
T-5
T-2
A-2
S-6
M-2

Long-Range Development Plan: 10 to 20 Years

Projects are listed below in the order of construction in their category based on demand triggers. The anticipated time frame for the start of construction is identified for each project assuming a base year of 2019.

A Airfield

15-20 Yrs

A-3. Crossfield Taxiway U
Taxiway parallel to Taxiway V to reduce anticipated airfield congestion around the West Terminal and associated concourses.

T Terminal

15-20 Yrs

T-6. West Terminal
A terminal with dual-level curbs on the north and south sides (similar to existing Terminal 4) allowing for processing of passengers for up to 35 narrowbody gates. It would include a PHX Sky Train station as well as adjacent terminal parking. The terminal roadways would align with existing crossfield taxiway bridges V and U.

T-7. West Terminal South Concourses
Three additional south concourses (in addition to Concourse WS4) providing 25 additional narrowbody gates (or 10 widebody and 5 narrowbody). The concourses would displace all existing West Cargo facilities, which would be relocated to the north.

10 to 20 Years Total Phase Cost: $1,924M

Select Project Costs:
T-6. West Terminal: $564M
T-7. West Terminal South Concourses: $956M
S-7. North Cargo Expansion: $199M

**Rough Order of Magnitude cost estimates do not include future cost escalation*

S Support

10-20 Yrs

S-7. North Cargo Expansion
Expansion of the North Cargo complex to allow for cargo growth and relocation of all-cargo operations from the West Cargo facility due to construction of the West Terminal (T-6) and associated concourses (T-7).

10-15 Yrs

S-8. General Aviation Redevelopment
Redevelopment of the existing general aviation facility to allow better utilization and inclusion of all general aviation activities, including VIP parking and aircraft staging area.

S-9. Vehicle Service Road Improvements
Realignment of the existing airside vehicle service road to bypass the existing American Airlines Maintenance Hangar apron area.

S-10. Passenger Cargo Relocation
Relocation and growth of passenger cargo (belly cargo) facilities from the West Cargo area to the North Aero Support Complex.

S-11. Flight Kitchen Relocation
Relocation of flight kitchen facilities from off-Airport to on-Airport.

S-12. Centralized Receiving and Distribution Facility
A new facility for screening and storage of Airport deliveries with secure airfield access.

10-15 Yrs

S-13. Ground Support Equipment Relocation
Relocation and growth of Ground Support Equipment maintenance and storage facilities from the West Cargo area to the North Aero Support Complex.

S-14. North Airline Maintenance Facility Expansion
Continued expansion of the existing north airline maintenance facility.

S-15. Aero Business/General Aviation
Aero business development areas to support future facilities requiring airfield access.

S-16. Aero Industrial/Aerospace
Aero industrial development areas to support future facilities requring roadway and airfield access.

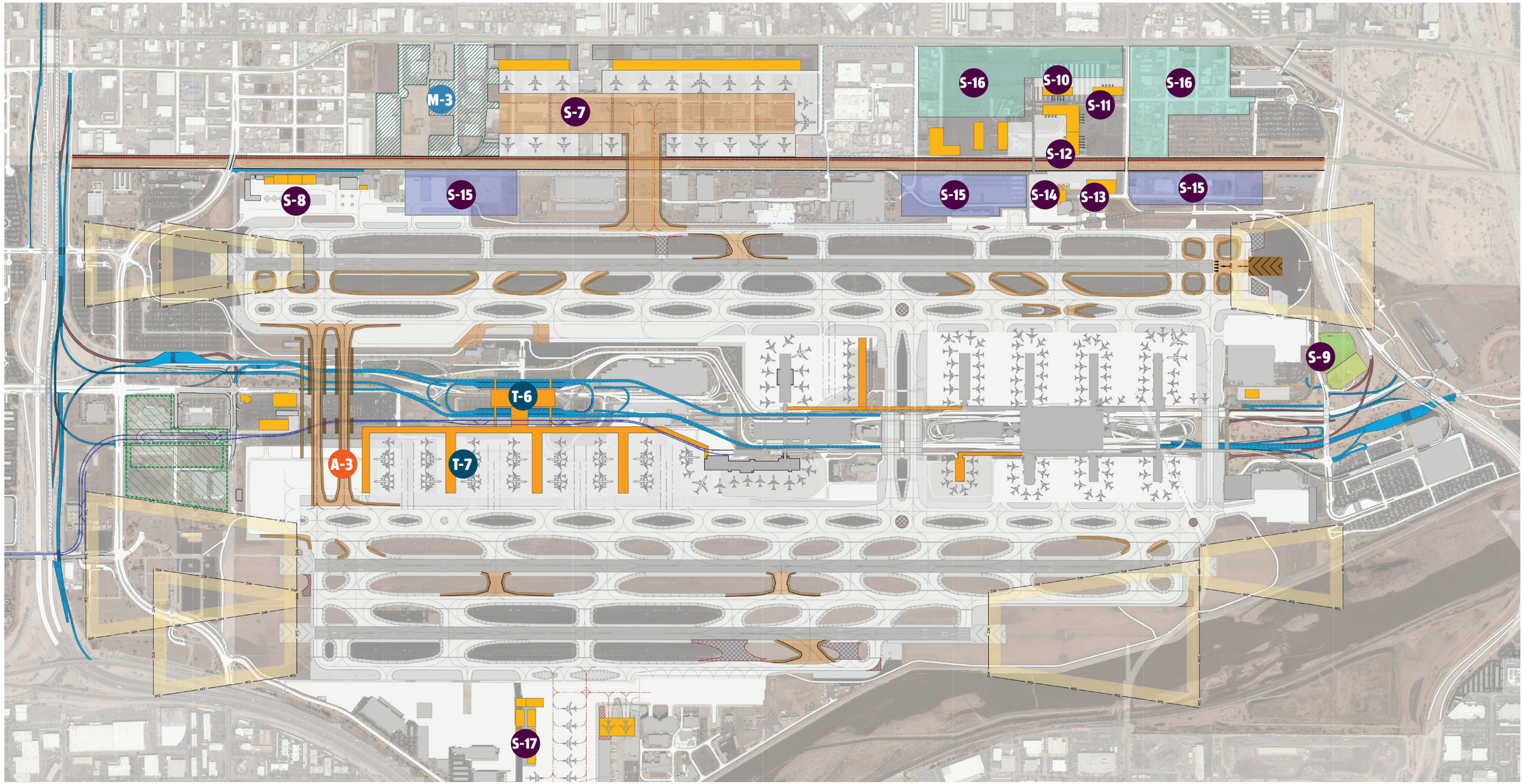
15-20 Yrs

S-17. Fixed Base Operator Expansion
Expansion of hangars and adjacent apron for general aviation fixed base operators.

M Miscellaneous

10-20 Yrs

M-3. Land Acquisition Areas
Continual purchasing of land between Washington Street and the Union Pacific Railroad trench for future Airport expansion.


M-3
S-7
S-16
S-10
S-11
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S-12
S-8
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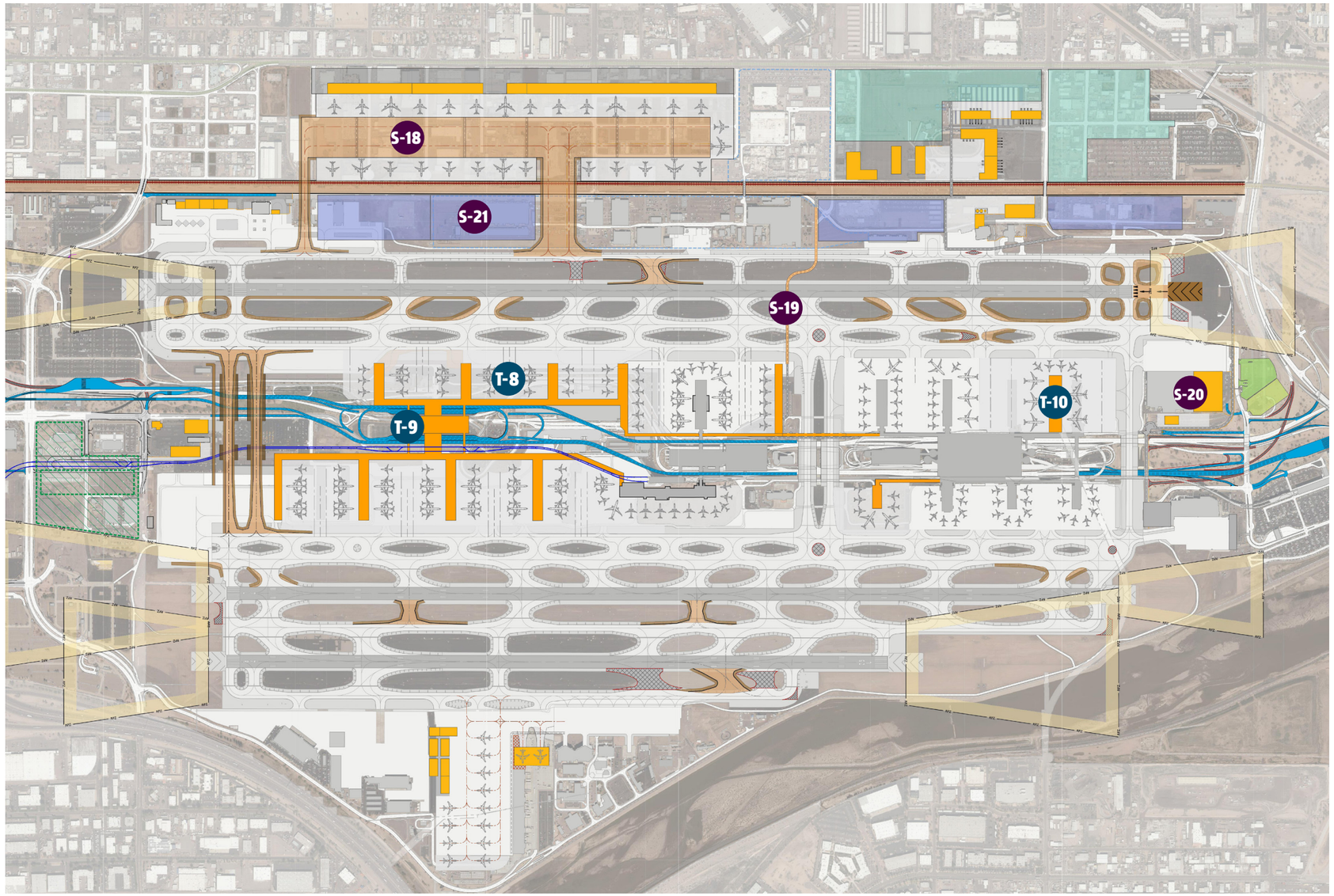
T-6
A-3
T-7
S-17

CAMP Development Plan: 20+ Years



T Terminal

20+ Yrs

T-8. West Terminal North Concourses

Four additional north concourses providing 42 additional narrowbody gates (or 4 widebody and 34 narrowbody) with a Terminal 3 connection.

T-9. West Terminal Expansion

Expansion of the West Terminal to accommodate increased passenger demand associated with the North Concourses.

T-10. International Concourse N3.5

A widebody capable concourse with expanded holdroom and concessions areas and facilities for processing international arriving passengers.

S Support

20+ Yrs

S-18. North Cargo Expansion

Expansion of the North Cargo complex.

S-19. Vehicle Service Road Tunnel

Vehicle tunnel connecting the North Aero Support Complex to the terminal core.

S-20. Airline Maintenance Expansion

Hangar expansion and improvements.

S-21. Aero Business/General Aviation

Aero business development areas to support future facilities requiring airfield access.

20+ Years Total Phase Cost: $1,434M

Select Project Costs:
T-8. West Terminal North Concourses: $800M
T-9. West Terminal: $235M

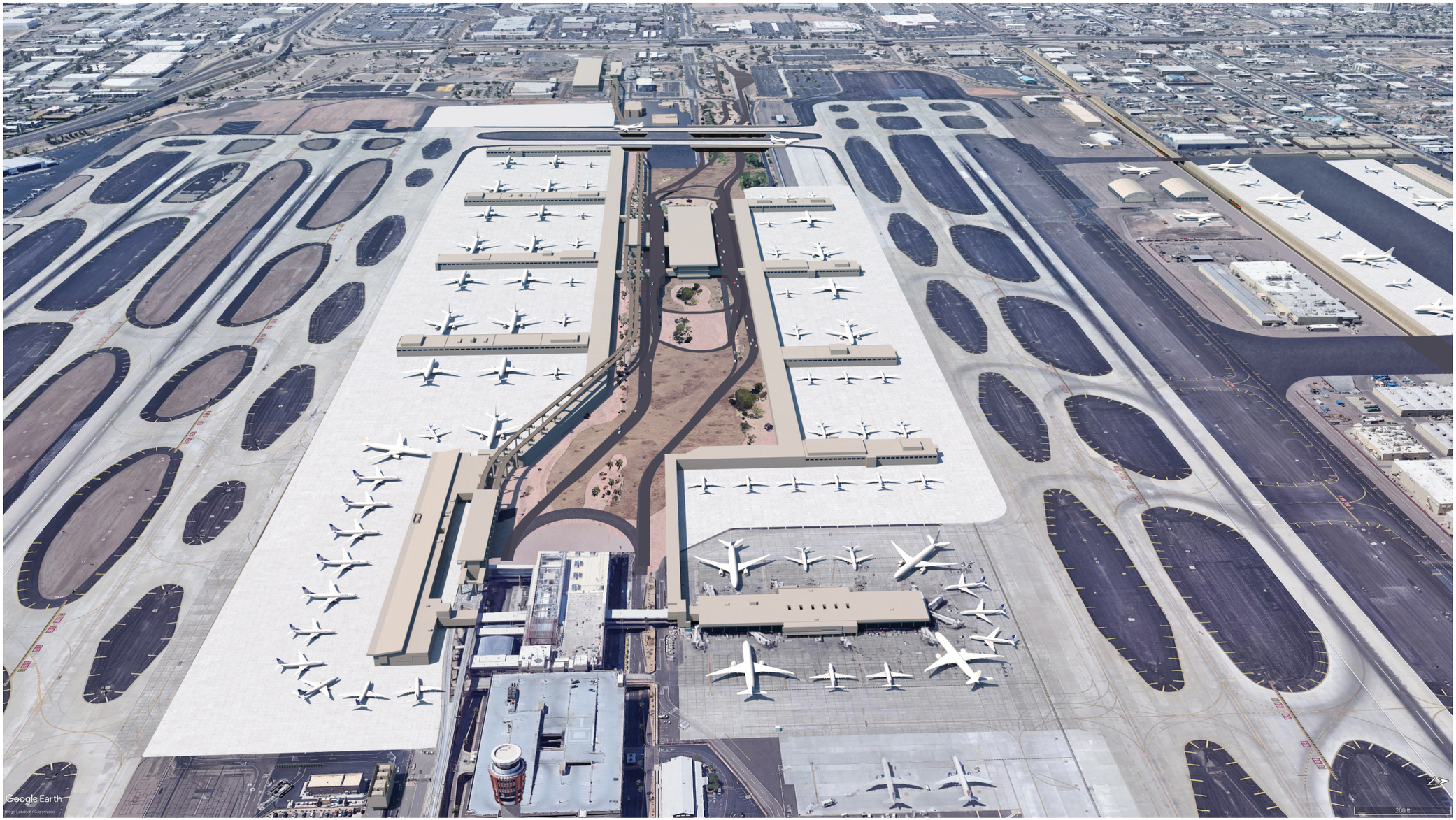
CAMP Project Renderings

North Cargo, Rail Trench, and General Aviation Layout (looking east)



CAMP Project Renderings

West Terminal with North and South Concourse Piers (looking west)



CAMP Project Renderings

North Cargo, Rail Trench, and General Aviation Layout (looking south)




Terminal 4
EAST EXIT
Arrivals
High Profile Parking
44th Street
East Economy Parking
Next Right
2 3 WEST EXIT
34th St. / Downtown
Rental Car Return
EXIT

1. INTRODUCTION

The Phoenix Sky Harbor International Airport (the Airport or PHX) Comprehensive Asset Management Plan (CAMP) is a 20-year master plan for strategically guiding Airport development. CAMP provides recommendations for meeting aviation growth in a cost effective and flexible manner.

CAMP recommendations are based on these key objectives:

- Ensuring safety and security
- Maintaining consistency with the overall vision and goals for the Airport
- Developing practical and affordable recommendations that provide facilities as they are needed
- Maintaining consistent and coordinated development that aligns with City of Phoenix and regional plans
- Minimizing impact on current operations
- Optimizing operational efficiencies and flexibility
- Enhancing customer service and satisfaction
- Providing flexibility to respond to the changing needs of the dynamic aviation industry
- Meeting sustainability goals
- Meeting environmental requirements

1.1 AIRPORT SETTING

PHX is a major transportation hub located 5 miles east of the City of Phoenix central business district and serves the Phoenix metropolitan area. As the thirtieth busiest airport in the United States (U.S.) in 2017 based on annual passengers, the Airport serves an important role in the national aviation system.[1]

The Airport is situated on approximately 3,000 acres in Maricopa County bordered by Interstate 10 (I-10) to the west, Air Lane to the north, State Route 143 and South 44th Street to the east, and the Salt River to the south. The City of Phoenix also owns several properties outside of these boundaries that are controlled and maintained by PHX AVN. The location of the Airport is shown on **Exhibit 1-1**. The general vicinity of the Airport and Airport property are shown on **Exhibit 1-2**.

1.2 HISTORICAL AIRPORT BACKGROUND

Scenic Airways developed the Airport in 1928 with a single runway (existing Runway 7L-25R). It was acquired by the City of Phoenix in 1935. In the 1950s, a second parallel runway (existing Runway 8-26) and a crossfield runway (Runway 3-21) were constructed.[2] The southernmost Runway 7R-25L was opened in the year 2000.

[1] Federal Aviation Administration, Air Carrier Activity Information System, November 7, 2018.

[2] Runway 3-21 was subsequently decommissioned and demolished to allow for the construction of Terminal 2.

Since the 1930s, the Airport has been served by many airlines, including those who serve or have served the Airport as a hub or focus city, such as Trans World Airlines (TWA), Bonanza Airlines, America West Airlines, US Airways, American Airlines, and Southwest Airlines.[3] PHX remains a hub airport for American Airlines (which merged with US Airways in 2013[4]), and has been a focus city for Southwest Airlines since 1982.[5]

The Airport has been developed with four independent terminals:

- Terminal 1 – Terminal 1 was constructed in 1952 and originally accommodated operations by American Airlines, TWA, Frontier Airlines, and Western Airlines. Construction of Terminal 1 also included the Airport's first Airport Traffic Control Tower (ATCT). Terminal 1 was demolished in 1991; remnants of the apron for the circular building are still visible around the West Economy Parking Lot and aircraft apron west of Terminal 2.
- Terminal 2 – Terminal 2 opened in 1962 with a terminal building, including ticketing and baggage claim, and a single pier with 19 aircraft gates. Over time, the gates have been reconfigured to accommodate larger aircraft, reducing the number of usable gates to 10.
- Terminal 3 – Terminal 3 opened in 1976 and was the first terminal at PHX to include a connected parking garage. It consists of a terminal building and two concourses; one on the north side and one on the south side of Sky Harbor Boulevard. This arrangement established the split terminal roadway as it remains today—allowing for terminal curb on both north and south sides of the terminal building. The North Concourse originally accommodated 16 aircraft gates and the South Concourse accommodated 6 gates. As of March 2018, the North Concourse supports 10 gates and the South Concourse is under reconstruction as part of the Terminal 3 Modernization Program.
- Terminal 4 – Terminal 4 opened in 1990 and was the last terminal to open at the Airport. The terminal, planned for four concourses on the north side and four on the south side, was initially constructed with three concourses on the north side and two concourses on the south side. The fourth concourse on the north side was opened in 2001 and the third concourse on the south side was opened in 2005. The fourth concourse on the south side is planned to be opened in 2021. As of 2017, Terminal 4 supported 83 aircraft gates on the seven separate concourses.

Numerous other facilities have been developed at the Airport over the years, including economy parking garages, the Rental Car Center, cargo facilities, airline maintenance facilities, and corporate and general aviation facilities. Since the 1950s, the Airport has been home to the 161st Air Refueling Wing of the Arizona Air National Guard.

[3] A focus city is an airport that primarily serves an airline's point-to-point routes and caters more to the local market rather than to connecting passengers.

[4] America West Airlines, https://www.aa.com/i18n/customer-service/about-us/history-of-american-airlines.jsp (accessed December 2017).

[5] Southwest Airlines, https://www.swamedia.com/h3ages/city-fact-sheets (accessed December 2017).

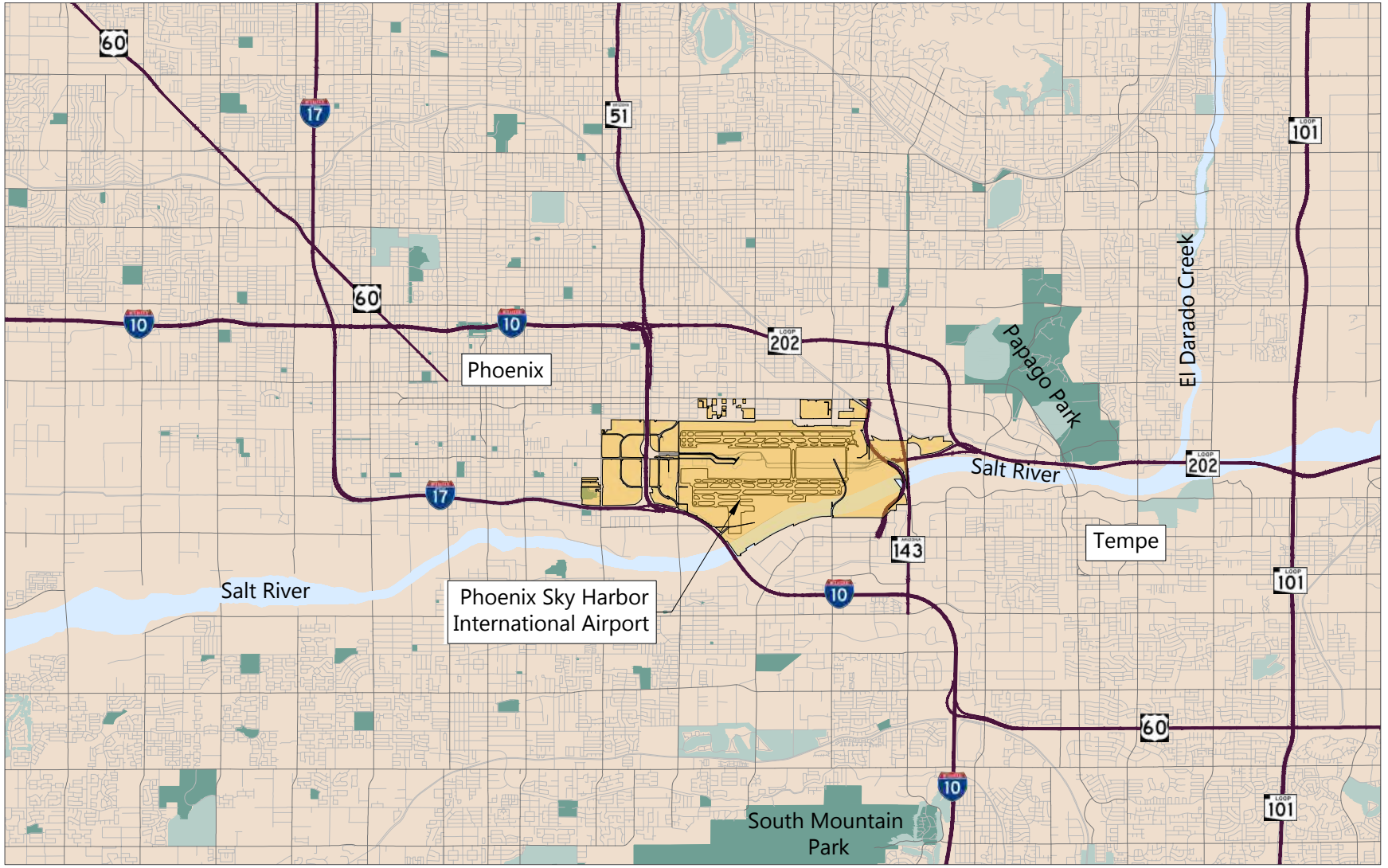
1.3 PLANNING PROCESS AND PUBLIC PARTICIPATION

To ensure a successful stakeholder-led planning process, a stakeholder involvement plan was followed to promote a high level of awareness which effectively balanced stakeholder input and interests. The overarching objective of the stakeholder involvement plan was to promote a high level of awareness of and support for CAMP. The planning process was intended to ensure general community support for CAMP by effectively balancing stakeholder input and interests.

Project committees and focus groups were formed and included individual citizens, elected officials, other city departments, state agencies, federal agencies, airport users and tenants, special interest groups, and others. These stakeholders provided valuable feedback and crucial information that helped guide the planning process. Two stakeholder committees and five focus groups were established:

- Planning Advisory Committee: This committee included City and agency leaders, business executives, elected officials or their staff, and others that represented groups interested in the community, the regional economy, and area transportation systems. These individuals provided a long-term view and focused on outcomes and synergies and provided overall strategic guidance for the CAMP process.
- Technical Advisory Committee: This committee included individuals who understand and provided input and direction regarding specific technical matters. These members provided reviews of a wide range of technical elements to ensure sound technical recommendations.
- Focus Groups: These groups addressed specialized topics that with teams organized around shared functional responsibilities or technical specialties and interests. A total of five groups were formed that focused on transportation, development, community, sustainability, and operations.

The stakeholder process included 14 project committee and focus group meetings as well as several community and industry group presentations. The public was also provided the opportunity to learn about CAMP and engage in the planning process through two public workshops. The public workshops were conducted using an open-house format with information stations. The workshop provide opportunities for members of the public to ask questions and provide input through comment cards and plan markups. All project materials, including draft documents, meeting presentations, and public workshop materials were available on the Airport's website.



SOURCE: ESRI Database (National Geographic Map), National Geographic, Esri, DeLorme, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, Increment P Corp., February 2016.

EXHIBIT 1-1

NORTH 0 2 Miles

Airport Location Map

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\01-Introduction\Ex-1-01-Airport Location.dwgLayout: Ex-01 Plotted: Sep 4, 2019, 03:16PM



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary).

NORTH

0 2,100 ft.

EXHIBIT 1-2

General Airport Vicinity Map

2. EXISTING CONDITIONS

The inventory information presented in this section provides the basis for evaluating facilities and determining future facility needs. This inventory was compiled primarily in late 2017 and, as such, represents the conditions at the Airport at that time. A summary of ongoing studies and planned near-term airport facilities are summarized at the end of this section.

2.1 AIRFIELD FACILITIES

PHX has three parallel runways oriented in an east/west direction. Runway 8-26 is north of the passenger terminals and Runways 7L-25R and 7R-25L are to the south. The runways are depicted on **Exhibit 2-1** with runway characteristics provided in **Table 2-1**.

TABLE 2-1 RUNWAY CHARACTERISTICS

	RUNWAY					
	8	26	7L	25R	7R	25L
Dimensions (feet)	11,489 x 150		10,300 x 150		7,800 x 150	
Surface	Concrete/grooved, in good condition		Concrete/grooved, in good condition		Concrete/grooved, in good condition	
Weight Bearing Capacity[1]	PCN 74 /R/B/W/T		PCN 70 /R/B/W/T		PCN 79 /R/B/W/T	
Single Wheel (pounds)	30,000		30,000		30,000	
Double Wheel (pounds)	200,000		235,000		200,000	
Double Tandem (pounds)	455,000		435,000		400,000	
Dual Double Tandem (pounds)	965,000		940,000		1,010,000	
Runway Edge Lights	High Intensity		High Intensity		High Intensity	
Elevation (above mean sea level)	1,111.0	1,134.6	1,110.1	1,134.0	1,110.9	1,126.2
Gradient	0.2%	-0.2%	0.2%	-0.2%	0.2%	-0.2%
Displaced Threshold (feet)	898	-	-	-	-	-
Declared Distances (feet)						
TORA[2]	11,489	11,489	10,300	10,300	7,800	7,800
TODA[2]	11,489	11,489	10,300	10,300	7,800	7,800
ASDA[2]	11,489	11,489	10,300	10,300	7,800	7,800
LDA[2]	10,591	11,489	10,300	10,300	7,800	7,800
Visual Approach Slope Indicator[3]	4-light PAPI on left (3.00 degrees glide path)		4-light PAPI on left (3.00 degrees glide path)		4-light PAPI on left (3.00 degrees glide path)	
Runway Centerline to Runway Centerline Separation (feet)	3,564				N\A	
	N\A		800			
RDC[4]	D/V/5000	D/V/4000	D/V/2400	D/V/5000	D/V/4000	D/V/2400

NOTES:

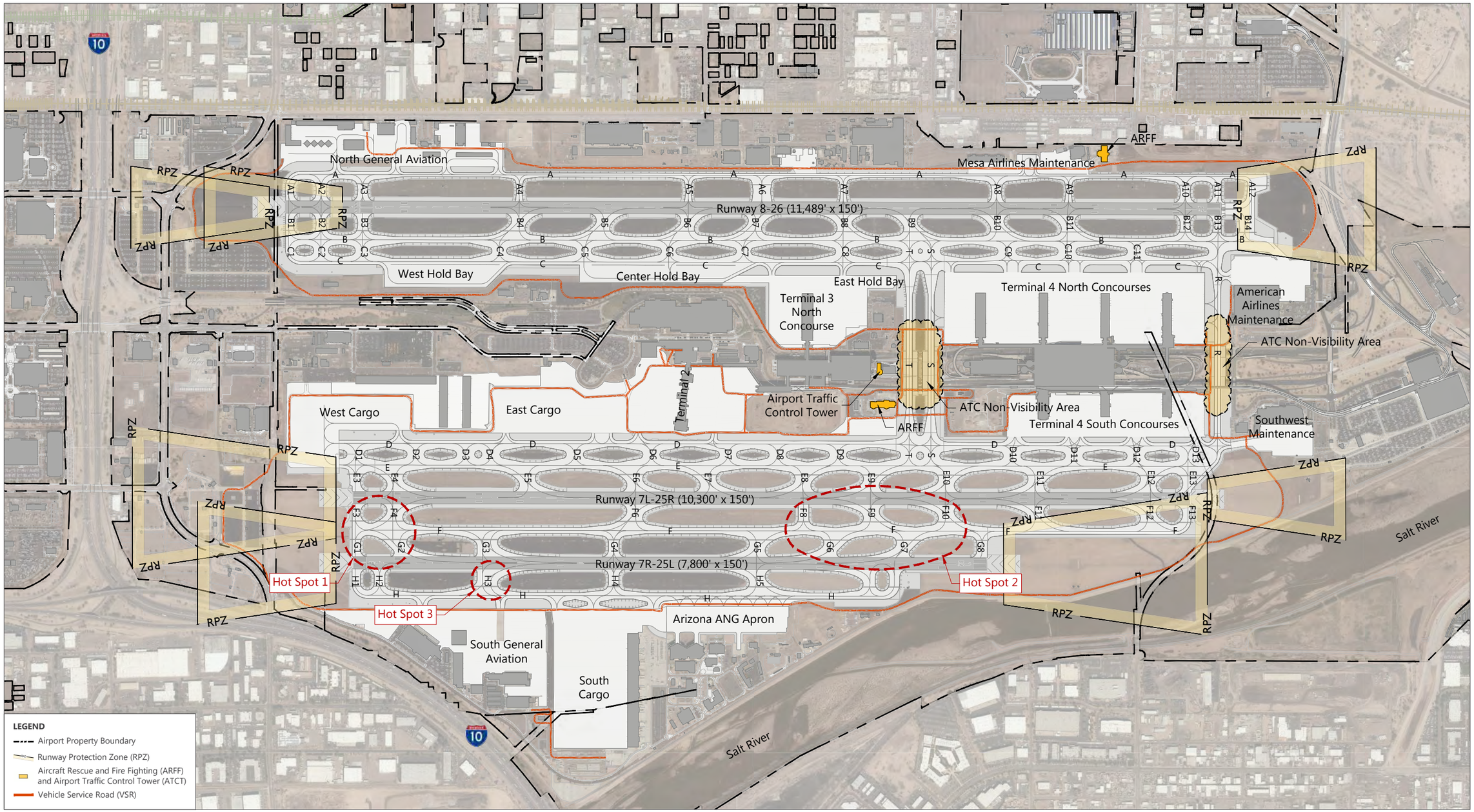
1 Runway pavement strength items: PCN: Pavement Classification Number, R/B/W/T: Rigid pavement type with medium strength and no tire pressure limits

2 Distances related to runway takeoff and landing requirements: TORA: Take-off Run Available, TODA: Take-off Distance Available, ASDA: Accelerate Stop Distance Available, LDA: Landing Distance Available,

3 PAPI: Precision Approach Path Indicator

4 RDC: Runway Design Code

SOURCE: Federal Aviation Administration, Airport/Facility Directory, October 12, 2017.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary).

NORTH 0 1,200 ft.

EXHIBIT 2-1

Airfield Facilities

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\02-Existing Conditions (Inventory)\Ex-2-01-Airfield Facilities.dwgLayout: 2-1 Plotted: Sep 6, 2019, 11:12AM

The critical design aircraft—designated by the Federal Aviation Administration (FAA) for PHX as the Boeing 747-400—sets the dimensional requirements on the airfield, such as runway and taxiway widths, the separations between runways and taxiways, and runway and taxiway safety area widths.[1] All three runways are equipped with an Instrument Landing System (ILS) as well as a variety of navigational aids (NAVAIDS), lighting, and instrumentation that are summarized in **Table 2-2**.

TABLE 2-2 RUNWAY INSTRUMENT AND LIGHTING SYSTEMS

	RUNWAY					
	8	26	7L	25R	7R	25L
Approach Aids						
Distance Measuring Equipment (DME)	●	●	●		●	
Glide Slope	●	●	●		●	●
Localizer	●	●	●		●	●
Runway Visual Range			●	●		
Precision Approach Path Indicator	●	●	●	●	●	●
Approach Lighting System						
MALSR: 1,400-foot medium intensity approach lighting system with runway alignment indicator lights			●		●	●
MALSF: 1,400-foot medium intensity approach lighting system with sequenced flashers	●					
High Intensity Runway Edge Lights	●		●		●	

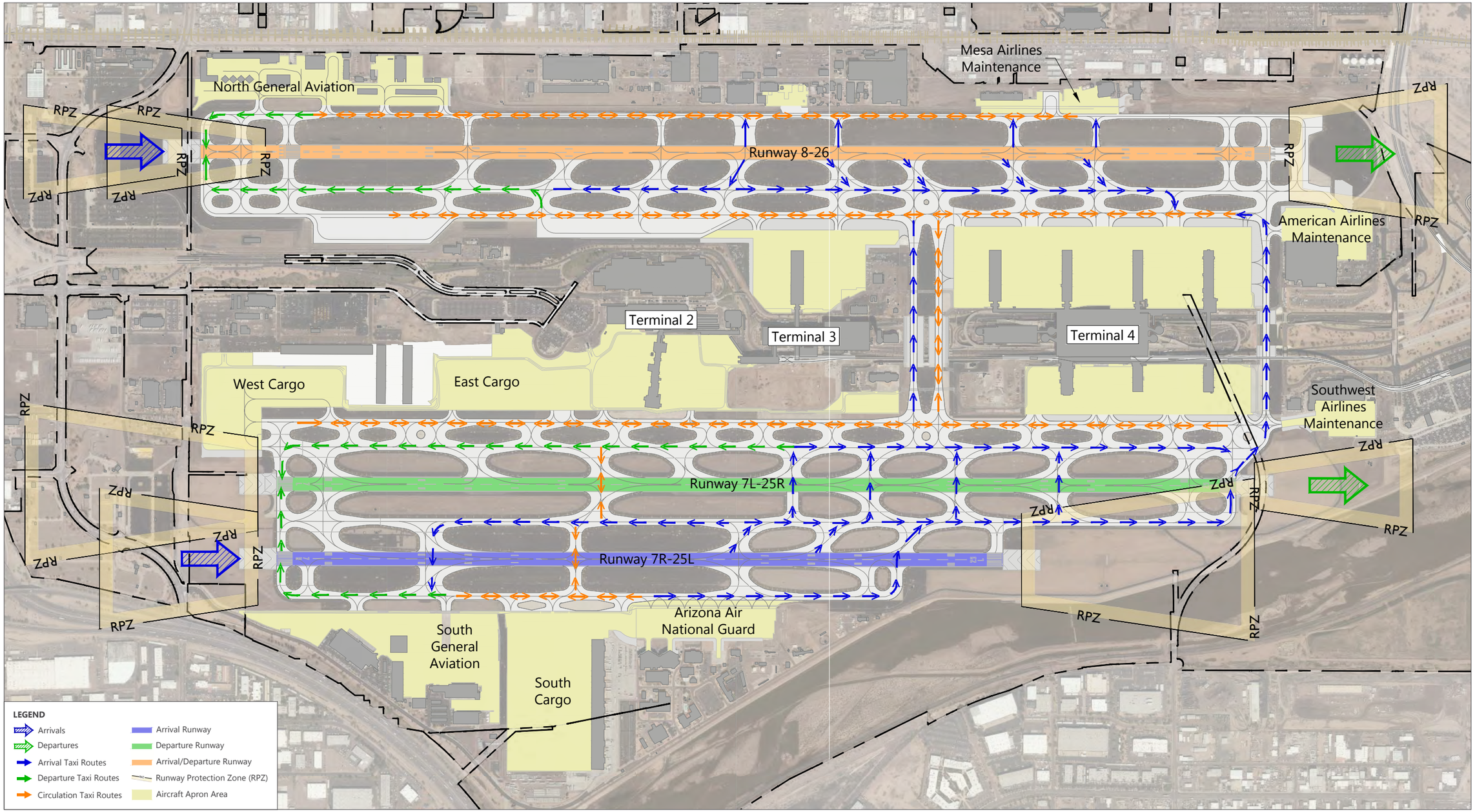
NOTE: MALSF: Medium-Intensity Approach Lighting System with Sequenced Flasher, MALSR: Medium-Intensity Approach Lighting System with Runway Alignment Indicator Lights

SOURCES: Jeppesen Airway Chart for Phoenix Sky Harbor International Airport, October 12, 2017; Federal Aviation Administration, Airport/Facility Directory, October 12, 2017.

Aircraft arrive and depart to the east (east flow) or to the west (west flow) depending on wind and weather conditions and noise considerations. During east flow, Runways 8 and 7R are the primary arrival runways and Runway 7L is the primary departure runway. During west flow, Runways 26 and 25L are the primary arrival runways and Runway 25R is the primary departure runway. **Exhibits 2-2** and **2-3** depict runway use during east and west flow and the associated aircraft taxiway routes to and from the runways. **Tables 2-3** and **2-4** summarize the departure and arrival runway use for east and west flow, respectively. For noise abatement purposes, the Airport has a goal to equalize aircraft departures to the east and west over an annualized period. Monthly runway use information is shared with the FAA to help meet this goal. In 2017, 49.7 percent of the departures were to the east and 50.3 percent were to the west.[2]

[1] Boeing 747-400 has an Aircraft Approach Category (AAC) of D (approach speed of 141 knots or more but less than 166 knots) and Airplane Design Group (ADG) V (meaning a wingspan of 171 feet or more but less than 214 feet and/or a tail height of 60 feet or more but less than 66 feet)

[2] City of Phoenix – Aviation Department 2016 Noise Report, revision 5/22/17.



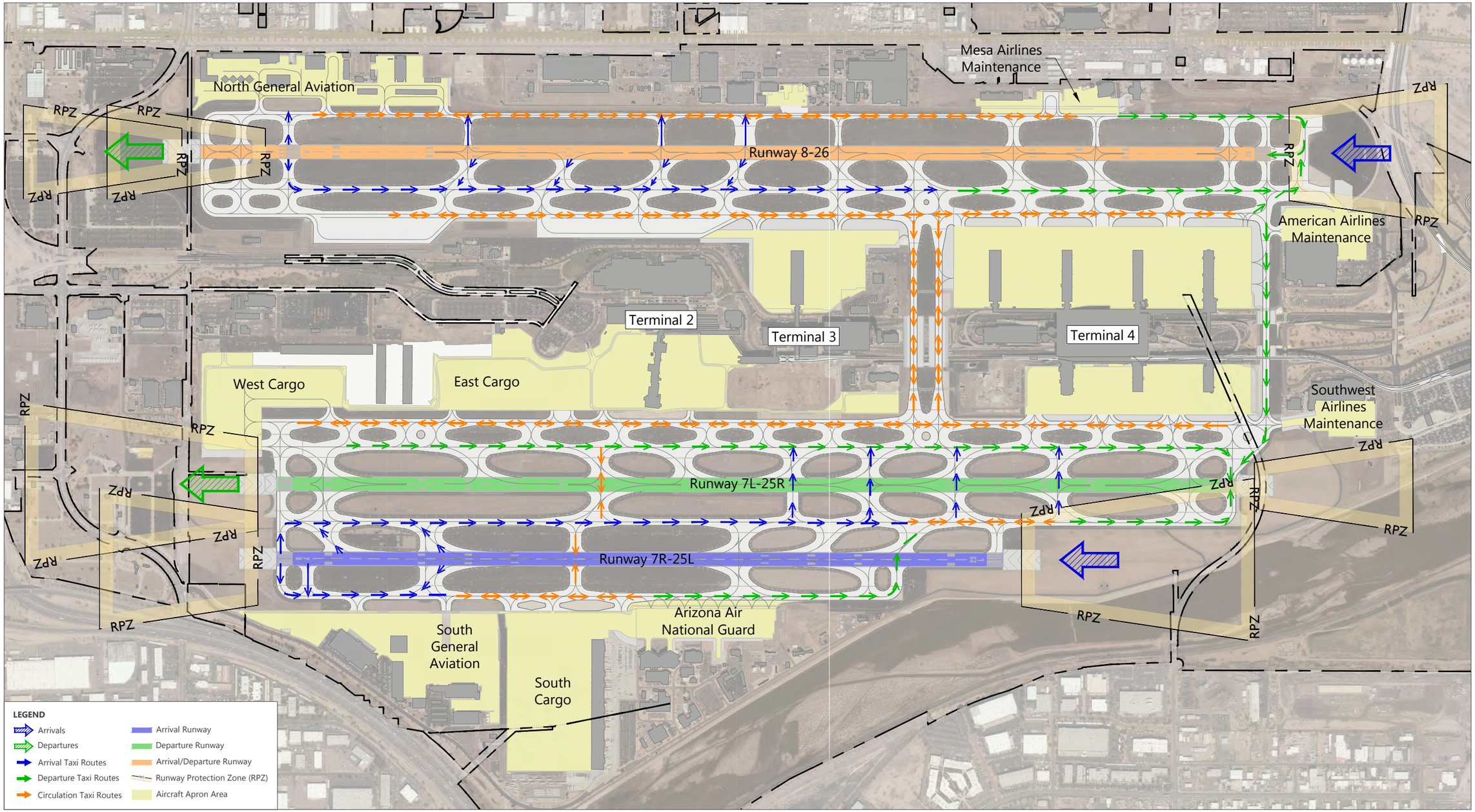
SOURCE: Woolpert, September 29, 2017; Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Phoenix Sky Harbor International Airport, *Airport Development Program Phase III*, September 2009 (Taxiway Flows).

NORTH 0 1,050 ft.

EXHIBIT 2-2

Representative Runway and Taxi Flows
East Flow

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\02-Existing Conditions (Inventory)\Ex-2-02,03-Taxiway Flows.dwgLayout: 2-2 Plotted: Sep 6, 2019, 11:14AM



SOURCE: Woolpert, September 29, 2017; Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Phoenix Sky Harbor International Airport, *Airport Development Program Phase III*, September 2009 (Taxiway Flows).

NORTH 0 1,050 ft.

EXHIBIT 2-3

Representative Runway and Taxi Flows
West Flow

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\02-Existing Conditions (Inventory)\Ex-2-02,03-Taxiway Flows.dwgLayout: 2-3 Plotted: Sep 6, 2019, 11:14AM

TABLE 2-3 2016 DEPARTURE RUNWAY USE

CONFIGURATION	RUNWAY	TOTAL NUMBER OF OPERATIONS	PERCENTAGE OF TOTAL OPERATIONS	PERCENTAGE OF TOTAL FLOWS
East	8	5,319	2.52%	45.74%
	7L	82,827	39.20%	
	7R	8,521	4.03%	
West	26	3,911	1.85%	54.26%
	25R	103,599	49.02%	
	25L	7,143	3.38%	
	Total	**211,320**	**100.00%**	**100.00%**

SOURCE: Aerobahn Flight Details Report for CY 2016, December 2017.

TABLE 2-4 2016 ARRIVAL RUNWAY USE

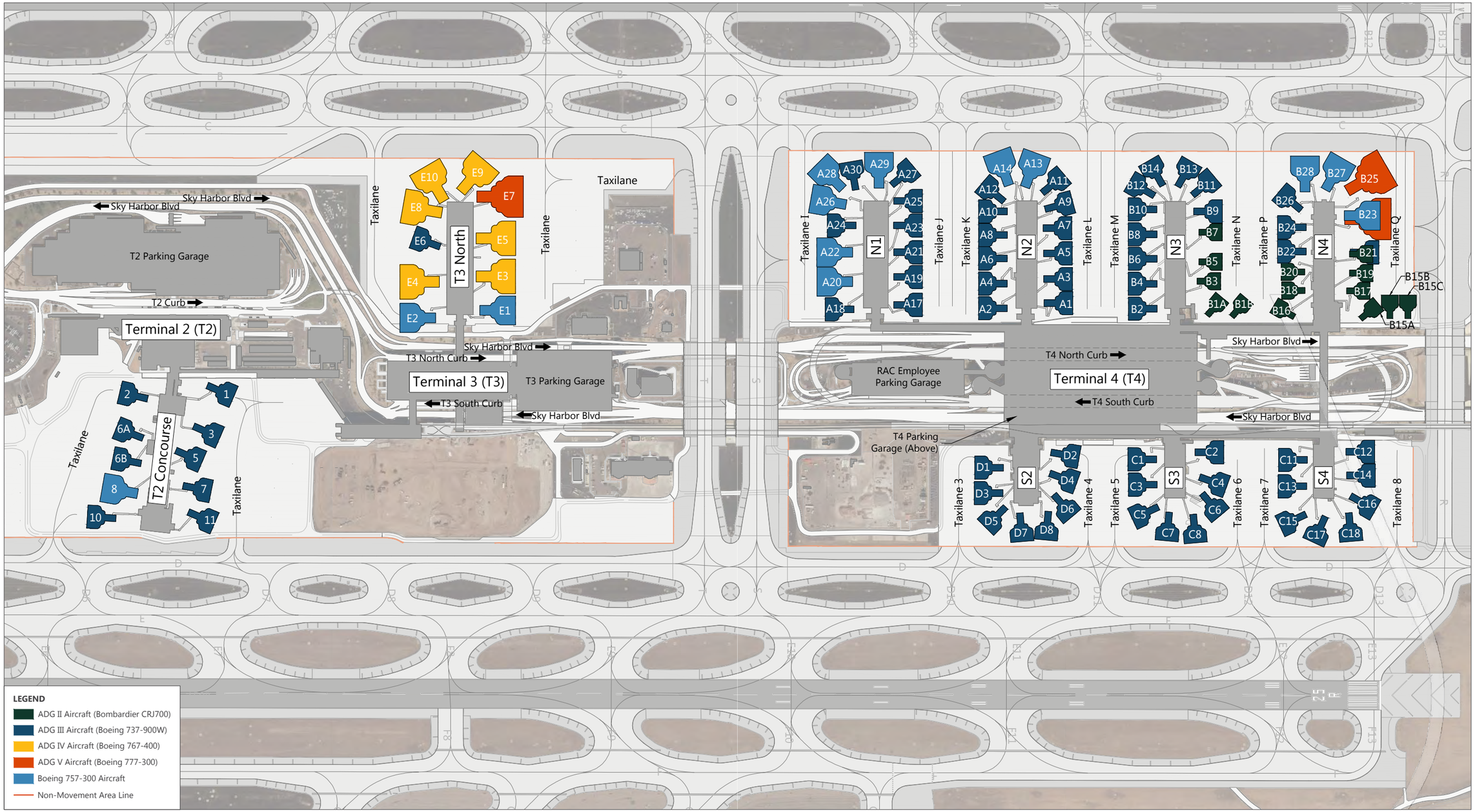
CONFIGURATION	RUNWAY	TOTAL NUMBER OF OPERATIONS	PERCENTAGE OF TOTAL OPERATIONS	PERCENTAGE OF TOTAL FLOWS
East	8	52,291	24.93%	41.58%
	7L	6,190	2.95%	
	7R	28,749	13.71%	
West	26	71,706	34.18%	58.42%
	25R	10,882	5.19%	
	25L	39,950	19.04%	
	Total	**209,768**	**100.00%**	**100.00%**

SOURCE: Aerobahn Flight Details Report for CY 2016, December 2017.

The taxiway system (including taxiway names) is depicted on Exhibit 2-1. Runway and taxiway separation standards are determined by the Airplane Design Group (ADG) of the design aircraft operating on the runway and the parallel taxiway. Design standards for taxiway pavement width, shoulder width, and edge safety margin are based on Taxiway Design Group (TDG). Most taxiway and shoulder widths at the Airport can accommodate TDG 5 aircraft (e.g., Boeing 747-8, Airbus A350). Portions of other taxiways are limited to TDG 4 aircraft (e.g., Boeing 757-300, McDonald Douglas MD-88). There are several taxiway dimensional deficiencies on the airfield, including objects within the Taxiway Object Free Area (TOFA). These deficiencies are being addressed in an ongoing Runway Incursion Mitigation Study described in Section 2.6.1.

Taxiways are within what is referred to as the movement area that is controlled by Air Traffic Control (ATC) staff in the Airport Traffic Control Tower (ATCT) located east of Terminal 3. Portions of crossfield Taxiways T, S, and R are not visible from the ATCT and aircraft moving through these areas are controlled by ATC staff using airport surface radar and operational procedures to ensure safe and efficient movement. Taxilanes provide access to aircraft parking areas, including the passenger terminal, cargo, and general aviation (GA) apron areas. The taxilane names in the terminal area are shown in **Exhibit 2-4**.

Apron areas at the Airport are used to park and service passenger, cargo, military, or GA aircraft or to hold aircraft that are waiting for a gate and are shown on Exhibit 2-1.



SOURCE: HNTB Runway Incursion Mitigation Study DRAFT August 2012; Woolpert, September 29, 2017; Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary).

EXHIBIT 2-4

Terminal/Concourse Facilities and Apron Layouts

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\02-Existing Conditions (Inventory)\Ex-2-04-Terminal and Gate Capacity.dwgLayout: 2-4 Plotted: Sep 4, 2019, 03:37PM

Vehicle service roads (VSRs) provide vehicular access to facilities located throughout the airfield and are shown on Exhibit 2-1. A perimeter VSR encircles the airfield and primarily runs along the secured fence-line of the Airport Operations Area (AOA). Portions of the VSR that are located within the movement area or runway/NAVAID critical areas require vehicles to follow a Letter of Agreement (LOA) established by the Airport and the ATC (approved by the FAA on July 15, 2005) to ensure the safe and efficient movement of aircraft and vehicles within these areas.

Access to the AOA is provided through a variety of controlled access points located along the perimeter fence and within specific facilities adjacent to the AOA.

Hot spots (HS), shown on FAA-developed Airport Diagrams, identify locations with a history of potential risk of collisions or runway incursions and where heightened attention by pilots and drivers is necessary. Exhibit 2-1 identifies three FAA designated hotspots at the Airport that are described below:[3]

- HS1 – Runway 7L and 7R departures sometimes misidentify Taxiway F for Runway 7L or 7R.
- HS2 – Pilots sometimes cross Runway 7L-25R at Taxiway F8, F9, or F10 without authorization.
- HS3 – Aircraft taxiing from southern ramps have turned onto Runway 25L when given instructions to cross Runway 25L at Taxiway H3.

2.2 TERMINAL AND CONCOURSE FACILITIES

There are three terminals (Terminal 2, Terminal 3, and Terminal 4) arranged in a pier-style concept centrally located between Runway 8-26 and Runway 7L-25R. **Tables 2-5** through **2-12** and Exhibit 2-4 provide information on and depict the existing terminal facilities.

All three terminals have undergone or are undergoing varying degrees of reconfiguration and redevelopment, as discussed in Section 2.6.

2.3 AIRPORT TENANT AND SUPPORT FACILITIES

Tenant and Airport support facilities are described in this section. **Exhibits 2-5** through **2-7** show the east, south, and west facilities.

[3] FAA hot spot descriptions as provided in the FAA Airport/Facility Direction (A/FD); October 12, 2017 to December 7, 2017.

TABLE 2-5 TERMINAL FACILITIES SUMMARY

BUILDING FUNCTION	TERMINAL 2	TERMINAL 3	TERMINAL 4	TOTAL
Airline Functions (sq ft) [1]	87,969	68,118	528,449	684,536
Ticket Counter (Total lf)[2]	240	180	640	1,060
Full Service Positions (#)[2]	27	31	101	159
Full Service Queue[2]	2,620	3,715	7,925	14,260
Self-Check Kiosk Pos. (#)[2]	25	14	83	122
Kiosk Area[1] (sq ft)	1,810	2,250	6,900	10,960
Curbside Positions (#)[2, 3]	12	5	16	33
Non-Public Area (sq ft)	1,243	-	10,870	12,113
Baggage (sq ft)	62,239	18,438[4]	206,560	287,237
PHX AVN	14,913	27,992	98,102	141,007
International/CBP (sq ft)	-	-	107,334	107,334
Primary Inspection Positions (#)[2]	-	-	16	16
Carousels (#)[2]	-	-	4	4
Carousels (lf)[2]	-	-	880	880
Concessions (sq ft)	32,723	67,059	142,083	241,865
Utilities & Building Services (sq ft)	6,114	2,315	109,988	118,417
Public Circulation (sq ft)	51,436	63,850[4]	519,251	634,537
EDS Machines (#)[2]	0	0	1	1
ATD Machines (#)[2]	3	2	12	17
Magnetometers (#)[2]	3	3	18	24
Vacant (T3) (sq ft)	-	35,919	-	35,919
Total Areas (sq ft)	**256,637**	**283,691[4]**	**1,722,637**	**2,262,965**

NOTES:

Lf: Linear feet; sq ft: Square feet; EDS: Explosive Detection System; ATD: Automatic Target Detection; CBP: Customs and Border Protection

1 Full-service queuing area is included in the subtotal for airline functions.

2 Data collected by TRACE Consulting, November 2017; all data collected by visual inspection and approximate measurements.

3 Delta Air Lines has 3 curbside positions on the south and 2 curbside positions on the north at the time of visual inspection in November 2017. These positions are subject to change during construction/phasing.

4 Terminal 3 baggage and public circulation areas originated from construction drawings provided by Airport staff in February 2019 and may be revised upon completion of the Terminal 3 Modernization Program (currently under construction).

SOURCE: City of Phoenix Aviation Department, Phoenix Sky Harbor International Airport Tenant Lease Space Books, July 1, 2017.

TABLE 2-6 AIRCRAFT GATES

AIRCRAFT TYPE	TERMINAL 2[1]	TERMINAL 3[1]	TERMINAL 4 – NORTH[2]	TERMINAL 4 – SOUTH	TOTAL GATES
ADG II	0	0	13	0	13
ADG III	9	1	35	24	69
Boeing 757	1	2	9	0	12
ADG IV	0	6	0	0	6
ADG V	0	1	2	0	3
Total	**10**	**10**	**59**	**24**	**103**

NOTES:

1 Existing November 2017 aircraft gate counts at Terminal 2 and Terminal 3 (does not include future Terminal 3 south or anticipated closure of east Terminal 2 gates).

2 Gate B21/B23 can be used as a Multiple Aircraft Ramp System (MARS) stand, limiting Gate B21 to an ADG II and allowing Gate B23 as an ADG V gate. This table incudes the largest capable aircraft at each gate.

SOURCES: HNTB Corporation, *Draft PHX RIM Study*, August 2017; City of Phoenix Aviation Department, December 2017.

TABLE 2-7 TERMINAL 2 PROCESSOR AREAS (1 OF 2)

BUILDING FUNCTION	TERMINAL 2 – PROCESSOR (SQ FT UNLESS OTHERWISE NOTED)						
	BASEMENT LEVEL	TICKETING LOBBY	BAGGAGE MAKE UP	BAGGAGE CLAIM AREA	BASEMENT STORAGE	MAIN LOBBY AREA	TOTAL
Airline Functions							
Ticket Counter, Office, Kiosk		10,829	317	1,225			12,371
Total lf[1]		240					240
Full Service Positions (#)[1]		27					27
Full Service Queue[1]		2,620					2,620
Self-Check Kiosk Pos. (#)[1]		25					25
Kiosk Area[1]		1,810					1,810
Curbside Positions (#)[1]		12					12
Subtotal[1]	0	15,563	317	1,225	0	0	14,573
Non-Public Areas							
TSA Offices/Support			640				640
Subtotal	0	0	640	0	0	0	640
Baggage							
EDS	11,136		18,540				29,676
Baggage Claim (Carousels)				10,367			10,367
Bag Storage Lockers				300			300
Bag Make Up (Outbound)			18,087				18,087
Bag Belts (Outbound Curbside)		114					114
Bag Belts (Inbound)	3,455						3,455
Bag Belts - Vacant (Outbound Curbside)		240					240
Subtotal	14,591	354	36,627	10,667	0	0	62,239
PHX AVN							
City Administrative	6,634	610		1,161	4,376		12,781
City Storage	2,049				146		2,195
Subtotal	8,683	610	0	1,161	4,522	0	12,774

TABLE 2-7 TERMINAL 2 PROCESSOR AREAS (2 OF 2)

BUILDING FUNCTION	TERMINAL 2 – PROCESSOR (SQ FT UNLESS OTHERWISE NOTED)						
	BASEMENT LEVEL	TICKETING LOBBY	BAGGAGE MAKE UP	BAGGAGE CLAIM AREA	BASEMENT STORAGE	MAIN LOBBY AREA	TOTAL
Concessions							
Retail						669	669
Office Space				568			568
Telephone Room		65					65
Food & Beverage						7,068	7,068
Storage					9,042		9,042
Bag Storage Lockers				180			180
Ground Transportation Counter				98			98
Subtotal	0	65	0	846	9,042	7,737	17,690
Utilities & Building Services							
Mechanical/Electrical				583			583
Telecommunications					589		589
Subtotal	0	0	0	583	589	0	1,172
Public Areas							
Circulation - Public						3,772	3,772
Security Checkpoints						13,600	13,600
ATD Machines (#)[1]						3	3
Magnetometers (#)[1]						3	3
Nursing Room		150					150
Subtotal	0	150	0	0	0	17,372	17,522
Total	**23,274**	**16,592**	**37,584**	**14,482**	**14,153**	**7,737**	**126,610**

NOTES:

EDS: Explosive Detection System; ATD: Automatic Target Detection

1 Data collected by TRACE Consulting, November 2017; all data collected by visual inspection, judgement, or approximate measurements.

SOURCE: City of Phoenix Aviation Department, Phoenix Sky Harbor International Airport Tenant Lease Space Books, July 1, 2017.

TABLE 2-8 TERMINAL 2 MEZZANINE AND CONCOURSE AREAS

BUILDING FUNCTION	TERMINAL 2 - MEZZANINE AND CONCOURSE (SQ FT)				
	MEZZANINE LEVEL	LOWER LEVEL CONCOURSE	UPPER LEVEL CONCOURSE	GATE HOLDROOM C, D	TOTAL
Airline Functions					
Club Room	2,998		4,055		7,053
Hold Room			35,877	5,400	41,277
Airline Office & Operations Area		23,763	9,906		33,669
Subtotal	2,998	23,763	49,838	5,400	81,999
Non-Public Areas					
EDS – Office	364				364
TSA		239			239
Subtotal	364	239	0	0	603
PHX AVN					
City Administrative		474	1,137		1,611
City Maintenance		376	152		528
Subtotal	0	850	1,289	0	2,139
Concessions					
Food & Beverage			4,964		4,964
Office Space	1,711	4,161	160		6,032
Retail			3,090		3,090
Services	947				947
Subtotal	2,658	4,161	8,214	0	15,033
Utilities & Building Services					
Mechanical/Electrical		4,382	277		4,659
Telecommunications		283			283
Subtotal	0	4,664	277	0	4,942
Public Areas					
Circulation - Public		15,680	13,782		29,462
Public Restrooms	900	736	2,816		4,452
Subtotal	900	16,416	16,598	0	33,914
Total	**6,920**	**50,094**	**76,216**	**5,400**	**138,630**

NOTES:
EDS: Explosive Detection System; ATD: Automatic Target Detection
SOURCE: City of Phoenix Aviation, Department Phoenix Sky Harbor International Airport Terminal 2 Tenant Lease Space Book, July 1, 2017.

TABLE 2-9 TERMINAL 3 PROCESSOR AREAS

BUILDING FUNCTION	TERMINAL 3 – PROCESSOR (SQ FT UNLESS OTHERWISE NOTED)		
	PRE-SECURITY	POST-SECURITY	TOTAL
Airline Functions			
Ticket Counter, Kiosk, etc.	13,745		13,745
Common Use[1]			
Total (lf)	180		180
Full Service Positions (#)	31		31
Full Service Queue	3,715		3,715
Self-Check Kiosk Pos. (#)	14		14
Kiosk Area	2,250		2,250
Curbside Positions (#)	5		5
Office	10,875		10,875
Storage		1,446	1,446
Subtotal	24,620	1,446	26,066
PHX AVN			
City Administrative	5,836		5,836
City Storage	1,028	962	1,990
Subtotal	6,864	962	7,826
Concessions			
Retail		6,805	6,805
Food & Beverage	798	16,961	17,759
Food & Beverage Storage		364	364
Bag Storage Lockers			0
Ground Transportation Counter			0
Subtotal	798	24,130	24,928
Building Services			
Maintenance Storage	88		88
Janitorial Storage	391	324	715
Subtotal	479	324	803
Security Checkpoints			
ATD Machines (#)	2		2
Magnetometers (#)	3		3
Vacant			
Vacant	4,946		4,946
Subtotal	4,946	0	4,946
Total Identified	**43,902**	**26,862**	**70,764**
Total Terminal Building	**143,896**	**151,812**	**295,708**
Total Unidentified Space[1]	**99,994**	**124,950**	**224,944**

NOTES:

EDS: Explosive Detection System; ATD: Automatic Target Detection

1 Total unidentified space unallocated based on pending construction totals as of December 2017.

SOURCE: City of Phoenix Aviation Department, Phoenix Sky Harbor International Airport, Terminal 3 Benchmark Information.xlsx, received December 2017.

TABLE 2-10 TERMINAL 3 MEZZANINE AND CONCOURSE AREAS

BUILDING FUNCTION	TERMINAL 3 - MEZZANINE AND CONCOURSE (SQ FT)		
	NORTH CONCOURSE	SOUTH CONCOURSE (UNDER CONSTRUCTION)	TOTAL
Airline Functions			
Ticket Counter, Kiosk, etc.	18,110	6,607	24,717
Office		13,602	13,602
Storage		3,733	3,733
Subtotal	18,110	23,942	42,052
PHX AVN			
City Administrative	777	15,550	16,327
City Storage		3,839	3,839
Subtotal	777	19,389	20,166
Concessions			
Retail		6,524	6,524
Retail – Storage		154	154
Food & Beverage	12,200	15,027	27,227
Food & Beverage Storage	2,358	1,118	3,476
Air Service Provider - Office		3,930	3,930
Air Service Provider - Storage		820	820
Subtotal	14,558	27,573	42,131
Building Services			
Maintenance Storage		163	163
Janitorial Storage	407	942	1,349
Subtotal	407	1,105	1,512
Vacant			
Vacant	24,361	6,612	30,973
Subtotal	24,361	6,612	30,973
Total Identified	**58,213**	**78,621**	**136,834**
Total Building	**144,256**	**229,914**	**374,170**
Total Unidentified Space	**86,043**	**151,293**	**237,336**

SOURCE: City of Phoenix Aviation Department, Phoenix Sky Harbor International Airport, Terminal 3 Benchmark Information.xlsx, received December 2017.

TABLE 2-11 TERMINAL 4 PROCESSOR AREAS (1 OF 2)

BUILDING FUNCTION	TERMINAL 4 – PROCESSOR (SQ FT UNLESS OTHERWISE NOTED)					
	BAGGAGE MAKE UP LEVEL	BAGGAGE CLAIM LEVEL	TICKETING LEVEL	PASSENGER LEVEL	PARKING LEVELS	TOTAL
Airline Functions						
Ticket Counter, Office, Kiosk	3,393	4,921	22,810	352		31,476
Total Ticket Counter lf			640			640
Full Service Positions (#)			101			101
Full Service Queue			7,925			5,050
Self-Check Kiosk Pos. (#)			83			69
Kiosk Area			6,900			5,650
Curbside Positions (#)			16			16
Joint Use/Common Use	27,276	39,993	2,497			69,766
Operations Area	12,836				93	12,929
Subtotal	43,505	44,914	25,307	352	93	114,171
Non-Public Areas						
TSA Offices/Support		1,827	2,185	1,105		5,117
Subtotal	0	1,827	2,185	1,105	0	5,117
Baggage						
EDS	30,805	40,444				71,249
Baggage Claim (Area Around Carrousels)		21,577				21,577
Bag Storage Lockers		512				512
Bag Make Up (Outbound)	27,275					27,275
Bag Belts (Outbound South)			1,326			1,326
Bag Belts (Outbound North)			1,650			1,650
Bag Belt Area (Out Bound)			1,236			1,236
Subtotal	58,080	62,533	4,212	0	0	124,825
PHX AVN						
City Administrative		968				968
City Storage		158	111	787	508	1,564
City Maintenance	49,881	210	384	263		50,738
Hallway Areas			1,070	1,003		2,073
Subtotal	49,881	1,336	1,565	2,053	508	55,343
International/CBP						
International/CBP		896				896
Subtotal	0	896	0	0	0	896

TABLE 2-11 TERMINAL 4 PROCESSOR AREAS (2 OF 2)

BUILDING FUNCTION	TERMINAL 4 – PROCESSOR (SQ FT UNLESS OTHERWISE NOTED)					
	BAGGAGE MAKE UP LEVEL	BAGGAGE CLAIM LEVEL	TICKETING LEVEL	PASSENGER LEVEL	PARKING LEVELS	TOTAL
Concessions						
Retail		1,450		15,121		16,571
News Racks				906		906
Travelers Assistance/Info Business Center		943				943
Office Space	267	1,055		1,515		2,837
Services				605		605
Food Court				8,035		8,035
Food & Beverage		2,061		11,908		13,969
Luggage Carts		507				507
Luggage Carts (Outside)		414				414
Storage	6,351			2,450	846	9,647
Concession & Hallway				1,747		1,747
Ground Transportation Counter		286				286
Subtotal	6,618	6,716	0	42,287	846	56,467
Utilities & Building Services						
Mechanical/Electrical		3,544	4,208	16,129		23,881
Telecommunications		240		80		320
Vertical Circulation		374		873		1,247
Subtotal	0	4,158	4,208	17,082	0	25,448
Public Areas						
Art Program				980		980
Police			630			630
Circulation - Public		27,959	72,016	97,061		197,036
Security Checkpoints				49,201		49,201
EDS Machines (#)[1]				1		1
ATD Machines (#)[1]				12		12
Magnetometers (#)[1]				18		18
Navigator Office			1,169			1,169
Special Purpose - USO/Chapel		150	3,518	1,161		4,829
Family Assistance Rooms			1,801			1,801
Nursing Room				243		243
Public Restrooms		3,112	2,741	7,903		13,756
Subtotal	0	31,221	81,875	156,549	0	269,645
Total	**158,084**	**153,601**	**119,352**	**219,428**	**1,447**	**651,912**

NOTES:
EDS: Explosive Detection System; ATD: Automatic Target Detection; CBP: Customs and Border Protection
1 Data collected by TRACE Consulting, November 2017; all data collected by visual inspection, judgement, or approximate measurements
SOURCE: City of Phoenix Aviation Department, Phoenix Sky Harbor International Airport Tenant Lease Space Books, July 1, 2017.

TABLE 2-12 TERMINAL 4 MEZZANINE AND CONCOURSE AREAS (1 OF 2)

	TERMINAL 4 - MEZZANINE AND CONCOURSE (SQ FT UNLESS OTHERWISE NOTED)																		
	CONCOURSE N1			CONCOURSE N2								CONCOURSE N3				CONCOURSE N4			
BUILDING FUNCTION	CONCOURSE APRON LEVEL	CONCOURSE PASSENGER LEVEL	N1 TO N2 TRANSFER BRIDGE	CONCOURSE BASEMENT LEVEL	CONCOURSE APRON LEVEL	CONCOURSE PASSENGER LEVEL	CONCOURSE MEZZANINE LEVEL	CONCOURSE TOWER BASE	CONCOURSE TOWER OBSERVATION LEVEL	N2 TO N3 TRANSFER BRIDGE APRON LEVEL	N2 TO N3 TRANSFER BRIDGE PASSENGER LEVEL	CONCOURSE APRON LEVEL	CONCOURSE PASSENGER LEVEL	CONCOURSE MEZZANINE LEVEL	N3 TO N4 TRANSFER BRIDGE PASSENGER LEVEL	CONCOURSE BASEMENT LEVEL	CONCOURSE APRON LEVEL	CONCOURSE PASSENGER LEVEL	CONCOURSE CLUB LEVEL
Airline Functions																			
Club Room		2,324					5,126							5,189					5,346
Hold Room		32,079				26,251							26,315					13,421	
Joint Use/Common Use																	241	16,341	1,510
Commuter Terminal													1,591						
Airline Office & Operations Area	25,530				11,516	100	12,901					11,516	100	24,809			6,765		
Tower/Base								870	760										
Utility/Mechanical/Chiller Room	1,466				2,310		225					2,385							
Customer Service		3,076																1,750	
Subtotal	26,996	37,479	0	0	13,826	26,351	18,252	870	760	0	0	13,901	28,006	29,998	0	0	7,006	31,512	6,856
Non-Public Areas																			
TSA Offices/Support	1,054						2,585							1,500			244		
Subtotal	1,054	0	0	0	0	0	2,585	0	0	0	0	0	0	1,500	0	0	244	0	0
Baggage																			
EDS	1,608																8,650		
Bag Make Up - Out Bound (North)					34,980							34,947							
Subtotal	1,608	0	0	0	34,980	0	0	0	0	0	0	34,947	0	0	0	0	8,650	0	0
PHX AVN																			
City Administrative	1,405						3,576												390
City Storage					718	21													
City Maintenance	1,728	271			654	247							236					236	
Hallway Areas					190		1,274							1,060		68	1,499		
Subtotal	3,133	271	0	0	1,562	268	4,850	0	0	0	0	0	236	1,060	0	68	1,499	236	390
International/CBP																			
CBP Reception Area																9,857			
Primary Inspection Positions (#)[1]																16			
CBP Baggage Claim/Re-Check																56,954			
Carousels (#)[1]																4			
Carousels (lf)[1]																880			
CBP Bag Belts - In Bound to Customs																4,327	12,000		
CBP Circulation/Hold Room																4,327	7,257	3,122	
CBP Offices																2,860			
CBP Bag Belts - Out Bound																377	5,357		
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	78,702	24,614	3,122	0
Concessions																			
Food & Beverage		152	808			2,570												625	
Food Court		7,596				4,943							7,314					5,689	
Wall Units		400				400							400					200	
Office Space																	467		
Retail		2,940				3,519							3,675					5,166	
Services																	268	535	
Storage/Hallway	2,168				1,871							1,702					1,640		
Subtotal	2,168	11,088	808	0	1,871	11,432	0	0	0	0	0	1,702	11,389	0	0	0	2,375	12,215	0
Utilities & Building Services																			
Mechanical/Electrical	5,707			19,019	1,405	60	7,010			1,500		3,272	101	7,810		5,695	4,572		980
Telecommunications	264				230												187		
Vertical Circulation	104	131		837	100	100	100					100	100	100			704	300	
Subtotal	6,075	131	0	19,856	1,735	160	7,110	0	0	1,500	0	3,372	201	7,910	0	5,695	5,463	300	980
Public Areas																			
Circulation - Public	981	15,397	22,327		812	15,516	913				27,750	812	15,502	576	22,800	1,260	600	16,911	2,286
Public Restrooms		5,040				3,743							3,743			535		3,838	
Subtotal	981	20,437	22,327	0	812	19,259	913	0	0	0	27,750	812	19,245	576	22,800	1,795	600	20,749	2,286
Vacant Areas	23,253											255					6,656		
Total	**65,268**	**69,406**	**23,135**	**19,856**	**54,786**	**57,470**	**33,710**	**870**	**760**	**1,500**	**27,750**	**54,989**	**59,077**	**41,044**	**22,800**	**86,260**	**57,107**	**68,134**	**10,512**

TABLE 2-12 TERMINAL 4 MEZZANINE AND CONCOURSE AREAS (2 OF 2)

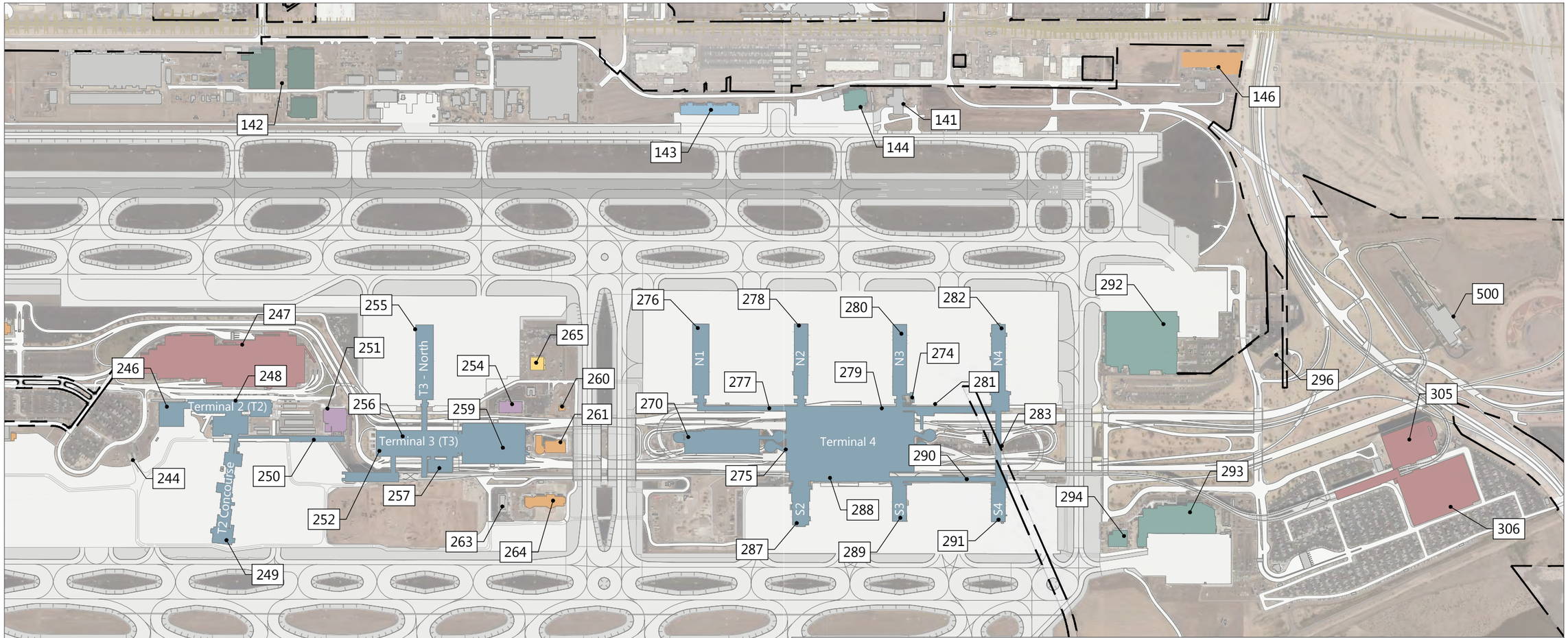
	TERMINAL 4 - MEZZANINE AND CONCOURSE (SQ FT UNLESS OTHERWISE NOTED)														
		CONCOURSE S4			CONCOURSE S3						CONCOURSE S2				
BUILDING FUNCTION	N4 TO S4 TRANSFER BRIDGE PASSENGER LEVEL	CONCOURSE APRON LEVEL	CONCOURSE PASSENGER LEVEL	S3 TO S4 TRANSFER BRIDGE PASSENGER LEVEL	CONCOURSE APRON LEVEL	CONCOURSE MEZZANINE LEVEL	CONCOURSE PASSENGER LEVEL	CONCOURSE ROOF LEVEL	S2 TO S3 TRANSFER BRIDGE PASSENGER LEVEL	S2 TRANSFER BRIDGE ROOF LEVEL	CONCOURSE BASEMENT LEVEL	CONCOURSE MEZZANINE LEVEL	CONCOURSE APRON LEVEL	CONCOURSE PASSENGER LEVEL	TOTAL (INCLUDING TABLE 1-11 1 OF 2)
Airline Functions															
Club Room															17,985
Hold Room			15,636				15,418							16,374	98,066
Joint Use/Common Use									41,110						18,092
Commuter Terminal															1,591
Airline Office & Operations Area		20,715			20,828		175						28,419		93,237
Tower/Base															1,630
Utility/Mechanical/Chiller Room															6,386
Customer Service														838	4,826
Subtotal	0	20,715	15,636	0	20,828	0	15,593	0	41,110	0	0	0	28,419	17,212	271,977
Non-Public Areas															
TSA Offices/Support						370									5,383
Subtotal	0	0	0	0	0	370	0	0	0	0	0	0	0	0	5,383
Baggage															
EDS											1,550				10,258
Bag Make Up - Out Bound (North)															69,927
Subtotal	0	0	0	0	0	0	0	0	0	0	1,550	0	0	0	80,185
PHX AVN															
City Administrative											7,906				5,371
City Storage							98				11,359				739
City Maintenance		237	84		248		76		110		3,303				3,372
Hallway Areas											5,765			1,031	4,091
Subtotal	0	237	84	0	248	0	174	0	110	0	28,333	0	0	1,031	13,573
International/CBP															
CBP Reception Area															9,857
Primary Inspection Positions (#)[1]															16
CBP Baggage Claim/Re-Check															56,954
Carousels (#)[1]															4
Carousels (lf)[1]															880
CBP Bag Belts - In Bound to Customs															16,327
CBP Circulation/Hold Room															14,706
CBP Offices															2,860
CBP Bag Belts - Out Bound															5,734
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	106,438
Concessions															
Food & Beverage									3,224					386	4,155
Food Court			6,573				3,432							6,796	25,542
Wall Units							200		200						1,400
Office Space															467
Retail			1,179				2,497							2,714	15,300
Services															803
Storage/Hallway		1,482			740							11,041		186	7,381
Subtotal	0	1,482	7,752	0	740	0	6,129	0	3,424	0	0	11,041	0	10,082	55,048
Utilities & Building Services															
Mechanical/Electrical		3,270	73		3,100		73	867		4,462	5,231	753	3,761	164	57,131
Telecommunications		216			171								270		681
Vertical Circulation		378	124		124		124			109	218	445	283	326	2,676
Subtotal	0	3,864	197	0	3,395	0	197	867	0	4,571	5,449	1,198	4,314	490	60,488
Public Areas															
Circulation - Public	15,831	305	6,708	24,586	305		6,708		23,710		974	458	1,038	11,202	144,443
Public Restrooms			1,959				1,883		2,647		1,152				16,899
Subtotal	15,831	305	8,667	24,586	305	0	8,591	0	26,357	0	2,126	458	1,038	11,202	161,342
Vacant Areas															30,164
Total	**15,831**	**26,603**	**32,336**	**24,586**	**25,516**	**370**	**30,684**	**867**	**71,001**	**4,571**	**37,458**	**12,697**	**33,771**	**40,017**	**754,434**

NOTES:

EDS: Explosive Detection System; ATD: Automatic Target Detection; CBP: Customs and Border Protection

1 Data collected by TRACE Consulting, November 2017; all data collected by visual inspection, judgement, or approximate measurements

SOURCE: City of Phoenix Aviation Department, Phoenix Sky Harbor International Airport Tenant Lease Space Books, July 1, 2017.



Building Number	Building Description
141	ARFF Building 29
142	Industrial Complex (Honeywell)
143	6-Unit Executive Hangar
144	Corporate Hangar and Shop (Mesa Airlines)
146	Fuel Terminal (Swissport Fueling)
241	ARFF Building 29
244	Gatehouse
246	Baggage Screening Facility
247	Parking Structure - Terminal 2
248	Terminal 2 (Core)
249	Terminal 2 (South Concourse)
250	Terminal 2 (East Concourse)
251	Airport Operations Center
252	Terminal 3 Core SES Building Airline Provisioning Facility
254	Parking Operations/PHX Sky Train Design Team Annex
255	Terminal 3 (North Concourse)
256	Terminal 3 (Core)
257	Terminal 3 Conveyor Building
259	Parking Structure - Terminal 3
260	North Airfield Electrical Vault
261	Airport Traffic Control Tower/Beacon and TRACON
263	Core Network/Electrical Vault
264	ARFF Building 19
265	Mail Sort Facility (C-Point)
270	Employee Parking
274	Commuter Boarding
275	Terminal 4 (Core)
276	Terminal 4 (Concourse N-1)
277	Terminal 4 (N-1 to N-2 Connecting Bridge)
278	Terminal 4 (Concourse N-2)
279	Terminal 4 (N-2 to N-3 Connecting Bridge)
280	Terminal 4 (Concourse N-3)
281	Terminal 4 (N-3 to N-4 Connecting Bridge)
282	Terminal 4 (Concourse N-4, International)
283	Terminal 4 (N-4 to S-4 Connecting Bridge)
287	Terminal 4 (Concourse S-2)
288	Terminal 4 (S-2 to S-3 Connecting Bridge)
289	Terminal 4 (Concourse S-3)
290	Terminal 4 (S-3 to S-4 Connecting Bridge)
291	Terminal 4 (S-4 Concourse)
292	Airline Maintenance Hangar (American Airlines)
293	Airline Maintenance Hangar (Southwest)
294	Airline Provisioning Facility (Southwest)
296	CNG Facility
305	East Economy Parking Garage 'A'
306	East Economy Parking Garage 'B'
500	PHX Sky Train Maintenance and Storage Facilities (MSF)

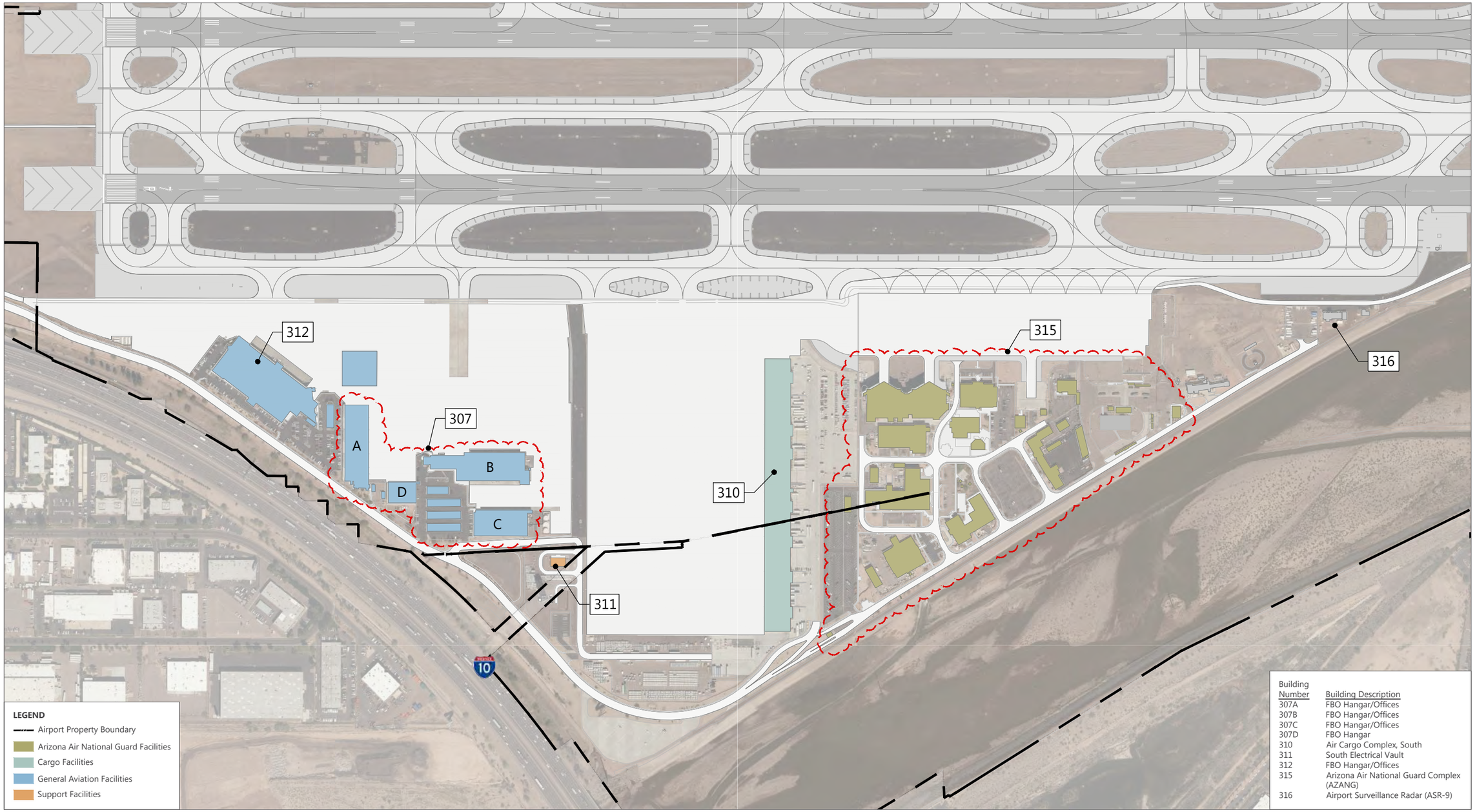
SOURCE: Woolpert Airports Geographic Information System (AGIS) for Phoenix Sky Harbor International Airport, flown May 28, 2017 and September 29, 2017; Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary).

NORTH 0 800 ft.

EXHIBIT 2-5

Ancillary Facility Locations - East

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\02-Existing Conditions (Inventory)\Ex-2-05,06,07-Support Facilities.dwgLayout: 2-5 Plotted: Sep 6, 2019, 11:20AM



Building Number	Building Description
307A	FBO Hangar/Offices
307B	FBO Hangar/Offices
307C	FBO Hangar/Offices
307D	FBO Hangar
310	Air Cargo Complex, South
311	South Electrical Vault
312	FBO Hangar/Offices
315	Arizona Air National Guard Complex (AZANG)
316	Airport Surveillance Radar (ASR-9)

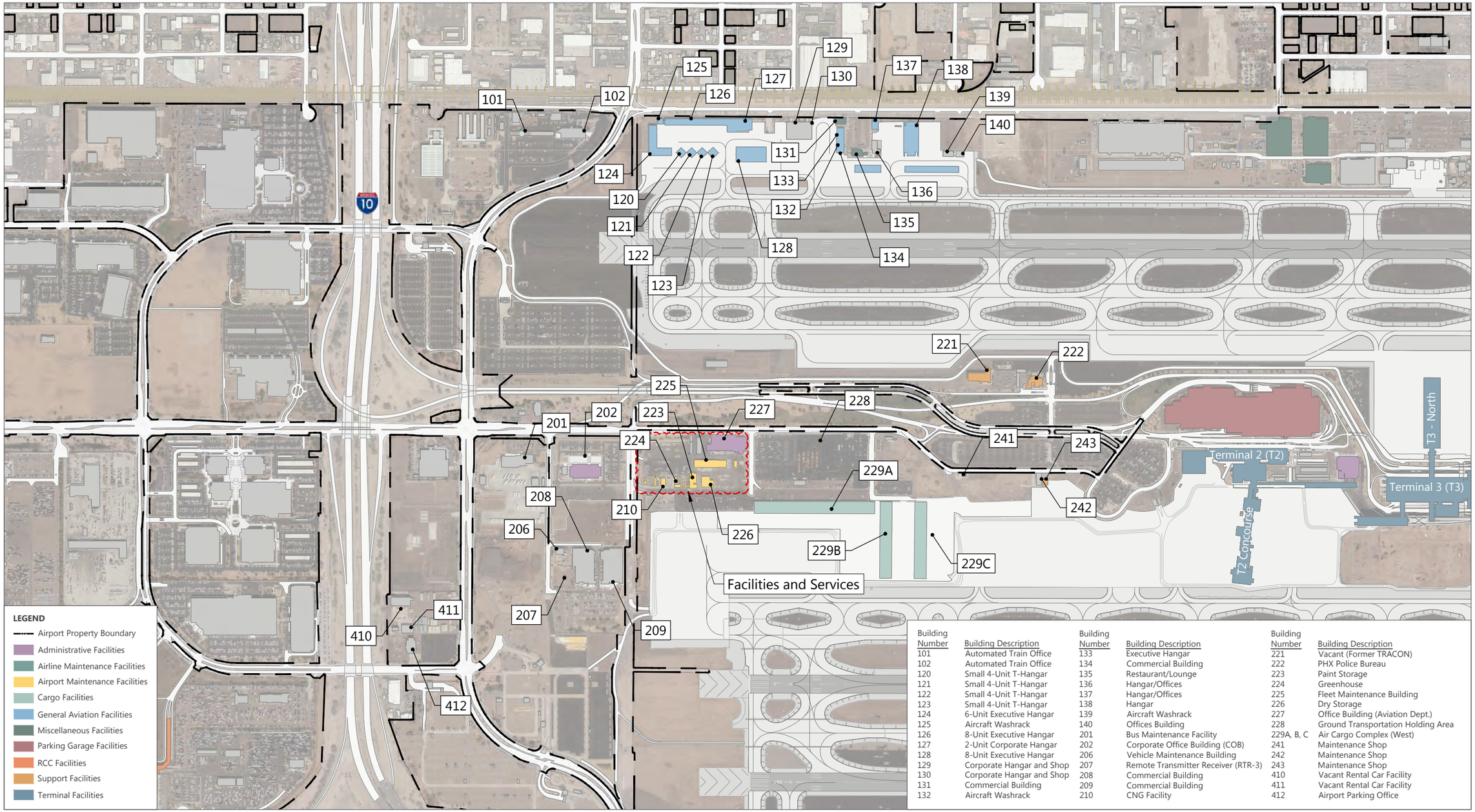
SOURCE: Woolpert Airports Geographic Information System (AGIS) for Phoenix Sky Harbor International Airport, flown May 28, 2017 and September 29, 2017; Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary).

NORTH 0 500 ft.

EXHIBIT 2-6

Ancillary Facility Locations - South

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\02-Existing Conditions (Inventory)\Ex-2-05,06,07-Support Facilities.dwgLayout: 2-6 Plotted: Sep 4, 2019, 04:13PM



Building Number	Building Description
101	Automated Train Office
102	Automated Train Office
120	Small 4-Unit T-Hangar
121	Small 4-Unit T-Hangar
122	Small 4-Unit T-Hangar
123	Small 4-Unit T-Hangar
124	6-Unit Executive Hangar
125	Aircraft Washrack
126	8-Unit Executive Hangar
127	2-Unit Corporate Hangar
128	8-Unit Executive Hangar
129	Corporate Hangar and Shop
130	Corporate Hangar and Shop
131	Commercial Building
132	Aircraft Washrack

Building Number	Building Description
133	Executive Hangar
134	Commercial Building
135	Restaurant/Lounge
136	Hangar/Offices
137	Hangar/Offices
138	Hangar
139	Aircraft Washrack
140	Offices Building
201	Bus Maintenance Facility
202	Corporate Office Building (COB)
206	Vehicle Maintenance Building
207	Remote Transmitter Receiver (RTR-3)
208	Commercial Building
209	Commercial Building
210	CNG Facility

Building Number	Building Description
221	Vacant (Former TRACON)
222	PHX Police Bureau
223	Paint Storage
224	Greenhouse
225	Fleet Maintenance Building
226	Dry Storage
227	Office Building (Aviation Dept.)
228	Ground Transportation Holding Area
229A, B, C	Air Cargo Complex (West)
241	Maintenance Shop
242	Maintenance Shop
243	Maintenance Shop
410	Vacant Rental Car Facility
411	Vacant Rental Car Facility
412	Airport Parking Office

SOURCE: Woolpert Airports Geographic Information System (AGIS) for Phoenix Sky Harbor International Airport, flown May 28, 2017 and September 29, 2017; Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary).

NORTH 0 800 ft.

EXHIBIT 2-7

Ancillary Facility Locations - West

2.3.1 AIR CARGO

Air cargo operations at PHX are split between the West Air Cargo Complex and the South Air Cargo Complex. Facilities within each complex are shown on Exhibits 2-6 and 2-7, and a summary of the facilities is provided in **Table 2-13**. In addition to the dedicated air cargo complexes, American Airlines and Southwest Airlines operate sorting facilities near the passenger terminals.

TABLE 2-13 AIR CARGO FACILITIES

FACILITY NUMBER	BUILDING NAME/DESCRIPTION	GROSS FACILITY AREA (SQ FT)			
		BUILDING AREA	LANDSIDE PARKING AREA	APRON	TOTAL SITE AREA
229 A	West Air Cargo, Building A	49,920	59,000		
229 B	West Air Cargo, Building B	49,920	59,000		
229 C	West Air Cargo, Building C	78,720	65,500		
	Total West Air Cargo	178,560	183,500	397,000[1]	759,060
310	South Air Cargo	173,135	282,000	1,200,000	1,655,135
	Total	**351,695**	**465,500**	**1,597,000**	**2,414,195**

NOTES:

1 Aircraft served at the West Air Cargo Buildings A, B, and C typically utilize four parking positions adjacent to West Cargo Buildings A and B. Other positions on the east and west cargo aprons are utilized for remote overnight passenger operations and therefore not included in this table.

SOURCES: Phoenix Sky Harbor International Airport West Air Cargo Tenant Lease Space Book, City of Phoenix Aviation Department, July 1, 2017; Phoenix Sky Harbor International Airport South Air Cargo Tenant Lease Space Book, City of Phoenix Aviation Department, July 1, 2017; InterVISTAS Consulting Group, *Phoenix Regional Air Cargo Planning Study, Final Report*, January 2014.

2.3.2 IN-FLIGHT CATERING SERVICES

The sole provider of in-flight catering services at PHX for the general traveling public is LSG Sky Chefs, Inc. LSG Sky Chefs currently occupies three facilities on the west side of the Airport. The existing LSG Sky Chefs facilities are shown on Exhibit 2-7. A summary of the facilities is provided in **Table 2-14**.

TABLE 2-14 FLIGHT KITCHEN FACILITIES

FACILITY NUMBER	BUILDING NAME DESCRIPTION	OCCUPANT LEASED TO	FACILITY AREA (SQ FT)		
			BUILDING AREA	LANDSIDE PARKING AREA	TOTAL SITE AREA
208	Commercial Building	LSG Sky Chefs	68,000		
209	Commercial Building	LSG Sky Chefs	61,000		
206	Commercial Building	LSG Sky Chefs	25,000		
		Total	**154,000**	**185,000**	**339,000**

NOTE: A single landside parking area is shared between the three buildings.

SOURCE: TRACE Consulting, December 2017 aerial space takeoffs from PHX AGIS aerial image flown May 28 and September 29, 2017.

2.3.3 GROUND SUPPORT EQUIPMENT

American Airlines, Southwest Airlines, and Delta Air Lines conduct their own ground handling and operate their own ground support equipment (GSE). Airlines that do not conduct their own ground handling contract this service to handling agents. **Table 2-15** lists GSE equipment owned by PHX AVN. **Table 2-16** summarizes the GSE maintenance facilities with locations depicted on Exhibit 2-5, 2-6, and 2-7. GSE is stored in and adjacent to these facilities and on passenger airline and cargo aprons.

TABLE 2-15 AIRPORT-OWNED GROUND SUPPORT EQUIPMENT

ASSET NUMBER	YEAR	MAKE	MODEL	PERFORMANCE CAPABILITIES
523403	2005	FORD	F550	Capable of reaching 17 ft 9 in (will access every aircraft up to a 747.)
9003	2011	TLD	GPU-4180 - T25928	400 MHz 180kVA - 550 amps worth of load, 250 amps per cable. 3 phase - 115 V / 440Hz. (Run time under load is 6-8 hours.)
9037	2012	TLD	GPU-4180 - T28330	400 MHz 180kVA - 550 amps worth of load, 250 amps per cable. 3 phase - 115 V / 440Hz. (Run time under load is 6-8 hours.)
9071	2014	TLD	GPU-4180 - T33971	400 MHz 180kVA - 550 amps worth of load, 250 amps per cable. 3 phase - 115 V / 440Hz. (Run time under load is 6-8 hours.)
8549	2002	ARVICO	GPU - 4-125STD-C	400MHz 120 kVA. (Will not accommodate wide-body aircraft.)
9035	2012	TLD	ACU-802-CUP	110-ton AC unit. (12-16 hours of run time depending on aircraft size; dual-hose can cool up to a 747 wide-body aircraft.)
9036	2012	TLD	ACU-804-CUP	65-ton AC unit. (12-16 hours of run time depending on aircraft size; single hose capable of cooling a narrow-body and will handle a wide-body aircraft.)

SOURCE: City of Phoenix Aviation Department, October 26, 2017.

TABLE 2-16 GROUND SUPPORT EQUIPMENT MAINTENANCE FACILITIES

FACILITY NUMBER	DESCRIPTION
292	Airline Maintenance Hangar (American Airlines)
293	Airline Maintenance Hangar (Southwest Airlines)
229A, 229B	Air Cargo Complex (West) – Multiple airlines
310	South Air Cargo Storage Area – FedEx/UPS

SOURCES: InterVISTAS Consulting Group, Aviation Department, *Phoenix Regional Air Cargo Planning Study, Final Report*, January 2014; TRACE Consulting, December 2017 aerial space takeoffs from PHX AGIS aerial image flown May 28 and September 29, 2017.

2.3.4 AIRLINE MAINTENANCE

American Airlines, Southwest Airlines, and Mesa Airlines operate maintenance facilities at PHX. The facilities are shown on Exhibit 2-5 and a summary of facilities is provided in **Table 2-17**. American Airlines and Southwest Airlines maintenance hangars also contain GSE maintenance facilities as noted in Section 2.3.3.

TABLE 2-17 ESTIMATED AIRLINE MAINTENANCE SPACE

FACILITY NUMBER	BUILDING NAME/DESCRIPTION	OCCUPANT/LEASED TO	GROSS FACILITY AREA (SQ FT)		
			BUILDING AREA	BUILDING SITE AREA	APRON
144	Corporate Hangar and Shop	Mesa Airlines	24,609		158,967
241	Maintenance Shop	Vacant	-	6,800	0
242	Maintenance Shop	Vacant	-	9,900	0
292	Airline Maintenance Hangar	American Airlines	-	626,000	384,831
293	Airline Maintenance Hangar	Southwest Airlines	-	355,500	237,510
294	Airline Provisioning Facility	Southwest Airlines	-	52,000	0
		Total	**24,609**	**1,050,200**	**781,308**

SOURCES: Faithful+Gould, Inc., *Facility Condition Assessment (Phase 4) for Phoenix Sky Harbor International Airport* (Full Report), Appendix D, June 30, 2015; HNTB Corporation, *Draft Phoenix Sky Harbor International Airport RIM Study*, August 2017; TRACE Consulting, December 2017 aerial space takeoffs from PHX AGIS aerial image flown May 28 and September 29, 2017.

2.3.5 AIRCRAFT FUELING AND FUEL STORAGE

Swissport International Ltd. provides aircraft fueling services for commercial airlines at PHX and their facility is located in the northeast portion of the Airport (see building number 146 in Exhibit 2-5). The FBOs Cutter and Swift Aviation provide aircraft fueling services for GA operators. Aircraft fueling facilities are also located at the Arizona Air National Guard (AZANG) facilities and at Fire Station 19.

2.3.6 AIRCRAFT RESCUE AND FIRE FIGHTING AND AIRPORT POLICE

PHX is a 14 CFR Part 139 certificated airport, and thus must meet certain operational and safety standards.[4] Based on the size of aircraft and number of daily departures at PHX, the Airport meets the requirements for aircraft rescue and firefighting (ARFF) Index D (aircraft at least 159 feet, but less than 200 feet in length). **Table 2-18** summarizes the ARFF equipment available at PHX. The Airport also has a dedicated PHX Police Airport Bureau located on the airfield, which is staffed 24 hours per day, 7 days a week. **Table 2-19** summarizes the dedicated ARFF and Airport Bureau Police facility space at PHX.

[4] Code of Federal Regulations (CFR), Title 14, Part 139, "Certification of Airports" December 12, 2017.

TABLE 2-18 AIRCRAFT RESCUE AND FIRE FIGHTING VEHICLES AND EQUIPMENT

EQUIPMENT NAME	FIRE ID	YEAR	WATER (GALLONS)	AFFF FOAM (GALLONS)	DRY CHEM (POUNDS)	HALOTRON (POUNDS)
Oshkosh Striker HPR	Foam 1 #331022	2013	4,500	600	500	N/A
Oshkosh Striker 4500	Foam 2 #131051	2011	4,500	600	500	N/A
Oshkosh Snozzle	Foam 3 #231006	2012	3,000	600	500	500
Oshkosh Striker HPR	AT 19 #531044	2005	4,500	600	500	N/A
E-One	Reserve #431045	2004	3,200	400	750	N/A
Reserve Foam Truck	Old F3 #631075	-	4,500	600	500	500
E-One Titan HPR	Reserve #931025	1999	4,200	540	750	N/A
Squad 19	#123454	2001	300	20	N/A	N/A
Structural Pumper	Engine 19 #531065	2005	500	40	N/A	N/A
Crew Cab	Battalion 19 #312911	2003	N/A	N/A	N/A	N/A
Elevated Platform Truck	Med Support #326401	1993	N/A	N/A	N/A	N/A
Rapid Response Emergency Airstair	APS60 FR #523404	-	N/A	N/A	N/A	N/A

NOTES:
AFFF Foam: Aqueous Film-Forming Foam Concentrates; Dry Chem: Dry Chemical Fire Retardant; Halotron: Clean Agent Fire Retardant
SOURCE: Phoenix Sky Harbor International Airport, *Airport Certification Manual*, January 2013.

TABLE 2-19 ON-AIRPORT AIRCRAFT RESCUE AND FIRE FIGHTING AND AIRPORT POLICE SPACE

FACILITY NUMBER	BUILDING NAME/DESCRIPTION	BUILDING AREA (SQ FT)
264	ARFF Station 19	34,101
141	ARFF Station 29	18,315
222	PHX Police Bureau	8,334
138	PHX Police Bomb Squad Storage	31,407

SOURCES: Faithful+Gould, Inc., *Facility Condition Assessment (Phase 2) for Phoenix Sky Harbor International Airport (Various Locations)*, August 13, 2013 (Rev A); City of Phoenix Aviation Department, December 2017.

2.3.7 AIRPORT ADMINISTRATION

PHX AVN employees mainly occupy the Corporate Office Building (COB), the Facilities and Services Complex, and the Airport Operations Center. Additional facilities include the Parking Operations/PHX SkyTrain Design Team Annex and the recently completed Airport Communications/Command Center. The locations of these facilities are shown on Exhibits 2-5 and 2-7 and information regarding the buildings is summarized in **Table 2-20**.

TABLE 2-20 ESTIMATED AIRPORT ADMINISTRATION SPACE

FACILITY NUMBER	BUILDING NAME/DESCRIPTION	AIRFIELD LOCATION	BUILDING AREA (SQ FT)
138	City Hangar (Airfield Electrical Maintenance)[1]	Northwest (2725 E Air Lane)	31,407
251	Airport Operations Center	Landside - Central between T2 and T3	12,410
251[2]	Ops Building "D" Gate Training[3]	East side of T2; South of Ops Center	2,400
251[2]	Parking Operations Shelter Gate D (Canopy Only)	East side of T2; between Gate D and Ops Center	3,776
251[2]	Aviation Operations Annex	Adjacent to Airport Ops Center	2,866
210	COP – Shade Canopy	Landside - West side	N/A
223	COP - Paint Storage	Landside - West side	4,947
224	COP – Parks Department	Landside - West side	3,200
225	COP - Fleet Maintenance	Landside - West side	15,576
226	COP - Dry Storage	Landside - West side	2,050
227	COP Facilities and Services Main Bldg.	Landside - West side	65,235
254	Parking Operations/PHX Sky Train Design Team Annex	Landside - Central North of T3	20,795
N/A	Modern Building Art Warehouse	Off-airport - North side	8,100
N/A	Modern Building Warehouse Vacant	Off-airport - North side	12,150
202	COB	Landside - West side	71,471
500	PHX Sky Train Maintenance and Storage Facilities (MSF)	Landside - East side	34,000

NOTES: Building occupants have been revised to reflect the existing occupants per guidance provided from the Aviation Department
COP: City of Phoenix

1 Facility Condition Assessment (Phase 2) for Phoenix Sky Harbor International Airport (Various Locations), Appendix C, Faithful+Gould, Inc., August 13, 2013 (Rev A);

2 Included as part of the Aviation Operations Complex on ALP

3 Facility Condition Assessment (Phase 3) for Phoenix Sky Harbor International Airport (Various Locations), Appendix C, Faithful+Gould, Inc., June 4, 2014

SOURCES: City of Phoenix Aviation Department, *Airport Layout Plan Drawing,* January 2010; Faithful+Gould, Inc., *Facility Condition Assessment (Phase 2) for Phoenix Sky Harbor International Airport (Various Locations)*, August 13, 2013 (Rev A); City of Phoenix Aviation Department, December 2017.

2.3.8 AIRFIELD SUPPORT

Airfield facilities that are not used by PHX AVN or airlines include various airfield support facilities. **Table 2-21** summarizes the support facilities at PHX.

2.3.9 GENERAL AVIATION

The majority of GA facilities at PHX are contained in the northwest and southwest portions of the airfield, with a few GA hangars located north of the east end of Runway 8-26. These facilities and aprons are depicted on Exhibits 2-6 and 2-7 and summarized in **Table 2-22**.

TABLE 2-21 ESTIMATED AIRFIELD SUPPORT SPACE

FACILITY NUMBER	BUILDING NAME/DESCRIPTION	BUILDING AREA (SQ FT)	SITE AREA (SQ FT)	USE OF SPACE
207	Remote Transmitter Receiver (RTR-3)			FAA equipment
243	Maintenance Shop (Swissport International Ltd.)		31,400	GSE and other maintenance
260	North Airfield Electrical Vault	1,880		North Runway Lighting Electrical Systems
261	Airport Traffic Control Tower and TRACON		170,000	ATC & TRACON Equipment and Personnel
263	Core Network and Electrical Vault Building	4,408		Various Telecom and Electrical Systems
266	Triturator		2,900	Waste Processing
311	South Airfield Electrical Vault	2,831		South Runway Lighting Electrical Systems

SOURCE: Faithful+Gould, Inc., *Facility Condition Assessment (Phase 3) for Phoenix Sky Harbor International Airport (Various Locations), Appendix C*, June 4, 2014; TRACE Consulting, December 2017 aerial space takeoffs from PHX AGIS aerial image flown May 28 and September 29, 2017.

TABLE 2-22 ESTIMATED GENERAL AVIATION SPACE

FACILITY NUMBER	BUILDING NAME/DESCRIPTION	AIRFIELD LOCATION	BUILDING AREA (SQ FT)	SITE AREA (SQ FT)	LOCATION DESCRIPTION	APRON AREA (SQ YD)
129/130	Corporate Hangar and Office (Salt River Project / Department of Public Safety)	Northwest	29,394	-	Northwest General Aviation Apron	131,741
120	Small 4-Unit T-Hangar	Northwest	Cumulative total square-footage of these facilities is 117,360	-		
121	Small 4-Unit T-Hangar					
122	Small 4-Unit T-Hangar					
123	Small 4-Unit T-Hangar					
124	6-Unit Executive Hangar					
125	Aircraft Wash Rack					
126	8-Unit Executive Hangar					
127	2-Unit Corporate Hangar					
128	8-Unit Executive Hangar					
132	Aircraft Wash Rack	Northwest	-	6,000		
133	Executive Hangar	Northwest	-	4,000		
136	Hangar/Offices	Northwest	-	15,000		
137	Hangar/Offices	Northwest	5,003	15,000		
139	Aircraft Wash Rack	Northwest	-	3,400		
143	East Executive Hangar E24-E29	Northeast	34,020			
307A	FBO Hangar/Offices (Cutter)	Southwest		56,800	Cutter Aviation Apron	92,167
307B	FBO Hangar/Offices (Cutter)	Southwest	-	61,100		
307C	FBO Hangar/Offices (Cutter)	Southwest	-	39,200		
307D	FBO Hangar (Cutter)	Southwest		14,800		
312	FBO Hangar/Offices (Swift)	Southwest	-	106,000	Swift Aviation Apron	74,106
		Total	**185,777**	**321,300**		**298,014**

SOURCES: Faithful+Gould, Inc., *Facility Condition Assessment (Phase 3) for Phoenix Sky Harbor International Airport (Various Locations), Appendix C*, June 4, 2014. Faithful+Gould, Inc., *Facility Condition Assessment (Phase 4) for Phoenix Sky Harbor International Airport (Full Report), Appendix D*, June 30, 2015; HNTB Corporation, Draft Phoenix Sky Harbor International Airport RIM Study, August 2017; TRACE Consulting, December 2017 aerial space takeoffs from PHX AGIS aerial image flown May 28 and September 29, 2017.

2.3.10 ARIZONA AIR NATIONAL GUARD

PHX is also home to the AZANG 161st Air Refueling Wing (ARW). The unit is currently assigned eight KC-135s, which occupy an exclusive apron located on the southeast portion of the airfield, east of the South Air Cargo Complex.[5] The AZANG 161st ARW facilities are shown on Exhibit 2-6 and are summarized in **Table 2-23**.

TABLE 2-23 ESTIMATED ARIZONA AIR NATIONAL GUARD SPACE

FACILITY NUMBER	BUILDING NAME/DESCRIPTION	NUMBER OF BUILDINGS	APRON AREA (ACRES)	CAMPUS (ACRES)
315	Arizona Air National Guard Complex	17	15	55

SOURCE: TRACE Consulting, December 2017 aerial space takeoffs from PHX AGIS aerial image flown May 28 and September 29, 2017.

2.3.11 MISCELLANEOUS FACILITIES

Several miscellaneous facilities not categorized with those described above are found at the Airport. These facilities range in size and function. **Table 2-24** summarizes these miscellaneous facilities that are depicted on Exhibits 2-5, 2-6, and 2-7.

TABLE 2-24 ESTIMATED MISCELLANEOUS FACILITIES SPACE

FACILITY NUMBER	EXHIBIT NUMBER	BUILDING NAME/DESCRIPTION	AIRFIELD LOCATION	BUILDING AREA (SQ FT)	SITE AREA (SQ FT)	SITE AREA (ACRES)
131	2-7	Commercial Building (Embry-Riddle)	Northwest	4,050	10,100	-
134	2-7	Commercial Building (Vacant)	Northwest	-	3,300	-
135	2-7	Former Restaurant (Vacant)	Northwest	4,297	10,900	-
140	2-7	Offices (Vacant)	Northwest		2,600	-
142	2-5	Industrial Complex (Honeywell)	North central	-	-	68.5

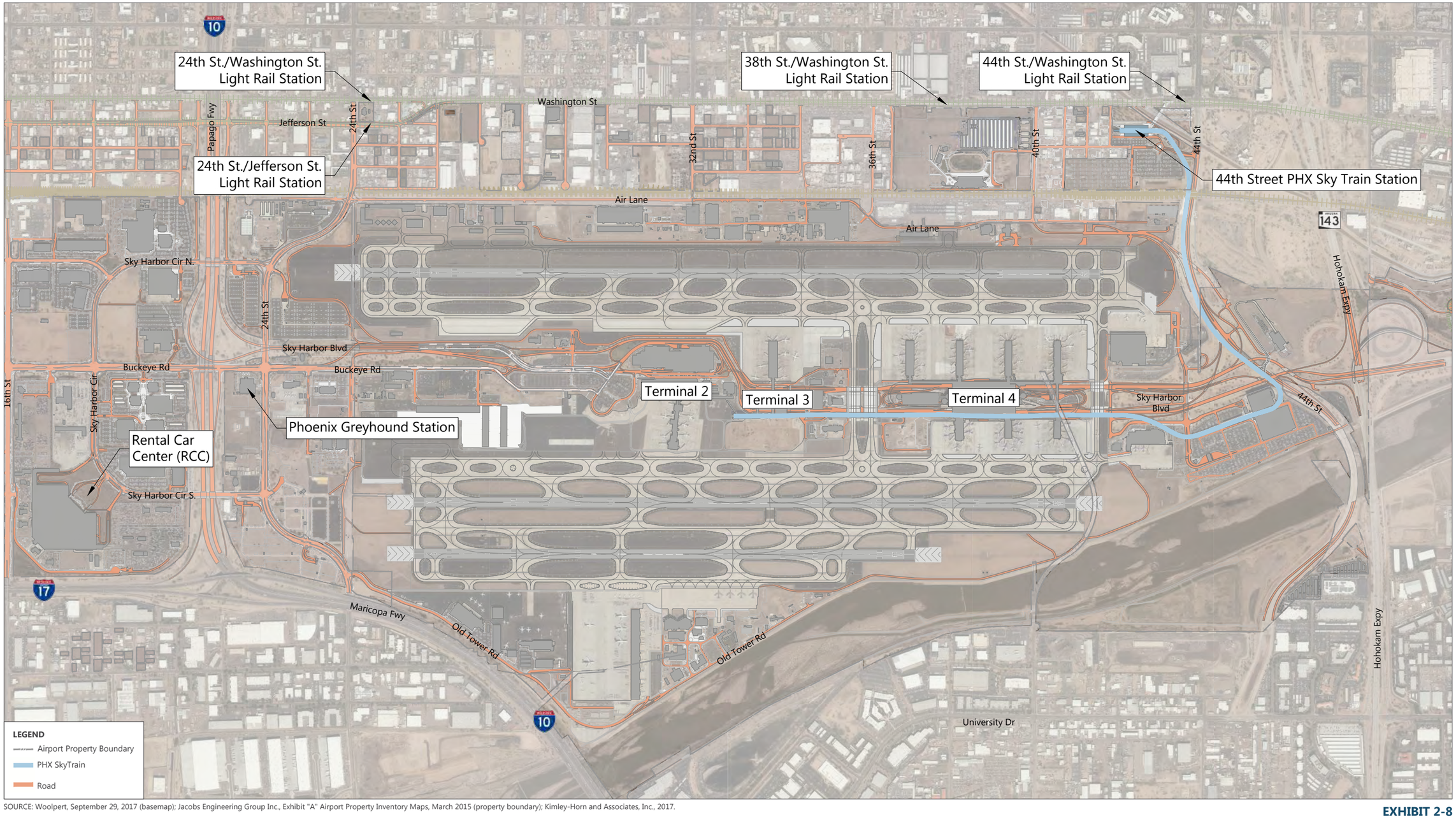
SOURCES: Faithful+Gould, Inc., *Facility Condition Assessment (Phase 3) for Phoenix Sky Harbor International Airport (Various Locations), Appendix C,* June 4, 2014; City of Phoenix Aviation Department, Future Airport Layout Plan Drawing, January 2010; HNTB Corporation, Draft Phoenix Sky Harbor International Airport RIM Study, August 2017; TRACE Consulting, December 2017 aerial space takeoffs from PHX AGIS aerial image flown May 28 and September 29, 2017.

2.4 LANDSIDE TRANSPORTATION FACILITIES

Landside facilities include the non-secure access and circulation facilities in and around the Airport. The existing non-secure ground transportation facilities and roadways are shown on **Exhibit 2-8**. Data collection consisted of 7-day vehicle volume counts at 77 locations within and around the Airport, including curbfront operational data and observations at all three Airport terminals during peak times.[6] Additional information on the traffic counts is provided in Section 2.4.3. The curbfront operations data collection included operational observations, vehicle classification counts, dwell times, and vehicle occupancies.

[5] Arizona Air National Guard, 161st Air Refueling Wing, 2014; http://www.skytamer.com/6.1/AZ/Phoenix,ANG161.html

[6] Traffic Data Collection for Phoenix Sky Harbor International Airport, Traffic Research and Analysis, Inc., October 2017.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Kimley-Horn and Associates, Inc., 2017.

NORTH

0 1,500 ft.

EXHIBIT 2-8

Ground Transportation Facilities

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\02-Existing Conditions (Inventory)\Ex-2-08-Landside Area.dwgLayout: 2-8 Plotted: Sep 6, 2019, 11:24AM

2.4.1 AIRPORT ACCESS TRANSPORTATION SYSTEM

Regional roadways surrounding the Airport include:

- Interstate 10 (I-10) - currently carries between 167,000 and 202,000 vehicles on a typical day near the Airport. The roadway cross-section of I-10 near the Airport varies between three and six travel lanes, along with a high-occupancy vehicle (HOV) lane in each direction.
- State Route 202 (Loop 202) - currently carries between 157,000 and 181,000 vehicles on a typical day near the Airport. Loop 202 near the Airport has three to five travel lanes and an HOV lane in each direction.
- State Route 143 (SR 143) or Hohokam Expressway - currently carries between 57,000 and 100,000 vehicles on a typical day near the Airport. SR 143 near the Airport has two to four travel lanes and no HOV lane in either direction.
- 24th Street - two or three travel lanes in each direction near the Airport and has signalized intersections at Air Lane, Sky Harbor Circle North, Buckeye Road, Sky Harbor Circle South, and Old Tower Road.
- 44th Street – two travel lanes in each direction near the Airport and an interchange to the Airport at Sky Harbor Boulevard.
- Buckeye Road – one or two travel lanes in each direction near the Airport and ends near Terminal 2 at Sky Harbor Boulevard.
- Sky Harbor Circle – two lanes in each direction with signalized intersections at 24th Street (Sky Harbor Circle North and South) and Buckeye Road.

Access roadways serve as the interface between the regional roadway system and the terminal curbfront facilities, parking areas, and support/ancillary facilities at PHX, and include:

- Sky Harbor Boulevard - a divided arterial that runs east-west between the north and south runways providing access to the passenger terminals and several parking areas and connects to I-10, Loop 202, SR 143, 44th Street, and Buckeye Road. Sky Harbor Boulevard experiences a significant volume of cut-through traffic, meaning traffic without an origin or destination at the Airport that uses Airport roadways to connect between other regional roadways. Recirculation, or turn-around roadways allow vehicles to return to a terminal or to the point where they entered the Airport.
- Old Tower Road – south of the runways providing access to the South Air Cargo area, the AZANG facilities, and GE facilities with one lane in each direction and one signalized intersection with 24th Street.
- Air Lane – north of the runways providing access to parcels south of the Union Pacific Railroad with one lane in each direction and one signalized intersection at 24th Street.

2.4.1.1 TRANSIT, PEDESTRIAN, AND BICYCLE FACILITIES

The PHX Sky Train is an automated train that transports passengers from the 44th Street PHX Sky Train Station and the East Economy Lot to Terminals 3 and 4. In the future, PHX Sky Train will extend west to the PHX Rental Car Center (RCC). Valley Metro Rail's light rail line and bus Route 1 (Washington Street), Route

32 (32nd Street), and Route 44 (44th Street) serve the Airport via a connection to the PHX Sky Train at the 44th Street PHX Sky Train Station. Greyhound Lines, Inc. has a bus station on the west side of the Airport on Buckeye Road. Valley Metro Route 13 (Buckeye Road) is the only local public bus route with direct service to the Airport, with service only to Terminal 2. Valley Metro Route 70 (24th Street/Glendale Avenue) runs along 24th Street near the Airport and provides transfer opportunities to Airport facilities via Routes 1 and 13. Route 70 will also serve the future 24th Street PHX Sky Train transit center.

There are several methods for pedestrians and bicyclists to gain access to some peripheral locations at the Airport such as the 44th Street PHX Sky Train Station and Terminal 2. ADA-accessible walkways, curbfronts, and the PHX Sky Train provide access to other terminals and parking areas throughout the Airport.[7] There are no dedicated bicycle facilities within the core terminal area.

2.4.2 CURBFRONT GROUND TRANSPORTATION

Passengers arriving at the terminal curbfronts utilize several modes of surface transportation including private vehicles; taxi/limousine service; transportation network companies (TNC) such as Uber and Lyft; public transportation; charter buses; and various shuttle services such as Valley Metro's Dial-A-Ride, inter-city, off-site parking, and hotel shuttles. The most heavily utilized mode of travel to the terminal curbfronts is the private vehicle. Terminal 2 has two curbfronts; an inner curb is designated for private vehicle, Dial-A-Ride, van service, TNC, inter-city shuttle, and taxi use. The outer curb is designated for charter vehicle, courtesy vehicle, rental car shuttle, and public bus (Valley Metro) use.

Terminal 3 curbs consist of an inner and an outer curbfront on both the north and south sides of the terminal. The north inner curb is designated for private vehicle use and the north outer curb is designated for taxi, inter-city shuttle, courtesy vehicle, and rental car shuttle use. The south inner curb is designated for private vehicle and Dial-A-Ride use and the south outer curb is designated for TNC, charter vehicle, and van service use. Much of Terminal 3 was under construction during the data collection period (October 9 through October 15, 2017), with both the south inner curb and the north inner curb closed when curbfront observations were conducted.

Terminal 4 arrival and departure curbs are split into separate levels. Level 1 is for arrival passengers and consists of two north curbs and two south curbs. The north inner curb is designated for private vehicle use. The north outer curb is designated for typical TNC service (e.g., Lyft, Lyft XL, UberX, UberXL, and UberSELECT), inter-city shuttle, taxi, and courtesy vehicle use. The south inner curb is designated for private vehicle and Dial-A-Ride use and high-end TNC (e.g., UberBlack and UberSUV). The south outer curb is designated for charter vehicle, rental car shuttle, taxi, van service, and typical TNC use.

Level 2 is for departure passengers and consists of one north curb and one south curb. The north and south curbs are both designated for all modes, however, PHX Valet Curbside and Dial-A-Ride have designated locations on the south curb.

[7] ADA-accessible refers to facilities being compliant with the Americans with Disabilities Act

2.4.3 ROADWAY SEGMENT LEVEL OF SERVICE ANALYSIS

Seven-day traffic counts were conducted at 77 locations on and around the Airport as described above. **Exhibit 2-9** shows the locations of the traffic tube counters.[8] Vehicle classification data were collected at 56 of the count locations.

The capacity of roadways is influenced by many factors including the proportion of heavy vehicles that utilize Airport roadways. The percentage of heavy vehicles (e.g., trucks, buses) were collected at these locations and ranged between 1 and 18 percent. **Exhibit 2-10** shows the heavy vehicle percentages around the Airport. A heavy vehicle percentage of 9 percent or more was collected at 21 of the 56 count locations. The majority of the higher heavy vehicle percentages were identified in the western portion of the Airport. However, the highest heavy vehicle percentages were noted on the east side of the Airport at count location 49, which is the northbound 44th Street exit ramp that connects to westbound Sky Harbor Boulevard.

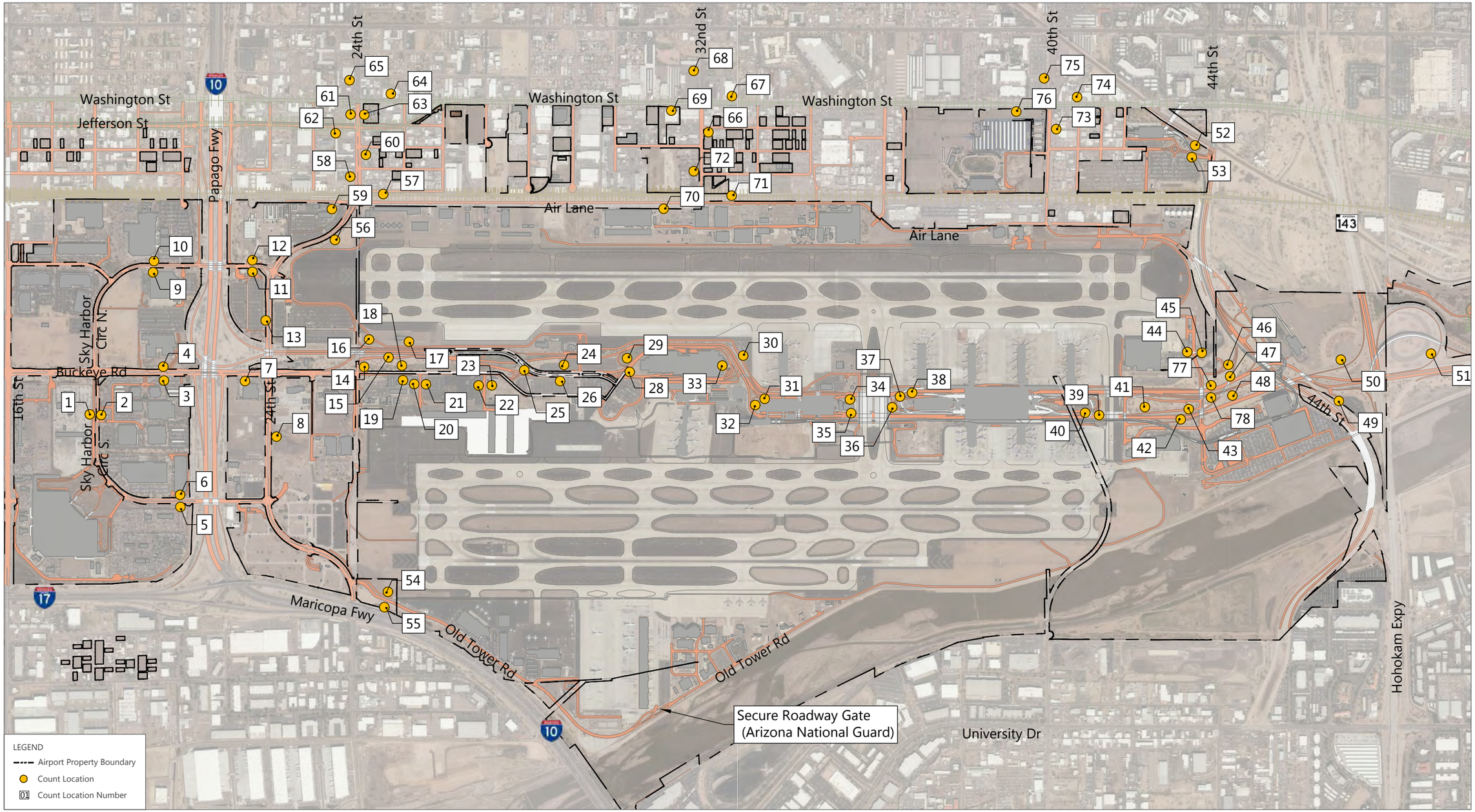
Level of service (LOS) analysis is typically conducted during the peak month at the Airport (March); however, data collection occurred in October due to project schedule.[9] Historically, October is an average month at PHX in terms of passenger volumes. Therefore, to assess the LOS for an above average day at the Airport, the traffic volume of the peak day of the 7-day count was identified at each count location. LOS was determined for each count location and most experienced LOS A, B, or C.[10] There were only four count locations that experienced LOS D and one count location that experienced LOS E. There were no count locations that experienced LOS F. **Table 2-25** provides a summary of the count locations experiencing LOS D or LOS E. **Exhibit 2-11** shows the LOS that corresponds to each count location.[11]

[8] Automatic traffic counts (tube counts) were conducted along roadways with traffic counters that record one-way traffic volumes in 15-minute intervals over the data collection period. These 7-day traffic counts were conducted in October 2017 to determine the peak traffic periods throughout the week

[9] LOS was determined for each count location using the methodology set forth in the Transportation Research Board's Airport Cooperative Research Program Report 40, *Airport Curbside and Terminal Area Roadway Operations*. Based on the *Highway Capacity Manual*, LOS values correlate to peak hour volume-to-capacity (v/c) ratios depending on the free-flow speed (i.e., speed limit) of the roadway.

[10] LOS A through LOS C represent minimal to limited congestion and are generally considered "acceptable." LOS D represents a condition with moderate congestion that is generally considered "of concern." LOS E represents a condition with significant congestion where volumes are near or at capacity. LOS F represents a condition with severe congestion where volumes are greater than capacity. LOS E and LOS F are generally considered "unacceptable."

[11] Traffic Data Collection for Phoenix Sky Harbor International Airport, Traffic Research and Analysis, Inc., October 2017.

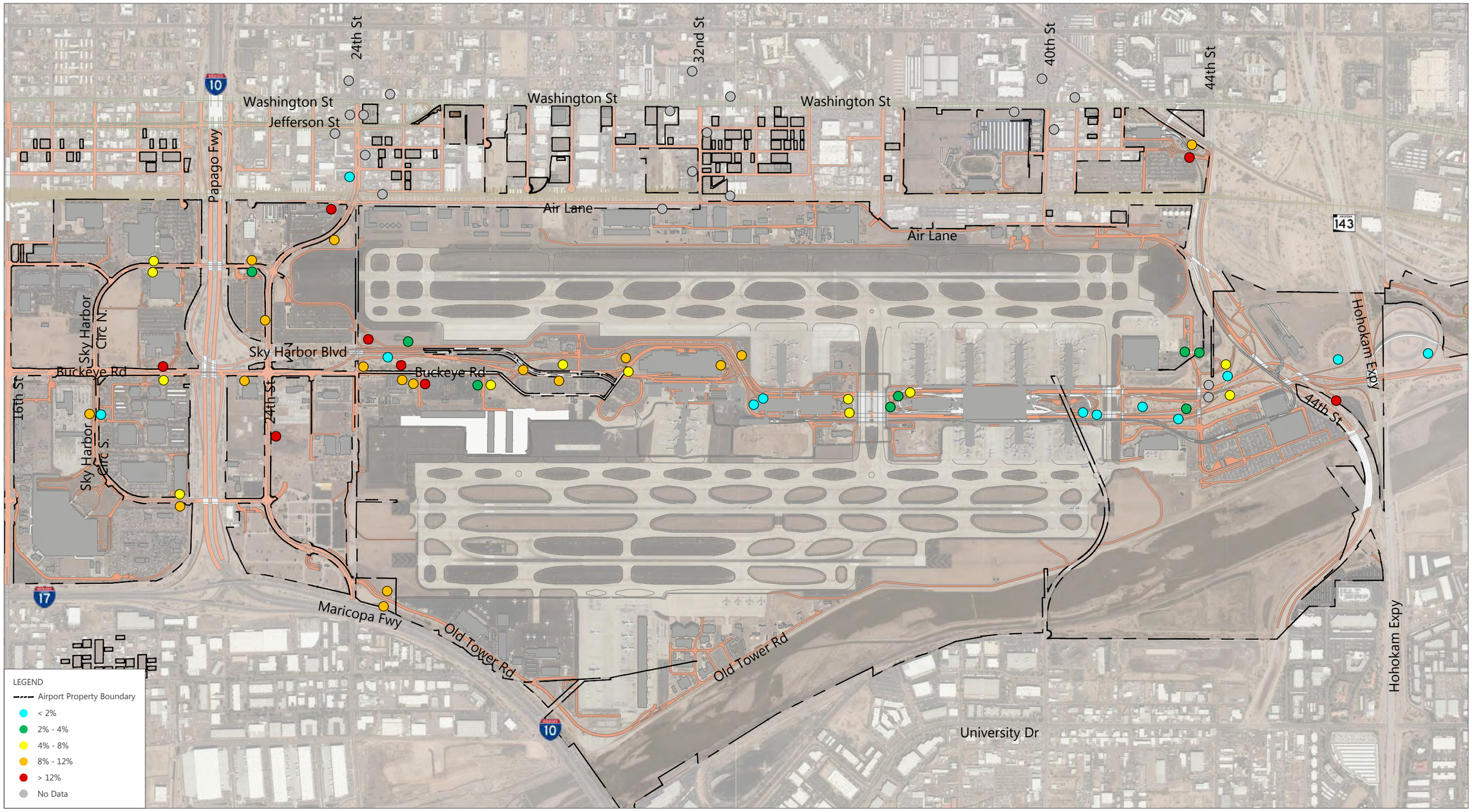


SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Kimley-Horn and Associates, Inc., 2017.

NORTH 0 1,500 ft.

EXHIBIT 2-9

Seven-Day Vehicle Count Locations



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Kimley-Horn and Associates, Inc., 2017.

NORTH 0 1,500 ft.

EXHIBIT 2-10

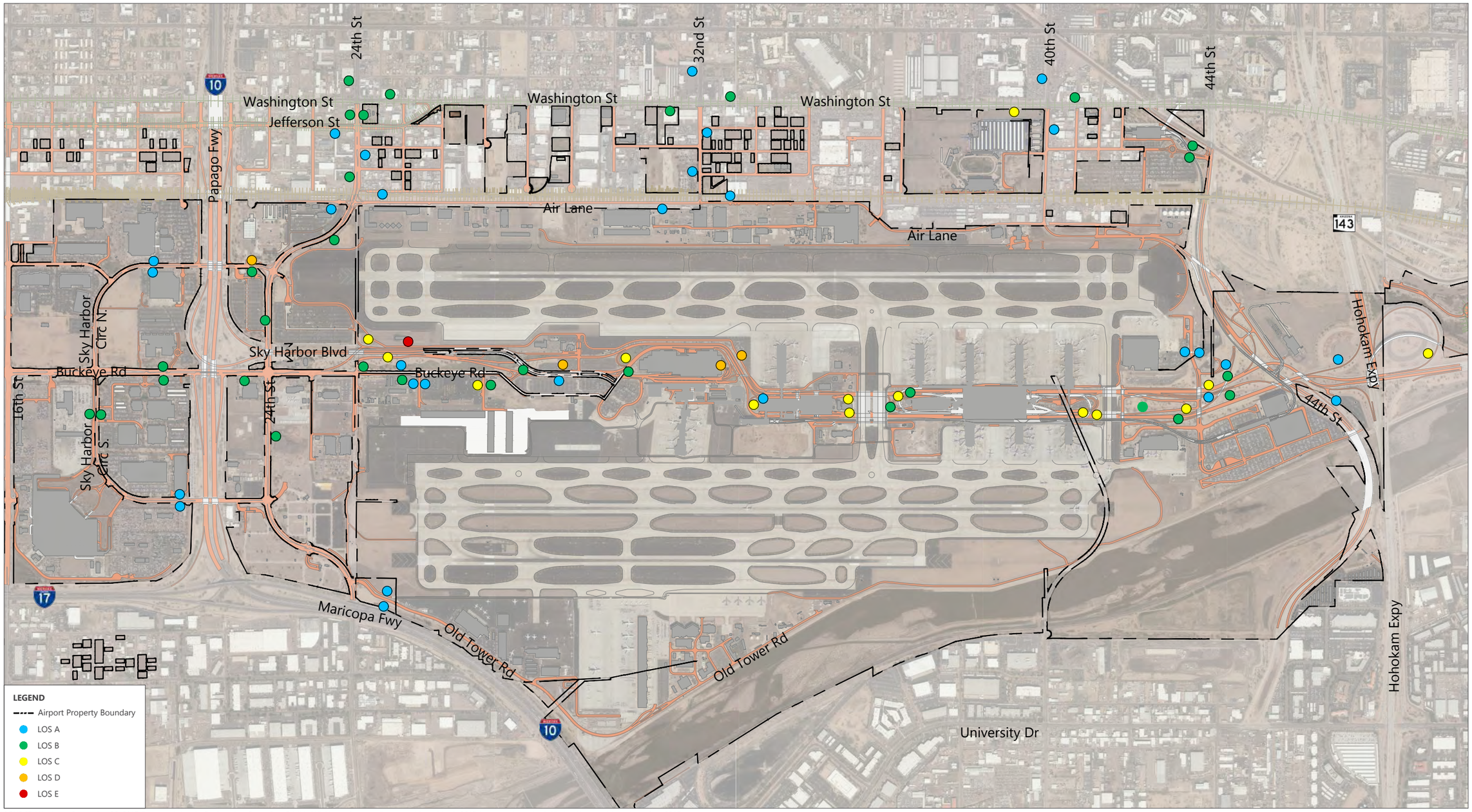
Heavy Vehicle Percentages

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\02-Existing Conditions (Inventory)\Ex-2-09,10,11-Count Locations.dwg Layout: 2-10 Plotted: Sep 6, 2019, 11:27AM

TABLE 2-25 COUNT LOCATIONS WITH LEVEL OF SERVICE D OR WORSE

COUNT LOCATION	LOCATION	NUMBER OF LANES	PEAK DAY			PEAK HOUR			
			COUNT DATE	DAY OF WEEK	VOLUME	START TIME	VOLUME	V/C RATIO	LOS
12	Westbound Sky Harbor Circle N. west of 24th Street	1	10/12/17	Thursday	8,966	7:15 AM	884	0.69	D
17	Westbound Sky Harbor Boulevard west of Copperhead Drive	1	10/13/17	Friday	17,088	2:30 PM	1,227	0.95	E
24	Eastbound Sky Harbor Boulevard west of 29th Street	2	10/12/17	Thursday	20,705	4:30 PM	1,816	0.70	D
29	Westbound Sky Harbor Boulevard east of Terminal 2 Parking	2	10/13/17	Friday	28,112	2:45 PM	1,936	0.75	D
30	Eastbound Sky Harbor Boulevard east of Terminal 2 Parking	2	10/10/17	Tuesday	27,065	4:00 PM	1,797	0.70	D

SOURCES: Traffic Research and Analysis, 2017; Kimley-Horn and Associates, Inc., 2017.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Kimley-Horn and Associates, Inc., 2017.

NORTH 0 1,500 ft.

EXHIBIT 2-11

Roadway Segment Level of Service

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\02-Existing Conditions (Inventory)\Ex-2-09,10,11-Count Locations.dwgLayout: 2-11 Plotted: Sep 6, 2019, 11:28AM

2.4.4 CURBFRONT OPERATIONS DATA COLLECTION

Peak curbfront arrival and departure times were identified for each terminal by reviewing the 7-day count locations listed in **Table 2-26** closest to the three terminals.

TABLE 2-26 COUNT LOCATIONS NEAR TERMINALS

COUNT LOCATION	TERMINAL	CURB USE
26	T2	Arrivals and Departures
28	T2	Arrivals and Departures
31	T3	Arrivals and Departures
32	T3	Arrivals and Departures
36	T3	Arrivals and Departures
37	T4	Arrivals
38	T4	Departures
39	T4	Departures
40	T4	Arrivals

SOURCES: Traffic Research and Analysis, 2017; Kimley-Horn and Associates, Inc., 2017.

The daily traffic volumes at the selected locations were totaled to capture a representation of the daily overall Airport arrival and departure activity. The totals were then compared between days of the week to identify the morning and afternoon peak hours and the days of the week that they occurred to determine when to ideally complete targeted curbside observations at each of the terminals. **Table 2-27** summarizes the daily volumes at the selected locations. The highest daily volumes occurred on Friday, Sunday, and Monday. **Table 2-28** summarizes the morning and afternoon peak hour data for the peak day at each of the selected locations. The highest peak hour volumes typically occurred on Friday afternoon, Sunday morning, and Monday morning.

TABLE 2-27 DAILY VOLUMES AT TERMINAL ENTRANCE COUNT LOCATIONS

	COUNT LOCATION								
DAY	26	28	31	32	36	37	38	39	40
Tuesday, October 10, 2017	6,702	4,562	2,027	7,718	2,889	4,473	9,515	14,069	4,637
Wednesday, October 11, 2017	6,302	4,286	1,978	7,378	3,094	4,471	9,088	14,481	4,627
Thursday, October 12, 2017	6,599	4,320	1,947	7,662	2,771	4,976	9,400	15,009	4,566
Friday, October 13, 2017	6,289	4,655	2,176	8,052	3,105	5,110	9,712	14,392	5,306
Saturday, October 14, 2017	5,031	3,991	1,713	6,781	2,460	4,504	8,475	11,494	4,602
Sunday, October 15, 2017	5,664	3,442	1,862	7,771	2,577	4,780	10,316	16,047	5,277
Monday, October 9/16, 2017	6,826	4,113	1,862	-[1]	3,250	4,279	-[1]	15,635	4,444

NOTE:
1 Counter was disrupted during recording causing incomplete data
SOURCES: Traffic Research and Analysis, 2017; Kimley-Horn and Associates, Inc., 2017.

TABLE 2-28 PEAK HOUR TRAFFIC VOLUMES AT TERMINAL ENTRANCE COUNT LOCATIONS

COUNT LOCATION	PEAK DAILY VOLUME	PEAK DAY OF THE WEEK	AM PEAK HOUR			PM PEAK HOUR		
			PEAK HOUR START TIME	VEHICLE COUNT	PERCENT OF DAILY VOLUME	PEAK HOUR START TIME	VEHICLE COUNT	PERCENT OF DAILY VOLUME
26	6,826	Monday	9:00 AM	479	7.0%	12:45 PM	465	6.8%
28	4,655	Friday	9:30 AM	313	6.7%	6:45 PM	361	7.8%
31	2,176	Friday	9:30 AM	163	7.5%	9:00 PM	179	8.2%
32	8,052	Friday	11:45 AM	508	6.3%	7:00 PM	528	6.6%
36	3,250	Monday	10:00 AM	245	7.5%	9:15 PM	341	10.5%
37	5,110	Friday	11:15 AM	332	6.5%	5:30 PM	426	8.3%
38	10,316	Sunday	6:30 AM	752	7.3%	1:15 PM	632	6.1%
39	16,047	Sunday	6:45 AM	1,148	7.2%	12:00 PM	974	6.1%
40	5,306	Friday	9:00 AM	345	6.5%	6:00 PM	595	11.2%

SOURCES: Traffic Research and Analysis, 2017; Kimley-Horn and Associates, Inc., 2017.

Based on the peak times identified from the traffic count data, curbfront data collection was conducted on Thursday, November 9, 2017 and Monday, November 13, 2017 at the locations and time periods shown in **Table 2-29**. While Friday is typically slightly busier than Thursday, observations were made Thursday rather than Friday to capture more representative patterns as Friday was the observed holiday for Veteran's Day.

TABLE 2-29 CURBFRONT DATA COLLECTION SCHEDULE

DATE	LOCATION	TIME
Thursday, November 9, 2017	Terminal 2 All Curbs	10:00 AM - 1:00 PM
		5:45 PM - 6:45 PM
	Terminal 3 North and South Curbs	10:00 AM - 1:00 PM
		7:00 PM - 8:00 PM
	Terminal 4 Arrivals North and South Curbs	6:00 PM - 8:00 PM
Monday, November 13, 2017	Terminal 4 Departures North and South Curbs	6:00 AM - 8:00 AM

SOURCE: Kimley-Horn and Associates, Inc., 2017.

The terminal curbfront data collection included:

- Vehicle classification counts
- Lane occupancy
- Vehicle occupancy and dwell times
- Other curbside observations (e.g., queues, level of congestion, and enforcement).

2.4.4.1 CURBFRONT VEHICLE CLASSIFICATION COUNTS

Vehicle classifications and dwell times were collected at the Airport curbfront at the times listed in Table 2-29 and are summarized in **Table 2-30**. **Tables 2-31** through **2-34** summarize the total vehicle counts by vehicle classification at each curb and time at each terminal.[12] The "percent of total" summarizes the traffic composition percentage by vehicle type during each data collection period.

TABLE 2-30 VEHICLE CLASSIFICATIONS

VEHICLE TYPE	VEHICLE EXAMPLE	AIRPORT UTILIZATION
Private Vehicle	Automobile, Pick-up Truck, SUV	Passenger pick-up and drop-off
Taxi	Taxi	Passenger pick-up and drop-off
Luxury Limo	Lincoln Town Car, Expedition	Passenger pick-up and drop-off
Bus	Public Bus, Rental Car Center Shuttle Bus, Charter, and Tour Bus	Public Transit, Valley Metro Route 13, Rental Car Center Shuttle Bus circulating between the Rental Car Center and all three terminals
Shuttle	Hotel Shuttles, Off-Airport Parking Shuttles, Airport Contracted Shuttles, Private Transportation Vans	Hotels, Contracted Shuttles, Transportation Vans and Off-Airport Parking Providers transport between off-airport locations and terminals
Delivery Truck	UPS, FedEx, Vendor	Deliveries
City of Phoenix Vehicle	City Truck or Car	Maintenance and other City vehicles work at designated areas at each terminal
Law Enforcement	Police, Ambulance, Airport Security	Recirculating (orbiting) trips maintaining and, when needed, directing traffic flow
TNC (e.g., Uber, Lyft, etc.)	Automobile, SUV	Passenger pick-up and drop-off

SOURCE: Kimley-Horn and Associates, Inc., 2017.

2.4.4.2 LANE OCCUPANCY

Table 2-35 summarizes the average recorded lane occupancy at each curb at each terminal.[13] The table indicates the average number of vehicles occupying a given lane at a given point in time. Lane 1, the lane closest to the terminal curb, was the lane utilized by most vehicles. Lanes 2 and 3 were rarely used at Terminals 2 and 3 but received more use at Terminal 4.

[12] Vehicle classification (or vehicle mix) refers to the portion of the traffic volume accounted for by individual modes, as defined by both the type of service each mode provides (e.g., taxi, courtesy vehicle, charter bus) and the type of vehicle used (e.g., sedan, passenger van, minibus, full-size bus). Each vehicle classification has a unique dwell time at the curb and observations were made during curb peak periods at each terminal curbfront and are summarized in 15-minute intervals and documented in more detail in the data forms included in Traffic Data Collection for Phoenix Sky Harbor International Airport, Traffic Research and Analysis, Inc., October 2017.

[13] The lane occupancy, or number of vehicles occupying each lane, was observed as part of the curbfront data collection effort. The lanes were numbered from the curbfront outwards towards the traffic flow lanes. Approximately every 15 minutes during the data collection period, a tally of the number of vehicles in each lane was conducted and documented. More detailed information is provided in the data forms included in Traffic Data Collection for Phoenix Sky Harbor International Airport, Traffic Research and Analysis, Inc., October 2017.

TABLE 2-31 TERMINAL 2 CURBFRONT PEAK HOUR VEHICLE CLASSIFICATION SUMMARY

TERMINAL AND TIME OF DAY	CURB LOCATION	VOLUME AND PERCENT	AUTOMOBILE, PICK-UP, SUV	TAXI	LUXURY LIMOUSINE	TNC	PUBLIC BUS	CHARTER & TOUR BUSES	OFF-AIRPORT PARKING SHUTTLE	RENTAL CAR CENTER SHUTTLE	AIRPORT CONTRACTED SHUTTLE	PRIVATE TRANSPORT VANS	HOTEL/MOTEL SHUTTLE	DELIVERY TRUCKS	LAW ENFORCEMENT VEHICLE	OTHER	TOTAL
T2 AM	Inner	Volume	216	5	6	58	0	1	4	1	5	17	5	0	11	1	330
		% of Total	65.5	1.5	1.8	17.6	0.0	0.3	1.2	0.3	1.5	5.2	1.5	0.0	3.3	0.3	100.0
	Outer	Volume	88	37	0	12	3	1	24	13	1	4	3	0	1	1	188
		% of Total	46.8	19.7	0.0	6.4	1.6	0.5	12.8	6.9	0.5	2.1	1.6	0.0	0.5	0.5	100.0
T2 AM Total	**All**	**Volume**	**304**	**42**	**6**	**70**	**3**	**2**	**28**	**14**	**6**	**21**	**8**	**0**	**12**	**2**	**518**
		% of Total	**58.7**	**8.1**	**1.2**	**13.5**	**0.6**	**0.4**	**5.4**	**2.7**	**1.2**	**4.1**	**1.5**	**0.0**	**2.3**	**0.4**	**100.0**
T2 PM	Inner	Volume	198	2	5	49	0	1	11	0	8	7	5	0	4	2	292
		% of Total	67.8	0.7	1.7	16.8	0.0	0.3	3.8	0.0	2.7	2.4	1.7	0.0	1.4	0.7	100.0
	Outer	Volume	122	18	3	11	2	5	18	11	3	2	4	0	2	3	204
		% of Total	59.8	8.8	1.5	5.4	1.0	2.5	8.8	5.4	1.5	1.0	2.0	0.0	1.0	1.5	100.0
T2 PM Total	**All**	**Volume**	**320**	**20**	**8**	**60**	**2**	**6**	**29**	**11**	**11**	**9**	**9**	**0**	**6**	**5**	**496**
		% of Total	**64.5**	**4.0**	**1.6**	**12.1**	**0.4**	**1.2**	**5.8**	**2.2**	**2.2**	**1.8**	**1.8**	**0.0**	**1.2**	**1.0**	**100.0**

SOURCE: Kimley-Horn and Associates, Inc., 2017.

TABLE 2-32 TERMINAL 3 CURBFRONT PEAK HOUR VEHICLE CLASSIFICATION SUMMARY

TERMINAL AND TIME OF DAY	CURB LOCATION	VOLUME AND PERCENT	AUTOMOBILE, PICK-UP, SUV	TAXI	LUXURY LIMOUSINE	TNC	PUBLIC BUS	CHARTER & TOUR BUSES	OFF-AIRPORT PARKING SHUTTLE	RENTAL CAR CENTER SHUTTLE	AIRPORT CONTRACTED SHUTTLE	PRIVATE TRANSPORT VANS	HOTEL/MOTEL SHUTTLE	DELIVERY TRUCKS	LAW ENFORCEMENT VEHICLE	OTHER	TOTAL
T3 AM	South Inner	Volume	226	11	17	17	0	1	3	0	1	7	2	2	0	3	290
		% of Total	77.9	3.8	5.9	5.9	0.0	0.3	1.0	0.0	0.3	2.4	0.7	0.7	0.0	1.0	100.0
	South Outer	Volume	963	105	32	167	0	7	36	41	30	31	27	9	4	12	1,464
		% of Total	65.8	7.2	2.2	11.4	0.0	0.5	2.5	2.8	2.0	2.1	1.8	0.6	0.3	0.8	100.0
T3 AM Total	**All**	**Volume**	**1,189**	**116**	**49**	**184**	**0**	**8**	**39**	**41**	**31**	**38**	**29**	**11**	**4**	**15**	**1,754**
		% of Total	**67.8**	**6.6**	**2.8**	**10.5**	**0.0**	**0.5**	**2.2**	**2.3**	**1.8**	**2.2**	**1.7**	**0.6**	**0.2**	**0.9**	**100.0**
T3 PM	South Inner	Volume	168	2	6	14	0	1	5	0	1	3	2	0	0	2	204
		% of Total	82.4	1.0	2.9	6.9	0.0	0.5	2.5	0.0	0.5	1.5	1.0	0.0	0.0	1.0	100.0
	South Outer	Volume	794	81	22	131	0	4	7	32	9	22	15	7	2	9	1,135
		% of Total	70.0	7.1	1.9	11.5	0.0	0.4	0.6	2.8	0.8	1.9	1.3	0.6	0.2	0.8	100.0
T3 PM Total	**All**	**Volume**	**1,269**	**101**	**31**	**176**	**0**	**6**	**23**	**38**	**12**	**32**	**23**	**7**	**3**	**11**	**1,732**
		% of Total	**73.3**	**5.8**	**1.8**	**10.2**	**0.0**	**0.3**	**1.3**	**2.2**	**0.7**	**1.8**	**1.3**	**0.4**	**0.2**	**0.6**	**100.0**

SOURCE: Kimley-Horn and Associates, Inc., 2017.

TABLE 2-33 TERMINAL 4 CURBFRONT PEAK HOUR VEHICLE CLASSIFICATION SUMMARY

TERMINAL AND TIME OF DAY	CURB LOCATION	VOLUME AND PERCENT	AUTOMOBILE, PICK-UP, SUV	TAXI	LUXURY LIMOUSINE	TNC VEHICLES	PUBLIC BUS	CHARTER & TOUR BUSES	OFF-AIRPORT PARKING SHUTTLE	RENTAL CAR CENTER SHUTTLE	AIRPORT CONTRACTED SHUTTLE	PRIVATE TRANSPORT VANS	HOTEL/MOTEL SHUTTLE	DELIVERY TRUCKS	LAW ENFORCEMENT VEHICLE	OTHER	TOTAL
T4 AM	Departures North	Volume	361	18	15	117	0	0	0	24	6	13	6	0	0	8	568
		% of Total	63.6	3.2	2.6	20.6	0.0	0.0	0.0	4.2	1.1	2.3	1.1	0.0	0.0	1.4	100.0
	Departures South	Volume	603	5	1	221	0	0	66	0	6	0	35	0	0	0	937
		% of Total	64.4	0.5	0.1	23.6	0.0	0.0	7.0	0.0	0.6	0.0	3.7	0.0	0.0	0.0	100.0
T4 AM Total	**Departures All**	**Volume**	**964**	**23**	**16**	**338**	**0**	**0**	**66**	**24**	**12**	**13**	**41**	**0**	**0**	**8**	**1,505**
		% of Total	**64.1**	**1.5**	**1.1**	**22.5**	**0.0**	**0.0**	**4.4**	**1.6**	**0.8**	**0.9**	**2.7**	**0.0**	**0.0**	**0.5**	**100.0**
T4 PM	Arrivals North Inner	Volume	899	2	3	8	0	0	1	0	0	8	0	0	0	0	921
		% of Total	97.6	0.2	0.3	0.9	0.0	0.0	0.1	0.0	0.0	0.9	0.0	0.0	0.0	0.0	100.0
	Arrivals North Outer	Volume	1,428	67	1	200	0	2	31	1	45	22	23	1	4	1	1826
		% of Total	78.2	3.7	0.1	11.0	0.0	0.1	1.7	0.1	2.5	1.2	1.3	0.1	0.2	0.1	100.0
	Arrivals South Inner	Volume	410	3	0	12	0	0	0	0	0	1	1	1	0	1	429
		% of Total	95.6	0.7	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.0	0.2	100.0
	Arrivals South Outer	Volume	939	64	21	114	0	2	10	20	28	16	10	4	0	3	1,231
		% of Total	76.3	5.2	1.7	9.3	0.0	0.2	0.8	1.6	2.3	1.3	0.8	0.3	0.0	0.2	100.0
T4 PM Total	**Arrivals All**	**Volume**	**3,676**	**136**	**25**	**334**	**0**	**4**	**42**	**21**	**73**	**47**	**34**	**6**	**4**	**5**	**4,407**
		% of Total	**83.4**	**3.1**	**0.6**	**7.6**	**0.0**	**0.1**	**1.0**	**0.5**	**1.7**	**1.1**	**0.8**	**0.1**	**0.1**	**0.1**	**100.0**

SOURCE: Kimley-Horn and Associates, Inc., 2017.

TABLE 2-34 TOTAL AIRPORT CURBFRONT PEAK HOUR VEHICLE CLASSIFICATION SUMMARY

TERMINAL	VOLUME AND PERCENT	AUTOMOBILE, PICK-UP, SUV	TAXI	LUXURY LIMOUSINE	TNC VEHICLES	PUBLIC BUS	CHARTER & TOUR BUSES	OFF-AIRPORT PARKING SHUTTLE	RENTAL CAR CENTER SHUTTLE	AIRPORT CONTRACTED SHUTTLE	PRIVATE TRANSPORT VANS	HOTEL/MOTEL SHUTTLE	DELIVERY TRUCKS	LAW ENFORCEMENT VEHICLE	OTHER	TOTAL
T2	Volume	304	42	6	70	3	2	28	14	6	21	8	0	12	2	518
	% of Total	58.7	8.1	1.2	13.5	0.6	0.4	5.4	2.7	1.2	4.1	1.5	0.0	2.3	0.4	100.0
T3	Volume	1,189	116	49	184	0	8	39	41	31	38	29	11	4	15	1,754
	% of Total	67.8	6.6	2.8	10.5	0.0	0.5	2.2	2.3	1.8	2.2	1.7	0.6	0.2	0.9	100.0
T4 Departures	Volume	964	23	16	338	0	0	66	24	12	13	41	0	0	8	1,505
	% of Total	64.1	1.5	1.1	22.5	0.0	0.0	4.4	1.6	0.8	0.9	2.7	0.0	0.0	0.5	100.0
T4 Arrivals	Volume	3676	136	25	334	0	4	42	21	73	47	34	6	4	5	4,407
	% of Total	83.4	3.1	0.6	7.6	0.0	0.1	1.0	0.5	1.7	1.1	0.8	0.1	0.1	0.1	100.0
All Terminals	**Volume**	**6,133**	**317**	**96**	**926**	**3**	**14**	**175**	**100**	**122**	**119**	**112**	**17**	**20**	**30**	**8,184**
	% of Total	**74.9**	**3.9**	**1.2**	**11.3**	**0.0**	**0.2**	**2.1**	**1.2**	**1.5**	**1.5**	**1.4**	**0.2**	**0.2**	**0.4**	**100.0**

SOURCE: Kimley-Horn and Associates, Inc., 2017.

TABLE 2-35 CURBFRONT LANE OCCUPANCY SUMMARY

TERMINAL	CURB	LANE 1	LANE 2	LANE 3
T2	Inner	6.2	0.3	0.1
	Outer	2.9	0.0	0.0
T3	North Outer	1.0	0.0	0.0
	South Inner	5.7	1.3	1.7
	South Outer	1.0	0.0	0.0
T4	Departures North	6.8	3.8	0.0
	Departures South	11.0	8.4	0.0
	Arrivals North Inner	4.6	2.6	5.0
	Arrivals North Outer	10.4	5.3	4.0
	Arrivals South Inner	3.7	0.2	3.8
	Arrivals South Outer	8.3	0.3	3.0

SOURCE: Kimley-Horn and Associates, Inc., 2017.

2.4.4.3 VEHICLE OCCUPANCY AND DWELL TIMES

The vehicle occupancies,[14] dwell times,[15] and average number of passengers dropped off and picked up by vehicle classification are summarized in **Tables 2-36** through **2-39**.[16] Only the vehicle types for which data were recorded are shown. The recorded vehicle lane usage percentage at each terminal is summarized in **Table 2-40**.

[14] Vehicle occupancy, or maximum number of people occupying each vehicle (including the driver), was also observed as part of the curbfront data collection effort. The vehicle occupancies were collected by vehicle type at each curbfront

[15] Dwell times, or lengths of time that vehicles wait at the curbfront were also observed during the data collection effort. Similar to the vehicle occupancies, the dwell times were collected by vehicle type at each curbfront and differ for pick-up and drop-off. Dwell time is the amount of time a vehicle spends parked at a curbfront lane (or other passenger loading or unloading area). Typically, the dwell time is the length of time between when the driver parks (i.e., the vehicle comes to a complete stop) and when the driver first attempts to rejoin the traffic stream (it does not include any time during which the driver may be ready to depart, but is prevented from doing so by other vehicles)

[16] Additional detail on vehicle occupancy and dwell times is available in Traffic Data Collection for Phoenix Sky Harbor International Airport, Traffic Research and Analysis, Inc., October 2017.

TABLE 2-36 TERMINAL 2 CURBFRONT VEHICLE OCCUPANCIES AND DWELL TIMES

LOCATION	CHARACTERISTIC	AUTOMOBILE, PICK-UP, SUV	TAXI	LUXURY LIMOUSINE	TNC VEHICLES	CHARTER & TOUR BUSES	OFF-AIRPORT PARKING SHUTTLE	RENTAL CAR CENTER SHUTTLE	AIRPORT CONTRACTED SHUTTLE	PRIVATE TRANSPORT VANS	HOTEL/MOTEL SHUTTLE	ALL VEHICLES
Inner Curb	Load/Unload Dwell Time (mm:ss)	1:01	0:17	0:37	0:44	-	-	-	-	1:15	0:59	0:56
	Passengers Picked Up	1.3	-	-	2.0	-	-	-	-	1.0	-	1.4
	Passengers Dropped Off	1.1	-	1.0	1.4	-	-	-	-	3.0	4.0	1.6
	Vehicle Occupancy	2.2	1.0	2.0	2.8	-	-	-	-	4.3	5.0	2.5
Outer Curb	Load/Unload Dwell Time (mm:ss)	-	-	-	-	1:09	0:41	4:30	1:38	3:40	1:06	3:05
	Passengers Picked Up	-	-	-	-	1.0	1.0	20.3	-	6.0	1.5	12.1
	Passengers Dropped Off	-	-	-	-	-	4.0	3.8	-	-	7.0	4.3
	Vehicle Occupancy	-	-	-	-	2.0	2.3	13.5	1.0	7.0	5.5	8.9
All	Load/Unload Dwell Time (mm:ss)	1:01	0:17	0:37	0:44	1:09	0:41	4:30	1:38	1:44	1:03	1:33
	Passengers Picked Up	1.3	-	-	2.0	1.0	1.0	20.3	-	3.5	1.5	5.3
	Passengers Dropped Off	1.1	-	1.0	1.4	-	4.0	3.8	-	3.0	5.5	2.1
	Vehicle Occupancy	2.2	1.0	2.0	2.8	2.0	2.3	13.5	1.0	4.8	5.3	4.4

SOURCE: Kimley-Horn and Associates, Inc., 2017.

TABLE 2-37 TERMINAL 3 CURBFRONT VEHICLE OCCUPANCIES AND DWELL TIMES

LOCATION	CHARACTERISTIC	AUTOMOBILE, PICK-UP, SUV	TAXI	LUXURY LIMOUSINE	TNC VEHICLES	AUTOMOBILE, PICK-UP, SUV	OFF-AIRPORT PARKING SHUTTLE	RENTAL CAR CENTER SHUTTLE	AIRPORT CONTRACTED SHUTTLE	PRIVATE TRANSPORT VANS	HOTEL/MOTEL SHUTTLE	ALL VEHICLES
North Curb	Load/Unload Dwell Time (mm:ss)	-	0:19	-	0:51	-	0:32	2:48	0:29	1:20	1:18	1:14
	Passengers Picked Up	-	1.0	-	-	-	1.5	13.0	-	2.0	1.7	3.8
	Passengers Dropped Off	-	-	-	1.0	-	-	4.0	-	-	-	2.5
	Vehicle Occupancy	-	2.0	-	2.0	-	2.0	11.0	1.0	3.0	2.7	4.1
South Inner Curb	Load/Unload Dwell Time (mm:ss)	1:03	-	1:05	0:46	2:53	0:15	-	0:18	0:41	-	1:01
	Passengers Picked Up	1.8	-	1.0	2.0	-	-	-	-	-	-	1.8
	Passengers Dropped Off	1.7	-	1.3	1.6	3.0	1.0	-	1.0	1.0	-	1.6
	Vehicle Occupancy	2.8	-	2.4	2.8	5.0	2.0	-	2.0	2.0	-	2.8
South Outer Curb	Load/Unload Dwell Time (mm:ss)	-	-	-	1:13	-	-	-	-	0:45	-	1:11
	Passengers Picked Up	-	-	-	2.0	-	-	-	-	-	-	2.0
	Passengers Dropped Off	-	-	-	-	-	-	-	-	2.0	-	2.0
	Vehicle Occupancy	-	-	-	2.7	-	-	-	-	3.0	-	2.7
All	Load/Unload Dwell Time (mm:ss)	1:03	0:19	1:05	1:00	2:53	0:28	2:48	0:23	0:55	1:18	1:04
	Passengers Picked Up	1.8	1.0	1.0	2.0	-	1.5	13.0	-	2.0	1.7	2.4
	Passengers Dropped Off	1.7	-	1.3	1.5	3.0	1.0	4.0	1.0	1.5	-	1.6
	Vehicle Occupancy	2.8	2.0	2.4	2.7	5.0	2.0	11.0	1.5	2.7	2.7	3.0

SOURCE: Kimley-Horn and Associates, Inc., 2017.

TABLE 2-38 TERMINAL 4 CURBFRONT VEHICLE OCCUPANCIES AND DWELL TIMES

LOCATION	CHARACTERISTIC	AUTOMOBILE, PICK-UP, SUV	TAXI	LUXURY LIMOUSINE	TNC VEHICLES	AUTOMOBILE, PICK-UP, SUV	OFF-AIRPORT PARKING SHUTTLE	RENTAL CAR CENTER SHUTTLE	AIRPORT CONTRACTED SHUTTLE	PRIVATE TRANSPORT VANS	HOTEL/MOTEL SHUTTLE	ALL VEHICLES
Arrivals North Inner	Load/Unload Dwell Time (mm:ss)	1:02	-	-	-	-	-	-	-	-	-	1:02
	Passengers Picked Up	1.6	-	-	-	-	-	-	-	-	-	1.6
	Passengers Dropped Off	-	-	-	-	-	-	-	-	-	-	-
	Vehicle Occupancy	2.9	-	-	-	-	-	-	-	-	-	2.9
Arrivals North Outer	Load/Unload Dwell Time (mm:ss)	-	1:12	1:00	0:53	2:01	1:08	-	-	5:30	0:35	1:25
	Passengers Picked Up	-	2.5	1.0	1.0	3.0	3.0	-	-	7.0	1.0	2.3
	Passengers Dropped Off	-	-	-	-	-	-	-	-	-	-	-
	Vehicle Occupancy	-	3.5	2.0	2.0	4.0	4.0	-	-	8.0	2.0	3.3
Arrivals South Inner	Load/Unload Dwell Time (mm:ss)	0:39	-	-	-	-	-	-	-	-	-	0:39
	Passengers Picked Up	1.4	-	-	-	-	-	-	-	-	-	1.4
	Passengers Dropped Off	-	-	-	-	-	-	-	-	-	-	-
	Vehicle Occupancy	2.5	-	-	-	-	-	-	-	-	-	2.5
Arrivals South Outer	Load/Unload Dwell Time (mm:ss)	0:31	0:11	-	0:30	-	-	3:15	1:45	-	-	1:13
	Passengers Picked Up	1.0	1.0	-	1.2	-	-	31.0	4.0	-	-	9.4
	Passengers Dropped Off	2.0	-	-	-	-	-	-	-	-	-	2.0
	Vehicle Occupancy	3.0	2.0	-	2.2	-	-	33.9	6.0	-	-	10.8
Departures North	Load/Unload Dwell Time (mm:ss)	0:58	0:20	0:31	0:40	3:54	-	0:53	0:45	-	-	0:55
	Passengers Picked Up	-	-	-	-	-	-	-	-	-	-	-
	Passengers Dropped Off	1.2	1.0	1.0	1.1	13.0	-	16.0	1.0	-	-	2.2
	Vehicle Occupancy	2.3	2.0	2.0	2.1	14.0	-	17.0	2.0	-	-	3.3
Departures South	Load/Unload Dwell Time (mm:ss)	1:04	1:33	1:07	0:32	-	0:42	-	-	0:51	1:06	0:55
	Passengers Picked Up	-	-	-	-	-	-	-	-	-	-	-
	Passengers Dropped Off	1.5	1.0	1.8	1.3	-	3.1	-	-	1.5	5.3	2.2
	Vehicle Occupancy	2.7	2.0	2.8	2.3	-	4.5	-	-	2.5	7.3	3.4
All	Load/Unload Dwell Time (mm:ss)	0:53	0:40	1:00	0:34	2:39	0:46	2:54	1:15	2:24	1:02	0:59
	Passengers Picked Up	1.5	1.6	1.0	1.2	3.0	3.0	31.0	4.0	7.0	1.0	4.5
	Passengers Dropped Off	1.4	1.0	1.6	1.3	13.0	3.1	16.0	1.0	1.5	5.3	2.2
	Vehicle Occupancy	2.6	2.4	2.5	2.2	7.3	4.4	31.5	4.0	4.3	6.7	4.7

SOURCE: Kimley-Horn and Associates, Inc., 2017.

TABLE 2-39 TOTAL AIRPORT CURBFRONT VEHICLE OCCUPANCIES AND DWELL TIMES

LOCATION	CHARACTERISTIC	AUTOMOBILE, PICK-UP, SUV	TAXI	LUXURY LIMOUSINE	TNC VEHICLES	AUTOMOBILE, PICK-UP, SUV	OFF-AIRPORT PARKING SHUTTLE	RENTAL CAR CENTER SHUTTLE	AIRPORT CONTRACTED SHUTTLE	PRIVATE TRANSPORT VANS	HOTEL/MOTEL SHUTTLE	ALL VEHICLES
Terminal 2	Load/Unload Dwell Time (mm:ss)	1:01	0:17	0:37	0:44	1:09	0:41	4:30	1:38	1:44	1:03	1:33
	Passengers Picked Up	1.3	-	-	2.0	1.0	1.0	20.3	-	3.5	1.5	5.3
	Passengers Dropped Off	1.1	-	1.0	1.4	-	4.0	3.8	-	3.0	5.5	2.1
	Vehicle Occupancy	2.2	1.0	2.0	2.8	2.0	2.3	13.5	1.0	4.8	5.3	4.4
Terminal 3	Load/Unload Dwell Time (mm:ss)	1:03	0:19	1:05	1:00	2:53	0:28	2:48	0:23	0:55	1:18	1:04
	Passengers Picked Up	1.8	1.0	1.0	2.0	-	1.5	13.0	-	2.0	1.7	2.4
	Passengers Dropped Off	1.7	-	1.3	1.5	3.0	1.0	4.0	1.0	1.5	-	1.6
	Vehicle Occupancy	2.8	2.0	2.4	2.7	5.0	2.0	11.0	1.5	2.7	2.7	3.0
Terminal 4	Load/Unload Dwell Time (mm:ss)	0:53	0:40	1:00	0:34	2:39	0:46	2:54	1:15	2:24	1:02	0:59
	Passengers Picked Up	1.5	1.6	1.0	1.2	3.0	3.0	31.0	4.0	7.0	1.0	4.5
	Passengers Dropped Off	1.4	1.0	1.6	1.3	13.0	3.1	16.0	1.0	1.5	5.3	2.2
	Vehicle Occupancy	2.6	2.4	2.5	2.2	7.3	4.4	31.5	4.0	4.3	6.7	4.7
All Terminals	Load/Unload Dwell Time (mm:ss)	0:57	0:31	0:57	0:42	2:26	0:41	3:10	1:07	1:56	1:06	1:06
	Passengers Picked Up	1.5	1.4	1.0	1.5	2.5	2.3	24.9	4.0	5.2	1.2	4.2
	Passengers Dropped Off	1.4	1.0	1.4	1.3	10.2	2.8	11.0	1.0	1.8	5.3	2.1
	Vehicle Occupancy	2.6	2.1	2.4	2.4	5.8	3.5	23.5	2.9	4.0	5.5	4.2

SOURCE: Kimley-Horn and Associates, Inc., 2017.

TABLE 2-40 CURBFRONT VEHICLE LANE USAGE SUMMARY

TERMINAL	CURB	LANE		
		LANE 1	LANE 2	LANE 3
T2	Inner Curb	92.0%	8.0%	0.0%
	Outer Curb	100.0%	0.0%	0.0%
	All	94.3%	5.7%	0.0%
T3	North Curb	100.0%	0.0%	0.0%
	South Curb Inner	48.4%	43.8%	7.8%
	South Curb Outer	100.0%	0.0%	0.0%
	All	62.5%	31.8%	5.7%
T4	Arrivals North Inner	90.5%	9.5%	0.0%
	Arrivals North Outer	68.8%	31.3%	0.0%
	Arrivals South Inner	60.5%	39.5%	0.0%
	Arrivals South Outer	100.0%	0.0%	0.0%
	Departures North	71.1%	28.9%	0.0%
	Departures South	43.1%	56.9%	0.0%
	All	68.6%	31.4%	0.0%
All Terminals and Curbs		71.9%	26.8%	1.3%

SOURCE: Kimley-Horn and Associates, Inc., 2017.

2.4.4.4 OTHER CURBSIDE OBSERVATIONS

During the data collection period, any observed queues, periods of congestion, and enforcement issues were documented. Observations included the following:

- As many as 80 people at one time were waiting for rental car shuttles at Terminal 4.
- The TNCs were most active at the Terminal 3 and Terminal 4 outer curbs.
- There were more vehicles curbside on the north side of Terminal 4 than the south side while there were more passengers on the south side of Terminal 4 than the north side, likely due to the large number of passengers on the south curb that were waiting to take a rental car center bus.
- There was significant cut-through traffic during the evening commute times, as evidenced by the spike in traffic volumes and congestion in the pass-by lanes of the outer curbs of Terminal 3 and Terminal 4.
- No citations were issued during observations, but enforcement staff were frequently observed directing drivers to move their unattended or illegally parked vehicles; enforcement staff also were observed during busier times stopping inner roadway through traffic to allow pedestrians to cross or vehicles to merge into the through traffic lanes.
- The temporary closure of the Terminal 3 return roadway due to the Terminal 3 Modernization Program resulted in greater congestion on the roadways between Terminals 3 and 2 due to the need for vehicles on the westbound Terminal 3 curb roadway to utilize the Terminal 2 return roadway.
- The Terminal 3 south inner curb is not used efficiently; almost all traffic stops at the east end of the curb while there were very few traffic stops at the west end of the curb. There is a similar pattern at the other terminals, where private vehicles stop at the first part of the curb they come to, but not to the same degree as that observed at Terminal 3.

2.4.5 PARKING

A comprehensive Parking Master Plan completed in 2012[17] provided an analysis of parking capacity and demand. An addendum to the Parking Master Plan was prepared in 2016[18] to reflect subsequent changes to parking facilities and passenger trends. The changes included (1) the opening of the PHX Sky Train connection to Terminal 3, which allowed for a higher level of service passenger connection to the East Economy Lots; (2) the opening of the 44th Street Employee Parking Lots; and (3) conversion of the West Economy Parking Lot into a Park and Walk facility without bus service.

Since the Addendum to the Parking Master Plan was prepared, there have been other changes to Airport parking. In 2017, the Corporate Office Building on Buckeye Road opened with 235 employee and visitor parking spaces. To accommodate more waiting vehicles, the East Cell Phone Lot was moved from Terminal 4 to a previously unused lot east of the American Airlines maintenance hangars. The new East Cell Phone Lot has 297 spaces.

There is a cell phone lot with approximately 100 parking spaces at the 44th Street PHX Sky Train Station. In 2017, this lot was reallocated to accommodate a mix of public parkers and TNC vehicles. **Exhibit 2-12** shows the location of each parking facility and **Table 2-41** shows the number of public and employee parking spaces at each location.

2.4.6 RENTAL CAR CENTER

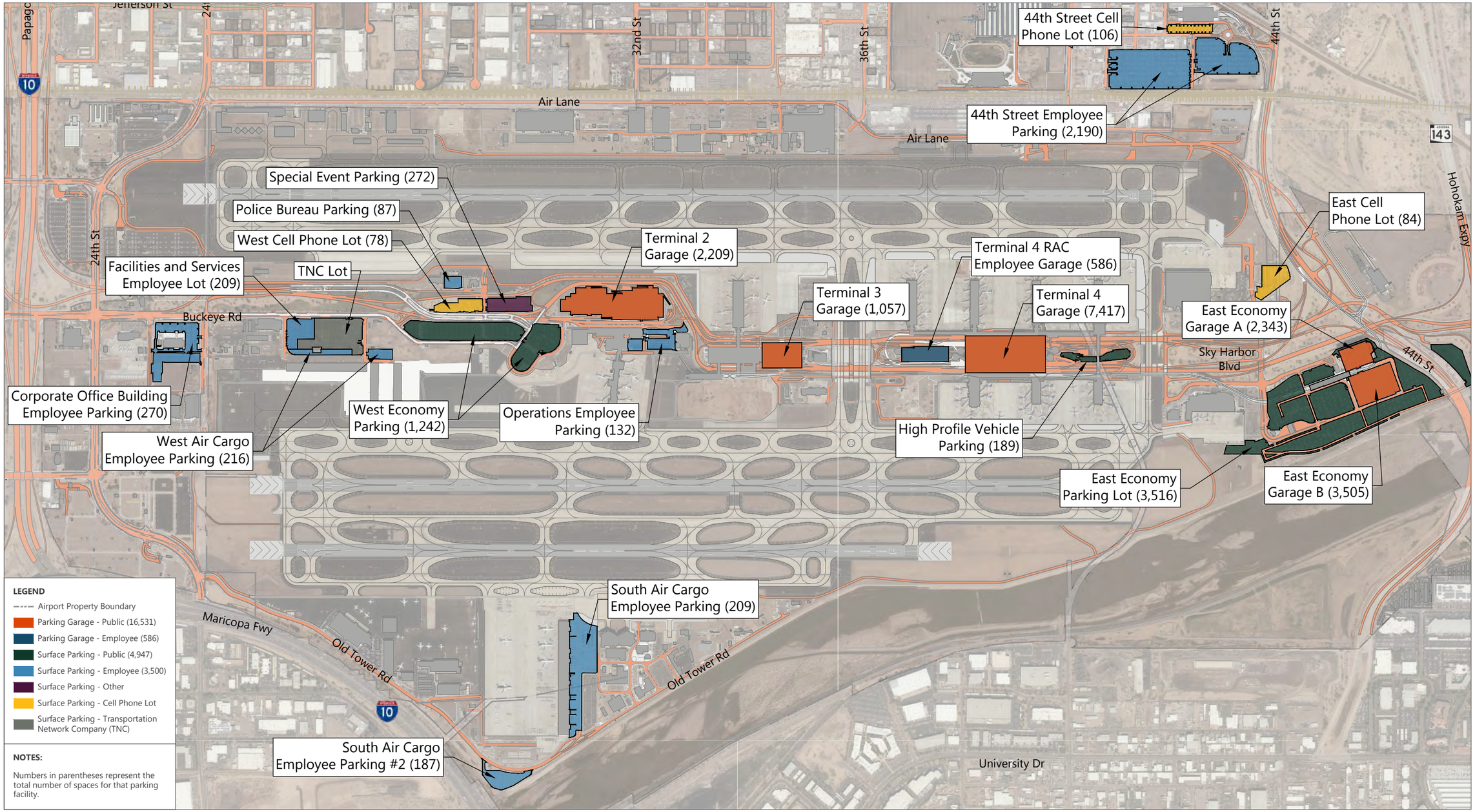
The RCC and associated Quick Turnaround Area (QTA) facilities and vehicle storage areas are shown on **Exhibit 2-13**. The RCC serves the following rental car companies:

- Advantage
- Alamo
- Avis
- Budget
- Dollar
- Enterprise
- E-Z Rent-A-Car
- Fox
- Hertz
- National
- Payless
- Silvercar
- Sixt
- Thrifty

A fleet of buses is used to transport passengers directly between each terminal and the RCC without any additional stops, departing every few minutes. The PHX Sky Train extension (discussed in Section 2.8) will connect to the RCC in 2022, eliminating the need for rental car buses on the Airport roadways, reducing travel times, and improving customer service.

[17] HNTB Corporation, *Parking Master Plan*, August 2012

[18] HNTB Corporation, *Parking Master Plan Update for Phoenix Sky Harbor International Airport,* Addendum 1, April 2016.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); HNTB Corporation, Parking Master Plan Update for Phoenix Sky Harbor International Airport, Addendum 1, April 2016.

EXHIBIT 2-12

On-Airport Parking Facilities

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\02-Existing Conditions (Inventory)\Ex-2-12-Parking Areas.dwg Layout: 2-12 Plotted: Sep 6, 2019, 11:31AM

TABLE 2-41 EXISTING ON-AIRPORT PARKING FACILITIES

FACILITY	SPACES				
	GENERAL (LONG TERM, ADA, MISC.)	SHORT TERM	VALET	EMPLOYEE	TOTAL
Terminal 2	1,977	232			2,209
Terminal 3	1,001	56			1,057
Terminal 4	6,037	259	74	461	6,831
West Economy Lot	1,047			195	1,242
East Economy Lot	3,516				3,516
Garage A	2,343				2,343
Garage B	3,505				3,505
44th Street				2,190	2,190
Terminal 4 RAC				586	586
South Air Cargo				396	396
West Air Cargo				216	216
Facilities Complex				209	209
COB Lot				270	270
Operations Lot				132	132
Police Lot				87	87
Total	**19,426**	**547**	**74**	**4,742**	**24,789**

NOTES: Parking estimates account for lost spaces attributed to construction and shared public/employee spaces. Motorcycle spaces are not included.
SOURCES: HNTB Corporation, Parking Master Plan Update for Phoenix Sky Harbor International Airport, Addendum 1, April 2016. Kimley-Horn and Associates, Inc., February 2018.

2.5 ENVIRONMENTAL BASELINE

The environmental baseline was prepared to evaluate the existing conditions of the Airport property and surrounding community with the purpose of determining what, if any, environmental factors should be considered during the planning process. By considering environmental factors in the planning process, the City can better evaluate Airport development alternatives, minimize potential impacts, and provide information that will help expedite subsequent environmental processing.

The environmental baseline focused on the specific environmental resources and impact categories reviewed under the National Environmental Policy Act (NEPA) and outlined under FAA Order 1050.1F – *Environmental Impacts: Policies and Procedures.*[19] Due to the location of the Airport and the surrounding environment, not all resources that are required to be reviewed under NEPA have the potential to be affected by proposed Airport development. However, known environmental constraints pertaining to potential Airport development are summarized in the following sections.

[19] U.S. Department of Transportation, Federal Aviation Administration, Order 1050.1F, *Environmental Impacts: Policies and Procedures*, July 16, 2015.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary).

NORTH 0 600 ft.

EXHIBIT 2-13

Rental Car Center Area

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\02-Existing Conditions (Inventory)\Ex-2-13-Rental Car Facilities.dwgLayout: 2-13 Plotted: Sep 4, 2019, 04:41PM

The following resource categories were identified as representing potential constraints to development at PHX:

- Air quality
- Archaeological resources
- U.S. Department of Transportation (DOT) Section 4(f) lands
- Hazardous materials
- Water resources

The locations of known environmental constraints are depicted on **Exhibit 2-14**, which focuses on the environmental resources that are located on or directly adjacent to Airport property. These features are discussed in the following paragraphs.

2.5.1 AIR QUALITY

The Clean Air Act (CAA) requires the USEPA to establish National Ambient Air Quality Standards (NAAQS) for air pollutants that are considered harmful to the health of the public and the environment. Primary standards provide protection for public health and secondary standards provide protection for public welfare (e.g., damage to buildings, vegetation, and visibility). There are currently NAAQS for six air pollutants that are referred to as the "criteria" air pollutants. The pollutants are:

- Ozone (O3)
- Nitrogen dioxide (NO2)
- Carbon monoxide (CO)
- Particulate Matter (PM) – Less than or equal to 10 micrometers (coarse particulate matter or PM10) and less than or equal to 2.5 micrometers (fine particulate matter or PM2.5)
- Sulfur dioxide (SO_2)
- Lead (Pb)

In accordance with the CAA, all areas within the U.S. are designated, with respect to the NAAQS, as attainment, nonattainment, maintenance, or unclassifiable. An area with air quality better than the NAAQS is designated attainment; an area with historical air quality conditions worse than the NAAQS is designated nonattainment. Maintenance areas are nonattainment areas that have been re-designated to attainment status. Maricopa County, Arizona, has been designated by the USEPA as a nonattainment area for ozone (2008 8-hour standard) and PM_{10} (1987), and maintenance for CO.

The conformity provisions of the CAA require that before a federal agency can approve a federal action, the agency must first show that actions occurring in a nonattainment or maintenance area conform to the applicable SIP. A SIP is the state's plan for how it will attain and maintain the NAAQS. Federal approvals associated with proposed development would require an air quality evaluation to show if emissions are sufficient to warrant a Conformity Determination and the emissions conform to the SIP in place at the time of the approval.



SOURCES: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., March 2019 (CAMP Preferred Concept); US Environmental Protection Agency, March 2018 (hazardous material sites and groundwater contamination sites); US Department of the Interior, National Park Service, March 2018 (historical, archaeological, architectural and cultural resources sites); Federal Emergency Management Agency, March 2018 (floodplains); Maricopa County, March 2018 (historic, archaeological, architectural and cultural resources sites); AZGEO Clearinghouse, Arizona Land Resource Services (roads and schools).

NORTH

0 1,200 ft.

EXHIBIT 2-14

Environmental Overview

2.5.2 ARCHAEOLOGICAL RESOURCES

Locally, through Section 802(A) of the City of Phoenix's Historic Preservation Ordinance, the City encourages the identification of prehistoric and historic resources, assists with the preservation of these resources, where applicable, and recognizes that archaeological resources found on public land are the property of all citizens. The City has been designated by the State Historic Preservation Officer (SHPO) as a Certified Local Government, which requires the City to maintain a historic preservation commission, enforce state and local preservation laws, provide for public participation in its activities, and enact the City's history preservation ordinance.

The presence of archaeological sites has been indicated on Airport property. Previously prepared archaeological evaluations have concluded that since the majority of the property has been disturbed during previous construction activities, archaeological resources have likely been removed. The Pueblo Grande Ruin National Register District in the northeast area of the Airport has been identified as having some potential for archaeological resources to be present, requiring an archaeological evaluation by the City Archaeologist as part of the environmental review process. If any archaeological resources are identified during construction, ground-disturbing activities must cease within 10 meters of the discovery and the City of Phoenix Archaeology Office must be notified immediately and allowed time to assess the discovery.

2.5.3 DEPARTMENT OF TRANSPORTATION SECTION 4(F) LANDS

Section 4(f) of the U.S. DOT Act of 1966 protects certain significant resources such as publicly owned parks, recreational areas, wildlife, and waterfowl refuges of national, state, or local significance, and public and private historic sites of national, state, or local significance. Paragraph B-2 of FAA Order 1050.1F states:

> Section 4(f) [of the DOT Act of 1966] provides that the Secretary of Transportation may approve a transportation program or project that requires the use of any publicly owned land from a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance, or land from any publicly or privately owned historic site of national, state, or local significance, only if there is no feasible and prudent alternative to the use of such land and the program or project includes all possible planning to minimize harm resulting from the use.

Consideration of Section 4(f) resources with regards to potential airport development focused on those eligible for listing or on the NRHP. Based on a review of previously prepared documentation and a search of the National Park Service website, two Section 4(f) resources were identified. *The Phoenix*, a three-panel mural by Paul Coze, located in the Terminal 2 passenger processor building. The mural is an art object that has been considered eligible for the NRHP. In addition to the identified on-Airport Section 4(f) resources, there are a number of community parks within proximity (less than two miles) to the Airport property.

Impacts to historic properties should be avoided where possible. When not possible, Section 4(f) regulations demand "all possible planning to minimize harm." If no alternative avoids a use (greater than *de minimis*), then a least overall harm analysis must be completed. Both historic and non-historic Section 4(f) resources can be found on and adjacent to the Airport property. In addition to avoiding direct impacts to these resources, proximity impacts, such as noise, vibration, and visual impacts should be considered when evaluating future proposed projects.

2.5.4 OFF-AIRPORT LAND USE

Compatible land uses near the Airport generally include industrial and/or commercial land use, while incompatible land uses generally include residential areas, areas likely to pose wildlife hazards, and public facilities such as schools, hospitals, and places of worship. **Exhibit 2-15** illustrates the land uses surrounding the Airport.

2.5.5 HAZARDOUS MATERIALS

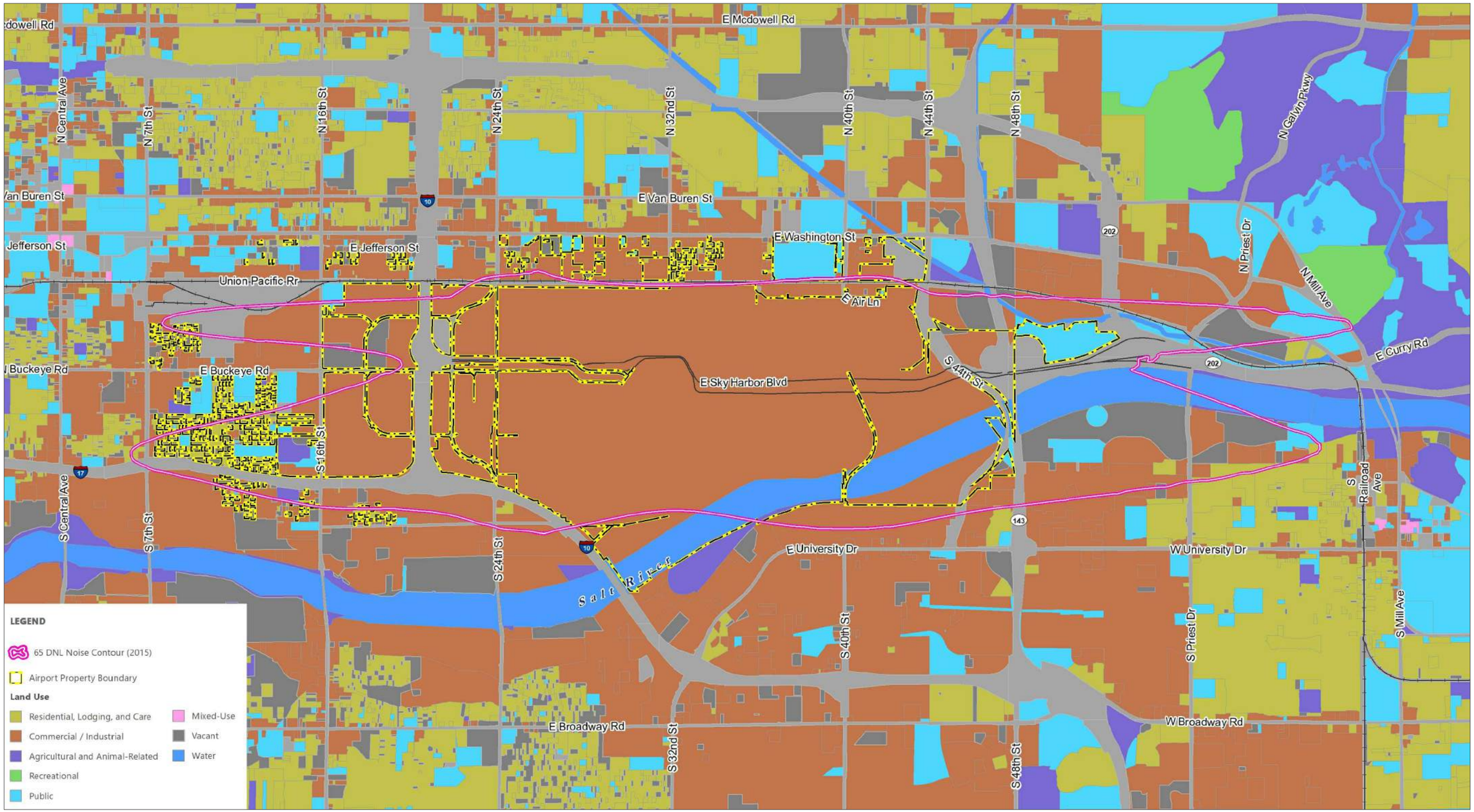
While there are numerous statutes, regulations, Executive Orders, and other requirements related to Hazardous Materials, Solid Waste, and Pollution Prevention, FAA Order 1050.1F identifies the Resource Conservation and Recovery Act (RCRA) (40 CFR 239–282) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 United States Code [USC] 103) as the statutes of greatest importance when proposing actions to construct and operate facilities.

CERCLA provides for consultation with natural resource trustees and cleanup of any release of a hazardous substance (excluding petroleum) into the environment. The act enabled the creation of the National Priority List (NPL), a list of sites with known releases or threatened releases of hazardous substances used to guide the USEPA in determining which sites warrant further investigation.

The RCRA governs the generation, treatment, storage, and disposal of hazardous wastes and establishes guidelines for hazardous waste and non-hazardous solid waste management activities.

Hazardous materials are commonly stored and used by a variety of businesses and are commonly encountered during construction activities. Hazardous materials typically require special handling, reuse, and disposal because of their potential to harm human health and the environment. A variety of regulatory agency sources are available to identify sites that may have been subject to a release of hazardous substances or that may have supported a use that could have resulted in hazardous conditions on site.

FAA Order 1050.1F defines the significance threshold for hazardous materials as a proposed action that involves property on or eligible for the NPL. A review of USEPA published information indicated that the Motorola 52nd Street Superfund site is listed on the NPL. The plume boundary of the site varies and extends onto the northern portion of the Airport property as shown on Exhibit 2-14. A series of monitoring wells associated with the plume are also located on Airport property. A second site, located on the AZANG leasehold, was also previously identified as a Superfund site. However, in 2014 the Arizona Department of Environmental Quality (ADEQ) determined that no further remedial action was necessary to address residual contamination and the site is no longer included on the NPL. A third site, the Estes Landfill Site, is located off Airport property but is also no longer listed on the NPL. Although, neither of those sites are currently listed on the NPL, additional analysis and permitting requirements may be necessary if development is proposed near the sites.



SOURCES: Roads, Parks, Schools, Municipal Boundaries: AZGEO Clearninghouse, Arizona Land Resource Services, Central Arizona Project, https://azgeo.az.gov/azgeo/; Noise contours: City of Phoenix, 2015; Service Layer Credits: (Land use Classification) Maricopa Association of Government (MAG) and the MAG member agencies https://www.maricopa.gov/3942/GIS-Mapping-Applications.

EXHIBIT 2-15

Off-Airport Land Use

USEPA records indicate that 13 RCRA waste generator identification numbers are associated with facilities on and near the Airport. The detailed facility report indicates that there were no violations at any of the facilities during the three-year period ending in March 2016. USEPA records also indicate the presence of 14 fuel storage tanks on Airport property.

Hazardous materials can differ from site to site and are most likely to be encountered during ground-disturbing activities. The most fundamental management for hazardous materials is to avoid contaminated sites, which often is not feasible. A hazardous materials assessment, such as a Phase 1 Environmental Site Assessment, typically would be needed as part of future project development if identified within proximity to noted sites. Where the potential for encountering contamination is suspected, avoidance or identification of mitigation measures can be implemented within reason, when possible.

2.5.6 WATER RESOURCES

The Airport property has been heavily modified by development and is nearly fully paved. The Airport lies within the watershed of the ephemeral lower Salt River, which flows along the south side of the property line.

Although no jurisdictional waters of the U.S. or wetlands are located within Airport property, any development on the south side of the Airport should account for potential impacts to the Salt River. A CAA Section 404 (Section 404) permit would be required for any development that results in fills to waters of the U.S. that are considered wetlands. Under Section 404, no discharge of dredged or fill material can be permitted if a practicable alternative exists that avoids or minimizes wetland impacts. Therefore, when an airport sponsor applies for a permit, the sponsor must demonstrate (1) steps taken to avoid wetland impacts where practicable, (2) steps taken to minimize potential impacts to wetlands, and (3) compensation for any remaining, unavoidable impacts through activities to restore or create wetlands.

Groundwater monitoring wells are located across the Airport property. The City maintains data on the extent of groundwater contamination associated with three CERCLA sites located on Airport property.

The City has historically tracked four fuel plumes located on the Airport property. The mapped extents of the plumes and associated groundwater monitoring wells are shown on Exhibit 2-14. The groundwater monitoring wells are located primarily within the northern half of the Airport property. Three of the four fuel plumes have now received regulatory closure. However, construction activities that may affect the existing monitoring wells require either protection of the well from construction activities or abandoning of the well under an Arizona Department of Water Resources permit. Since some of the wells are tenant owned, coordination would be required with the tenant and regulatory agencies if they are potentially impacted by proposed development.

2.5.7 OTHER RESOURCES

If proposed Airport development induces a change or increase in aircraft activity or alters the use of the runway system, aircraft noise exposure contours would be needed to identify off-Airport noise and land use effects.

A review of published Federal Emergency Management Association (FEMA) floodplain mapping indicates that the Salt River, which runs south of the Airport property, is designated as a regulatory floodway and

within the 100-year floodplain. Proposed projects that could have the potential to impact the Salt River would require coordination with FEMA and the City of Phoenix Floodplain Management.

2.6 PLANNED AIRPORT DEVELOPMENT AND OTHER STUDIES

Several studies and development projects were completed or underway at the time of this inventory in late 2017. The studies and planned airport facilities are discussed in the following subsections.

2.6.1 PREVIOUS AND ONGOING STUDIES

Several previous studies have been completed and others were ongoing at the Airport as of December 2017. These studies were considered as part of the CAMP process and include:

- West Crossover Taxiways Project Definition Document (2017) – The 2010 Airport Development Program (ADP) Phase III recommended north-south (crossover) taxiways at the west end of the Airport (Taxiways U and V).[20] The West Crossover Taxiways Project Definition Document validates the ADP and contains sufficient project definition beyond the ADP planning efforts, including recommended alignments to accommodate the future PHX Sky Train Stage 2 alignment and potential Sky Harbor Boulevard widening, structures, utilities, and NAVAIDs that may be affected by the taxiways.
- Runway Incursion Mitigation (RIM) Study (Ongoing) – Reviews existing airfield pavement geometry at the Airport as it relates to current FAA design standards.[21] The goal is to mitigate airfield "hot spots" involving previous aircraft incursions.
- AGIS Survey and Airspace Analysis (Ongoing) – Update to the PHX Airport Geographic Information System (AGIS) data and Airport Airspace analysis.
- Airbus A380/Boeing 747-700 Operational Plan (2017) – Developed aircraft ground movement strategies to allow the Airport to accommodate ADG VI (Airbus A380/Boeing 747-800) aircraft.[22]
- Phoenix Regional Air Cargo Planning Study (2014) – Identifies opportunities for air cargo growth within Phoenix metropolitan area airports and to assess development activities the airports should consider to accommodate that growth.[23]
- S1 Project Definition Report (2017) – A Project Definition report to form the basis for design and construction of the S1 Concourse Development Program (S1).[24] The planning study includes optimal organization of the S1 apron/terminal and its relationship to Terminal 4 and Airport; sufficiently detailed and aeronautically driven pathway of airfield and terminal development to meet 2034 planning horizons; a plan for the development that meets Airport planning principals and considers stakeholder interest and aspirations; and a pathway for the project to proceed to meet future demand at an affordable level.

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[20] RS&H Inc. *Phoenix Sky Harbor International Airport West Crossover Taxiways Project Definition Document*, October 2017.

[21] HNTB Corporation, *RIM Study – DRAFT Working Document*, December 2017

[22] Phoenix Sky Harbor International Airport A380/747-8 Operational Plans Project Kick-Off Meeting, July 10, 2017

[23] InterVISTAS Consulting Group, *Phoenix Regional Air Cargo Planning Study*, January 2014

[24] Airbiz Aviation Strategies Pty Ltd., *Phoenix Sky Harbor International Airport Project Definition Report FINAL*, November 14th, 2017

- Land Reuse Strategy Planning Area (2017) – The Airport acquired 782 noise impacted land parcels through the Voluntary Acquisition and Relocation Services (VARS) program.[25] In accordance with FAA requirements, a plan to reuse and redevelop 743 of these parcels has been developed. The PHX AVN submitted the PHX Land Reuse Strategy and community preferred framework for redevelopment to the FAA in January 2018.
- Sustainability Study (Ongoing) – Update to the Sustainability Management Plan from 2015. Study builds on the progress, validates objectives, aligns the Aviation Department's strategy with the aviation industry and City of Phoenix's 2050 goals, and incorporates new technology and innovation.
- Vehicle Traffic Model Update (Ongoing) – Update to the existing Sky Harbor Boulevard vehicle traffic model.
- Cut-through Traffic Review (Ongoing) – Study to examine strategies intended to discourage cut-through traffic on Sky Harbor Boulevard.
- I-10 West Sky Harbor Access Value Planning Study (2017) – A series of charrettes with several different Airport access concepts designed to improve vehicle operations in and out of the Airport.[26]
- Interstate 10/Interstate 17 Corridor Master Plan (2014) – Recommends improvements to Airport access from I-10, including reconfiguring the I-10/SR-143 interchange to improve safety and efficiency and adding a dedicated high occupancy vehicle (HOV) ramp from SR-143 to I-10.[27]
- PHX Sky Train Stage 2 West Terminal Study (2017) – Evaluation of impacts to the future terminal development within the planned PHX Sky Train Stage 2 alignment.[28]
- PHX Sky Train Stage 2 Program Update (2014) – Update to previous Stage 2 alignment studies based on current conditions and development plans; develop basic station concepts; assess alternative concepts; and update the program cost estimate.[29]
- Mini-CAMP – Phase 1 (2017) – A near-term review of facilities to be relocated as part of PHX Sky Train Stage 2 extension to the rental car center).[30]
- Mini-Camp Part 2 (Mid-point review) (2017) – A near-term review of potential aircraft hardstand and gate relocation alternatives from impacts by PHX Sky Train Stage 2 and closure of Terminal 2.[31]
- West Ground Transportation Center (GTC) Public-private partnership (P3) Program (Ongoing) – PHX AVN has issued a formal Request for Information (RFI) from firms experienced in large scale commercial

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[25] C&S Engineers, Inc., *PHX Land Reuse Strategy Final Report*, March 2017

[26] HDR Engineering, Inc., *I-10 West Sky Harbor Access Value Planning Study FINAL Report*, February 2017

[27] Maricopa Association of Governments, Arizona Department of Transportation, U.S. Department of Transportation Federal Highway Administration, *Interstate 10/Interstate 17 Corridor Master Plan (FY 2014), Alternatives Screening Technical Report*, September 2017.

[28] HOK Group, Inc., *Phoenix Sky Harbor International Airport PHX Sky Train Stage 2, West Terminal Station Study Design Report*, August 3, 2017

[29] Gannett Fleming, Inc., *PHX Sky Train Stage 2 Program Update*, September 2014

[30] HNTB Corporation, *Phoenix Sky Harbor International Airport Mini-CAMP Summary*, August 2017

[31] HNTB Corporation, *Phoenix Sky Harbor International Airport Mini-CAMP Phase 2 Mid-Point Review*, August 2017

development with interest in a future West GTC that includes an agreement to design, build, finance, operate, and maintain a hotel, commercial office building, a parking garage(s), and any other mix of commercially viable development.[32]

2.6.2 PLANNED AIRPORT FACILITIES

At the time of this inventory, PHX AVN was in the design and construction phase of several significant development projects. Construction was continuing on the Terminal 3 Modernization Program, while the Terminal 4 S1 Concourse and PHX Sky Train Stage 2 were in the design phase. This section briefly summarizes the progress of these projects as of December 2017, as well as the coordinated pre-planning logistical effort included as part of the design stage for the PHX Sky Train Stage 2 extension project. **Exhibit 2-16** illustrates the planned future facilities discussed below.

2.6.2.1 PASSENGER TERMINAL IMPROVEMENTS

Future development of the terminal facilities at PHX includes completion of the Terminal 3 Modernization Program (ultimately resulting in a new south concourse and the eventual demolition of Terminal 2). The addition of a new eight-gate concourse in the southwest corner of Terminal 4 (Concourse S1) is in the design phase.[33]

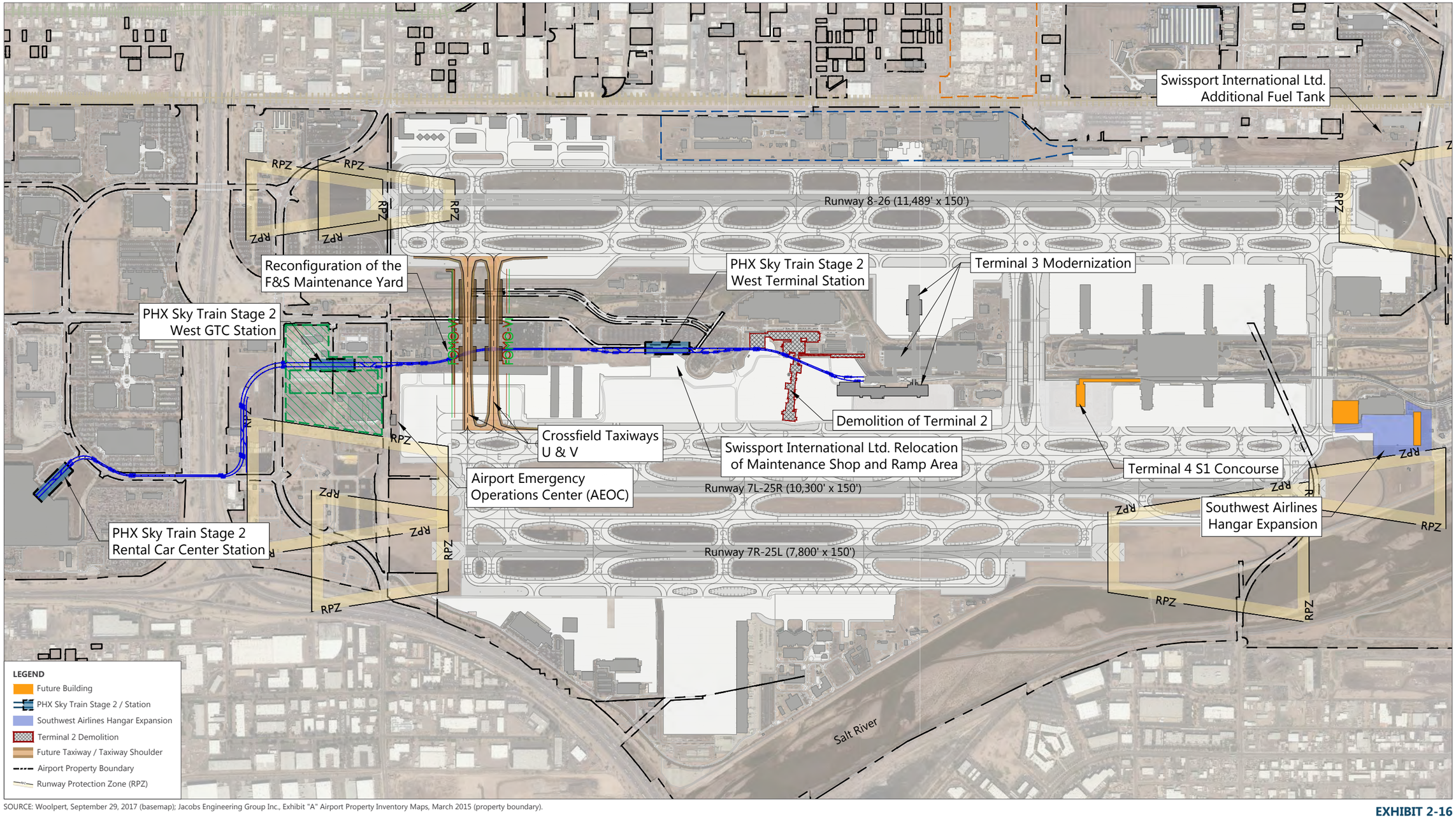
2.6.2.2 PHX SKY TRAIN STAGE 2

PHX Sky Train Stage 2 will extend the guideway from Terminal 3 west to the RCC, replacing the buses that transport rental car patrons between the passenger terminals and the RCC. This will reduce congestion on the Airport roadways as well as provide reduced travel times and a higher level of customer service for rental car patrons.

PHX AVN commissioned a study, referred to as the Mini-Comprehensive Asset Management Plan (Mini-CAMP) to identify facilities that would need to be relocated and where to enable construction of PHX Sky Train Stage 2. The study process included meetings with PHX AVN divisions to provide input and obtain feedback and ideas on potential locations for the facilities needing relocation.

[32] City of Phoenix Aviation Department, *Request for Information West Ground Transportation Center Development Opportunity at Phoenix Sky Harbor International Airport AVN RFI 17-024*, May 2017.

[33] City of Phoenix Aviation Department, *Airport Development,* 2015; https://www.skyharbor.com/About/Development.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary).

NORTH 0 1,200 ft.

EXHIBIT 2-16

Ongoing and Planned Projects

Key facilities that will be affected by the project were identified and prioritized. These key facilities include:

- Ground transportation staging area
- Parking office (new site not needed)
- Abandoned vehicle lot
- FedEx lease hold west of 24th Street
- Bus maintenance storage facility
- Clean Energy Compressed Natural Gas (CNG) Station
- Tow lot
- West Economy parking
- Terminal 2 Gate 1
- LSG Sky Chefs

Several additional, but lesser priority facilities that could be affected were also identified. These facilities include the CNG station, the Facility and Services Fuel Island, Facility and Services trash bunker, and the special event/Arizona Cardinals parking area.[34] A number of parking related changes are required as part of the extension, including the relocation of the Ground Transportation (GT) staging and rest facility to West Tonto Street, the addition/relocation of a visitor lot at the RCC, and reconfiguration of the Facility and Services parking lots at Buckeye Road and 25th Street.

The FAA issued a Finding of No Significant Impact for the PHX Sky Train Stage 2 Environmental Assessment in February 2018. Construction is anticipated to commence in Spring 2018.

2.6.2.3 AIRPORT EMERGENCY OPERATIONS CENTER

The existing Sky Harbor Communications Center has been identified as being deficient in size, layout, location, and function. The new Airport Emergency Operations Center (AEOC) (under construction as of December 2017) will be a multi-purpose facility and include an Operations Center, Combined Maintenance and Technology Work Order Center, and an Emergency Operations Center.[35] The building will be one story, approximately 12,000 square feet, and is anticipated to open in the second quarter of 2018. This facility is shown on Exhibit 2-16.

2.6.2.4 OTHER FACILITIES

Additional ongoing planning projects shown on Exhibit 2-16 include:

- The relocation of the existing Swissport International Ltd. maintenance shop and ramp area due to PHX Sky Train Stage 2.

[34] HNTB Corporation, *Draft Phoenix Sky Harbor International Airport Mini-CAMP Summary*, (2017).

[35] City of Phoenix Request for Council Action form A.R. 4.11 AV17000048: Phoenix Sky Harbor International Airport New Command Center – CMAR Construction Services.

- An additional jet fuel tank to be operated by Swissport International Ltd.
- The reconfiguration of the Facility and Services maintenance yard and parking areas due to PHX Sky Train Stage 2.
- The expansion of the Southwest Airlines maintenance hangar and GSE maintenance services, which is scheduled for completion in 2019.

A summary of the other planned development is provided in **Table 2-42**.

TABLE 2-42 OTHER PLANNED DEVELOPMENT PROJECTS

BUILDING NAME/DESCRIPTION	AIRFIELD LOCATION	ESTIMATED SITE AREA (SQ FT)
Southwest Airlines Hangar Expansion	East	10,000
PHX AVN Facilities and Services Complex	West	N/A
Swissport International Ltd. maintenance shop	West	N/A
Swissport International Ltd. fuel tank	Northeast	N/A

SOURCE: City of Phoenix Aviation Department, December 2017.

3. ACTIVITY FORECASTS

This section presents an analysis of historical aviation activity at PHX and summarizes forecasts of future activity at the Airport through 2037.[1] The forecasts are unconstrained, meaning that increases in future activity would not be hindered by availability of facilities such as aircraft gates or airfield capacity. Activity forecasts are provided for enplaned passengers, aircraft operations, and cargo volume activity. The forecasts provide the basis for determining facility requirements and for conducting environmental, financial, and other analyses for the CAMP.

The forecasts were prepared during the months of September through November 2017 using calendar year 2016 as the base year, the latest year for which complete passenger, operations, and cargo volume data were available. While 2016 serves as the base year, the forecast incorporates partial actual 2017 activity to more accurately represent the current state of the Airport. Published airline schedules for December 2017 provide the basis for discussions regarding the airlines serving the Airport, destinations served from the Airport, and average aircraft seat capacity. Published schedule data through December 2018 were used to validate assumptions and inform the development of future activity forecasts. While full year 2017 enplaned passenger data were not available at the time the forecast was developed, certain historical information was updated in February 2018 to reflect 2017 activity where available.[2] Many of the tables in this document contain both historical and forecast information for 2017

The enplaned passenger forecasts were based on both socioeconomic regression analysis and modeling of airline network characteristics. Socioeconomic regression analysis was used to identify causal relationships between local and national demographic and economic factors and passengers beginning or ending their journey at the Airport (Origin & Destination [O&D] passengers). The evaluation of these relationships was used in conjunction with independent projections of population and economic activity to develop forecasts of future O&D passengers. The modeling of airline network characteristics was used to evaluate connecting passenger characteristics and how airlines use the Airport to connect passengers traveling between other cities. Trends in the Airport's share of connecting passenger volumes as well as the proportion of connecting passengers relative to O&D passengers were used to develop the forecast of connecting passenger activity.

Forecasts of passenger airline aircraft operations were developed based on historical and forecast relationships between enplaned passengers, load factors, and average aircraft seat capacities based on the aircraft types currently operating and expected to operate at the Airport. GA and air taxi operations were forecast using anticipated national average growth rates for each sector. Military operations were forecast to remain constant at 2016 levels of activity.

A market share analysis approach was taken to forecast cargo activity, with cargo operations derived using expected changes in average payload and an analysis of future fleet mix for all-cargo carriers.

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[1] Unless otherwise noted, all years are represented as calendar years.

[2] Full year 2017 passenger airline aircraft operations and origin and destination data were unavailable at the time of this report due to the latency of U.S. Department of Transportation data reporting periods.

In addition to the forecast of activity (the baseline forecast), additional scenarios were developed to estimate possible variations in activity associated with factors that could affect aviation activity such as changes in local or national economic conditions and changes in airline service patterns. The baseline and scenario forecasts developed for the Airport represent a range of potential future activity. Actual activity may vary due to unforeseen events or changes in airline service at the Airport.

3.1 HISTORICAL AVIATION ACTIVITY

The Airport is classified by the FAA as a large hub airport, accounting for greater than 1.0 percent of the total enplaned passengers in the U.S. Approximately 22.0 million total passengers were enplaned and 430,968 aircraft operations were conducted at the Airport in 2017. According to Airports Council International (ACI) North America, in 2016 the Airport ranked 12th in the nation in terms of passengers, 11th in terms of aircraft movements, and 20th in terms of cargo weight handled. **Table 3-1** presents a summary of enplaned passengers and aircraft operations since 2007. Significant changes in passenger activity are discussed below.

TABLE 3-1 HISTORICAL ENPLANED PASSENGERS AND AIRCRAFT OPERATIONS BY YEAR

YEAR	ENPLANED PASSENGERS	PASSENGER YEAR OVER YEAR PERCENTAGE CHANGE	AIRCRAFT OPERATIONS	OPERATIONS YEAR OVER YEAR PERCENTAGE CHANGE
2007	20,943,933		539,211	
2008	19,816,196	-5.4%	502,499	-6.8%
2009	18,853,719	-4.9%	457,207	-9.0%
2010	19,225,050	2.0%	459,300	0.5%
2011	20,213,897	5.1%	461,989	0.6%
2012	20,181,774	-0.2%	450,204	-2.6%
2013	20,166,971	-0.1%	436,184	-3.1%
2014	21,012,920	4.2%	430,461	-1.3%
2015	22,001,885	4.7%	440,411	2.3%
2016	21,673,418	-1.5%	440,643	0.1%
2017	22,016,714	1.6%	430,968	-2.2%
Compound Annual Growth Rate				
2007 to 2010	-2.8%		-5.2%	
2010 to 2013	1.6%		-1.7%	
2013 to 2017	2.2%		-0.3%	2013 to 2017
2007 to 2017	0.5%		-2.2%	2007 to 2017

SOURCES: City of Phoenix Aviation Department, December 2017.

In 2008, enplaned passenger volume decreased 5.4 percent compared with 2007 to 19.8 million as airlines began to reduce capacity and experience weaker load factors at the onset of the Great Recession. Between 2007 and 2008 US Airways and Southwest Airlines, the two largest carriers at the Airport at that time, reduced departing seat capacity and experienced a decrease in enplaned passengers. Nearly all other airlines shed departing seat capacity and enplaned passengers during this period. One exception was WestJet, which extended its seasonal service to Canada. ATA Airlines ceased operations in April 2008, which also contributed to the decrease in passenger volumes that year. Enplaned passenger volume continued to decrease in 2009 as economic recession depressed demand for air travel.

Passenger enplanement volumes began to recover in 2010 and 2011 as US Airways and Southwest Airlines restored some capacity that was cut in the two years prior. Enplaned passengers for both airlines increased at a faster rate than departing seats resulting in higher load factors. Enplaned passengers on Delta Air Lines also increased with the addition of nonstop service to Los Angeles International Airport (LAX) in 2011, while WestJet added seasonal service to Vancouver, Edmonton, and Winnipeg in the same year. The gains were partially offset by capacity reductions from United and Frontier Airlines, the latter of which merged with Midwest Airlines in 2011.

Enplaned passenger volume was virtually unchanged from 2011 levels in 2012 and 2013. US Airways increased capacity through a combination of more departures and higher average number of seats per departure. The increase was partially offset by Southwest Airlines, which reduced departing seats as it restructured its network while integrating with AirTran Airways. United Airlines also continued to reduce capacity as it completed its merger with Continental Airlines. In October 2013, Spirit Airlines initiated service at the Airport with nonstop routes to Denver International Airport (DEN), Dallas Fort Worth International Airport (DFW), Minneapolis-Saint Paul International Airport (MSP), and Chicago's O'Hare International Airport (ORD). Volaris also initiated service at the Airport in 2013 with nonstop routes to Don Miguel Hidalgo y Costilla International Airport (GDL) in Guadalajara, Mexico and Mexico City International Airport (MEX) in Mexico City, Mexico.

Enplaned passenger volume increased 4.2 percent in 2014 and another 4.7 percent in 2015. US Airways and American Airlines closed their merger in late 2013 and integrated their networks over the course of 2014 and 2015. The consolidated airline increased service from the Airport to legacy American Airline hubs at John F. Kennedy International Airport (JFK), Miami International Airport (MIA), DFW, and ORD. American Airlines' capacity growth at the Airport during this period was driven by an increase in the average number of seats per departure while the number of departures decreased. Southwest Airlines' enplaned passengers increased in 2014 on flat capacity growth due to higher load factors. In late 2014 the repeal of the Wright Amendment enabled Southwest Airlines to launch nonstop service from the Airport to Dallas Love Field (DAL), which represented the largest component of Southwest Airlines growth at the Airport in 2015. In 2014, Aeromexico suspended service to Mexico's Hermosillo International Airport (HMO), the only destination it served from the Airport.

In 2016, enplaned passengers decreased 1.5 percent to 21.7 million due in large part to American Airlines reducing departing seat capacity as its realigned capacity across its hubs. During this period American Airlines shifted capacity from PHX and Philadelphia International Airport (PHL) to its hubs at LAX, Charlotte Douglas International Airport (CLT), and ORD. These capacity reductions were partially offset by Southwest Airlines, which increased service to DAL, DEN, and initiated nonstop service to Dwight D. Eisenhower

National Airport (ICT) in Wichita, Kansas. Additionally, United Airlines increased capacity from the Airport to its hubs at San Francisco International Airport (SFO), LAX, DEN, and ORD and Frontier Airlines initiated nonstop service to seven new destinations, including Atlanta Hartsfield Jackson International Airport (ATL), Detroit Metropolitan Wayne County International Airport (DTW), Portland International Airport (PDX), and Seattle-Tacoma International Airport (SEA).

In 2017 enplaned passengers increased 1.6 percent to 22.0 million with Southwest representing the largest component of growth. Although Southwest Airlines did not add any new destinations in 2017, enplaned passenger increased on marginally higher departing seat capacity and higher load factors. Frontier Airlines also contributed to increases in passengers in 2017, launching new service to Orlando International Airport (MCO), Austin-Bergstrom International Airport (AUS), and San Antonio International Airport (SAT).

3.1.1 AIRLINE SERVICE

As of December 2017, 23 airlines provided scheduled passenger service from the Airport, of which 10 are mainline U.S. airlines, 5 are regional U.S. airlines, and 4 are foreign flag airlines. A total of 4 all cargo airlines serve the Airport. **Table 3-2** presents the airlines serving the Airport in December 2017.

TABLE 3-2 AIRLINES SERVING THE AIRPORT

MAINLINE U.S. AIRLINES	REGIONAL U.S. AIRLINES	FOREIGN FLAG AIRLINES	ALL-CARGO CARRIERS
American Airlines	Boutique Air	Air Canada [4]	Amazon Air
Alaska Airlines	Compass Airlines [1]	British Airways	DHL
Delta Air Lines	Great Lakes	Volaris	FedEx
Frontier Airlines	Mesa Airlines [2]	WestJet	UPS
Hawaiian Airlines	SkyWest [3]		
JetBlue Airways			
Southwest Airlines			
Spirit Airlines			
Sun Country			
United Airlines			

NOTES:
1 Compass Airlines operates as a regional carrier for Delta Air Lines.
2 Mesa Airlines operates as a regional carrier for American Airlines.
3 SkyWest operates as a regional carrier for American Airlines, Delta Air Lines, and United Airlines.
4 Air Canada includes Air Canada's subsidiary Air Canada Rouge and Air Canada's regional airline Jazz.
SOURCE: Innovata, December 2017.

The Airport is served by a large and stable scheduled passenger airline base, which has helped promote competitive pricing and scheduling diversity across the major markets served from the Airport. **Table 3-3** presents the passenger airlines serving the Airport since 2007 and **Table 3-4** presents the enplaned passengers and share of total enplaned passengers since 2013. Of the U.S. passenger airlines, 10 have served the Airport continuously during the period from 2007 to 2017, along with three of the foreign flag airlines.

TABLE 3-3 PASSENGER AIRLINES SERVING THE AIRPORT BY YEAR

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Boutique Air									•	•	•
American Airlines[1]	•	•	•	•	•	•	•	•	•	•	•
Air Canada	•	•	•	•	•	•	•	•	•	•	•
Alaska Airlines	•	•	•	•	•	•	•	•	•	•	•
JetBlue Airways	•	•	•	•	•	•	•	•	•	•	•
British Airways	•	•	•	•	•	•	•	•	•	•	•
Delta Air Lines[2]	•	•	•	•	•	•	•	•	•	•	•
Frontier Airlines[3]	•	•	•	•	•	•	•	•	•	•	•
Hawaiian Airlines	•	•	•	•	•	•	•	•	•	•	•
Spirit Airlines							•	•	•	•	•
Sun Country	•	•	•	•	•	•	•	•	•	•	•
United Airlines[4]	•	•	•	•	•	•	•	•	•	•	•
Southwest Airlines[5]	•	•	•	•	•	•	•	•	•	•	•
WestJet	•	•	•	•	•	•	•	•	•	•	•
Volaris							•	•	•	•	•
Great Lakes Airlines	•	•	•	•	•	•	•	•	•	•	•
Airlines No Longer Serving the Airport											
Aeromexico	•	•	•	•	•	•	•	•			
ATA Airlines	•	•									

NOTES:
1 Includes America West Airlines which merged with US Airways in 2005 and US Airways which merged with American Airlines in 2013.
2 Includes Northwest Airlines which was acquired by Delta Air Lines in 2009.
3 Includes Midwest Airlines which merged with Frontier Airlines in 2011.
4 Includes Continental Airlines which was acquired by United Airlines in 2010.
5 Includes AirTran Airways which was acquired by Southwest Airlines in 2011.
SOURCE: Innovata, December 2017.

TABLE 3-4 ENPLANED PASSENGERS BY AIRLINE SINCE 2013

	2013		2014		2015		2016		2017	
	ENPLANED PASSENGERS	SHARE	ENPLANED PASSENGERS	SHARE	ENPLANED PASSENGERS	SHARE	ENPLANED PASSENGERS	SHARE	ENPLANED PASSENGERS	SHARE
American Airlines[1]	10,574,678	52.4%	10,958,205	52.1%	11,109,180	50.5%	10,336,309	47.7%	10,207,086	46.4%
Southwest Airlines[2]	6,225,321	30.9%	6,458,307	30.7%	7,049,484	32.0%	7,238,184	33.4%	7,462,745	33.9%
Delta Air Lines	1,252,628	6.2%	1,272,154	6.1%	1,375,635	6.3%	1,387,462	6.4%	1,416,829	6.4%
United Airlines[3]	972,572	4.8%	968,745	4.6%	1,017,195	4.6%	1,101,431	5.1%	1,156,819	5.3%
Frontier	207,794	1.0%	240,425	1.1%	263,460	1.2%	331,797	1.5%	448,737	2.0%
Alaska	329,708	1.6%	358,073	1.7%	369,804	1.7%	390,826	1.8%	425,278	1.9%
WestJet	169,445	0.8%	194,845	0.9%	224,097	1.0%	218,924	1.0%	230,468	1.0%
Air Canada	78,629	0.4%	81,451	0.4%	102,569	0.5%	113,438	0.5%	135,852	0.6%
Spirit	27,767	0.1%	141,611	0.7%	146,718	0.7%	176,091	0.8%	113,219	0.5%
British Airways	98,292	0.5%	101,535	0.5%	104,743	0.5%	104,075	0.5%	107,586	0.5%
JetBlue Airways	89,070	0.4%	87,722	0.4%	91,037	0.4%	93,954	0.4%	91,749	0.4%
Hawaiian Airlines	85,242	0.4%	83,805	0.4%	86,941	0.4%	85,678	0.4%	89,140	0.4%
Sun Country Airlines	28,971	0.1%	29,840	0.1%	38,747	0.2%	59,216	0.3%	84,811	0.4%
Volaris	4,521	0.0%	21,793	0.1%	17,354	0.1%	26,695	0.1%	34,435	0.2%
Other	22,333	0.1%	14,409	0.1%	4,921	0.0%	9,338	0.0%	11,960	0.1%
Airport Total	**20,166,971**	**100.0%**	**21,012,920**	**100.0%**	**22,001,885**	**100.0%**	**21,673,418**	**100.0%**	**22,016,714**	**100.0%**

NOTES:

1 Includes US Airways.

2 Includes AirTran Airways.

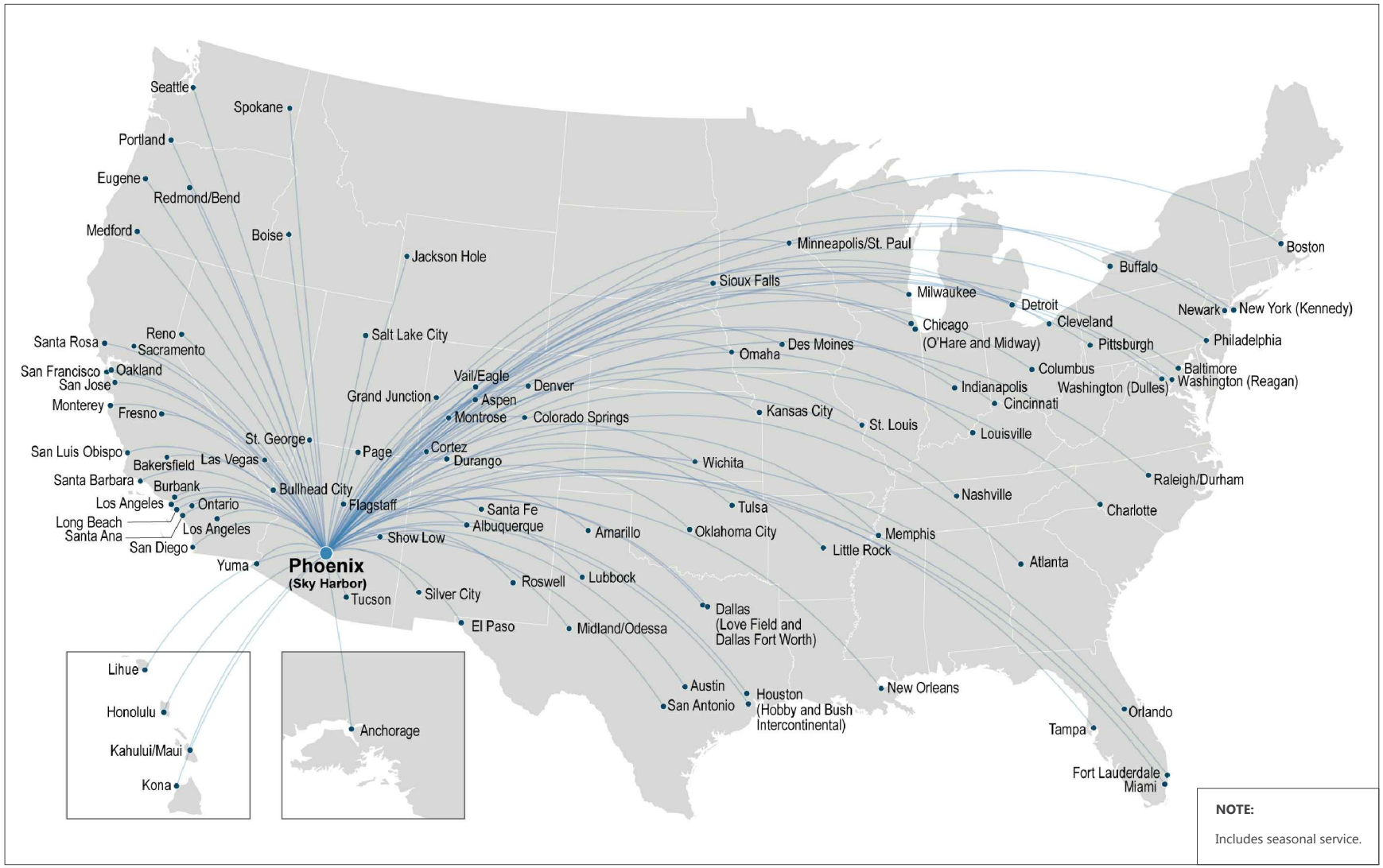
3 Includes Continental Airlines.

SOURCE: City of Phoenix Aviation Department, January 2018.

Specific factors concerning the scheduled passenger airlines serving the Airport are discussed below:

- American Airlines accounts for the largest share of enplaned passengers at the Airport. In 2017, American Airlines enplaned 10.2 million passengers at the Airport which represented 46.4 percent of total enplaned passengers that year. American Airlines operated 252 average daily departures to 78 domestic and 12 international destinations in 2017. In 2013, American merged with US Airways and the two airlines completed their operational integration in 2015. US Airways merged with America West Airlines in 2005, which had operated its largest hub at the Airport since the 1980s.
- Southwest Airlines is the Airport's second largest passenger airline, with 7.5 million enplaned passengers in 2017, which represented 33.9 percent of the total enplaned passengers that year. In 2017, Southwest Airlines operated 167 average daily departures to 50 domestic destinations from the Airport. Southwest Airlines does not serve international destinations from the Airport.
- Delta Air Lines and United Airlines are the Airport's third and fourth largest passenger airlines respectively, providing nonstop scheduled service to their major connecting hubs. In 2017, Delta Air Lines operated 30 average daily departures to 7 destinations from the Airport while United Airlines operated 25 average daily departures to 7 destinations.
- Frontier and Spirit Airlines are ultra low-cost carriers (ULCC) serving the Airport. In 2017, Frontier Airlines served 16 destinations and represented 2.0 percent of total passenger enplaned passengers while Spirit Airlines served 4 destinations and represented 0.5 percent of total passenger enplaned passengers that year.
- Foreign flag airlines British Airways, Air Canada, and WestJet have continuously served the Airport during the period from 2007 to 2017. Volaris initiated service to Mexico from the Airport in 2013 while Aeromexico suspended all service from the Airport in 2014.

Together American and Southwest Airlines have historically carried over 80 percent of the Airport's total passengers. None of the other airlines have accommodated more than 6.4 percent of the Airport's enplaned passengers in any of the past 5 years. **Exhibit 3-1** presents the nonstop domestic destinations served from the Airport in 2017. **Exhibit 3-2** presents the nonstop international destinations served from the Airport in 2017.



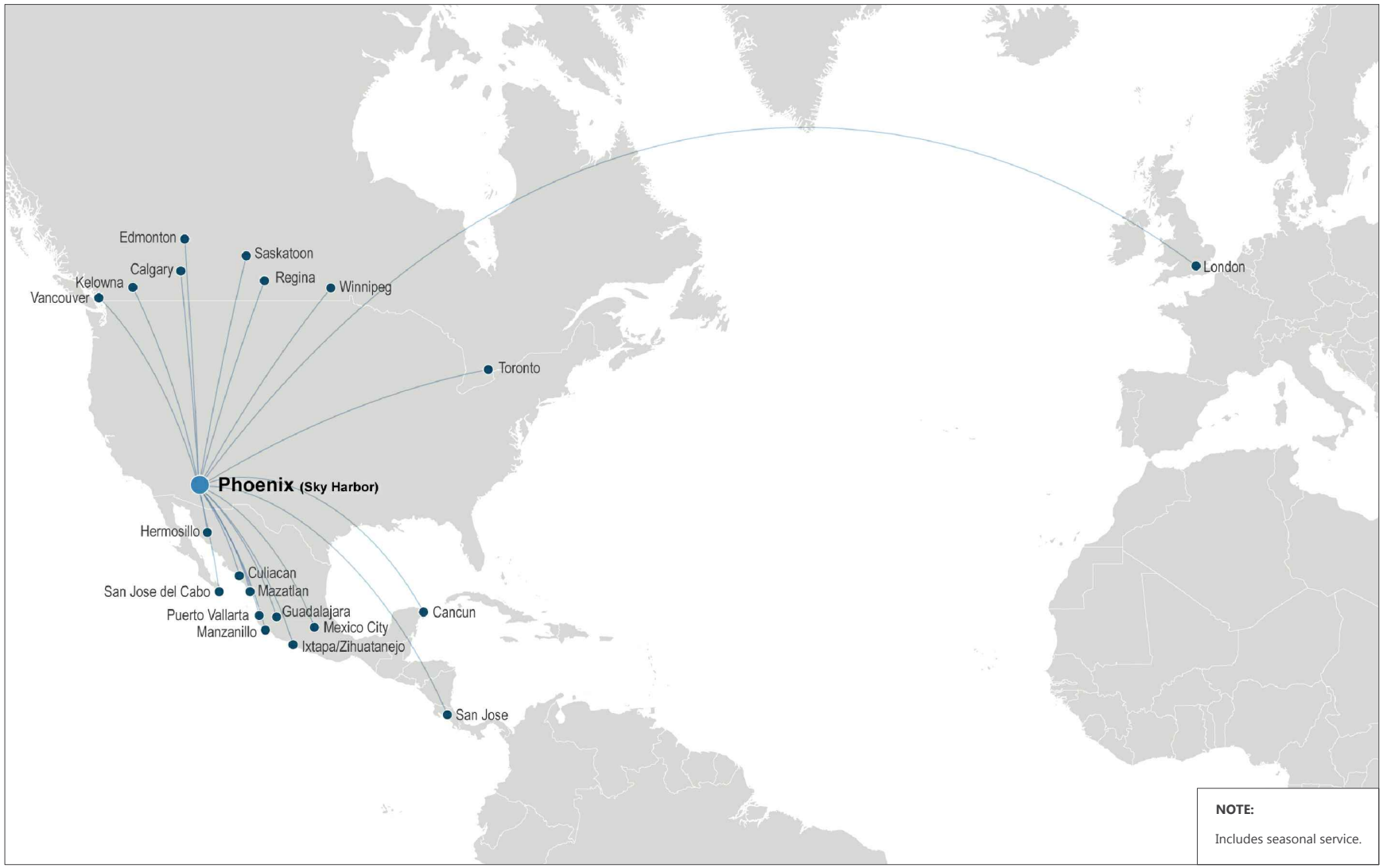
SOURCE: Innovata LLC, January 2018; Ricondo & Associates, Inc., January 2018.

EXHIBIT 3-1

NORTH

Nonstop Domestic Service

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\03-Forecast\Ex-3-01,02-Domestic-International Locations.dwgLayout: 3-1 Plotted: Sep 5, 2019, 08:46AM



SOURCE: Innovata LLC, January 2018; Ricondo & Associates, Inc., January 2018.

EXHIBIT 3-2

NORTH

Nonstop International Service

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\03-Forecast\Ex-3-01,02-Domestic-International Locations.dwgLayout: 3-2 Plotted: Sep 5, 2019, 08:45AM

3.1.2 PASSENGER AIRLINE ACTIVITY

Table 3-5 presents the historical distribution of origin and destination (O&D) and connecting enplaned passengers at the Airport. As the Airport serves as a hub airport for American and a focus city for Southwest Airlines, a large percentage of passengers use the Airport as an intermediate point on a journey between other cities. The connecting passenger share of total enplaned passengers increased from a low of 35.9 percent in 2007 to a high of 44.8 percent in 2012. In 2016, the share of connecting passengers decreased 4.4 percentage points to 38.8 percent compared to 2015. This decrease in share of connecting passengers was due to both a decrease in connecting passengers as well as an increase in O&D passengers. The increase in O&D passengers was due in part to the growth of ULCCs Frontier and Spirit Airlines, both of which expanded service at the Airport in 2016. The ULCCs primarily serve O&D passengers and their growth stimulates O&D passenger demand on other airlines that match the ULCC's lower fares.

TABLE 3-5 ORIGINATING & DESTINATION AND CONNECTING PASSENGERS BY YEAR

	O&D ENPLANED PASSENGERS	O&D SHARE OF TOTAL PASSENGERS	CONNECTING ENPLANED PASSENGERS	CONNECTING SHARE OF TOTAL PASSENGERS	TOTAL AIRPORT ENPLANED PASSENGERS
2007	13,430,991	64.1%	7,512,942	35.9%	20,943,933
2008	11,900,303	60.1%	7,915,893	39.9%	19,816,196
2009	10,876,759	57.7%	7,976,960	42.3%	18,853,719
2010	10,824,832	56.3%	8,400,218	43.7%	19,225,050
2011	11,200,708	55.4%	9,013,189	44.6%	20,213,897
2012	11,142,907	55.2%	9,038,867	44.8%	20,181,774
2013	11,262,313	55.8%	8,904,658	44.2%	20,166,971
2014	11,734,151	55.8%	9,278,769	44.2%	21,012,920
2015	12,503,104	56.8%	9,498,781	43.2%	22,001,885
2016	13,260,516	61.2%	8,412,902	38.8%	21,673,418
2017[1]					22,016,714
Compound Annual Growth Rate					
2007 to 2010	-6.9%		3.8%		-2.8%
2010 to 2013	1.3%		2.0%		1.6%
2013 to 2016	5.6%		-1.9%		2.4%
2007 to 2016	-0.1%		1.3%		0.4%

NOTE:

1 Due to delays in U.S. Department of Transportation reporting, 2017 originating and connecting passenger volumes were not available at the time of this report.

SOURCES: City of Phoenix Aviation Department, December 2017 (total enplaned passengers); U.S. Department of Transportation, Origin and Destination Passenger Survey, January 2018 (segmentation of passengers); U.S. Department of Transportation, T-100 Database (segmentation of passengers), January 2018.

The historical segmentation of mainline and regional enplaned passengers is presented in **Table 3-6**. Enplaned passenger volumes on regional carriers have grown at an average annual rate of 1.4 percent compared to 0.4 percent for total enplaned passengers, resulting in an increase in the share of passengers on regional airlines, from 8.7 percent in 2007 to 9.6 percent in 2016. Regional carriers operating for American Airlines, and its historical predecessors America West and US Airways, have represented the largest component of regional operations at the Airport. The combination of these three airlines provided the consolidated American Airlines with a diverse fleet of aircraft and more flexibility to deploy the right sized aircraft to match demand on routes across the network. For example, American Airlines has transitioned its service to key destinations such as Albuquerque International Sunport (ABQ), Hollywood Burbank Airport (BUR), San Antonio International Airport (SAT), and El Paso International Airport (ELP) from predominately mainline operations to predominately regional operations.

TABLE 3-6 MAINLINE AND REGIONAL ENPLANED PASSENGERS

	MAINLINE ENPLANED PASSENGERS	MAINLINE PERCENT OF TOTAL	REGIONAL ENPLANED PASSENGERS	REGIONAL PERCENT OF TOTAL	TOTAL ENPLANED PASSENGERS
2007	19,118,921	91.3%	1,825,012	8.7%	20,943,933
2008	17,970,834	90.7%	1,845,362	9.3%	19,816,196
2009	17,026,483	90.3%	1,827,236	9.7%	18,853,719
2010	17,497,323	91.0%	1,727,727	9.0%	19,225,050
2011	18,306,891	90.6%	1,907,006	9.4%	20,213,897
2012	18,246,643	90.4%	1,935,131	9.6%	20,181,774
2013	18,251,240	90.5%	1,915,731	9.5%	20,166,971
2014	18,968,820	90.3%	2,044,100	9.7%	21,012,920
2015	19,824,747	90.1%	2,177,138	9.9%	22,001,885
2016	19,602,853	90.4%	2,070,565	9.6%	21,673,418
2017[1]					22,016,714
Compound Annual Growth Rate					
2007 to 2010	-2.9%		-1.8%		-2.8%
2010 to 2013	1.4%		3.5%		1.6%
2013 to 2016	2.4%		2.6%		2.4%
2007 to 2016	0.3%		1.4%		0.4%

NOTE:
1 The number of enplaned passengers by airline or category of airlines was not available at the time of this report.
SOURCE: City of Phoenix Aviation Department, January 2018.

As shown in **Table 3-7**, passengers departing on flights to domestic destinations have represented the majority of total enplaned passengers at the Airport. British Airways, Air Canada, WestJet, Volaris and American Airlines provide service to international destinations. Aeromexico provided nonstop service to Mexico until it suspended service to the Airport in 2014. International enplaned passengers peaked in 2011

as Air Canada and WestJet increased service to destinations in Canada. In 2012, American Airlines started reducing international departing seats by suspending service to Acapulco International Airport (ACA), Guaymas International Airport (GYM), and Montego Bay-Sangster International Airport (MBJ), in addition to reducing capacity to other destinations in Mexico and Canada.

Foreign flag carriers have continued to increase the number of departing seats from the Airport. In 2016, a 13 percent reduction in international passengers was caused by American Airlines reducing international departing seat capacity by 21 percent but partially offset by increasing seat capacity by Volaris and Air Canada. Between 2007 and 2017 international enplaned passenger volume increased at a compound annual growth rate (CAGR) of 1.7 percent compared to 0.4 percent for domestic enplaned passengers.

TABLE 3-7 DOMESTIC AND INTERNATIONAL ENPLANED PASSENGERS

	DOMESTIC ENPLANED PASSENGERS	DOMESTIC PERCENT OF TOTAL	INTERNATIONAL ENPLANED PASSENGERS	INTERNATIONAL PERCENT OF TOTAL	TOTAL ENPLANED PASSENGERS
2007	20,069,928	95.8%	874,005	4.2%	20,943,933
2008	18,888,324	95.3%	927,872	4.7%	19,816,196
2009	17,919,398	95.0%	934,321	5.0%	18,853,719
2010	18,159,969	94.5%	1,065,081	5.5%	19,225,050
2011	19,079,266	94.4%	1,134,631	5.6%	20,213,897
2012	19,061,542	94.4%	1,120,232	5.6%	20,181,774
2013	19,051,128	94.5%	1,115,843	5.5%	20,166,971
2014	19,888,108	94.6%	1,124,812	5.4%	21,012,920
2015	20,862,996	94.8%	1,138,889	5.2%	22,001,885
2016	20,686,980	95.4%	986,438	4.6%	21,673,418
2017	20,986,902	95.3%	1,029,812	4.7%	22,016,714
Compound Annual Growth Rate					
2007 to 2010	-3.3%		6.8%		-2.8%
2010 to 2013	1.6%		1.6%		1.6%
2013 to 2017	2.4%		-2.0%		2.2%
2007 to 2017	0.4%		1.7%		0.5%

SOURCE: City of Phoenix Aviation Department, January 2018.

3.1.3 AIRCRAFT OPERATIONS

Table 3-8 presents the historical operations at the Airport between 2007 and 2017. Total operations have decreased at a CAGR of 2.2 percent over this time. Air Carrier and Air Taxi operations represent the largest component of the total decrease in operations. Much of the decrease occurred during the 2007 to 2010 period when economic recession weakened demand and airlines reduced departing seat capacity. Operations did not return to pre-recession levels after 2010 because airlines deployed larger aircraft that provided incremental departing seat capacity with the same or fewer number of departures and achieved

higher average load factors as they rationalized capacity. **Table 3-9** presents the breakdown between mainline and regional passenger operations as well as the average number of seats per departure for both. The average number of seats per departure increased at a CAGR of 1.2 percent for mainline operations and 1.0 percent for regional operations over the period from 2007 to 2016. The average seats per departure for all passenger operations increased at a CAGR of 1.0 percent over the period even as the mainline share of total operations decreased from 80.9 percent in 2007 to 78.0 percent in 2016.

The historical scheduled passenger operations and share of total operations by airline is presented in **Table 3-10**. American and Southwest Airlines have consistently represented between 82 and 86 percent of total passenger operations over the past 10 years. United Airlines represented the third largest share of operations until 2011, when Delta Air Lines surpassed United Airlines.

TABLE 3-8 HISTORICAL AIRCRAFT OPERATIONS

YEAR	AIR CARRIER/AIR TAXI	GENERAL AVIATION	MILITARY	TOTAL OPERATIONS
2007	494,938	41,266	3,007	539,211
2008	468,872	30,868	2,759	502,499
2009	432,403	22,239	2,565	457,207
2010	424,901	31,868	2,531	459,300
2011	438,901	20,582	2,506	461,989
2012	425,729	21,737	2,738	450,204
2013	412,934	20,863	2,387	436,184
2014	407,331	20,579	2,551	430,461
2015	414,936	22,553	2,922	440,411
2016	417,233	20,857	2,553	440,643
2017	407,658	21,014	2,296	430,968
Compound Annual Growth Rate				
2007 to 2010	-5.0%	-8.3%	-5.6%	-5.2%
2010 to 2013	-0.9%	-13.2%	-1.9%	-1.7%
2013 to 2017	-0.3%	0.2%	-1.0%	-0.3%
2007 to 2017	-1.9%	-6.5%	-2.7%	-2.2%

SOURCE: City of Phoenix Aviation Department, January 2018.

3.2 FACTORS AFFECTING AVIATION ACTIVITY AT THE AIRPORT

A discussion of the qualitative factors that could influence future activity at the Airport is presented in this section. Consideration of the data and concepts related to these factors has both directly and indirectly informed the development of activity forecasts for the Airport.

TABLE 3-9 MAINLINE AND REGIONAL OPERATIONS AND AVERAGE AIRCRAFT SEATS

	MAINLINE PASSENGER OPERATIONS			REGIONAL PASSENGER OPERATIONS			TOTAL PASSENGER AIRLINE OPERATIONS			
YEAR	OPERATIONS	SHARE OF PASSENGER AIRLINE OPERATIONS	AVERAGE SEATS PER DEPARTURE	OPERATIONS	SHARE OF PASSENGER AIRLINE OPERATIONS	AVERAGE SEATS PER DEPARTURE	OPERATIONS	AVERAGE SEATS PER DEPARTURE	SHARE OF AIRPORT TOTAL	TOTAL AIRPORT OPERATIONS
2007	360,352	80.9%	143	84,964	19.1%	59	445,316	127	82.6%	539,211
2008	339,084	80.7%	142	81,144	19.3%	63	420,228	127	83.6%	502,499
2009	311,898	80.2%	143	76,886	19.8%	65	388,784	128	85.0%	457,207
2010	312,136	81.4%	144	71,334	18.6%	65	383,470	129	83.5%	459,300
2011	318,434	79.8%	144	80,404	20.2%	63	398,838	128	86.3%	461,989
2012	307,494	78.9%	145	82,152	21.1%	59	389,646	127	86.5%	450,204
2013	298,322	78.7%	148	80,574	21.3%	62	378,896	130	86.9%	436,184
2014	293,610	78.8%	153	78,946	21.2%	64	372,556	134	86.5%	430,461
2015	295,654	78.7%	157	80,118	21.3%	66	375,772	137	85.3%	440,411
2016	294,102	78.0%	159	82,976	22.0%	65	377,078	138	85.6%	440,643
Compound Annual Growth Rate										
2007 to 2010	-4.7%		0.2%	-5.7%		3.3%	-4.9%	0.6%		-5.0%
2010 to 2013	-1.5%		1.1%	4.1%		-1.4%	-0.4%	0.3%		-0.4%
2013 to 2016	-0.5%		2.3%	1.0%		1.3%	-0.2%	2.0%		0.1%
2007 to 2016	-2.2%		1.2%	-0.3%		1.1%	-1.8%	1.0%		-1.8%

NOTE: Due to delays in U.S. Department of Transportation reporting, average seats per departure information were not available at the time of this report.
SOURCES: City of Phoenix Aviation Department, January 2018 (total airport operations); U.S. Department of Transportation, T-100 Database, January 2018 (segmentation of passenger operations).

TABLE 3-10 PASSENGER AIRLINE OPERATIONS AND SHARE BY AIRLINE

	AMERICAN AIRLINES		SOUTHWEST AIRLINES		DELTA AIR LINES		UNITED AIRLINES		OTHER AIRLINES		
YEAR	OPERATIONS	SHARE OF OPERATIONS	OPERATIONS	SHARE OF OPERATIONS	OPERATIONS	SHARE OF OPERATIONS	OPERATIONS	SHARE OF OPERATIONS	OPERATIONS	SHARE OF OPERATIONS	TOTAL
2007	227,780	51.2%	144,054	32.3%	19,936	4.5%	25,066	5.6%	28,480	6.4%	445,316
2008	214,904	51.1%	138,604	33.0%	20,178	4.8%	23,280	5.5%	23,262	5.5%	420,228
2009	201,912	51.9%	124,626	32.1%	19,550	5.0%	22,004	5.7%	20,692	5.3%	388,784
2010	202,026	52.7%	121,710	31.7%	19,300	5.0%	21,450	5.6%	18,984	5.0%	383,470
2011	208,492	52.3%	127,966	32.1%	20,994	5.3%	20,126	5.0%	21,260	5.3%	398,838
2012	210,042	53.9%	122,164	31.4%	19,120	4.9%	17,840	4.6%	20,480	5.3%	389,646
2013	206,136	54.4%	115,720	30.5%	18,966	5.0%	16,992	4.5%	21,082	5.6%	378,896
2014	202,360	54.3%	112,850	30.3%	18,892	5.1%	16,796	4.5%	21,658	5.8%	372,556
2015	199,170	53.0%	116,212	30.9%	21,728	5.8%	16,218	4.3%	22,444	6.0%	375,772
2016	192,944	51.2%	119,650	31.7%	21,616	5.7%	17,034	4.5%	25,834	6.9%	377,078
Compound Annual Growth Rate											
2007 to 2010	-3.9%		-5.5%		-1.1%		-5.1%		-12.6%		-4.9%
2010 to 2013	0.7%		-1.7%		-0.6%		-7.5%		3.6%		-0.4%
2013 to 2016	-2.2%		1.1%		4.5%		0.1%		7.0%		-0.2%
2007 to 2016	-1.8%		-2.0%		0.9%		-4.2%		-1.1%		-1.8%

NOTE: Due to delays in U.S. Department of Transportation reporting, the number of operations by each airline was not available at the time of this report.
SOURCE: U.S. Department of Transportation, T-100 Database, January 2018.

3.2.1 POPULATION

The demand for air travel is, to a large degree, dependent on the demographic and economic characteristics of the geographical area served by the airport. This dependence is particularly significant for O&D passengers. With a population of 4.7 million in CY 2016, the Phoenix-Mesa-Scottsdale Metropolitan Statistical Area (Phoenix MSA)[3] is the twelfth most populous MSA in the United States.[4] The City of Phoenix was the fifth largest city in the United States in CY 2016 with a population of 1.6 million.[5] The population of the Phoenix MSA increased at a CAGR of 1.6 percent between 2007 and 2016, which was double the rate of growth of the United States as a whole during this period. The population of the Phoenix MSA is projected by Woods & Poole Economics, Inc. to increase at a CAGR of 1.7 percent between 2016 and 2037, continuing to outpace the growth of the United States population, which is projected to increase at a rate of 0.9 percent.[6]

3.2.2 ECONOMIC ACTIVITY

As discussed in Section 3.3.2.1, Gross Regional Product (GRP) for the Phoenix MSA is expected to increase at a 2.9 percent CAGR through the projection period, and national Gross Domestic Product (GDP) is expected to increase at a 2.0 percent CAGR through the projection period. This growth in economic activity is expected to support increasing demand for air service. The detailed components of economic activity are discussed below.

3.2.2.1 EMPLOYMENT

Employment growth is a critical factor in the stimulation of demand for air travel. Between 2007 and 2016, employment in the Phoenix MSA grew at a CAGR of 0.6 percent—lower than that of the United States (0.8 percent). However, Phoenix MSA employment growth is projected to outpace U.S. employment growth in the future. Between 2016 and 2037, Phoenix MSA employment is projected by Woods & Poole to increase at a CAGR of 1.9 percent, while U.S. employment is projected to grow at 1.3 percent over the same period.

As reported by the U.S. Bureau of Labor Statistics, the annual unemployment rate in the two-county Phoenix MSA was lower than or equal to that of the United States in all years from 2007 through 2016. In December 2017, the non-seasonally adjusted unemployment rate in both the Phoenix MSA and the United States was 3.9 percent.

3.2.2.2 BUSINESS CLIMATE

The business climate in the Phoenix MSA offers advantages to new, expanding, and relocating companies. These advantages include a strategic location, reasonable labor and business costs, and a growing labor pool. The region offers a strategic location on the Canada-Mexico corridor as well as proximity to California,

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[3] The Phoenix-Mesa-Scottsdale Metropolitan Statistical Area consists of the counties of Maricopa and Pinal.

[4] United States Census Bureau Annual Estimates of the Resident Population, https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk (Accessed March 2018).

[5] United States Census Bureau Annual Estimates of the Resident Population for Incorporated Places of 50,000 or more, https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk (accessed March 2018)

[6] Woods & Poole Economics, Inc., *2017 Complete Economic and Demographic Data Source*, 2017.

the nation's largest economy. Minimal regulation, low unionization, and being a right-to-work state make Phoenix MSA's labor costs competitive in the western region of the U.S.[7] The corporate income tax in Arizona was decreased to 4.9 percent in 2017,[8] and state, county, and local incentive programs exist to attract businesses to the region. The lower cost of living (relative to the national average and neighboring California),[9] and warm, clement weather attract workers to the region.

The geographical location and low risk of natural disasters, stable climate, and reliable energy make the region a desirable location for mission critical operations. State and local governments have also been successful in making the area even more attractive to operations by enacting tax credits and exemptions and other programs to strategically attract business investments in the region. For example, the state and local governments offer tax exemptions on qualifying purchases of computer data center equipment.[10]. As a result, the Phoenix region currently has the seventh largest concentration of data centers nationally.[11] Other businesses located in the Phoenix MSA include logistics and distribution, manufacturing, research and development, service centers, and startups, which collectively generate a stable and diverse base of demand for air transportation services.

3.2.2.3 MAJOR EMPLOYERS AND FORTUNE 500 HEADQUARTERS

The ten largest public and private employers in the region, ranked by number of employees in the Phoenix MSA, are Banner Health (27,320 employees), State of Arizona (24,830 employees), Walmart (17,270 employees), Fry's Food Stores (13,340 employees), County of Maricopa (12,960 employees), Wells Fargo (12,740 employees), City of Phoenix (11,080 employees), Intel Corporation (10,940 employees), Arizona State University (10,490 employees), and Bank of America (9,800 employees).[12] Other entities with major operations in the region include American Airlines, American Express, Apollo Education Group, Boeing, CDW, GoDaddy, Honeywell, Microsoft, PayPal, and Waste Management.

In addition to providing an important source of local employment, private sector employers in particular depend on airline passenger and freight services for the continued health and expansion of their enterprises. The Airport's role as a passenger and air cargo hub makes it an important resource for employers in the Phoenix MSA. The largest private sector employers in the region, as listed above, represent a wide range of industries, including healthcare, retail, commercial banking, and semiconductor and related device manufacturing.

Large, global companies with corporate headquarters in the Phoenix MSA also depend on airline passenger service for the national and international travel necessary to facilitate their enterprises. Each year, *Fortune*

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[7] Greater Phoenix Economic Council, https://www.gpec.org (accessed March 2018).

[8] Arizona Commerce Authority, https://www.azcommerce.com (accessed March 2018).

[9] University of Arizona, Eller College of Management, Economic and Business Research Center, *Arizona's Economy, Fall 2017 Issue*, September 2017.

[10] Arizona Commerce Authority, https://www.azcommerce.com (accessed March 2018).

[11] Greater Phoenix Economic Council, https://www.gpec.org (accessed March 2018).

[12] Maricopa Association of Governments, *2016 Maricopa Association of Governments (MAG) Employer and Job Centers Database,* 2017 (accessed March 2018).

magazine ranks the top 500 U.S. public companies in terms of annual revenue. In 2017, four Fortune 500 companies had corporate headquarters in the Phoenix MSA, including: Avnet (ranked 108th in 2016 revenues), Freeport-McMoRan (ranked 175th in 2016 revenues), Republic Services (ranked 299th in 2016 revenues), and Insight Enterprises (ranked 473rd in 2016 revenues). In 2017, the Phoenix MSA's four Fortune 500 headquarters were the only Fortune 500 headquarters in the State of Arizona.

3.2.2.4 MAJOR INDUSTRY SECTORS

While the early Phoenix economy was dominated by the agricultural and mining sectors, after World War II, the regional economy began to diversify. Major industries in the region today include advanced business services, aerospace, healthcare and biomedical, semiconductors, and software.

The top five industry sectors, measured by total nonfarm employment in the Phoenix MSA in 2017, are professional and business services (17.0 percent), retail and wholesale trade (15.7 percent), education and health services (15.1 percent), government (11.7 percent), and leisure and hospitality (10.9 percent), as reported by the U.S. Bureau of Labor Statistics. Business services, education and health services, and leisure and hospitality employment have all increased their share of total employment since 2008, with education and health services having the largest increase in employment share of 3.3 percent. Increased education and health services employment is consistent with nationwide trends in the sector, as the health services industry grows throughout the nation.

3.2.2.5 TOURISM AND CONVENTIONS

A total of 22.8 million domestic overnight visitors traveled to the Phoenix MSA in 2016, 86 percent traveling for leisure and 14 percent on business.[13] Overnight visitors had their choice of 465 hotels in the Phoenix MSA with more than 64,000 rooms.[14] The Airport's international passenger airline service and the region's proximity to Mexico make it a popular destination for international visitors as well. Visitors to the Phoenix MSA supported more than 108,000 local jobs and generated more than $13.8 billion in direct spending and $1.7 billion in state and local tax revenue in 2016.[15]

The Phoenix MSA's travel and tourism attractions include a variety of museums (the Heard Museum, Musical Instrument Museum, Phoenix Art Museum), theaters, annual events (Fiesta Bowl, Waste Management Phoenix Open for the PGA Tour), sports (six professional sports teams, Major League Baseball spring training, more than 200 golf courses), natural resources, and other attractions. Regional attractions and activities, as well as the region's warm weather and sunshine, not only complement the quality of life of Phoenix MSA residents but also attract visitors to the area that generate economic activity and additional travel demand.

Conventions are also an important source of visitors to the Phoenix MSA. The primary convention center in the Phoenix MSA is the Phoenix Convention Center. Located in downtown Phoenix, the facility has more than 900,000 square feet of meeting and exhibit space, as well as a 2,312 seat Symphony Hall and 1,364

[13] Arizona Office of Tourism, https://tourism.az.gov (accessed March 2018).

[14] Visit Phoenix (formerly Greater Phoenix Convention & Visitors Bureau), https://www.visitphoenix.com (accessed March 2018).

[15] Ibid.

seat historic Orpheum Theatre.[16] The region is also home to many hotels and resorts with extensive venues that can support large conferences and trade events that attract visitors from across the country as well as other countries.

3.2.3 STATE OF THE AIRLINE INDUSTRY

In the aftermath of the September 11, 2001 terrorist attacks, there was a material decline in the demand for airline travel, which exacerbated problems for the U.S. airline industry already weakened by a slowing economy and rising labor and fuel costs. As a result of these conditions, U.S. airlines reported losses totaling more than $22 billion (excluding extraordinary charges and gains) between 2001 and 2004. Industry conditions improved between 2005 and 2007, with the consolidated U.S. airline industry posting operating profits in all three years.[17] In 2008 and first half of 2009, the combination of weakening economic conditions and record high fuel prices produced the worst financial conditions for U.S. airlines since the September 11, 2001 terrorist attacks. Airlines responded to these adverse conditions by reducing capacity to minimize operating losses. Between 2007 and 2009 departing seat capacity from U.S. airports decreased 9.1 percent and the number of passengers fell 8.7 percent.[18]

Conditions for the industry began to improve in 2009. Industry consolidation, capacity realignment, decreasing fuel costs, and improving economic conditions enabled improving financial performance. The U.S. airline industry is projected to post a consolidated $15.6 billion net profit in 2017, down slightly from record profits of $16.5 billion in 2016.[19] These profits were achieved as U.S. enplaned passenger volumes increased at a CAGR of 2.8 percent between 2010 and 2016.[20]

3.2.4 MERGERS AND ACQUISITIONS

U.S. airlines have merged or acquired competitors to achieve operational and commercial synergies and improve their financial performance. The Airport has been at the forefront of the recent wave of consolidation, starting in 2005 when America West Airlines, which operated its principal hub at the Airport, merged with US Airways. The consolidated US Airways maintained its hub at the Airport as it integrated the legacy America West Airlines network into much larger US Airways network with hubs in CLT and PHL. In 2009, Delta Air Lines acquired Northwest Airlines. In 2010, United Airlines acquired Continental Airlines. In 2011, Southwest Airlines acquired AirTran Airways. In 2013, US Airways and American Airlines merged, creating the world's largest airline in terms of departing seat capacity and operating revenue. The consolidated American Airlines maintained its hub operation at the Airport as it integrated US Airways' operations into the much larger American Airlines network. In 2016, Alaska Airlines acquired Virgin America. This consolidation across the industry has resulted in the realignment of some capacity as airlines integrate their networks and rationalize their deployment of aircraft and departing seats. Further consolidation of the U.S. airline industry could affect the amount of capacity offered and alter the competitive landscape.

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[16] Phoenix Convention Center & Venues, https://www.phoenixconventioncenter.com (accessed March 2018).

[17] Airlines for America (A4A), *2009 Economic Report*, July 2009.

[18] U.S. Department of Transportation, T-100 Database, January 2018.

[19] International Air Transport Association, *2017 Industry Profitability Outlook*, December 2017.

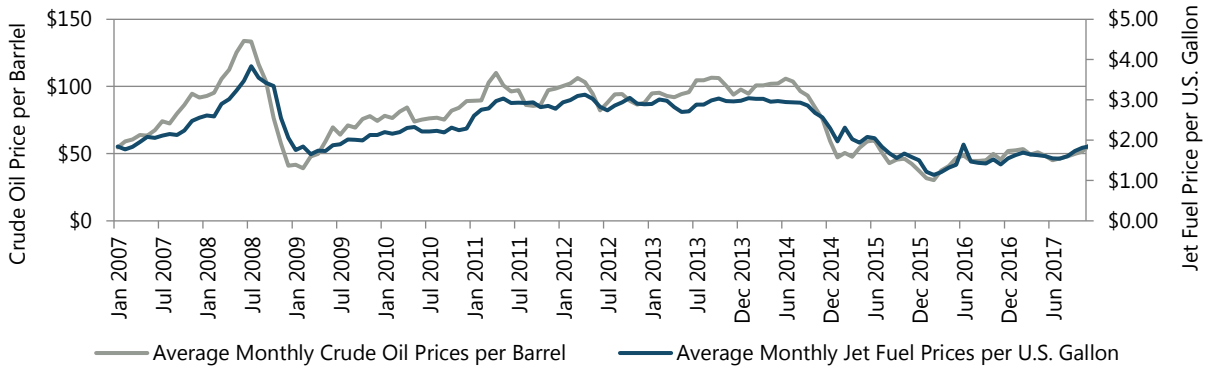
[20] U.S. Department of Transportation, Bureau of Transportation Statistics, January 2018.

3.2.5 COST OF AVIATION FUEL

The cost of aviation fuel is one of the largest and most volatile components of airline operating expenses. Historically fuel has been the first or second largest operating expense for the airline industry, alternating with labor expense. According to the International Air Transport Association (IATA), fuel accounted for 17.4 percent of airline operating costs in 2017.[21]

Starting in the second half of 2014 and continuing through 2015, the average price of jet fuel decreased dramatically. While it has increased marginally since then, at the end of 2017 it was approximately 60 percent of the price in January 2014.[22] Lower fuel prices have the potential to provide airlines with more flexibility in pricing and allocation of capacity. The incremental benefits of lower fuel prices are more pronounced on routes that generate lower average fares or are operated with less efficient aircraft. **Exhibit 3-3** presents the monthly average prices of jet fuel and crude oil between January 2007 and November 2017. Fluctuating fuel costs will continue to influence airline pricing and network strategy decisions, resulting in changes in capacity deployment and volume of passenger traffic.

EXHIBIT 3-3 HISTORICAL FUEL PRICES



SOURCES: U.S. Energy Information Administration, January 2018 (crude oil prices); Bureau of Transportation Statistics, January 2018 (jet fuel prices).

3.2.6 THREAT OF TERRORISM AND GEOPOLITICAL ISSUES

Since September 11, 2001, the recurrence of terrorism incidents against either domestic or world aviation has remained a risk to achieving activity forecasts. Tighter security measures have restored the public's confidence in the integrity of the U.S. and global aviation security systems. However, any terrorist incident targeting aviation could have an immediate and significant impact on the demand for air travel.

3.2.7 AMERICAN AIRLINES

American Airlines is the largest airline at the Airport in terms of enplaned passengers, representing 46.4 percent of the total enplaned passengers in 2017. As shown in **Table 3-11**, the Airport is American Airlines sixth largest hub in terms of departing seats, with scheduled nonstop service to 90 destinations. PHX serves

[21] International Air Transport Association, *Fact Sheet-Fuel*, June 2017.

[22] U.S. Department of Transportation, Bureau of Transportation Statistics, *Airline Fuel Cost, and Consumption*, 2017.

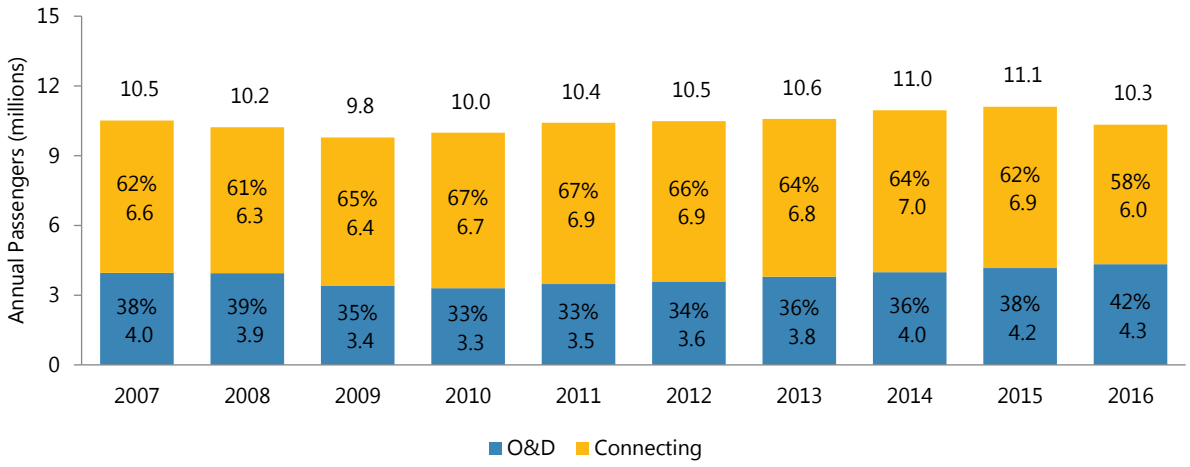
an important role in the airline's route network connecting passengers between the western U.S. and other domestic destinations as well as between Mexico and domestic destinations. As shown in **Exhibit 3-4**, connecting passengers represent a majority of American's enplaned passengers at the Airport.

TABLE 3-11 AMERICAN AIRLINES DEPARTING SEATS BY HUB IN 2017

RANK	AIRPORT	DEPARTING SEATS	DESTINATIONS SERVED
1	Dallas Fort Worth International	33,368,057	212
2	Charlotte Douglas International	25,181,091	159
3	Miami International	17,438,677	135
4	Chicago O'Hare International	16,812,484	139
5	Philadelphia International	12,646,289	121
6	Phoenix Sky Harbor International	12,090,915	90
7	Los Angeles International	9,581,733	74
8	Washington Reagan	7,353,357	73
9	LaGuardia (New York)	5,331,005	41
10	John F. Kennedy International (New York)	4,437,527	53

SOURCE: Innovata, January 2018.

EXHIBIT 3-4 AMERICAN AIRLINES PASSENGER SEGMENTATION



SOURCES: City of Phoenix Aviation Department, September 2017 (enplaned passengers); U.S. Department of Transportation, Origin and Destination Passenger Survey, January 2018 (segmentation of passengers); U.S. Department of Transportation, T-100 Database, January 2018 (segmentation of passengers); Ricondo & Associates, Inc., January 2018 (analysis).

The share of total enplaned connecting passengers at the Airport on American Airlines fell from 62.5 percent in 2015 to 58.0 percent in 2016 as the result of both a decrease in connecting passengers and an increase in O&D passengers. American Airlines has realigned capacity across some of its hubs as it integrated its network with US Airways. In 2016 and 2017, American Airlines reduced departing seat capacity at the Airport

as well as at its hub at PHL while growing capacity at LAX, CLT, and ORD. LAX represents a significant source of connecting passengers for American Airlines. The decrease in departing seat capacity between the Airport and LAX coupled with the increase in departing seats from LAX to destinations overflying PHX has reduced connecting passenger volumes at PHX. However, O&D passengers for American Airlines increased in 2016 despite the decrease in total departing seats. In 2018, the scheduled departing seats from the Airport are expected to increase 2.7 percent compared to 2017.[23]

American Airlines has codeshare cooperation with three alliance partners serving the Airport: Alaska Airlines, British Airways, and WestJet. The alliance partners benefit from American Airlines' significant presence at the Airport, enhancing opportunities to connect passengers across the combined networks. American Airlines' cooperation with British Airways also includes a revenue sharing joint-venture on transatlantic routes.

3.2.8 SOUTHWEST AIRLINES

Southwest Airlines is the second largest airline at the Airport, representing 33.9 percent of total enplaned passengers in 2017. As shown in **Table 3-12**, PHX is the airline's sixth largest focus city in terms of departing seats with nonstop service to 50 destinations. While American Airlines operates a hub and spoke network that routes connecting passengers through large hubs, Southwest Airlines has developed a point-to-point route network that primarily accommodates O&D passengers. In the larger focus cities, the geographic diversity of destinations served and volume of frequencies enable Southwest Airlines to accommodate connecting passengers as well. As shown in **Exhibit 3-5**, Southwest Airlines connecting passengers represented 31.7 percent of total enplaned passengers at the Airport in 2016, down from 33.9 percent in 2015.

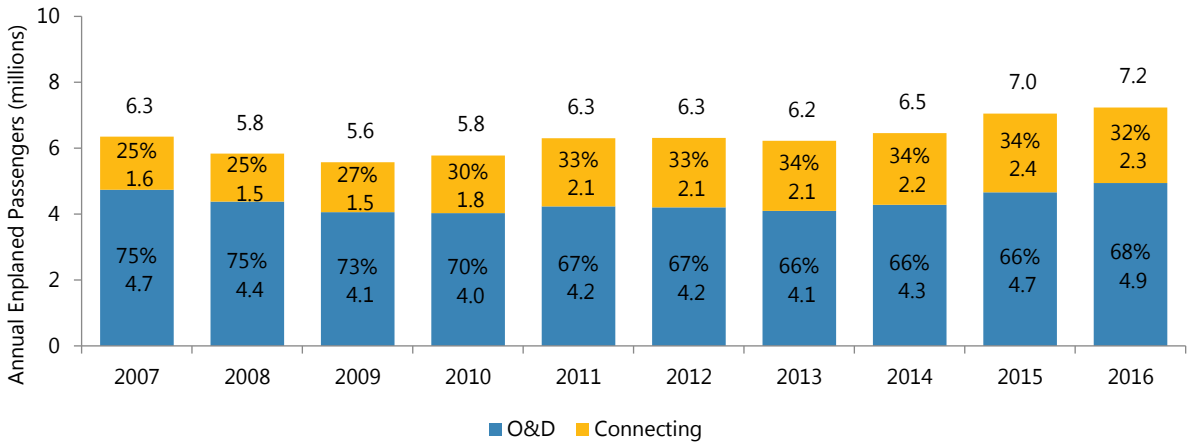
TABLE 3-12 SOUTHWEST AIRLINES DEPARTING SEATS BY FOCUS CITY IN 2017

RANK	AIRPORT	DEPARTING SEATS	NONSTOP DESTINATIONS SERVED
1	Chicago Midway International	12,820,456	70
2	Baltimore-Washington International	11,417,012	64
3	Las Vegas McCarran International	11,127,452	60
4	Denver International	10,585,298	63
5	Dallas Love Field	9,257,719	56
6	Phoenix Sky Harbor International	9,170,706	50
7	Houston Hobby	8,261,932	57
8	Los Angeles International	6,481,782	33
9	Atlanta Hartsfield Jackson International	6,448,419	39
10	Orlando International	6,384,049	52

SOURCE: Innovata, January 2018.

[23] Based on departing passenger airline seat data from Innovata in January 2018.

EXHIBIT 3-5 SOUTHWEST AIRLINES PASSENGER SEGMENTATION



SOURCES: City of Phoenix Aviation Department, September 2017 (total Southwest enplaned passengers); U.S. Department of Transportation Origin and Destination Passenger Survey, January 2018 (segmentation of passengers); U.S. Department of Transportation, T-100 Database, January 2018 (segmentation of passengers); Ricondo & Associates, Inc., January 2018 (analysis).

The size and scope of Southwest Airlines' service from PHX has not materially changed in recent years. The integration of Southwest Airlines and AirTran Airways did not affect service offerings from the Airport. Destinations served by AirTran Airways transferred to Southwest Airlines' operations. With the lifting of the Wright Amendment restrictions in late 2014, Southwest Airlines launched nonstop service to DAL. The service to DAL represents the largest component of the airline's growth at the Airport since 2014. While Southwest Airlines launched international service to Mexico and the Caribbean from select cities in 2014, it continues to only serve domestic destinations from the Airport.

3.2.9 ULTRA LOW-COST CARRIERS

While the Airport is a focus city for low-cost carrier Southwest Airlines, it also has service from ULCCs Frontier and Spirit Airlines, both of which have increased their presence and share of activity at PHX in recent years. Frontier Airlines, which has served the Airport for many years, transitioned to the ULCC business model in 2014, adding more point-to-point service and offering deeply discounted fares. In 2017, the Airport was Frontier Airlines' ninth largest market, with nonstop service to 16 destinations. Spirit Airlines is another ULCC that launched service at the Airport in 2013 and as of 2017 served four destinations from the Airport. As shown in **Table 3-13**, ULCCs have increased departing seat capacity at the Airport at a much faster rate than the carriers serving the Airport as a whole over the past 5 years. While ULCCs only represent 2.5 percent of total departing seat share, other airlines have matched their low fares, which has had the effect of stimulating demand on overlapping routes. As ULCCs primarily serve O&D passengers, their growth has contributed to the overall increase in the percentage share of O&D passengers at the Airport.

TABLE 3-13 ULTRA LOW-COST CARRIERS DEPARTING SEATS AND SEAT SHARE

YEAR	ULCC DEPARTING SEATS	ANNUAL INCREASE / (DECREASE)	TOTAL AIRPORT DEPARTING SEATS	ANNUAL INCREASE / (DECREASE)	ULCC DEPARTING SEAT SHARE
2014	440,637	69.1%	25,270,791	2.3%	1.7%
2015	477,910	8.5%	26,107,161	3.3%	1.8%
2016	621,638	30.1%	26,267,397	0.6%	2.4%
2017	650,816	4.7%	26,151,556	(0.4%)	2.5%

NOTE: ULCC: Ultra Low-Cost Carriers. Only includes Frontier Airlines and Spirit Airlines.
SOURCE: Innovata, January 2018 (departing seats); Ricondo & Associates, Inc., January 2018 (analysis).

3.2.10 PHOENIX-MESA GATEWAY AIRPORT

Phoenix-Mesa Gateway Airport (AZA) is located 33 miles southeast of PHX in Mesa, Arizona. In 2017, Allegiant Air and WestJet operated scheduled passenger service from the AZA. Allegiant Air operated an average of 13 daily flights and provided service to 47 destinations in the U.S., of which 21 are also served from PHX. Allegiant Air is a ULCC that caters to leisure-oriented travelers. Therefore, the airline offers a low frequency of flights, with flights on most routes operating only once or twice a week. WestJet offers seasonal service in the winter months from AZA to Calgary International Airport (YYC) and Edmonton International Airport (YEG) in Canada. WestJet's service from AZA overlaps with its service from PHX. However, WestJet serves six additional destinations in Canada from PHX and its service to YYC is year-round.

Table 3-14 presents the average daily departing flights and seats from PHX and AZA to destinations that were served by both airports in 2017. The Airport's share of departing seats is greater than AZA's share to 19 out of 21 destinations served from both Airports, with AZA offering greater departing seat capacity to Sioux Falls Regional Airport in South Dakota and Eugene Airport in Oregon. In aggregate, PHX represents 94.5 percent of the departing seats to destinations served from both Phoenix area airports. While the limited service offered from AZA does not represent a significant competitive threat to PHX, expansion of air service at AZA could eventually affect demand at PHX.

3.3 ENPLANED PASSENGER FORECAST

Forecasts of aviation activity were developed considering historical activity, including passenger trends at the Airport and across the industry, historical trends and projections of local and national socioeconomic factors, and anticipated trends in the use of the Airport by American Airlines, Southwest Airlines, and other airlines. An overview of the methodologies used in forecasting aviation activity at the Airport and the forecast results through 2037 are discussed in this section.

TABLE 3-14 DESTINATIONS SERVED FROM BOTH PHOENIX SKY HARBOR INTERNATIONAL AND PHOENIX-MESA GATEWAY AIRPORTS IN 2017

DESTINATION	PHOENIX-MESA GATEWAY		PHOENIX SKY HARBOR		PHOENIX SKY HARBOR SHARE	
	DAILY FLIGHTS	DAILY SEATS	DAILY FLIGHTS	DAILY SEATS	DAILY FLIGHTS	DAILY SEATS
Sioux Falls Regional	0.69	108	0.91	69	56.8%	39.0%
Oakland International	0.43	68	8.41	1,212	95.1%	94.7%
Las Vegas McCarran International	0.43	67	15.12	2,348	97.2%	97.2%
Des Moines International	0.37	58	2.21	309	85.6%	84.1%
Wichita Dwight D. Eisenhower National	0.33	52	1.00	147	75.3%	73.9%
Eugene	0.32	50	0.58	40	64.2%	44.4%
Cincinnati Northern Kentucky International	0.29	45	0.85	155	74.8%	77.5%
Colorado Springs	0.19	30	1.00	157	83.7%	83.8%
Calgary International	0.18	26	2.85	390	94.0%	93.7%
Omaha Eppley Airfield	0.07	11	4.12	580	98.3%	98.1%
Louisville International	0.07	11	1.03	166	93.5%	93.7%
Rogue Valley International (Medford, OR)	0.07	11	0.58	40	89.0%	78.4%
Memphis International	0.07	11	1.09	129	93.9%	92.1%
Boise	0.07	11	3.30	425	98.0%	97.5%
Kansas City International	0.07	11	5.72	840	98.8%	98.7%
Edmonton International	0.07	10	1.30	170	95.2%	94.5%
Cleveland Hopkins International	0.06	9	2.03	359	97.1%	97.4%
Milwaukee General Mitchell International	0.04	6	4.51	662	99.2%	99.2%
Indianapolis International	0.04	6	3.66	512	99.0%	98.9%
Fresno Yosemite International	0.01	2	4.79	360	99.7%	99.4%
Charles M. Schulz - Sonoma County (Santa Rosa, CA)	0.003	0.4	1.36	95	99.8%	99.6%
Total	**3.88**	**604**	**66.41**	**9,165**	**94.5%**	**93.8%**

SOURCE: Innovata, January 2018 (daily flights and seats for calendar year 2017); Ricondo & Associates, Inc., January 2018 (analysis).

3.3.1 ASSUMPTIONS UNDERLAYING THE FORECAST

The forecasts of enplaned passengers and aircraft operations were based on many underlying assumptions, including the following:

- Activity at the Airport will not be constrained by facilities, or lack thereof, at the Airport.
- The Airport will continue to serve as a connecting hub for American Airlines' domestic route network and will continue to be one of its principal gateways to Mexico. The Airport will also continue to serve as a large focus city for Southwest Airlines. The air service profile presented in current airline schedules for both American and Southwest Airlines is assumed to be representative of the future networks of

both. The Airport will also continue to serve all major O&D markets in the U.S., in part by U.S. carriers other than American and Southwest Airlines.

- Additional airline consolidation/mergers that may occur during the forecast period are not likely to affect numbers of enplaned passengers at the Airport. New airline alliances, should they develop, would be restricted to code-sharing and joint frequent flyer programs, and would not reduce airline competition at the Airport.
- For these analyses, and like the FAA's nationwide forecasts, it was assumed that there will be no terrorist incidents during the forecast period that would have significant, negative, or prolonged effects on aviation activity at the Airport or nationwide.
- Economic disturbances will occur during the forecast period, causing year-to-year variations in airline traffic. However, traffic at the Airport and nationwide is forecast to increase over the long term.
- It was assumed that no major "acts of God" that may disrupt the national or global airspace system will occur during the forecast period that would negatively affect aviation activity.

Many of the factors influencing aviation activity cannot be quantified, and any forecast is subject to uncertainties. As a result, the forecasting process should not be viewed as precise. Actual airline traffic at the Airport may differ from the forecasts presented herein, because events and circumstances do not occur as expected, and those differences may be material.

3.3.2 PASSENGER FORECAST METHODOLOGY AND RESULTS

Independent forecasts were developed for O&D and connecting passengers using the Airport. These categories were further segmented to identify domestic and international enplaned passengers. The methodologies used to develop these forecasts are described below.

3.3.2.1 ORIGINATING AND DESTINATION PASSENGER FORECAST METHODOLOGY

The forecast of future O&D passenger activity was developed using socioeconomic regression analysis. Historical O&D passenger volumes were analyzed to identify their relationship with socioeconomic variables at the national level as well as for the Phoenix Metropolitan Area. Socioeconomic variables such as gross regional product, per capita personal income, employment, and population are traditionally considered to be good indicators of passenger demand and were analyzed to identify relationships with O&D passenger activity. Regression analysis was used to identify predictive relationships between passenger demand and these socioeconomic variables. Historical and projected socioeconomic data were obtained from Woods & Poole Economics, Inc. and selected metrics are shown in **Table 3-15**.

A standard measure of how well each variable explains passenger demand is the regression model's coefficient of determination, or R-squared value. A result of 100 percent is the maximum value possible and represents a perfect fit between the variables analyzed. For purposes of this analysis, an R-squared value of 70 percent or better was considered adequate.

TABLE 3-15 HISTORICAL AND PROJECTED SOCIOECONOMIC VARIABLES

	PHOENIX MSA				UNITED STATES		
YEAR	POPULATION[1]	GROSS REGIONAL PRODUCT[2]	EARNINGS[2]	EMPLOYMENT[3]	POPULATION[1]	GROSS DOMESTIC PRODUCT[2]	EMPLOYMENT[3]
Historical							
2007	4,018	197,953	120,922	2,431	301,231	14,820,650	179,886
2008	4,106	185,634	114,730	2,385	304,094	14,617,095	179,640
2009	4,154	173,074	106,040	2,255	306,771	14,320,115	174,234
2010	4,205	172,312	102,901	2,212	309,347	14,618,132	173,035
2011	4,250	174,747	105,306	2,267	311,719	14,792,272	176,279
2012	4,328	180,596	109,161	2,313	314,103	15,115,991	179,082
2013	4,401	183,253	112,721	2,377	316,427	15,415,698	182,408
2014	4,487	188,287	116,895	2,440	318,907	15,829,180	186,168
2015	4,575	197,731	122,615	2,522	321,421	16,501,908	190,195
2016	4,652	204,176	126,213	2,573	324,161	16,923,958	193,023
Projected							
2017	4,733	210,553	130,075	2,626	327,168	17,298,638	195,849
2018	4,817	217,115	134,048	2,680	330,207	17,673,837	198,635
2019	4,901	223,859	138,131	2,735	333,280	18,052,252	201,404
2020	4,987	230,810	142,340	2,792	336,383	18,436,030	204,187
2021	5,074	237,969	146,674	2,849	339,515	18,825,583	206,984
2022	5,163	245,348	151,141	2,908	342,677	19,221,367	209,800
2023	5,253	252,937	155,735	2,967	345,865	19,622,540	212,627
2024	5,344	260,678	160,421	3,027	349,081	20,027,671	215,450
2025	5,437	268,577	165,202	3,087	352,315	20,436,994	218,270
2026	5,531	276,635	170,080	3,148	355,562	20,850,396	221,083
2027	5,626	284,847	175,050	3,209	358,822	21,267,484	223,883
2028	5,722	293,214	180,115	3,271	362,087	21,688,340	226,669
2029	5,820	301,743	185,278	3,332	365,362	22,113,028	229,437
2030	5,918	310,411	190,526	3,393	368,644	22,541,404	232,186
2031	6,017	319,213	195,855	3,455	371,884	22,972,998	234,909
2032	6,116	328,147	201,265	3,516	375,078	23,408,118	237,611
2033	6,215	337,209	206,753	3,576	378,237	23,846,446	240,285
2034	6,315	346,397	212,319	3,637	381,358	24,288,017	242,932
2035	6,415	355,723	217,970	3,697	384,442	24,733,432	245,562
2036	6,516	365,192	223,709	3,757	387,494	25,183,071	248,178
2037	6,617	374,802	229,535	3,818	390,515	25,637,132	250,785
Compound Annual Growth Rate							
2007 to 2016	1.6%	0.3%	0.5%	0.6%	0.8%	1.5%	0.8%
2016 to 2027	1.7%	3.1%	3.0%	2.0%	0.9%	2.1%	1.4%
2027 to 2037	1.6%	2.8%	2.7%	1.8%	0.8%	1.9%	1.1%
2016 to 2037	1.7%	2.9%	2.9%	1.9%	0.9%	2.0%	1.3%

NOTES:

1 In thousands.

2 In millions of USD.

3 In thousands.

SOURCE: Woods & Poole Economics, Inc. 2017.

Historical domestic and international O&D passenger trends were analyzed independently and used to forecast O&D passenger activity at the Airport. **Table 3-16** presents the range of regression analysis results and the selected baseline growth rate used to develop the forecast of O&D passengers. The O&D passengers were then apportioned to airlines based on their historical share of enplaned passengers and adjusted to include nonrevenue passengers.

3.3.2.2 CONNECTING PASSENGER FORECAST METHODOLOGY

The forecast of future connecting passenger activity was based on independent analyses of the role of the Airport in accommodating connecting passengers in the route networks of American and Southwest Airlines. **Table 3-17** presents the top 10 largest domestic O&D regional markets (e.g., California to/from South Central U.S., shown in the table as California – South Central) for which passengers connected at the Airport and the historical share that each airline carried over its network as well as the share of each airline's passengers that connected at the Airport.

TABLE 3-16 ORIGINATING AND DESTINATION PASSENGER FORECAST REGRESSION ANALYSIS RESULTS

PASSENGER SEGMENT	INDEPENDENT VARIABLE	RANGE OF R-SQUARED	2016 TO 2040 COMPOUND ANNUAL GROWTH RATE RANGE	SELECTED BASELINE GROWTH
Domestic O&D Passengers	MSA Gross Regional Product MSA Earnings MSA Employment U.S. Employment U.S. Domestic Enplaned Passengers	81.3% to 94.2%	1.4% to 2.0%	1.8%
International O&D Passengers	MSA Population MSA Gross Regional Product MSA Employment U.S. Population U.S. GDP	72.3% to 93.5%	2.8% to 3.5%	3.3%

SOURCES: Woods & Poole Economics, Inc. 2017 (socioeconomic variables); Ricondo & Associates, Inc., January 2018 (analysis).

TABLE 3-17 SHARE OF DOMESTIC ORIGINATING & DESTINATION CONNECTIONS BY YEAR AND AIRLINE

	AMERICAN AIRLINES' SHARE OF TOTAL O&D MARKET			PHX CONNECTING SHARE OF TOTAL AMERICAN AIRLINES' O&D PASSENGERS			SOUTHWEST AIRLINES' SHARE OF TOTAL O&D MARKET			PHX CONNECTING SHARE OF TOTAL SOUTHWEST AIRLINES' O&D PASSENGERS		
DOMESTIC REGION	2014	2015	2016	2014	2015	2016	2014	2015	2016	2014	2015	2016
California - South Central	34.3%	31.8%	32.1%	15.3%	13.7%	10.7%	27.0%	30.4%	31.4%	15.4%	14.1%	12.0%
California - Southeast	29.4%	29.9%	29.0%	13.9%	12.8%	10.3%	13.6%	13.8%	13.6%	9.0%	9.1%	9.5%
California - Mid Atlantic	28.5%	29.3%	24.9%	22.7%	21.3%	22.2%	13.0%	14.3%	14.7%	11.7%	11.7%	9.3%
California - Mountain West	12.1%	12.3%	12.0%	20.7%	19.5%	14.9%	45.0%	44.3%	43.2%	1.7%	1.8%	1.7%
California - Great Plains	20.8%	19.8%	18.4%	40.7%	42.4%	36.6%	23.9%	25.1%	26.2%	14.6%	13.9%	11.1%
California - Midwest	26.5%	25.4%	24.3%	19.2%	17.7%	13.9%	20.5%	21.0%	21.2%	9.0%	9.2%	7.3%
Mountain West - South Central	24.7%	23.5%	23.9%	8.2%	7.8%	5.2%	35.8%	38.5%	38.8%	3.6%	3.6%	3.3%
California - Northeast	20.7%	20.5%	20.2%	11.1%	11.3%	9.7%	6.1%	5.9%	6.2%	4.2%	4.6%	3.8%
Mountain West - Southeast	24.5%	23.8%	22.4%	7.3%	6.6%	5.0%	23.8%	24.3%	23.5%	1.8%	1.5%	1.4%
Mid Atlantic - Mountain West	27.0%	27.3%	26.5%	8.2%	7.8%	7.8%	27.7%	28.4%	28.4%	1.3%	1.2%	1.1%
Total Domestic	**21.9%**	**21.3%**	**20.8%**	**1.7%**	**1.8%**	**1.3%**	**24.0%**	**24.1%**	**23.9%**	**1.8%**	**1.9%**	**1.7%**

SOURCE: U.S. Department of Transportation, Origin and Destination Passenger Survey, January 2018 (segmentation of passengers); Ricondo & Associates, Inc., January 2018 (analysis).

The following steps were taken to develop the forecast of connecting passengers:

- The volume of O&D passengers for each domestic region was projected out to 2037 based on the FAA's 2017 Aerospace Forecast.
- For each domestic region, the O&D passengers were apportioned to American Airlines and Southwest Airlines based on their expected share of each regional market.
- For each regional market the volume of American Airlines and Southwest Airlines passengers connecting at PHX was forecast based on an expected share of each airlines' passengers for that regional market that connects at PHX.
- The share of the total O&D market apportioned to Southwest Airlines and American Airlines as well as the share of those passengers connecting at the Airport was based on analysis of the historical passenger volumes connecting at the Airport as well as near-term future published schedules.
- Other airline connecting passengers as well as international connecting passengers were forecast based on their historical share of total connecting passengers, which is not expected to materially change over the forecast period.
- Total connecting passengers were adjusted to include nonrevenue passengers.

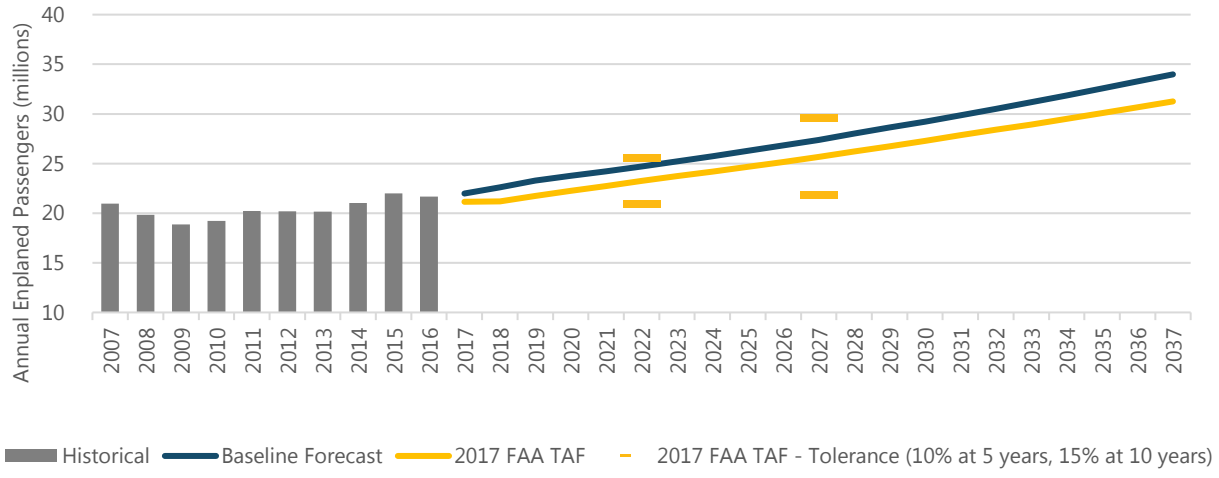
3.3.2.3 PASSENGER FORECAST RESULTS

Table 3-18 presents the historical and projected O&D and connecting passengers. Total enplaned passenger volume is forecast to increase at a CAGR of 2.2 percent between 2017 and 2037. O&D passengers are forecast to increase at a CAGR of 2.0 percent compared to 2.6 percent for connecting passengers. The faster growth of connecting passengers is due in part to an expected increase in the connecting passenger shares at the Airport for American and Southwest Airlines, which decreased in 2016 due to post consolidation capacity realignment, as discussed in Section 3.2.8, as well as the impact of the recent growth of ULCCs which have stimulated O&D passenger growth. The forecast assumes that as the incremental ULCC capacity matures, the stimulating impact it has had on O&D passenger demand will diminish and the share of connecting passengers for American and Southwest Airlines will increase. **Table 3-19** presents the historical and projected domestic and international passengers. Domestic passengers are forecast to increase at a CAGR of 2.1 percent compared to 3.5 percent for international passengers.

3.3.2.4 COMPARISON TO OTHER PASSENGER FORECASTS

Table 3-20 presents a comparison of the enplaned passenger forecast to the 2017 Terminal Area Forecast (TAF) for the Airport. **Exhibit 3-6** depicts the same information in graphic form. For the period from 2016 to 2037, the baseline forecast projects a CAGR of 2.2 percent compared to 1.9 percent for the TAF. While differences exist between the forecasts in the composition of enplaned passengers (the baseline forecast includes nonrevenue passengers, while the FAA's TAF does not), the baseline forecast remains within the variance tolerance levels specified by the FAA (within 10 percent over 5 years, and within 15 percent over 10 years). It is also important to note that the FAA TAF is forecast on a federal fiscal year basis (October through September) while the baseline forecast is prepared on a calendar year basis.

EXHIBIT 3-6 ENPLANED PASSENGER FORECAST COMPARISON



SOURCES: City of Phoenix Aviation Department, September 2017 (historical enplaned passengers); Federal Aviation Administration, 2017 Terminal Area Forecast, January 2018; Ricondo & Associates, Inc., January 2018 (baseline forecast).

TABLE 3-18 HISTORICAL AND FORECAST ORIGINATING AND DESTINATION AND CONNECTING PASSENGERS BY YEAR

YEAR	ORIGINATING AND DESTINATION PASSENGERS	CONNECTING PASSENGERS	TOTAL ENPLANED PASSENGERS
Historical			
2007	13,430,991	7,512,942	20,943,933
2008	11,900,303	7,915,893	19,816,196
2009	10,876,759	7,976,960	18,853,719
2010	10,824,832	8,400,218	19,225,050
2011	11,200,708	9,013,189	20,213,897
2012	11,142,907	9,038,867	20,181,774
2013	11,262,313	8,904,658	20,166,971
2014	11,734,151	9,278,769	21,012,920
2015	12,503,104	9,498,781	22,001,885
2016	13,260,516	8,412,902	21,673,418
2017[1]			22,016,714
Forecast			
2017	14,215,178	7,763,914	21,979,092
2018	14,574,569	8,037,492	22,612,060
2019	14,939,375	8,329,288	23,268,662
2020	15,226,001	8,530,885	23,756,886
2021	15,505,468	8,721,671	24,227,139
2022	15,792,400	8,917,684	24,710,084
2023	16,086,142	9,119,025	25,205,167
2024	16,390,128	9,330,843	25,720,971
2025	16,708,911	9,559,022	26,267,933
2026	17,027,223	9,785,383	26,812,606
2027	17,358,471	10,026,276	27,384,747
2028	17,711,360	10,292,661	28,004,020
2029	18,061,853	10,555,521	28,617,374
2030	18,410,533	10,815,877	29,226,409
2031	18,770,638	11,090,891	29,861,529
2032	19,137,328	11,374,472	30,511,801
2033	19,507,752	11,662,771	31,170,523
2034	19,890,151	11,966,383	31,856,533
2035	20,276,559	12,274,910	32,551,469
2036	20,668,512	12,590,736	33,259,248
2037	21,066,255	12,914,544	33,980,799
Compound Annual Growth Rate			
2007 to 2016	-0.1%	1.3%	0.4%
2016 to 2027	2.5%	1.6%	2.1%
2027 to 2037	2.0%	2.6%	2.2%
2016 to 2037	2.2%	2.1%	2.2%

NOTE: Due to delays in U.S. Department of Transportation reporting, 2017 originating and connecting passenger volumes were not available at the time of this report.

SOURCES: City of Phoenix Aviation Department, December 2017 (historical enplaned passengers); U.S. Department of Transportation, Origin and Destination Passenger Survey, January 2018 (segmentation of historical enplaned passengers); U.S. Department of Transportation, T-100 Database, January 2018 (segmentation of historical enplaned passengers); Ricondo & Associates, Inc., January 2018 (forecast).

TABLE 3-19 HISTORICAL AND FORECAST DOMESTIC AND INTERNATIONAL PASSENGERS BY YEAR

YEAR	DOMESTIC PASSENGERS	INTERNATIONAL PASSENGERS	TOTAL ENPLANED PASSENGERS
Historical			
2007	20,069,928	874,005	20,943,933
2008	18,888,324	927,872	19,816,196
2009	17,919,398	934,321	18,853,719
2010	18,159,969	1,065,081	19,225,050
2011	19,079,266	1,134,631	20,213,897
2012	19,061,542	1,120,232	20,181,774
2013	19,051,128	1,115,843	20,166,971
2014	19,888,108	1,124,812	21,012,920
2015	20,862,996	1,138,889	22,001,885
2016	20,686,980	986,438	21,673,418
2017	28,986,902	1,029,812	22,016,714
Forecast			
2017	20,939,437	1,039,656	21,979,092
2018	21,527,842	1,084,218	22,612,060
2019	22,138,744	1,129,918	23,268,662
2020	22,581,923	1,174,963	23,756,886
2021	23,006,735	1,220,404	24,227,139
2022	23,443,363	1,266,721	24,710,084
2023	23,891,660	1,313,507	25,205,167
2024	24,359,986	1,360,986	25,720,971
2025	24,858,922	1,409,011	26,267,933
2026	25,355,185	1,457,421	26,812,606
2027	25,878,349	1,506,398	27,384,747
2028	26,447,935	1,556,086	28,004,020
2029	27,011,436	1,605,937	28,617,374
2030	27,570,424	1,655,985	29,226,409
2031	28,155,399	1,706,129	29,861,529
2032	28,755,347	1,756,454	30,511,801
2033	29,363,307	1,807,217	31,170,523
2034	29,997,928	1,858,605	31,856,533
2035	30,640,935	1,910,534	32,551,469
2036	31,296,470	1,962,777	33,259,248
2037	31,965,611	2,015,188	33,980,799
Compound Annual Growth Rate			
2007 to 2016	0.3%	1.4%	0.4%
2016 to 2027	2.1%	3.9%	2.1%
2027 to 2037	2.1%	3.0%	2.2%
2016 to 2037	2.1%	3.5%	2.2%

SOURCES: City of Phoenix Aviation Department, December 2017 (historical enplaned passengers); Ricondo & Associates, Inc., January 2018 (forecast).

TABLE 3-20 ENPLANED PASSENGER FORECAST COMPARISON

YEAR	HISTORICAL/ BASELINE FORECAST	2017 FAA TAF	VARIANCE OF BASELINE VERSUS 2017 TAF
Historical			
2007	20,943,933	20,859,333	0.4%
2008	19,816,196	19,871,669	-0.3%
2009	18,853,719	18,481,233	2.0%
2010	19,225,050	18,732,500	2.6%
2011	20,213,897	19,673,884	2.7%
2012	20,181,774	19,592,094	3.0%
2013	20,166,971	19,494,281	3.5%
2014	21,012,920	20,030,285	4.9%
2015	22,001,885	21,209,433	3.7%
2016	21,673,418	20,977,638	3.3%
2017	22,016,714	21,145,299	4.1%
Forecast			
2017	21,979,092	21,145,299	3.9%
2018	22,612,060	21,174,990	6.8%
2019	23,268,662	21,744,524	7.0%
2020	23,756,886	22,260,719	6.7%
2021	24,227,139	22,746,471	6.5%
2022	24,710,084	23,238,096	6.3%
2023	25,205,167	23,716,563	6.3%
2024	25,720,971	24,195,631	6.3%
2025	26,267,933	24,672,345	6.5%
2026	26,812,606	25,164,415	6.5%
2027	27,384,747	25,672,496	6.7%
2028	28,004,020	26,199,888	6.9%
2029	28,617,374	26,743,000	7.0%
2030	29,226,409	27,293,065	7.1%
2031	29,861,529	27,844,803	7.2%
2032	30,511,801	28,394,146	7.5%
2033	31,170,523	28,936,785	7.7%
2034	31,856,533	29,500,323	8.0%
2035	32,551,469	30,080,924	8.2%
2036	33,259,248	30,669,926	8.4%
2037	33,980,799	31,256,419	8.7%
Compound Annual Growth Rate			
2007 to 2016	0.4%	0.1%	
2016 to 2027	2.1%	1.9%	
2027 to 2037	2.2%	2.0%	
2016 to 2037	2.2%	1.9%	

SOURCES: City of Phoenix Aviation Department, September 2017 (historical enplaned passengers); Federal Aviation Administration, 2017 Terminal Area Forecast, January 2018; Ricondo & Associates, Inc., January 2018 (forecast).

3.4 CARGO FORECAST

The following section presents historical air cargo data, key elements affecting air cargo demand, analysis of the composition of the market, and the current and future competitive landscape. These factors were all considered in development of the baseline and high and low scenario forecasts of future air cargo activity at the Airport.

3.4.1 AIR CARGO OVERVIEW AND INDUSTRY TRENDS

The global air cargo industry has undergone a major transformation over the past two decades. In the early 2000s, the e-commerce or e-tailing revolution was just materializing. It was far from certain that many of the integrated carriers, companies, cargo operators such as UPS, FedEx, or DHL who provide fully integrated door-to-door transportation/logistics services, would embrace home delivery due to the high cost associated with the number of undelivered parcels caused by not-at-home end-recipients. Higher margin business-to-business services, especially in the buoyant economic years preceding the recession of 2008, drove innovation in the industry, with huge corporate budgets resulting in initiatives such as electronic proof-of-delivery notes, providing for greater levels of visibility in the supply chain. Business-to-consumer home delivery companies, often off-shoots of traditional home shopping, and catalogue retailers were a separate sector. Today, it is hard to convey the extent of the change in management sentiment and operational and technological focus with business-to-consumer such an important part of the major players' thinking and revenues.

According to Boeing in their *World Air Cargo Forecast*, global e-commerce is projected to more than double over the next five years, growing from $1.7 trillion in 2016 to $3.6 trillion by 2020. The early translation is that the global air cargo tonnage increase of 8.5 percent in 2016 compared with 2015 was the strongest year for the market over the past five years, with the domestic U.S. market growing by 9.3 percent and the international market by 5.4 percent. The influence on airports is significant. Many airports are struggling to keep pace with the expanding infrastructure and facility requirements that the cargo industry requires to accommodate record tonnage volumes. To accommodate this growth, the logistics chain will have to become more efficient to keep up with increasing activity at all airports, but especially at those with limited acreage designated specifically for cargo activity.

3.4.2 THE AMAZON IMPACT ON THE CARGO MARKET

In late 2015, Amazon received a license from the U.S. government to act as a freight forwarder for ocean container shipping. That approval came on the heels of Amazon winning a similar license from the Chinese Ministry of Commerce. Armed with licenses from both countries, the online retailer is now positioned to buy space on container ships at wholesale rates and resell at retail rates, which will allow the company to connect two of the world's largest markets while cutting out competitors.

Amazon then took another strategic move when it signed a deal with Air Transport Services Group to lease 20 Boeing 767 aircraft to shuttle merchandise around the U.S. as part of the online retailer's efforts to reduce its high shipping expenses. Combined, these moves confirm earlier reports that Amazon is planning a global expansion of its "Fulfillment by Amazon" service, which provides storage, packing, and shipping services to small independent merchants that sell products on Amazon's Website.

Approximately 20 different partners currently share the duties of shipping Amazon's 600 million packages a year, with FedEx, USPS, and UPS moving the most. However, the number of partners and the volumes handled by the leading companies mentioned could be materially affected by Amazon Air (formerly known as Prime Air) network and its rapidly expanding logistics services. The implications to airport operators, their tenants, the balance of demand/capacity of on-airport facilities, and the overall tonnage handled remain by Amazon's corporate growth is to be determined but it is anticipated that the overall air cargo industry landscape will change.

3.4.3 IMPACT OF DRONES

The practical application of drones delivering packages is evolving. Ultimately, the drone delivery concept is intended to fulfill the "last mile" portion of the package delivery process. Its impact on the traditional air cargo industry centers around several key areas including the efficiency of the drone concept versus the traditional pickup-and-delivery (PUD) vehicles and the location of the drone base within a given community. Even if a large percentage of e-commerce products or packages can be delivered using drones, it's still inefficient for a drone to deliver a single package many miles away and fly back to its hub to recharge. A typical PUD vehicle could deliver many more packages in the same time. Seemingly in response to this fact, a package delivery company is exploring a more advanced application of drones where they deliver packages from PUD vehicles in order to increase the efficiency of the driver and vehicle.

Since the drone delivery concept is intended to transport the packages from a local or regional distribution center to the customer's destination, it is not anticipated that drones would impact the traditional air cargo industry where freighter aircraft transport air cargo containers or pallets of packages to an airport where the cargo is then broken down and trucked to regional sort facilities for final PUD vehicle dispatch to customer destinations. The drones would, in theory, supplement and/or replace the traditional PUD vehicles in this example.

3.4.4 PHOENIX AIR CARGO MARKET

According to ACI North America, the Airport ranked as the 21st busiest cargo airport in North America in 2016, with total cargo volume of 354,085 tons. The increase in cargo tonnage at the Airport between 2015 and 2016 (14.1 percent) was the highest amongst all of the top 25 North American airports, outpacing DFW at 12.8 percent, ONT at 12.1 percent, and SEA at 10.2 percent. PHX has maintained similar rankings over the past eight years with a low of 25th in 2009.

3.4.4.1 HISTORICAL CARGO ACTIVITY

Since 2009, the total cargo handled at the Airport has experienced a CAGR of 5.3 percent. Most of the airlines serving the Airport were affected by the economic slowdown between 2008 and 2009 but experienced a significant rebound in 2010 and 2011. Since 2011, the overall cargo volume has experienced

steady recovery (2.3 percent CAGR) across all carrier groups (passenger, integrated, and all-cargo carriers).[24] **Table 3-21** provides a summary of recent historical air cargo activity by cargo carrier group at the Airport.

TABLE 3-21 HISTORICAL AIR CARGO TONNAGE BY CARRIER GROUP

	HISTORICAL (U.S. TONS)								COMPOUND ANNUAL GROWTH RATE
CARRIER GROUP	2009	2010	2011	2012	2013	2014	2015	2016	2009-2016
Passenger	61,015	68,606	79,785	80,415	77,426	83,030	75,804	61,221	0.0%
Integrated	160,101	172,073	187,102	196,245	198,992	200,890	200,862	219,991	4.6%
All-Cargo	25,480	35,658	33,367	23,813	27,930	28,575	33,538	72,873	16.2%
Total	**246,597**	**276,337**	**300,254**	**300,473**	**304,347**	**312,495**	**310,204**	**354,085**	**5.3%**
Annual Growth		12.1%	8.7%	0.1%	1.3%	2.7%	-0.7%	14.1%	

SOURCE: City of Phoenix Aviation Department, September 2017.

From a U.S. airport perspective, the increases in cargo tonnage at the Airport since 2009 have been somewhat unique since only a few other large market airports experienced similar results during this period. Out of the top 25 cargo airports in the U.S., only 3 had greater percentage growth than PHX with Cincinnati/Northern Kentucky International Airport (CVG) at 27.8 percent, ONT at 5.6 percent, and ORD at 5.5 percent posting greater increases in cargo volumes than PHX (5.3 percent). Additionally, some traditionally large U.S. cargo gateways – Newark Liberty International Airport (EWR), Washington Dulles International Airport (IAD), and Philadelphia International Airport (PHL) have all experienced decreases in total cargo tonnage since 2009 by 1.2 percent, 1.4 percent, and 1.0 percent, respectively.

The integrated providers represented the largest segment of the Airport's 2016 cargo market, handling 62 percent of the total cargo, and have remained reasonably consistent since 2009 when the carrier group handled 65 percent of total PHX cargo tonnage. UPS and FedEx continue to lead the integrated carriers at the Airport and accounted for nearly 100 percent of the cargo handled by that carrier group in 2016. The CAGR of 4.6 percent in cargo tonnage carried by integrated carriers at PHX since 2009 outpaced the growth rate at every integrated carrier's national and regional hub, including Memphis International Airport (MEM) and Louisville International Airport (SDF) the primary FedEx and UPS hubs, respectively, except for the UPS regional hub at ONT. The regional economic growth in the Phoenix area and Amazon's outsourcing of transportation and delivery of their parcel activity has contributed to the steady performance by these integrated carriers over the past eight years.

The 15 largest cargo carriers at the Airport are presented in **Table 3-22** and this group carried 99.8 percent of the Airport's total tonnage in 2016 compared with 98.1 percent in 2009. American Airlines leads the passenger carrier group (9.6 percent market share in 2016); however, the carrier has experienced significant year-over-year declines in total cargo tonnage the last two years with a 19.9 percent decrease from 2015

[24] Cargo Carrier Groups defined: Passenger—cargo capacity provided by the passenger airlines in their aircraft belly holds; Integrated—cargo capacity provided by companies like UPS and FedEx who own the entire logistic chain and transportation equipment for door-to-door deliveries; All-cargo—airport-to-airport cargo capacity provided by airlines that own only freighter aircraft.

through 2016, following a 14.9 percent decrease from 2014 to 2015. Southwest Airlines is the only other passenger carrier that has more than 1 percent of the total Airport cargo market with 2016 total cargo of14,170 tons or 4.0 percent of the Airport total. Both carriers have networks at the Airport built on single aisle aircraft that have limited cargo capacity. It is not expected that either airline will materially change their fleet mix at the Airport in a way that would accommodate increased levels of cargo activity.

TABLE 3-22 HISTORICAL AIR CARGO TONNAGE BY AIRLINE

	HISTORICAL TONNAGE (U.S. TONS)								COMPOUND ANNUAL GROWTH RATE
AIRLINE	2009	2010	2011	2012	2013	2014	2015	2016	2009 TO 2016
FedEx	110,908	118,152	121,085	123,891	125,933	125,626	122,591	136,064	3.0%
UPS	49,194	53,921	66,017	72,355	73,059	75,264	78,270	83,927	7.9%
DHL/Atlas Air	--	--	--	7,258	--	--	20,309	42,912	--
American Airlines[1]	36,264	43,629	52,541	49,425	47,264	50,026	42,597	34,136	-0.9%
Air Transport Int'l (ATI)	8,584	10,379	6,737	--	--	--	2,029	15,685	9.0%
Southwest Airlines	15,142	15,138	15,599	16,892	15,867	17,368	17,889	14,170	-0.9%
Ameriflight	5,960	5,647	5,009	5,018	4,915	4,727	5,330	5,376	-1.5%
ABX Air	8,771	17,700	19,743	8,789	19,507	20,461	2,411	5,349	-6.8%
United Airlines	432	530	802	1,575	2,760	4,961	5,459	5,056	42.1%
British Airways	3,443	4,645	4,014	3,739	4,106	4,317	4,204	3,814	1.5%
IFL Group	--	--	--	1,459	2,049	2,043	2,144	2,180	--
Delta Air Lines	1,056	1,648	3,381	3,737	4,570	4,826	4,199	1,882	8.6%
Empire Airlines	1,533	1,491	1,478	980	1,282	1,313	1,314	1,371	-1.6%
Hawaiian Airlines	647	392	426	815	1,122	764	700	847	3.9%
Sun Country	--	--	--	--	--	--	272	663	--
Other Airlines	4,662	3,065	3,423	4,541	1,914	799	485	653	-24.5%
Total	**246,597**	**276,337**	**300,254**	**300,473**	**304,347**	**312,495**	**310,204**	**354,085**	**5.3%**

NOTE:
1 Incudes US Airways.
2 Columns may not sum to totals due to rounding.
SOURCE: City of Phoenix Aviation Department, July 2017.

3.4.4.2 DOMESTIC AIRPORT COMPETITION

The west coast and southwest air cargo market is served by a traditional gateway at LAX, a burgeoning Asian cargo hub at DFW, and a specialized oil and gas hub at IAH that combine to be the Airport's primary regional competitors. These are characterized by the following:

- Major U.S. cargo gateways (LAX, ORD, JFK, and MIA) will continue to maintain their regional dominance in terms of total cargo tonnage for the foreseeable future. The freight forwarders will continue to support all-cargo freighter aircraft, supplemented by the large amount of passenger belly capacity (spare cargo volume in an airplane's baggage hold), to the international regions served from LAX as a west coast competitor to PHX.
- DFW has developed into a burgeoning Asian cargo gateway due to its concentration in the technology sector located in the Metroplex and telecom corridor. New and expanded Asian freighter flights have

been added recently and the UPS regional hub at DFW accommodates a large portion of the southwest intra-regional parcel volumes. Amazon Air aircraft are also operating on the northeast side of the Airport with some expansion possibilities.

- IAH is a significant international and domestic cargo gateway due in large part to the wide range of destinations, high numbers of daily all-cargo freighter flights to/from Europe and Latin America and to a lesser degree Asia, large volumes of belly cargo capacity in widebody passenger aircraft, and the concentration of logistics companies and freight forwarders that specialize in the oil and gas industry. IAH is also attempting to participate in the Latin American market and its perishable shipments and specialized handling capabilities.
- The all-cargo airline carrier group has experienced significant changes since 2009. At large international gateways like LAX and ORD, freight forwarders utilize freighter aircraft from the all-cargo airlines and the large volume of cargo capacity in widebody aircraft utilized by the international passenger airlines. The all-cargo carrier group at PHX is mostly domestic and largely driven by the recent growth in Amazon parcel and Amazon Air activity (as described earlier in this section).
- Locally, AZA has cargo development strategies in place and should not be overlooked in terms of future regional cargo volumes. This includes a planned international cargo facility and development named SkyBridge Arizona that will house both U.S. and Mexican customs services.[25] This facility will enable shippers to send products directly to Mexico without having to go through customs processing in Mexico.[26]

3.4.5 AIRPORT CARGO ACTIVITY FORECAST

3.4.5.1 INDEPENDENT CARGO INDUSTRY FORECASTS

Although the worldwide air cargo market increased almost 20 percent in 2010 over the depressed levels of 2009, total air cargo traffic stagnated from mid-2011 to early 2013. This lengthy period of weak growth can be attributed to two factors: a weak world economy and weak trade growth. Since the onset of the global economic crisis in 2008, world air cargo traffic has averaged only 1.7 percent growth per year through 2015, according to Boeing.[27] Air cargo traffic gradually accelerated in late 2016 and 2017 and is expected to resume long-term trend growth in 2018.[28]

The latest independent forecasts of global cargo prepared by aircraft manufacturers Airbus and Boeing are presented in **Table 3-23**. The Airbus forecast indicates an annual growth rate of 3.8 percent through 2037 and the Boeing forecast indicates an annual growth of 4.3 percent per year through 2035, based primarily on anticipated underlying global economic growth. The Boeing *World Air Cargo Forecast* also indicates a low case growth rate of 3.6 percent and a high case of 5.0 percent.

[25] Phoenix Mesa-Gateway Airport, available at http://www.gatewayairport.com/content/planning/SkyBridgeArizona.pdf

[26] Air Cargo World, available at https://aircargoworld.com/allposts/phoenix-airport-creates-skybridge-arizona-hub-for-u-s-mexico-customs/

[27] Boeing, *World Air Cargo Forecast 2017-2017*, October 2016.

[28] Ibid.

TABLE 3-23 GLOBAL AIR CARGO FORECASTS

	FORECAST PERIOD	ANNUAL GROWTH RATE
Airbus	2017-2036	3.8%
Boeing	2016-2035	4.3%

SOURCES: *Airbus Cargo Global Market Forecast 2017*, April 2017; *Boeing World Air Cargo Forecast 2016-2017*, October 2016.

According to the Boeing and Airbus forecasts, Asia will continue to lead the world in average annual air cargo growth, with domestic China and intra-Asia markets expanding 6.2 percent and 5.5 percent per year, respectively. The Asia-North America and Europe-Asia markets are forecast to grow slightly faster than the world average growth rate. Latin American markets to North America and to Europe are forecast to grow at approximately the world average growth rate, as are Middle East markets to Europe.

3.4.5.2 AIR CARGO FORECAST

The development of the air cargo demand forecasts involves both quantitative analysis and professional judgment. Historical air cargo activity data were examined to identify past trends that will give an indication of future activity levels. Methodologies employed for this forecast include both a bottom-up and top-down approach using time-series extrapolation and market share analysis. Regression analysis was attempted; however, the varying growth rates within the cargo carrier groups did not produce reasonable independent variable correlation.

The total baseline forecast volume of air cargo at PHX, along with both a high and low scenario forecast are presented in **Table 3-24**. Under the baseline, total cargo tonnage is forecast to increase from 354,085 tons in 2016 to 501,011 tons in 2027, a CAGR of 3.2 percent. The total volume of air cargo is forecast to increase at a CAGR of 3.1 percent per year to 666,047 tons from 2016 through 2037. The high and low forecast scenarios of air cargo activity are also discussed further in Section 3.4.5.4.

3.4.5.3 KEY ASSUMPTIONS—BASELINE AIR CARGO FORECAST

The following assumptions were used to develop the baseline forecast for air cargo activity at the Airport.

For the near-term (ten year) planning period, it was assumed that:

- The passenger airlines carrier group will continue to pace the regional economic growth rates but also serve the Phoenix market with a disproportionate amount of single aisle aircraft that do not provide tremendous amount of cargo capacity.
- The integrated carriers (FedEx and UPS) will continue their local operations that support the regional economy and transportation requirements. However, unlike the past several years, the expansion in Amazon and other e-commerce activity that generated a large volume of the overnight (and 2nd day activity) for these carriers is likely to shift to the e-commerce company's internal networks. As discussed earlier in this section, Amazon is rapidly expanding its Amazon Air network. It is not expected that this shift in e-commerce activity would produce negative annual growth rates at FedEx and UPS, however, it is likely to slow the recent growth rates that have been experienced with the integrated carrier group at the Airport over the past several years.

TABLE 3-24 FORECAST OF AIR CARGO ACTIVITY

YEAR	BASELINE FORECAST (U.S. TONS)				HIGH SCENARIO FORECAST (U.S. TONS)				LOW SCENARIO FORECAST (U.S. TONS)			
	PASSENGER	INTEGRATED	ALL-CARGO	TOTAL	PASSENGER	INTEGRATED	ALL-CARGO	TOTAL	PASSENGER	INTEGRATED	ALL-CARGO	TOTAL
Historical												
2009	61,015	160,101	25,480	246,597	61,015	160,101	25,480	246,597	61,015	160,101	25,480	246,597
2010	68,606	172,073	35,658	276,337	68,606	172,073	35,658	276,337	68,606	172,073	35,658	276,337
2011	79,785	187,102	33,367	300,254	79,785	187,102	33,367	300,254	79,785	187,102	33,367	300,254
2012	80,415	196,245	23,813	300,473	80,415	196,245	23,813	300,473	80,415	196,245	23,813	300,473
2013	77,426	198,992	27,930	304,347	77,426	198,992	27,930	304,347	77,426	198,992	27,930	304,347
2014	83,030	200,890	28,575	312,495	83,030	200,890	28,575	312,495	83,030	200,890	28,575	312,495
2015	75,804	200,862	33,538	310,204	75,804	200,862	33,538	310,204	75,804	200,862	33,538	310,204
2016	61,221	219,991	72,873	354,085	61,221	219,991	72,873	354,085	61,221	219,991	72,873	354,085
Forecast												
2017	62,507	227,250	77,245	367,002	62,752	230,990	83,804	377,546	62,446	226,041	75,788	364,274
2018	63,819	234,523	81,648	379,990	64,320	241,385	96,374	402,079	63,570	231,692	78,819	374,080
2019	65,160	242,027	85,975	393,162	65,800	251,523	107,939	425,262	64,650	237,484	81,814	383,948
2020	66,463	249,772	90,274	406,509	67,313	262,087	120,892	450,292	65,749	243,421	84,678	393,848
2021	67,792	257,765	93,885	419,442	68,794	272,571	135,399	476,763	66,736	249,020	87,387	403,143
2022	69,148	265,884	97,406	432,438	70,239	282,656	148,939	501,833	67,737	254,747	90,009	412,493
2023	70,531	274,260	100,815	445,606	71,714	293,114	163,833	528,660	68,753	260,352	92,709	421,813
2024	71,941	282,899	104,092	458,932	73,148	303,373	176,939	553,460	69,784	266,079	95,027	430,890
2025	73,380	291,952	107,422	472,754	74,611	313,991	191,094	579,696	70,831	271,800	97,403	440,033
2026	74,848	301,002	110,860	486,710	76,103	324,981	204,471	605,555	71,893	277,535	99,838	449,266
2027	76,270	310,333	114,407	501,011	77,625	336,030	218,784	632,439	72,972	283,280	102,034	458,286
2028	77,719	319,892	118,069	515,679	79,178	347,455	231,911	658,544	74,066	289,030	104,279	467,376
2029	79,196	329,703	121,847	530,746	80,761	358,921	245,825	685,508	75,177	294,782	106,573	476,532
2030	80,701	339,773	125,746	546,219	82,377	370,765	258,117	711,259	76,305	300,530	108,918	485,753
2031	82,153	350,107	129,770	562,030	84,024	383,001	271,023	738,047	77,449	306,271	111,314	495,034
2032	83,632	360,710	133,922	578,265	85,705	395,257	281,863	762,825	78,534	311,998	113,763	504,294
2033	85,137	371,588	138,208	594,933	87,419	407,905	293,138	788,462	79,555	317,707	116,038	513,300
2034	86,670	382,747	142,630	612,047	89,167	420,958	304,864	814,988	80,509	323,394	118,359	522,262
2035	88,143	394,191	147,195	629,528	90,950	434,428	317,058	842,437	81,475	329,054	120,726	531,255
2036	89,642	405,977	151,905	647,523	92,769	448,330	329,740	870,840	82,453	334,681	123,141	540,274
2037	91,165	418,116	156,766	666,047	94,625	462,677	342,930	900,232	83,442	340,270	125,603	549,316
Compound Annual Growth Rate												
2009 to 2016	0.0%	4.6%	16.2%	5.3%	0.0%	4.6%	16.2%	5.3%	0.0%	4.6%	16.2%	5.3%
2016 to 2027	2.0%	3.2%	4.2%	3.2%	2.2%	3.9%	10.5%	5.4%	1.6%	2.3%	3.1%	2.4%
2027 to 2037	1.8%	3.0%	3.2%	2.9%	2.0%	3.2%	4.6%	3.6%	1.3%	1.8%	2.1%	1.8%
2016 to 2037	1.9%	3.1%	3.7%	3.1%	2.1%	3.6%	7.7%	4.5%	1.5%	2.1%	2.6%	2.1%

NOTE: Historical cargo volume for 2017 was not available at the time of this report.
SOURCES: City of Phoenix Aviation Department, July 2017 (historical activity); Ricondo & Associates, Inc., November 2017 (forecast).

- The all-cargo carrier group will experience strong growth rates (4.2 percent CAGR) through the mid-planning period (2027) with the continued expansion of e-commerce activity in the region. It is still to be determined what activity Amazon Air will conduct at PHX. For this reason, the baseline cargo forecast includes continued growth in the regional growth from those companies but through their partner airlines such as ATI, ABX, and others.

For the long-term (10 to 20 years) planning period, it was assumed that all-cargo and integrated carrier group will moderate to more closely match or slightly outpace the regional GDP (3.2 percent and 3.0 percent respectively). Passenger airline cargo is anticipated to continue to pace regional economic growth rates with a slight decrease in growth due to airlines maximizing aircraft seat capacity and passenger load factors which increases the need for passenger bags and reduces the space available for cargo in the baggage/cargo compartment.

3.4.5.4 SENSITIVITY ANALYSIS

A sensitivity analysis was developed to address the potential for higher or lower increases in cargo demand that could be associated with faster or slower economic growth, an increase or decrease in regional manufacturing activity, or a network adjustment by one or more of the major cargo airlines and/or the freight forwarding community.

The high forecast scenario reflects the possibility of Amazon expanding their current operation at the Airport to include a substantial increase in activity and total cargo tonnage through a regional hub and direct Amazon Air flights at the Airport. This scenario assumes cargo market development efforts by the Airport and other stakeholders could produce an increase in all-cargo airline activity. New special handling (e.g., fumigation and refrigeration) facilities at the Airport, could help PHX participate in the growing perishables and other fresh commodities from Latin America and Europe and provide expanded opportunities for increased cargo volumes throughout the planning horizon (and contribute to new international passenger routes). This scenario also assumes incremental international widebody passenger airline service which will enable additional capacity for containerized cargo activity.

The low forecast scenario reflects the possibility of both the integrated and all-cargo carrier groups experiencing slower than expected growth rates under the assumption that e-commerce activity slows down significantly. Amazon recently announced an almost 20 percent rise in its annual Prime membership cost, largely driven to help cover transportation costs. The impact of these changes on e-commerce consumer behavior is still unknown. The low forecast scenario includes consideration of a consumer driven decrease in demand resulting in a slowdown in e-commerce air cargo activity at the Airport. Additionally, the low forecast scenario does not assume growth in the regional manufacturing sector. Therefore, cargo demand would remain more associated with the regional population and GDP growth rates.

3.5 OPERATIONS FORECAST

3.5.1 PASSENGER AIRLINE OPERATIONS FORECAST

The operations forecast was developed using the passenger forecast and an analysis of airline completion rates, load factors, and airline future fleet plans. Future increases in passengers are forecast to be accommodated by a combination of increased operations, increased average seats per departure and slightly higher load factors. As show in **Table 3-25**, passenger airline operations are forecast to increase at an average CAGR of 2.2 percent between 2016 and 2037. During this period average load factor is forecast to increase from 81.7 percent in 2016 to 83.6 percent in 2037 as airlines employ tools to more efficiently manage inventory and maximize revenue. The average number of seats per departure is forecast to increase from 138.0 in 2016 to 170.1 in 2037, as both American and Southwest Airlines are expected to take delivery of larger narrowbody aircraft during the forecast period that they would deploy on routes serving the Airport. Other airlines serving the Airport have aircraft scheduled for delivery during the projection period that will drive an overall increase in the airlines' average seats per departure. **Table 3-26** presents the historical fleet mix for the Airport between 2014 and 2016 as well as the forecast fleet mix for select years of the forecast period. Passenger aircraft are categorized into groupings based on seat capacity. General Aviation (GA) operations are categorized by groupings common in FAA reporting (single engine, multi engine and jet).

3.5.2 ALL-CARGO OPERATIONS FORECAST

Historical and forecast annual all-cargo freighter operations at the Airport are summarized in **Table 3-27**. To forecast future aircraft operations, average payload was assumed to increased 1 percent per year through 2027, and 2 percent per year from 2027 through 2037 to keep pace with industry expectations that larger freighter aircraft such as the 767-300ERF, 777F and 747-8F are incorporated into fleet planning by the integrated and all-cargo carriers.

3.5.3 GENERAL AVIATION, AIR TAXI, AND MILITARY OPERATIONS FORECAST

GA and air taxi operations were analyzed for their historical relationship with socioeconomic factors, similar to the O&D passenger forecast methodology described earlier. However, these analyses did not identify any strong causal relationships that could be used to predict activity at the Airport. The Airport's historical GA and air taxi activity was compared to activity at the national level, which generated similar growth trends in recent years. Therefore, the national average forecasted growth rates for each sector of activity, as presented in the FAA's 2017 Aerospace Forecast,[29] were applied to independently forecast GA and air taxi activity at the Airport. Military operations for the year 2016 are assumed to remain constant through the forecast period. **Table 3-28** presents the historical and forecast GA, air taxi, and military operations.

[29] Federal Aviation Administration, *2017 Aerospace Forecast*, January 2018

TABLE 3-25 AIRLINE PASSENGER OPERATIONS FORECAST SUMMARY

YEAR	ENPLANED PASSENGERS	YEAR OVER YEAR CHANGE	AVERAGE LOAD FACTOR	AVERAGE SEATS PER DEPARTURE	PASSENGER AIRLINE OPERATIONS	YEAR OVER YEAR CHANGE
Historical						
2007	20,943,933		76.6%	126.7	445,316	
2008	19,816,196	-5.4%	76.0%	126.9	420,228	-5.6%
2009	18,853,719	-4.9%	77.5%	128.0	388,784	-7.5%
2010	19,225,050	2.0%	79.1%	128.9	383,470	-1.4%
2011	20,213,897	5.1%	80.2%	127.6	398,838	4.0%
2012	20,181,774	-0.2%	81.5%	126.8	389,646	-2.3%
2013	20,166,971	-0.1%	81.4%	130.0	378,896	-2.8%
2014	21,012,920	4.2%	83.4%	134.2	372,556	-1.7%
2015	22,001,885	4.7%	84.3%	137.5	375,772	0.9%
2016	21,673,418	-1.5%	81.7%	138.0	376,775	0.3%
Forecast						
2017	21,979,092	1.4%	80.6%	138.8	379,956	0.8%
2018	22,612,060	2.9%	81.5%	140.2	382,259	0.6%
2019	23,268,662	2.9%	81.7%	143.0	385,005	0.7%
2020	23,756,886	2.1%	81.8%	145.8	385,076	0.0%
2021	24,227,139	2.0%	81.8%	148.4	385,665	0.2%
2022	24,710,084	2.0%	81.9%	150.8	386,647	0.3%
2023	25,205,167	2.0%	82.0%	152.9	388,668	0.5%
2024	25,720,971	2.0%	82.1%	154.8	391,396	0.7%
2025	26,267,933	2.1%	82.1%	156.8	394,297	0.7%
2026	26,812,606	2.1%	82.3%	157.8	399,148	1.2%
2027	27,384,747	2.1%	82.4%	158.9	404,301	1.3%
2028	28,004,020	2.3%	82.5%	160.0	410,040	1.4%
2029	28,617,374	2.2%	82.6%	161.1	415,567	1.3%
2030	29,226,409	2.1%	82.8%	162.2	420,910	1.3%
2031	29,861,529	2.2%	82.9%	163.3	426,514	1.3%
2032	30,511,801	2.2%	83.0%	164.4	432,213	1.3%
2033	31,170,523	2.2%	83.1%	165.5	437,909	1.3%
2034	31,856,533	2.2%	83.2%	166.6	443,865	1.4%
2035	32,551,469	2.2%	83.4%	167.8	449,818	1.3%
2036	33,259,248	2.2%	83.5%	168.9	455,820	1.3%
2037	33,980,799	2.2%	83.6%	170.1	461,881	1.3%
Compound Annual Growth Rate						
2007 to 2016	0.4%			1.0%	-1.8%	
2016 to 2027	2.1%			1.3%	0.6%	
2027 to 2037	2.2%			0.7%	1.3%	
2016 to 2037	2.2%			1.0%	1.0%	

NOTE: Load factor does not include non-revenue passengers

SOURCES: City of Phoenix Aviation Department, September 2017 (historical enplaned passengers and operations); U.S. Department of Transportation, T-100 Database (historical load factor and average seats per departure), January 2018; Ricondo & Associates, Inc., January 2018 (forecast).

TABLE 3-26 OPERATIONS FORECAST FLEET MIX

AIRCRAFT CATEGORY	SEAT RANGE	REPRESENTATIVE AIRCRAFT	2014		2015		2016		2022		2027		2037	
			DEPARTURES	PERCENT	DEPARTURES	PERCENT	DEPARTURES	PERCENT	DEPARTURES	PERCENT	DEPARTURES	PERCENT	DEPARTURES	PERCENT
Passenger														
Small Piston / Turboprop/Regional Jet	50 or fewer	ERJ-145	16,116	9%	14,980	8%	15,345	8%	11,683	6%	8,639	4%	3,786	2%
Medium Regional Jet / Turboprop	51 to 76	CRJ-900	3,596	2%	4,229	2%	6,683	4%	6,114	3%	7,112	4%	9,166	4%
Large Regional Jet / Turboprop	77 to 100	E-190	20,118	11%	21,146	11%	19,752	10%	14,949	8%	12,634	6%	9,519	4%
Small Narrowbody	101 to 130	A319	22,760	12%	17,180	9%	13,970	7%	9,689	5%	10,037	5%	10,735	5%
Medium Narrowbody	131 to 180	A320-200	96,451	51%	95,330	50%	103,952	55%	120,874	63%	131,109	64%	153,965	67%
Large Narrowbody	181 to 220	A321-200	27,256	15%	35,088	19%	28,662	15%	28,348	15%	31,795	16%	41,910	18%
Widebody	> than 221	777-200	1,187	1%	1,221	1%	1,418	1%	1,667	1%	1,825	1%	1,860	1%
Subtotal			187,484	100%	189,174	100%	189,782	100%	193,324	100%	202,151	100%	230,941	100%
General Aviation														
Single Engine			5,184	25%	4,617	20%	789	4%	803	4%	816	4%	842	4%
Multi Engine			5,445	26%	6,332	28%	5,642	27%	5,743	27%	5,834	27%	6,024	27%
Jet			9,950	48%	11,604	51%	14,426	69%	14,684	69%	14,915	69%	15,401	69%
Subtotal			20,579	100%	22,553	100%	20,857	100%	21,231	100%	21,564	100%	22,267	100%
Military														
Subtotal			2,551	100%	2,922	100%	2,553	100%	2,553	100%	2,553	100%	2,553	100%
Airport Total			**210,614**	**100%**	**214,649**	**100%**	**213,192**	**100%**	**217,108**	**100%**	**226,268**	**100%**	**255,760**	**100%**

NOTES:

1 The representative aircraft indicated are not exhaustive and do not imply any particular aircraft will operate at the Airport in the future. They are provided as a comparison to aircraft seen operating at the Airport in 2016.

2 The passenger airline fleet mix projections are determined by the operating characteristics and aircraft orders of airlines operating at the Airport and forecast passenger demand influences on aircraft size.

SOURCES: City of Phoenix Aviation Department, September 2017 (historical consolidated operations); U.S. Department of Transportation, T-100 Database, January 2018 (segmentation of historical passenger aircraft categories); Federal Aviation Administration, OPSNET, January 2018 (segmentation of historical general aviation aircraft categories); Ricondo & Associates, Inc., January 2018 (forecast).

TABLE 3-27 HISTORICAL AND FORECAST FREIGHTER AIRCRAFT OPERATIONS

	FREIGHTER VOLUME (TONS)	FREIGHTER AIRCRAFT OPERATIONS	PAYLOAD PER OPERATION (TONS)
Historical			
2007	185,582	11,459	17.5
2008	207,731	11,090	20.6
2009	220,469	10,578	23.1
2010	220,059	10,064	23.7
2011	226,921	9,551	24.1
2012	229,465	9,292	24.8
2013	234,400	9,400	24.5
2014	292,864	9,261	28.2
2015	185,582	9,573	17.5
2016	207,731	10,373	20.6
Forecast			
2017	304,496	10,678	28.5
2018	316,171	10,978	28.8
2019	328,003	11,276	29.1
2020	340,046	11,574	29.4
2021	351,650	11,851	29.7
2022	363,290	12,122	30.0
2023	375,075	12,391	30.3
2024	386,990	12,658	30.6
2025	399,374	12,934	30.9
2026	411,862	13,206	31.2
2027	424,741	13,484	31.5
2028	437,960	13,631	32.1
2029	451,550	13,779	32.8
2030	465,519	13,926	33.4
2031	479,877	14,075	34.1
2032	494,633	14,223	34.8
2033	509,796	14,371	35.5
2034	525,377	14,520	36.2
2035	541,385	14,669	36.9
2036	557,882	14,820	37.6
2037	574,882	14,972	38.4
Compound Annual Growth Rate			
2007 to 2016	6.7%	-0.3%	7.0%
2016 to 2027	3.4%	2.4%	1.0%
2027 to 2037	3.1%	1.1%	2.0%
2016 to 2037	3.3%	1.8%	1.5%

NOTE:

1 Excludes air taxi aircraft operated in cargo service. These aircraft are covered under the air taxi operations forecasts.

2 Data from the Integrated Carrier group are included in the freighter volumes for those airlines operating freighter aircraft at the Airport.

SOURCE: Federal Aviation Administration, Form 108 (historical), July 2017; Ricondo & Associates, Inc., January 2018 (forecast).

TABLE 3-28 GENERAL AVIATION, AIR TAXI AND MILITARY OPERATIONS

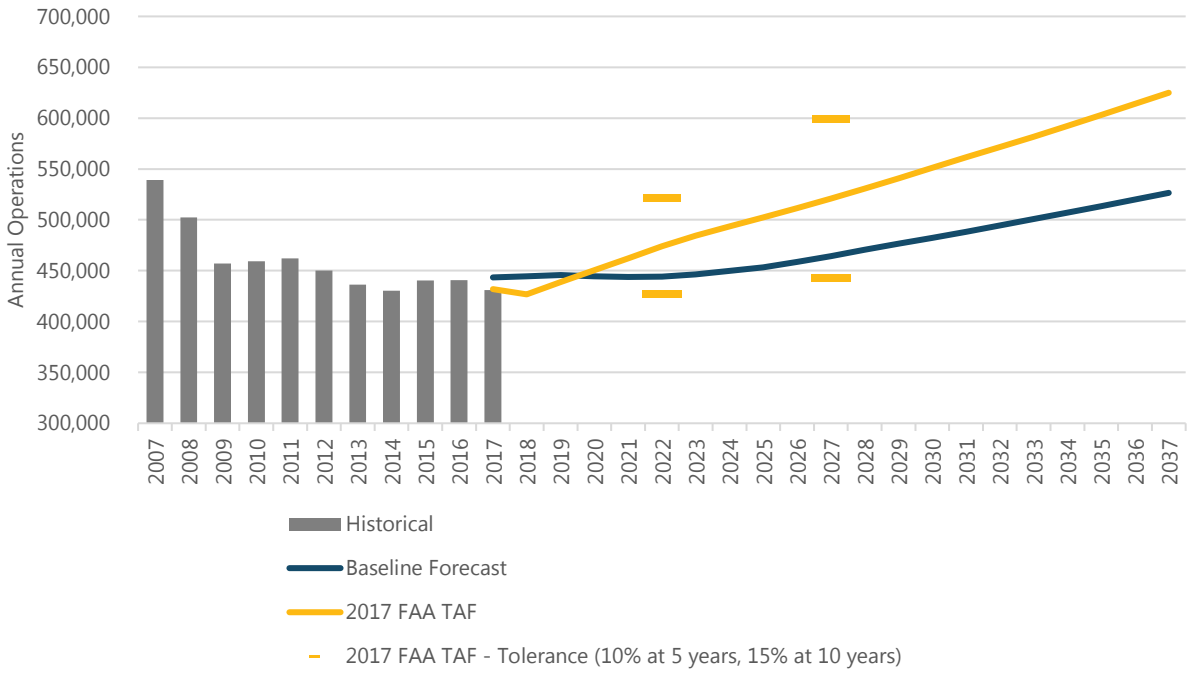
YEAR	GENERAL AVIATION	AIR TAXI	MILITARY
Historical			
2007	41,266	38,163	3,007
2008	30,868	37,554	2,759
2009	22,239	33,041	2,565
2010	31,868	31,367	2,531
2011	20,582	30,512	2,506
2012	21,737	26,791	2,738
2013	20,863	24,638	2,387
2014	20,579	25,514	2,551
2015	22,553	29,591	2,922
2016	20,857	30,085	2,553
Forecast			
2017	20,909	29,295	2,553
2018	20,973	27,718	2,553
2019	21,037	25,920	2,553
2020	21,101	24,173	2,553
2021	21,166	22,575	2,553
2022	21,231	21,636	2,553
2023	21,297	21,564	2,553
2024	21,363	21,761	2,553
2025	21,430	21,977	2,553
2026	21,497	22,198	2,553
2027	21,564	22,423	2,553
2028	21,632	22,650	2,553
2029	21,701	22,881	2,553
2030	21,770	23,115	2,553
2031	21,839	23,352	2,553
2032	21,909	23,592	2,553
2033	21,980	23,834	2,553
2034	22,051	24,079	2,553
2035	22,122	24,329	2,553
2036	22,194	24,581	2,553
2037	22,267	24,835	2,553
Compound Annual Growth Rate			
2007 to 2016	-7.3%	-2.1%	-1.8%
2016 to 2027	0.3%	-2.6%	0.0%
2027 to 2037	0.3%	1.0%	0.0%
2016 to 2037	0.3%	-0.9%	0.0%

SOURCES: City of Phoenix Aviation Department, September 2017 (historical operations); Ricondo & Associates, Inc., January 2018 (forecast).

3.5.4 COMPARISON TO OTHER OPERATIONS FORECASTS

Table 3-29 presents a comparison of the operations forecast to the 2017 Terminal Area Forecast (TAF) for the Airport. **Exhibit 3-7** depicts the same information in graphic form. For the period from 2016 to 2037, the baseline forecast projects a CAGR of 0.9 percent compared to 1.7 percent for the TAF. This variance is likely due to different assumptions about the average seat capacity used to accommodate forecast passenger activity, as the variance between the baseline forecast and the TAF for enplaned passengers is much smaller, as discussed in Section 3.3.2.4. It is also important to note that the FAA TAF is forecast on a federal fiscal year basis (October through September) while the baseline forecast is prepared on a calendar year basis.

EXHIBIT 3-7 OPERATIONS FORECAST COMPARISON



SOURCES: City of Phoenix Aviation Department, September 2017 (historical operations); Federal Aviation Administration, 2017 Terminal Area Forecast, January 2018; Ricondo & Associates, Inc., January 2018 (baseline forecast).

TABLE 3-29 OPERATIONS FORECAST COMPARISON

YEAR	HISTORICAL/ BASELINE FORECAST	2017 FAA TAF	VARIANCE OF BASELINE VERSUS 2017 TAF
Historical			
2007	539,211	541,140	-0.4%
2008	502,499	521,112	-3.6%
2009	457,207	460,291	-0.7%
2010	459,300	449,140	2.3%
2011	461,989	461,712	0.1%
2012	450,204	454,475	-0.9%
2013	436,184	437,395	-0.3%
2014	430,461	430,471	0.0%
2015	440,411	438,424	0.5%
2016	440,643	442,322	-0.4%
2017	430,968	432,025	-0.2%
Forecast			
2017	443,392	432,025	2.6%
2018	444,481	426,734	4.2%
2019	445,791	438,860	1.6%
2020	444,478	450,350	-1.3%
2021	443,809	462,045	-3.9%
2022	444,189	474,014	-6.3%
2023	446,472	484,292	-7.8%
2024	449,731	493,405	-8.9%
2025	453,190	502,293	-9.8%
2026	458,603	511,462	-10.3%
2027	464,326	520,922	-10.9%
2028	470,506	530,740	-11.3%
2029	476,480	540,852	-11.9%
2030	482,274	551,093	-12.5%
2031	488,333	561,369	-13.0%
2032	494,490	571,604	-13.5%
2033	500,646	581,723	-13.9%
2034	507,068	592,226	-14.4%
2035	513,491	603,042	-14.8%
2036	519,968	614,011	-15.3%
2037	526,508	624,936	-15.8%
Compound Annual Growth Rate			
2007 to 2016	-2.2%	-2.2%	
2016 to 2027	0.5%	1.5%	
2027 to 2037	1.3%	1.8%	
2016 to 2037	0.9%	1.7%	

SOURCES: City of Phoenix Aviation Department, September 2017 (historical operations); Federal Aviation Administration, 2017 Terminal Area Forecast, January 2018; Ricondo & Associates, Inc., January 2018 (baseline forecast).

3.6 FORECAST SCENARIOS

In addition to the baseline forecast, three additional scenarios, a high forecast scenario and two low forecast scenarios, were developed to estimate the possible variation in passenger related activity resulting from changes in the socioeconomic and competitive environment assumed in the baseline forecast. As described in Section 3.3.2, long-term future demand forecast in the baseline forecast was estimated using a combination of regression analysis that identified predictive relationships between socioeconomic variables and passenger demand as well as an estimate of the share of American and Southwest Airlines' connecting passengers using the Airport as an intermediate point on a journey between two cities. For the additional scenarios, inputs to the variables underpinning the regression equations and connecting passenger share models were adjusted to represent changes in the underlying demand, competitive environment, and role of the airport in the route networks of the airlines serving the Airport. **Table 3-30** presents the enplaned passenger forecast and **Table 3-31** presents the aircraft operations forecast for the baseline and three scenarios, the assumptions of which are described below. **Exhibit 3-8** depicts the enplaned passenger forecast scenarios in graphic form and includes the FAA TAF and tolerances. **Exhibit 3-9** depicts the same information for aircraft operations.

3.6.1 SCENARIO 1: ACCELERATED GROWTH

In the accelerated growth scenario, it was assumed that population and economic activity would grow at a faster rate between 2017 and 2023 than what is assumed in the baseline scenario, with activity peaking in 2020 and returning to baseline levels of year over year growth from 2024 to 2037. These adjusted socioeconomic variables were applied to O&D forecast model to derive a higher O&D passenger forecast. The faster rates of growth were also assumed to affect the growth patterns of U.S. domestic O&D regional markets and the volume of the passengers connecting at the Airport increases accordingly. The Airport's share of American and Southwest Airlines' connecting passengers is the same as in the baseline forecast.

This scenario also assumes that the increased population and economic activity would encourage a ULCC to open a focus city operation at the Airport. The scenario identifies Frontier Airlines as the most likely candidate for this expansion and assumes it would increase the size of its operation at the Airport to mimic its operations at its current larger focus cities, which is approximately double the number of departing seats and destinations served from the Airport in 2017. The expansion of Frontier Airlines service is assumed to stimulate incremental O&D traffic on overlapping routes on other airlines.

The accelerated scenario projects enplaned passenger growth between 2016 and 2037 at a CAGR of 2.6 percent compared to 2.2 percent for the baseline forecast and passenger operations increase at a CAGR of 1.3 percent compared to 1.0 percent for the baseline forecast.

3.6.2 SCENARIO 2: REDUCTION IN CONNECTING PASSENGER ACTIVITY

In the second scenario it was assumed that connecting passenger traffic is reduced as capacity is realigned across airline networks. The capacity reduction would begin early in the forecast period and result in connecting passenger volume decreasing by 13 percent as compared to the baseline forecast.

TABLE 3-30 ENPLANED PASSENGERS – FORECAST SCENARIOS

YEAR	BASELINE FORECAST	SCENARIO 1: ACCELERATED GROWTH	SCENARIO 2: REDUCTION IN CONNECTING PASSENGER ACTIVITY	SCENARIO 3: ECONOMIC RECESSION
Historical				
2007	20,943,933	20,943,933	20,943,933	20,943,933
2008	19,816,196	19,816,196	19,816,196	19,816,196
2009	18,853,719	18,853,719	18,853,719	18,853,719
2010	19,225,050	19,225,050	19,225,050	19,225,050
2011	20,213,897	20,213,897	20,213,897	20,213,897
2012	20,181,774	20,181,774	20,181,774	20,181,774
2013	20,166,971	20,166,971	20,166,971	20,166,971
2014	21,012,920	21,012,920	21,012,920	21,012,920
2015	22,001,885	22,001,885	22,001,885	22,001,885
2016	21,673,418	21,673,418	21,673,418	21,673,418
Forecast				
2017	21,979,092	22,088,027	21,979,092	21,979,092
2018	22,612,060	23,553,751	21,821,733	22,612,060
2019	23,268,662	24,733,546	21,839,760	20,725,960
2020	23,756,886	25,536,592	22,291,547	19,475,014
2021	24,227,139	26,221,602	22,726,786	19,410,376
2022	24,710,084	26,836,917	23,173,744	19,947,583
2023	25,205,167	27,471,971	23,631,862	20,994,277
2024	25,720,971	28,032,269	24,108,974	22,584,435
2025	26,267,933	28,627,374	24,614,631	23,768,254
2026	26,812,606	29,220,388	25,118,104	24,456,824
2027	27,384,747	29,843,219	25,646,696	24,979,129
2028	28,004,020	30,517,051	26,218,410	25,544,546
2029	28,617,374	31,184,435	26,784,558	26,104,543
2030	29,226,409	31,847,354	27,346,601	26,660,587
2031	29,861,529	32,538,506	27,932,359	27,240,498
2032	30,511,801	33,246,077	28,531,810	27,834,275
2033	31,170,523	33,963,051	29,138,827	28,435,783
2034	31,856,533	34,709,507	29,770,633	29,062,258
2035	32,551,469	35,465,475	30,410,434	29,696,897
2036	33,259,248	36,235,349	31,061,788	30,343,289
2037	33,980,799	37,020,191	31,725,521	31,002,286
Compound Annual Growth Rate				
2007 to 2016	0.4%	0.4%	0.4%	0.4%
2016 to 2027	2.1%	3.0%	1.5%	1.3%
2027 to 2037	2.2%	2.2%	2.1%	2.2%
2016 to 2037	2.2%	2.6%	1.8%	1.7%

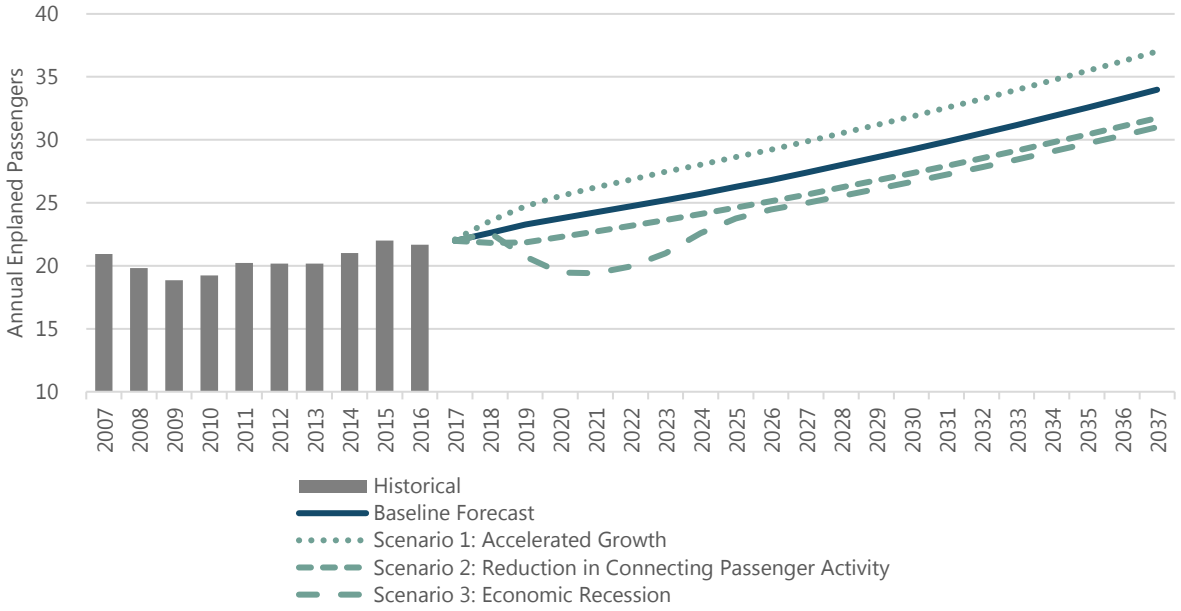
SOURCES: City of Phoenix Aviation Department, September 2017 (historical enplaned passengers); Ricondo & Associates, Inc., January 2018 (forecast).

TABLE 3-31 AIRCRAFT OPERATIONS – FORECAST SCENARIOS

	SCENARIO 1: ACCELERATED GROWTH						SCENARIO 2: REDUCTION IN CONNECTING PASSENGER ACTIVITY						SCENARIO 3: ECONOMIC RECESSION					
YEAR	PASSENGER	CARGO	GENERAL AVIATION	AIR TAXI	MILITARY	TOTAL	PASSENGER	CARGO	GENERAL AVIATION	AIR TAXI	MILITARY	TOTAL	PASSENGER	CARGO	GENERAL AVIATION	AIR TAXI	MILITARY	TOTAL
Historical																		
2007	445,316	11,459	41,266	38,163	3,007	539,211	445,316	11,459	41,266	38,163	3,007	539,211	445,316	11,459	41,266	38,163	3,007	539,211
2008	420,228	11,090	30,868	37,554	2,759	502,499	420,228	11,090	30,868	37,554	2,759	502,499	420,228	11,090	30,868	37,554	2,759	502,499
2009	388,784	10,578	22,239	33,041	2,565	457,207	388,784	10,578	22,239	33,041	2,565	457,207	388,784	10,578	22,239	33,041	2,565	457,207
2010	383,470	10,064	31,868	31,367	2,531	459,300	383,470	10,064	31,868	31,367	2,531	459,300	383,470	10,064	31,868	31,367	2,531	459,300
2011	398,838	9,551	20,582	30,512	2,506	461,989	398,838	9,551	20,582	30,512	2,506	461,989	398,838	9,551	20,582	30,512	2,506	461,989
2012	389,646	9,292	21,737	26,791	2,738	450,204	389,646	9,292	21,737	26,791	2,738	450,204	389,646	9,292	21,737	26,791	2,738	450,204
2013	378,896	9,400	20,863	24,638	2,387	436,184	378,896	9,400	20,863	24,638	2,387	436,184	378,896	9,400	20,863	24,638	2,387	436,184
2014	372,556	9,261	20,579	25,514	2,551	430,461	372,556	9,261	20,579	25,514	2,551	430,461	372,556	9,261	20,579	25,514	2,551	430,461
2015	375,772	9,573	22,553	29,591	2,922	440,411	375,772	9,573	22,553	29,591	2,922	440,411	375,772	9,573	22,553	29,591	2,922	440,411
2016	376,775	10,373	20,857	30,085	2,553	440,643	376,775	10,373	20,857	30,085	2,553	440,643	376,775	10,373	20,857	30,085	2,553	440,643
Forecast																		
2017	381,327	11,039	20,961	29,784	2,553	445,665	379,956	10,678	20,909	29,295	2,553	443,392	379,956	10,585	20,878	29,295	2,553	443,267
2018	391,710	11,727	21,066	29,188	2,553	456,245	365,403	10,978	20,973	27,718	2,553	427,624	382,259	10,781	20,899	27,718	2,553	444,210
2019	398,696	12,357	21,171	28,313	2,553	463,090	352,565	11,276	21,037	25,920	2,553	413,351	352,929	10,977	20,920	25,639	2,553	413,017
2020	400,526	13,036	21,277	27,463	2,553	464,855	351,890	11,574	21,101	24,173	2,553	411,291	325,148	11,168	20,941	23,716	2,553	383,526
2021	402,987	13,749	21,384	26,640	2,553	467,312	351,595	11,851	21,166	22,575	2,553	409,739	318,556	11,337	20,961	21,938	2,553	375,345
2022	405,738	14,401	21,491	26,107	2,553	470,289	351,688	12,122	21,231	21,636	2,553	409,230	318,724	11,503	20,982	20,841	2,553	374,603
2023	409,597	15,096	21,557	26,020	2,553	474,823	353,558	12,391	21,297	21,564	2,553	411,362	326,865	11,664	21,047	20,771	2,553	382,900
2024	412,825	15,711	21,624	26,258	2,553	478,971	356,114	12,658	21,363	21,761	2,553	414,449	342,176	11,811	21,113	20,962	2,553	398,615
2025	416,228	16,357	21,691	26,518	2,553	483,348	358,810	12,934	21,430	21,977	2,553	417,703	352,102	11,957	21,179	21,169	2,553	408,959
2026	421,210	16,977	21,759	26,786	2,553	489,285	363,591	13,206	21,497	22,198	2,553	423,046	356,356	12,100	21,245	21,383	2,553	413,637
2027	426,508	17,614	21,828	27,057	2,553	495,559	368,651	13,484	21,564	22,423	2,553	428,675	361,499	12,233	21,312	21,599	2,553	419,195
2028	432,416	18,033	21,897	27,330	2,553	502,229	374,243	13,631	21,632	22,650	2,553	434,709	367,180	12,242	21,379	21,818	2,553	425,172
2029	438,849	18,453	21,966	27,609	2,553	509,430	379,658	13,779	21,701	22,881	2,553	440,571	372,688	12,247	21,447	22,040	2,553	430,975
2030	445,108	18,814	22,036	27,892	2,553	516,403	384,920	13,926	21,770	23,115	2,553	446,284	378,046	12,249	21,515	22,266	2,553	436,628
2031	451,657	19,182	22,106	28,178	2,553	523,677	390,424	14,075	21,839	23,352	2,553	452,243	383,652	12,248	21,583	22,494	2,553	442,530
2032	458,324	19,470	22,177	28,467	2,553	530,991	396,025	14,223	21,909	23,592	2,553	458,302	389,360	12,242	21,653	22,725	2,553	448,533
2033	465,007	19,763	22,248	28,759	2,553	538,330	401,633	14,371	21,980	23,834	2,553	464,371	395,080	12,228	21,722	22,958	2,553	454,541
2034	471,983	20,060	22,320	29,055	2,553	545,971	407,486	14,520	22,051	24,079	2,553	470,689	401,053	12,209	21,792	23,194	2,553	460,801
2035	478,970	20,362	22,392	29,356	2,553	553,634	413,348	14,669	22,122	24,329	2,553	477,021	407,038	12,187	21,863	23,435	2,553	467,076
2036	486,028	20,669	22,465	29,661	2,553	561,376	419,265	14,820	22,194	24,581	2,553	483,414	413,084	12,162	21,934	23,678	2,553	473,411
2037	493,169	20,981	22,539	29,967	2,553	569,209	425,249	14,972	22,267	24,835	2,553	489,875	419,201	12,133	22,006	23,923	2,553	479,816
Compound Annual Growth Rate																		
2007 to 2016	-1.8%	-1.1%	-7.3%	-2.6%	-1.8%	-2.2%	-1.8%	-1.1%	-7.3%	-2.6%	-1.8%	-2.2%	-1.8%	-1.1%	-7.3%	-2.6%	-1.8%	-2.2%
2016 to 2027	1.1%	4.9%	0.4%	-1.0%	0.0%	1.1%	-0.2%	2.4%	0.3%	-2.6%	0.0%	-0.3%	-0.4%	1.5%	0.2%	-3.0%	0.0%	-0.5%
2027 to 2037	1.5%	1.8%	0.3%	1.0%	0.0%	1.4%	1.4%	1.1%	0.3%	1.0%	0.0%	1.3%	1.5%	-0.1%	0.3%	1.0%	0.0%	1.4%
2016 to 2037	1.3%	3.4%	0.4%	0.0%	0.0%	1.2%	0.6%	1.8%	0.3%	-0.9%	0.0%	0.5%	0.5%	0.7%	0.3%	-1.1%	0.0%	0.4%

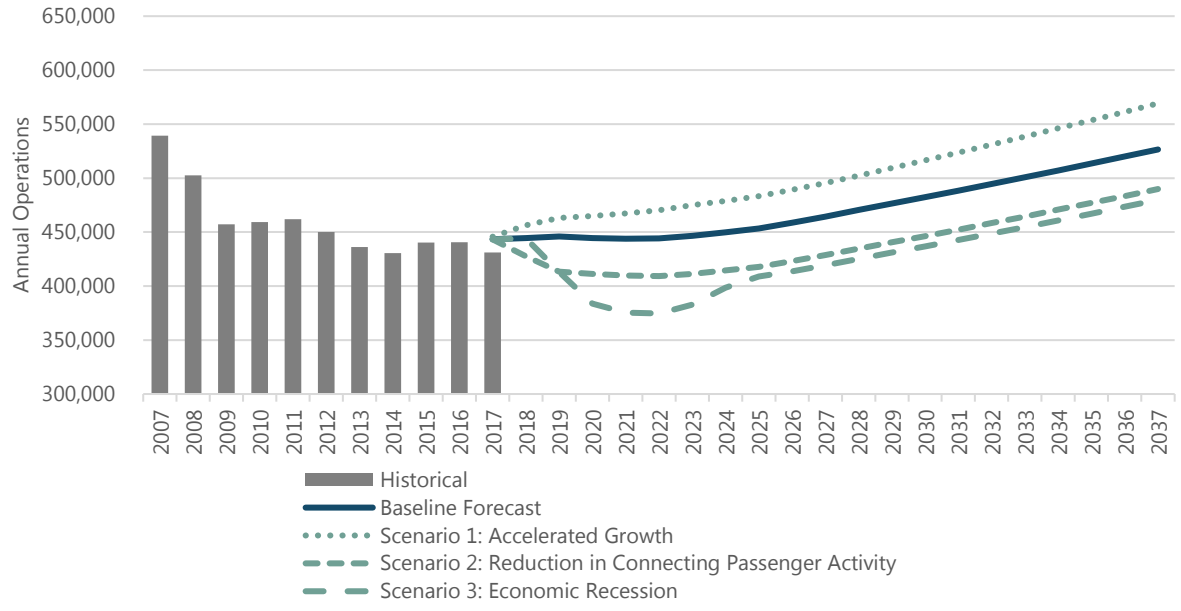
SOURCES: City of Phoenix Aviation Department (historical operations), September 2017; Ricondo & Associates, Inc., January 2018 (forecast).

EXHIBIT 3-8 ENPLANED PASSENGER SCENARIO FORECASTS COMPARISON



SOURCES: City of Phoenix Aviation Department, September 2017 (historical enplaned passengers); Federal Aviation Administration, 2017 Terminal Area Forecast, January 2018; Ricondo & Associates, Inc., January 2018 (baseline forecast).

EXHIBIT 3-9 OPERATIONS FORECAST SCENARIOS COMPARISON



SOURCES: City of Phoenix Aviation Department, September 2017 (historical operations); Federal Aviation Administration, 2017 Terminal Area Forecast, January 2018; Ricondo & Associates, Inc., January 2018 (baseline forecast).

This scenario results in enplaned passengers increasing between 2016 and 2037 at a CAGR of 1.8 percent compared to 2.2 percent for the baseline forecast and passenger operations increasing at a CAGR of 0.6 percent compared to 1.0 percent for the baseline forecast.

3.6.3 SCENARIO 3: ECONOMIC RECESSION

In the third scenario, it was assumed that weakened economic activity would drive a decrease in O&D and connecting passenger volumes. The economic recession was assumed to begin in 2019 and drives year over year decreases in passenger activity through 2021. Growth would resume in 2022 and traffic would increase at an accelerated rate through 2026, mimicking the patterns of the 2008 recession and subsequent recovery. From 2027 through 2037, year over year growth patterns would be in line with the baseline forecast.

The scenario assumes the weakened demand between 2019 and 2021 equally depresses O&D and connecting passenger activity and that all airlines reduce capacity and experience a decrease in enplaned passengers.

This scenario results in enplaned passengers increasing between 2016 and 2037 at a CAGR of 1.7 percent compared to 2.2 percent for the baseline forecast and increases in passenger operations at a CAGR of 0.5 percent compared to 1.0 percent for the baseline forecast.

3.7 DESIGN DAY FLIGHT SCHEDULES

3.7.1 OVERVIEW

For purposes of assessing demand for future facility and operating requirements, design day flight schedules (DDFSs) of passenger airline passenger and aircraft operations activity at the Airport were developed. The design day represents activity throughout the hours of the selected peak month average day (PMAD) at the Airport.

The following sections describe the methodology and assumptions used in the development of the DDFSs, and the DDFSs for the base year (2017) and the future planning horizons of 2022, 2027, and 2037.

3.7.2 DESIGN DAY FLIGHT SCHEDULE DEVELOPMENT – PASSENGER AIRLINES

Each DDFS represents aircraft operations and passenger activity anticipated at the Airport during the PMAD and provides information on aircraft arrival and departures times, aircraft type, arriving and departing passenger volumes specific to each flight including originating/destination and connecting passengers, aircraft seating capacity, and load factors. The origin or destination airport, airline and/or operator are also included in each DDFS.

3.7.3 DESIGN DAY FLIGHT SCHEDULE – BASE YEAR (2017)

To develop the passenger airline DDFS, the monthly passenger activity levels (scheduled seat capacity and operations) for 2017 were reviewed to determine the peak month at the Airport. Published data and Airport statistics identified March as the peak month for passenger aircraft operations and passenger volumes.

Published airline schedules for each day in March 2017 were reviewed and it was determined that Thursday, March 9, 2017, represented the PMAD and serves as the base schedule. Published airline schedules for this

day provide the airline, aircraft type, number of seats, flight origin, flight destination, and flight times for each scheduled passenger airline operation.

Passenger volumes on each flight were calculated by applying flight-specific actual load factors from U.S. Department of Transportation, T100 Segment Data to published schedules.[30] Origin and destination (O&D) and connecting passenger percentages were applied to indicate the passenger types on board each flight.[31]

3.7.4 DESIGN DAY FLIGHT SCHEDULE – FUTURE YEARS (2022, 2027, AND 2037)

Future year DDFSs were informed by the baseline activity forecasts presented earlier in this chapter. Other assumptions used in the development of DDFSs include:

- The base year PMAD to annual ratio of passengers and operations remains stable over the planning horizons.
- Potential new nonstop service was identified based on projected O&D passenger levels in future years. Base year domestic O&D passengers were compiled by market and projected for future years using annual forecast growth rates. Passenger level thresholds were developed by multiplying an average aircraft seat capacity, load factor, and number of daily operations to identify a level of service that potential new markets could support (i.e., 150 seats, 80 percent load factor, 2 daily departures, 365 days a year). Potential new markets were identified when projected O&D passenger volumes surpassed the threshold. New destinations and increased service to existing destinations were assumed to be served by current and new airlines operating at the Airport.

The base year DDFS was used in the successive development of the 2022, 2027 and 2037 DDFSs. Future load factors and seat capacity were determined through an iterative process that simulated an individual airline's changes in flight frequency and aircraft size in response to forecast growth. The steps listed below provide an overview of the airline schedule development process:

- Forecast passenger and aircraft operation growth rates were applied to the base year schedule to establish "targets" of passenger and aircraft operations levels for each of the future DDFSs. These targets provided guidance by maintaining forecast market share and identified the number of additional aircraft operations expected in each of the future design day flight schedules.
- Forecast passenger growth rates from 2017 to 2022 were applied to the base schedule on a route-by-route basis. This was followed by a test calculation (run on a route-by-route basis) to determine if forecast 2022 passenger levels could be accommodated on base year aircraft seat capacity (i.e., was the load factor below 100 percent). If the load factor was greater than the flight-specific threshold (approximately 95 percent), the base year aircraft was either (1) increased in aircraft size, (2) unchanged and a new flight added, and/or (3) unchanged if the load factor was below 100 percent in order to meet forecast operations and projected fleet mix targets. If the forecast passenger growth resulted in reasonable load factors, the aircraft assigned in the schedule remained unchanged.

[30] U.S. Department of Transportation, Air Carrier Statistics Database (T100), January 2018.

[31] U.S. Department of Transportation, Airline Origin and Destination Survey (D1B1), January 2018.

- In some cases, professional judgment was used to determine whether an increase in gauge and/or a new flight(s) was added to an airline-market combination. These decisions were primarily based on whether (1) the airline fleet consists of, or the airline has on order, the necessary size of aircraft for the applicable DDFS period, (2) a larger gauge aircraft is available that could reasonably and effectively operate in the market, and (3) a new flight addition would be consistent with forecast increases in aircraft operations and the projected fleet mix.
- If an additional flight(s) was added to an existing market, passengers were redistributed across all flights in that airline-market combination. Flights added to the DDFS were matched with new flight arrivals/departures and based on typical aircraft turnaround times for the specific airline and fleet types serving the Airport. If applicable, new flights were assumed to return to their origins/destinations rather than "flowing through" to other origins and destinations. Arrival and departure times for new flights to existing markets were established considering flight times currently scheduled by the specific airline, estimates of times airline travelers would typically want to arrive at and depart from the Airport, and the timing of connecting opportunities at destination hubs.
- Once the 2022 DDFS was completed, the process was repeated for the 2027 and 2037 DDFS.

It was assumed that aircraft gauge would not decrease in future years, unless (1) no larger gauge aircraft was available in the fleet, and (2) the new additional flight in the airline-market combination resulted in unreasonably low load factors for the combination. For example, in a future schedule, capacity growth in a market currently served by a single daily Airbus A321 operation may have been accommodated through a combination of an Airbus A320 and a new flight operation in an Airbus A319 to maintain reasonable load factors consistent with airline practices.

3.7.5 DESIGN DAY FLIGHT SCHEDULE SUMMARY – PASSENGER AIRLINES

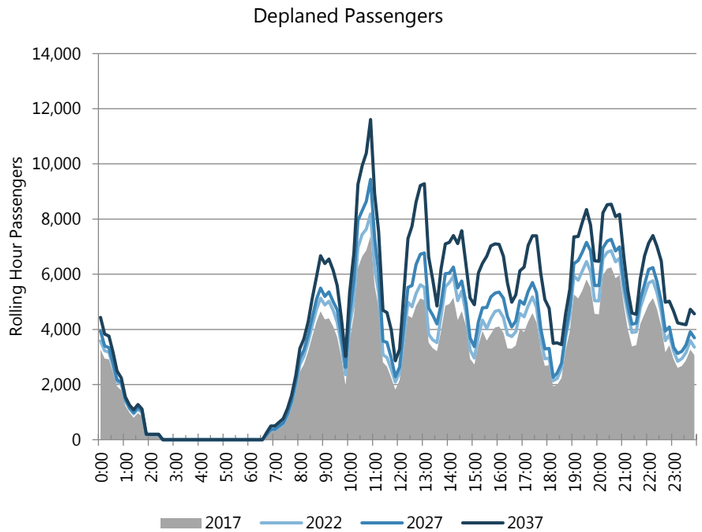
Results and statistics, for the Base (2017), 2022, 2027 and 2037 schedules are shown in **Table 3-32** and **Exhibits 3-10** through **3-12**.

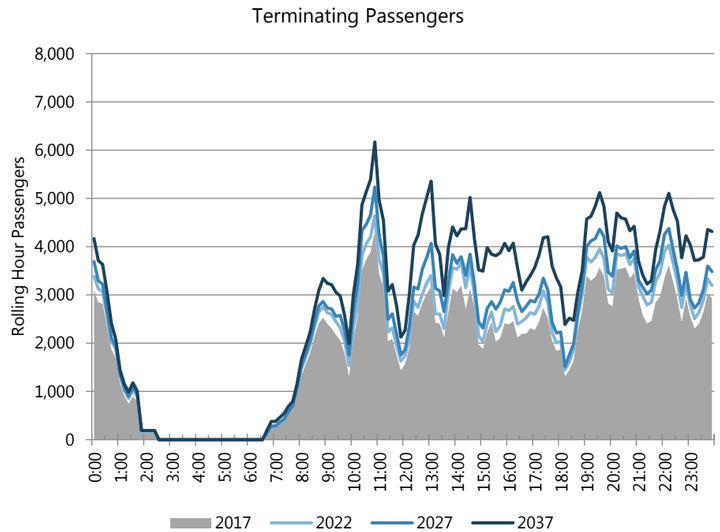
TABLE 3-32 DESIGN DAY ARRIVAL AND DEPARTURE SUMMARY

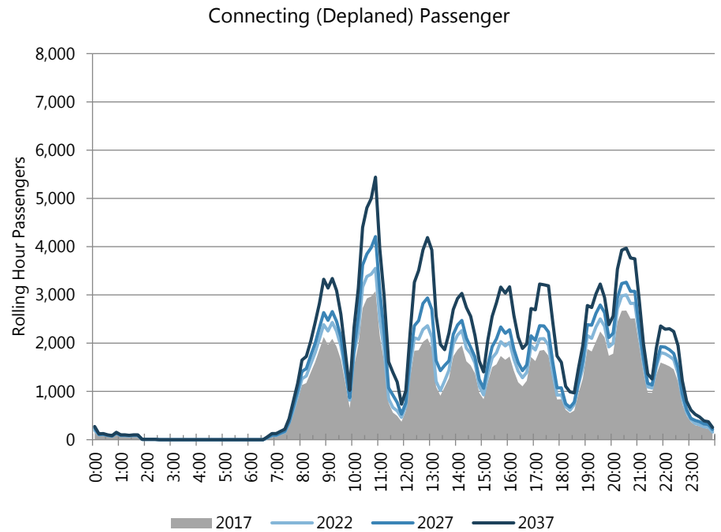
	ARRIVALS					DEPARTURES					TOTAL				
YEAR	PASSENGERS	SEATS	LOAD FACTOR	AVERAGE SEATS	OPERATIONS	PASSENGERS	SEATS	LOAD FACTOR	AVERAGE SEATS	OPERATIONS	PASSENGERS	SEATS	LOAD FACTOR	AVERAGE SEATS	OPERATIONS
All Passengers															
2017	69,107	79,856	86.5%	142.1	562	73,258	79,787	91.8%	142.0	562	142,365	159,643	89.2%	142.0	1,124
2022	77,402	88,404	87.6%	154.3	573	82,059	88,523	92.7%	154.5	573	159,461	176,927	90.1%	154.4	1,146
2027	85,500	96,108	89.0%	160.7	598	90,650	96,222	94.2%	160.9	598	176,150	192,330	91.6%	160.8	1,196
2037	105,564	116,338	90.7%	170.1	684	111,934	116,615	96.0%	170.5	684	217,497	232,953	93.4%	170.3	1,368
Compound Annual Growth Rate															
2017 - 2022	2.3%	2.1%			0.4%	2.3%	2.1%			0.4%	2.3%	2.1%			0.4%
2022 - 2027	2.0%	1.7%			0.9%	2.0%	1.7%			0.9%	2.0%	1.7%			0.9%
2027 - 2037	2.1%	1.9%			1.4%	2.1%	1.9%			1.4%	2.1%	1.9%			1.4%
2017 - 2037	2.1%	1.9%			1.0%	2.1%	1.9%			1.0%	2.1%	1.9%			1.0%
Domestic and Preclearance															
2017	67,466	77,831	86.7%	142.0	548	71,437	77,612	92.0%	141.9	547	138,903	155,443	89.4%	142.0	1,095
2022	75,468	86,127	87.6%	154.1	559	79,905	86,096	92.8%	154.3	558	155,372	172,223	90.2%	154.2	1,117
2027	83,269	93,479	89.1%	160.3	583	88,166	93,481	94.3%	160.6	582	171,435	186,960	91.7%	160.5	1,165
2037	102,440	112,739	90.9%	169.5	665	108,369	112,814	96.1%	169.9	664	210,809	225,553	93.5%	169.7	1,329
Compound Annual Growth Rate															
2017 - 2022	2.3%	2.0%			0.4%	2.3%	2.1%			0.4%	2.3%	2.1%			0.4%
2022 - 2027	2.0%	1.7%			0.8%	2.0%	1.7%			0.8%	2.0%	1.7%			0.8%
2027 - 2037	2.1%	1.9%			1.3%	2.1%	1.9%			1.3%	2.1%	1.9%			1.3%
2017 - 2037	2.1%	1.9%			1.0%	2.1%	1.9%			1.0%	2.1%	1.9%			1.0%
International															
2017	1,641	2,025	81.0%	144.6	14	1,821	2,175	83.7%	145.0	15	3,461	4,200	82.4%	144.8	29
2022	1,934	2,277	84.9%	162.6	14	2,154	2,427	88.8%	161.8	15	4,089	4,704	86.9%	162.2	29
2027	2,231	2,629	84.9%	175.3	15	2,483	2,741	90.6%	171.3	16	4,715	5,370	87.8%	173.2	31
2037	3,124	3,599	86.8%	189.4	19	3,565	3,801	93.8%	190.1	20	6,688	7,400	90.4%	189.7	39
Compound Annual Growth Rate															
2017 - 2022	3.3%	2.4%			0.0%	3.4%	2.2%			0.0%	3.4%	2.3%			0.0%
2022 - 2027	2.9%	2.9%			1.4%	2.9%	2.5%			1.3%	2.9%	2.7%			1.3%
2027 - 2037	3.4%	3.2%			2.4%	3.7%	3.3%			2.3%	3.6%	3.3%			2.3%
2017 - 2037	3.3%	2.9%			1.5%	3.4%	2.8%			1.4%	3.3%	2.9%			1.5%

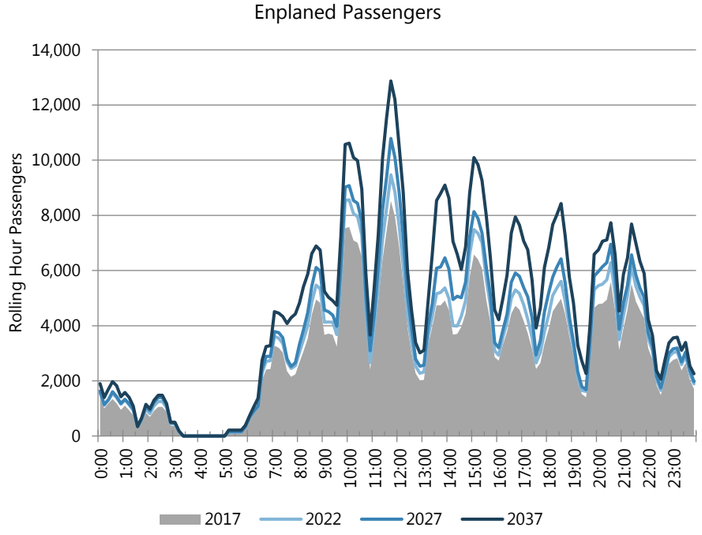
SOURCES: Innovata, January 2018 (scheduled flights); U.S. Department of Transportation, T-100 and DB1B Databases, January 2018 (load factor, originating and destination passengers); Ricondo & Associates, Inc., February 2018 (design day activity).

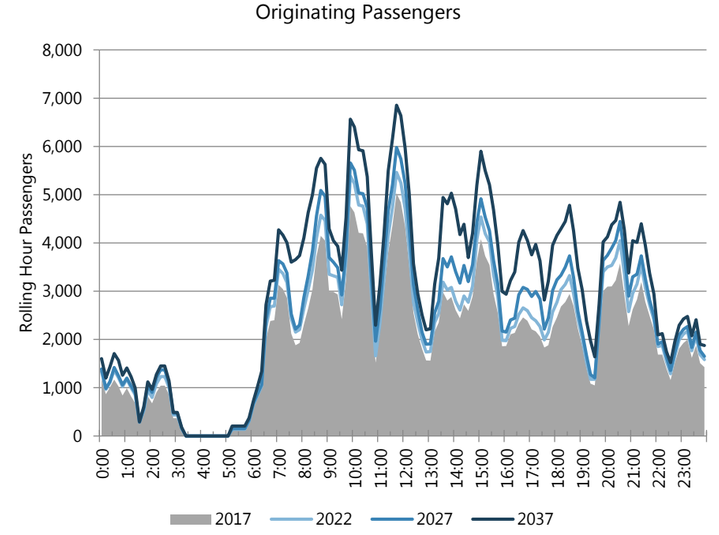
EXHIBIT 3-10 ROLLING HOUR PASSENGERS

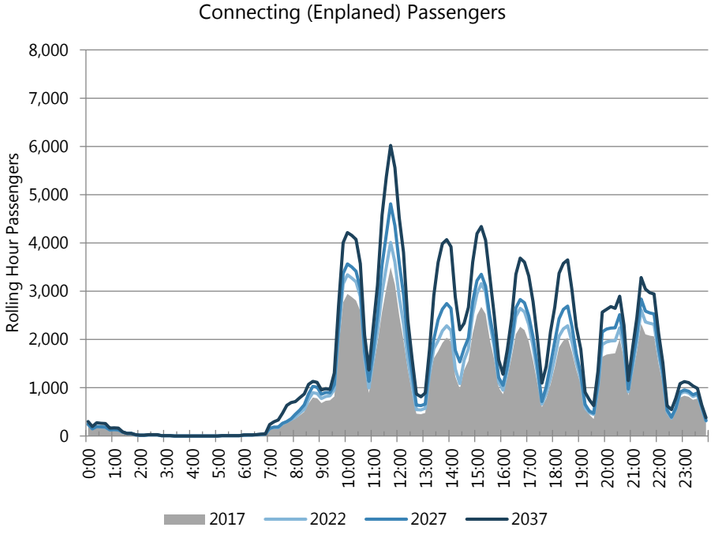






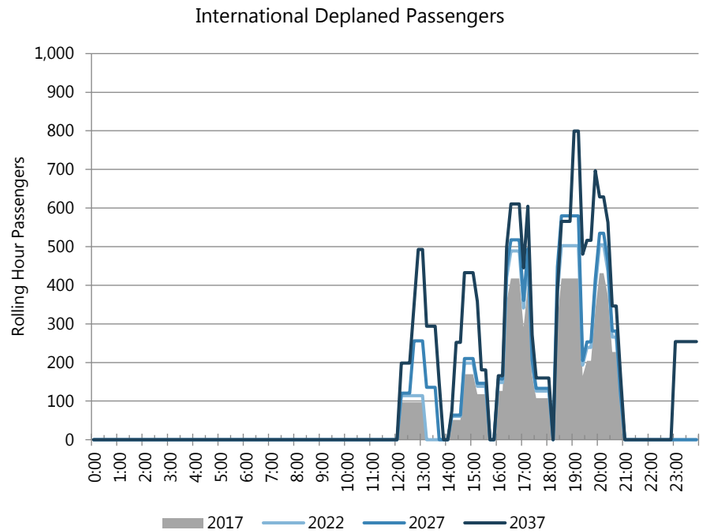


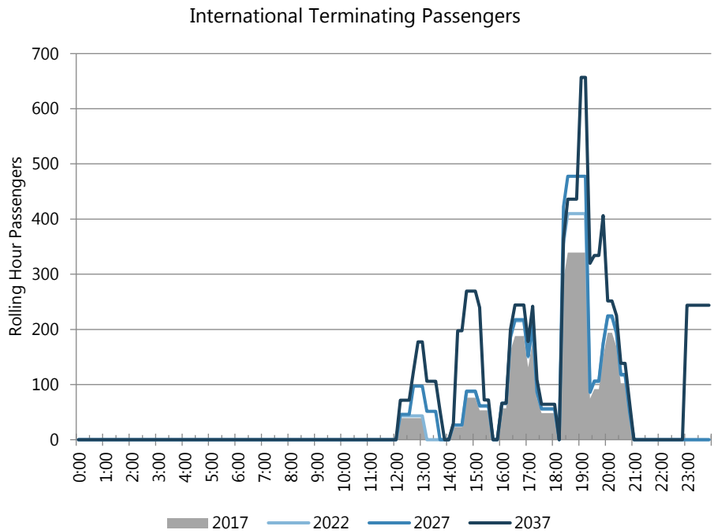


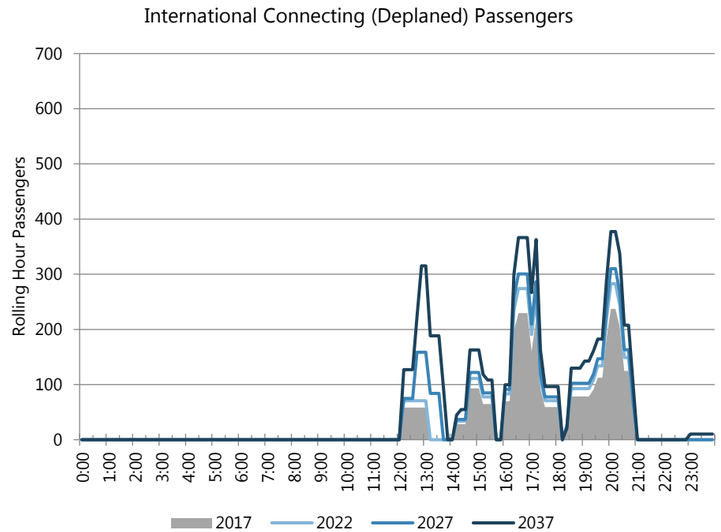


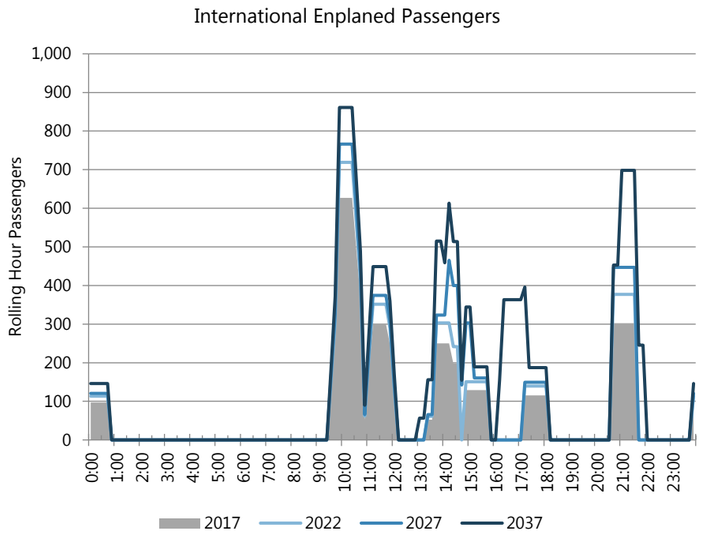
SOURCES: Innovata, January 2018 (scheduled flights); U.S. Department of Transportation, T-100 and DB1B Databases, January 2018 (load factor, originating and destination passengers); Ricondo & Associates, Inc., February 2018 (design day activity).

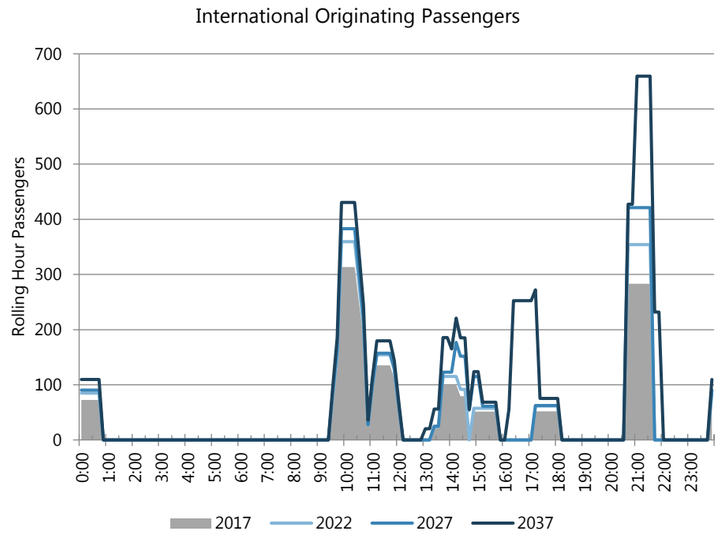
EXHIBIT 3-11 ROLLING HOUR INTERNATIONAL PASSENGERS

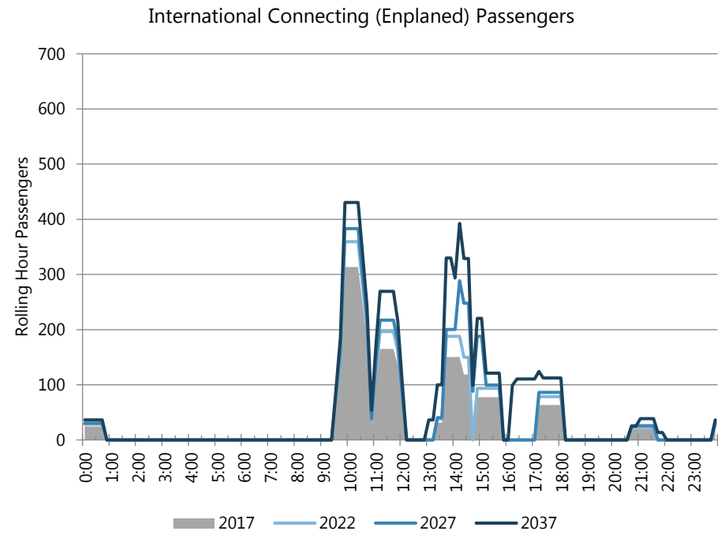






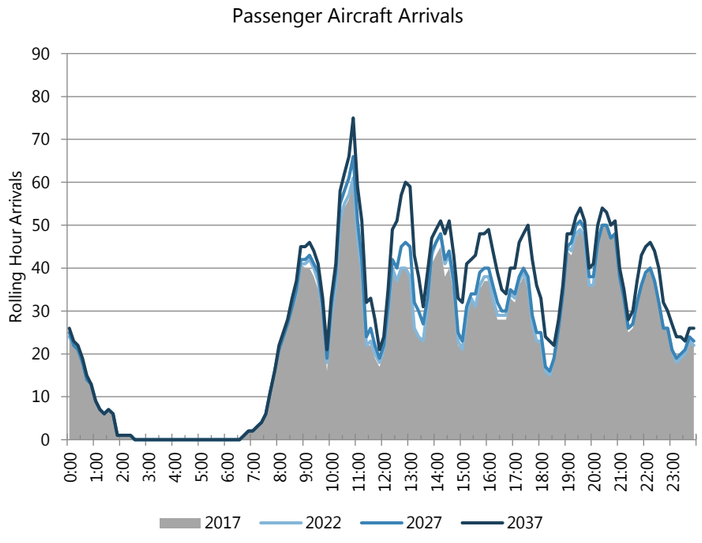


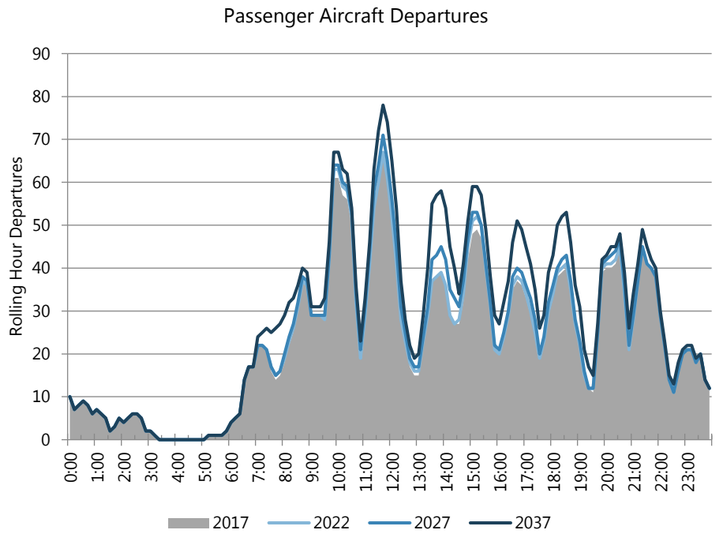


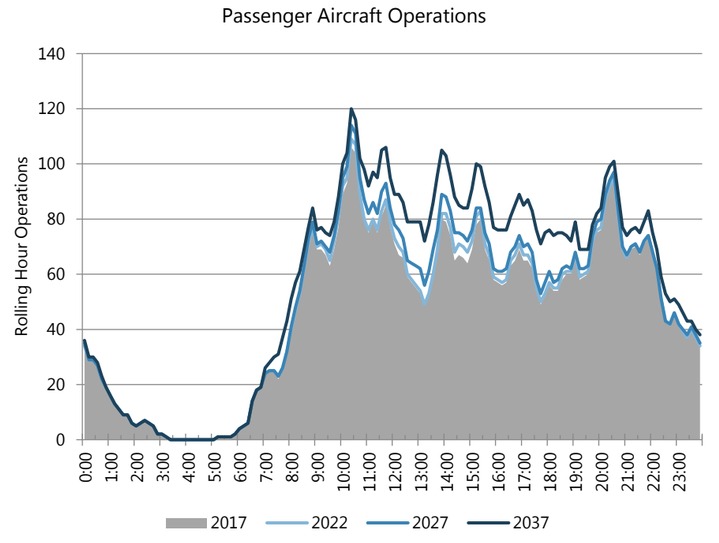


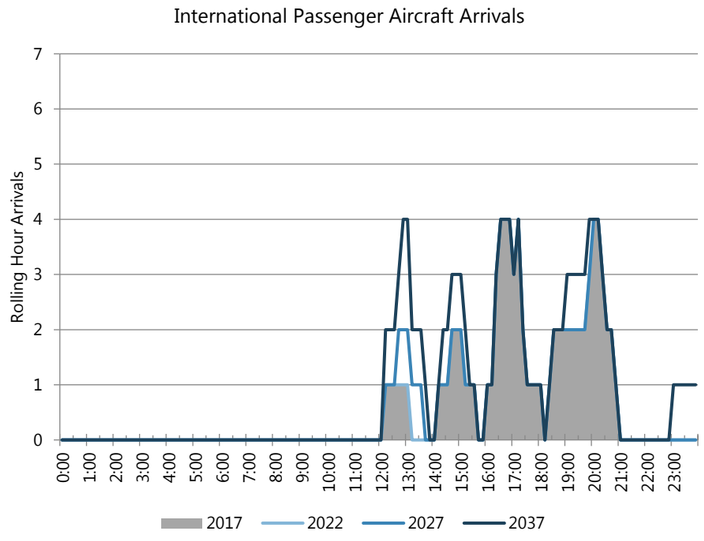
SOURCES: Innovata, January 2018 (scheduled flights); U.S. Department of Transportation, T-100 and DB1B Databases, January 2018 (load factor, originating and destination passengers); Ricondo & Associates, Inc., February 2018 (design day activity).

EXHIBIT 3-12 ROLLING HOUR PASSENGER AIRCRAFT OPERATIONS













SOURCES: Innovata, January 2018 (scheduled flights); U.S. Department of Transportation, T-100 and DB1B Databases, January 2018 (load factor, originating and destination passengers); Ricondo & Associates, Inc., February 2018 (design day activity).

4. FACILITY REQUIREMENTS

This section describes the relationship between demand and capacity of various airport systems and a general assessment of the capacity of existing facilities to meet future demand levels. It also summarizes the facility requirements to accommodate demand through the forecast horizon.

This section is organized by functional system. The facility requirements for each system provide the foundation for the subsequent identification of alternative concepts to meet forecast demand over the 20-year planning horizon.

- **Airfield Facilities**. These facilities include airfield elements supporting arrival, departure, taxiing, and overnight parking of aircraft beyond the terminal apron area. The ability of the existing airfield to accommodate forecast operational demand (magnitude and characteristics), in terms of both runway capacity and design standards, was evaluated.
- **Terminal and Concourse Facilities**. These facilities include the passenger processing, baggage screening and handling, airline, and security facilities from the terminal curbside to the aircraft gates. Enplaning, deplaning, and connecting passenger demand defines the need for facilities, such as passenger holdrooms, baggage claim, public circulation areas, airline leased space (ticket counters, operations area, baggage makeup area), security screening space, concessions, and other terminal space. Terminal gate/aircraft parking requirements were established according to PMAD demand for commercial passenger aircraft serving, and anticipated to serve, the Airport.
- **Landside Transportation Facilities**. These facilities include terminal curbsides; on- and off-Airport roadways, access, and circulation systems; and parking facilities. The ability of the existing terminal curbsides to accommodate forecast demand, in terms of numbers and types of vehicles, was the basis for establishing curbside requirements. Roadway demand is a function of passenger demand and the distribution of the various modes of transportation that serve the Airport. Parking facilities include all on-Airport parking facilities, such as short-term, long-term, and employee garages and surface lots.
- **Airport Tenant and Support Facilities**. These facilities include cargo, airline support (aircraft and equipment maintenance), GA, Airport support (e.g., maintenance, administration, operations, ARFF station, fuel storage), and FAA facilities (e.g., ATCT, TRACON).

The methodologies used to determine facility requirements are in accordance with industry standards, FAA guidance, and planning factors adjusted as appropriate to reflect actual Airport use characteristics.

4.1 PLANNING ACTIVITY LEVELS

The forecasts and design day flight schedules (DDFSs) were used to develop facility requirements for terminal, ground transportation, cargo, and GA facilities. Three planning activity levels (PALs) were identified corresponding with the following baseline forecast years and annual passenger activity levels in million annual passengers (MAP).

- PAL 1: 2022 at 49 MAP
- PAL 2: 2027 at 55 MAP
- PAL 3: 2037 at 68 MAP

For purposes of assessing demand for future facility requirements, design day activity was forecast for passenger and aircraft operations activity at the Airport for the PMAD. A summary of annual activity, design day demand, and peak rolling hour demand for the baseline forecast is summarized in **Table 4-1**.[1]

The peak month for international arriving passengers requiring U.S. Customs and Border Protection (CBP) processing occurs in December due to an increase in international passenger activity starting approximately a week before the Christmas holiday and ending approximately a week after. The peak international arrival day in 2017 occurred on December 23rd with several other days during this holiday period experiencing similar levels of international arrival demand. To determine gate and processing requirements for a peak international day, a PAL 3 international peak design day arrival schedule was developed.

4.2 AIRFIELD FACILITIES

Planning and design of airport facilities are typically based on the role of the airport and the design aircraft expected to operate on the airfield. The FAA provides planning and design guidance through published ACs, Orders, and other guidelines intended to promote airport safety, efficiency, and economy. FAA airfield planning and design standards governing the geometric layout of runways and taxiways are provided in AC 150/5300-13A, *Airport Design*.[2]

The RIM Study referenced in Section 2.6.1 was started prior to CAMP to study airfield improvements that would increase efficiency of the airfield and enhance safety. The RIM Study also included a facility requirements analysis that reviewed the existing airfield for design standards deficiencies and the capacity of the airfield. The airfield facilities requirements section summarizes and incorporates the findings of the RIM Study.

4.2.1 CRITICAL AIRCRAFT

The FAA defines an airport's critical aircraft as "the most demanding aircraft type, or grouping of aircraft with similar characteristics, that make regular use of the airport" where regular use is defined as 500 annual operations; an operation is defined as a takeoff or landing.[3] The critical aircraft sets the dimensional requirements for airfield geometry and the size of certain areas protecting the safety of aircraft operations and passengers. The critical aircraft is used to determine the design codes to be used for planning:

- **Airport Reference Code (ARC)**. The airport designation that signifies the highest AAC and ADG that one or more runway(s) at the airport can accommodate. The ARC is used for planning and design purposes but does not limit the aircraft that may be able to operate safely at an airport.
- **Runway Design Code (RDC)**. The code signifying the design standards for a runway, consisting of the most demanding AAC and ADG that the runway is designed to accommodate, and approach visibility minimums expressed as Runway Visual Range (RVR) in feet.

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[1] The peak hour usually does not occur in a clock hour but across two clock hours. Rolling peak hour demand is the sum of demand for the prior 60-minute period.

[2] Federal Aviation Administration, Advisory Circular 150/5300-13A Change 1, *Airport Design*, September 28, 2012.

[3] Federal Aviation Administration, Advisory Circular 150/5000-17, *Critical Aircraft and Regular Use Determination*, June 20, 2017.

TABLE 4-1 PLANNING ACTIVITY LEVELS

	2017	PAL 1	PAL 2	PAL 3
Annual Activity				
Enplaned Passengers	22,016,714	24,710,084	27,384,747	33,980,799
Domestic	20,986,902	23,443,363	25,878,349	31,965,611
International	1,029,812	1,266,721	1,506,398	2,015,188
Aircraft Operations	443,392	444,189	464,326	526,508
Design Day				
Enplaned Passengers – Domestic and International[1]	73,258	82,059	90,650	111,934
Domestic	69,343	77,289	85,089	104,605
International	3,915	4,770	5,560	7,329
Enplaned Passengers – Originating and Connecting[1]	73,258	82,059	90,650	111,934
Originating	49,328	54,800	60,007	72,742
Connecting	23,930	27,259	30,642	39,192
Deplaned Passengers – Domestic, Preclearance, and International	69,107	77,402	85,500	105,564
Domestic and Preclearance[2]	67,466	75,468	83,269	102,440
International	1,641	1,934	2,231	3,124
Deplaned Passengers – Destination and Connecting[1]	69,107	77,402	85,500	105,564
Destination	45,090	50,008	54,601	66,096
Connecting	24,016	27,395	30,899	39,468
Passenger Airline Operations	1,124	1,146	1,196	1,368
Departures	562	573	598	684
Arrivals	562	573	598	684
Peak Rolling Hour				
Enplaned Passengers[1]	8,527	9,473	10,790	12,874
Originating	5,030	5,462	5,979	6,853
Connecting	3,497	4,011	4,810	6,020
Deplaned Passengers[1]	7,389	8,189	9,441	11,610
Terminating	4,312	4,638	5,233	6,169
Connecting	3,077	3,550	4,209	5,440
Passenger Airline Operations	106	109	114	120

NOTES:

1 Due to rounding, numbers presented in this table may not sum to the totals provided.

2 Preclearance includes passengers arriving from Canadian airports with U.S. Customs and Border Protection preclearance facilities. These passengers are processed as domestic passengers.

SOURCE: Ricondo & Associates, Inc., April 2018.

- **Approach Reference Code**. The code signifying the landing capabilities of a runway and its associated parallel taxiway and consists of three components: AAC, ADG, and RVR.
- **Departure Reference Code**. The code signifying the takeoff capabilities of a runway and consists of the AAC and ADG.

The existing critical aircraft is the Boeing 747-400 which has an AAC of D (approach speed of 141 knots or more but less than 166 knots) and an ADG of V (meaning a wingspan of 171 feet or more but less than 214 feet and/or a tail height of 60 feet or more but less than 66 feet). The ARC for PHX is D/V.

The Boeing 747-400 is operated by British Airways, which has announced a phased retirement of this aircraft by 2024. The aircraft is forecast to be replaced with similar capacity aircraft such as the Airbus A350-1000, Boeing 777-300ER, or Boeing 787-10. These aircraft are similar in geometry to the Boeing 747-400; however, all three are categorized as TDG 6 compared to TDG 5 for the Boeing 747-400. There is a potential for seasonal or unscheduled service by ADG VI aircraft (e.g., Airbus A380-800), but the number of operations of that aircraft is not forecast to exceed 500 annual operations. **Table 4-2** summarizes the design codes and groups for the future airfield based on a review of the RIM Study.

TABLE 4-2 FUTURE DESIGN CODES

RUNWAY END	AIRPORT REFERENCE CODE[1]	RUNWAY DESIGN CODE[2]	APPROACH REFERENCE CODE[3]	DEPARTURE REFERENCE CODE[4]	TAXIWAY DESIGN GROUP
8	D/V	D/V/5000	D/V/5000	D/V	6
26		D/V/4000	D/V/4000	D/V	6
7L		D/V/2400	D/V/2400	D/V	6
25R		D/V/5000	D/V/5000	D/V	6
7R		D/V/4000	D/V/4000	D/V	6
25L		D/V/2400	D/V/2400	D/V	6

NOTES
1 Airport Reference Code includes AAC and ADG.
2 Runway Design Code includes AAC, ADG, and RVR in feet.
3 Approach Reference Code includes AAC, ADG, and RVR in feet.
4 Departure Reference Code includes AAC and ADG.
SOURCE: HNTB, *Runway Incursion Mitigation Study*, February 2018.

4.2.2 RUNWAY INCURSION MITIGATION STUDY RECOMMENDATIONS

The RIM Study reviewed the airfield for deficiencies associated with design standards such as taxiway pavement widths, safety clearances, centerline separations, and hold positions for aircraft. The study also identified areas where the airfield geometry does not meet taxiway design standards in AC 150/5300-13A, which are intended to enhance safety by avoiding runway incursions. The RIM Study documented the following recommendations:

- Remove incompatible objects from the runway object free area (ROFA).
- Meet ADG V standards throughout the entire airfield, where practicable.

- Mitigate taxiway crossings in the middle third of the runway (Taxiways A5/B6, A6/B7, A7/B8, E6/F6, E8/F8, E9/F9, G4/H4, G5/H5).
- Mitigate wide expanses of pavement (Taxiways A6, A12, and B14; intersection of Taxiways S, T, B, and C; intersection of Taxiways S, T, D, and E; intersection of Taxiways D3, D4, D, and E; and intersection of Taxiways R, D13, E13, D, and E).
- Mitigate direct runway access from aprons (Taxiways A8, A9, D1, and H5; Point L; and Terminal 3 North Concourse East Apron).
- Mitigate the aligned taxiway leading into Runway 26.
- Mitigate the potential for loss of situational awareness on Taxiways T and R in the northbound direction.
- Meet current recommendations for taxiway nomenclature on the field.
- Mitigate the misidentification of runway thresholds for Runways 25L and 25R.
- Mitigate all identified hot spots and FAA RIM locations.
- Reconstruct Taxiway F8 to meet current design standards for exit taxiways.
- Iimprove taxiway fillets with priority given to potential taxi routings for TDG 6 aircraft.
- Update ATCT Standard Operating Procedure (SOP) to reflect the inability to hold Airbus A340-600, Airbus A350-1000, Boeing 747-400, and Boeing 777-300ER aircraft between Runways 7L-25R and 7R-25.
- Maintain hold position markings for the nonmovement area boundary in their current location (291 feet provided versus the 261 feet required) to protect future potential upgrades to the approaches for Runway 8-26 and to be consistent with Runways 7L-25R and 7R-25L.

The preferred alternatives to address these recommendations are identified in Section 5 of the RIM Study.

4.2.3 AIRFIELD CAPACITY

Airfield capacity is defined as the maximum number of aircraft operations that can be accommodated on an airfield during a specific period without incurring an unacceptable level of delay. Airfield capacity varies according to weather conditions, types of aircraft operating on the airfield, airfield configuration, and ATC procedures. The number and location of runway exits also influences airfield capacity. Aircraft delay increases exponentially as the number of aircraft operations (i.e., demand) nears or exceeds the airfield capacity under a specific operating condition. The following terms, as defined by the FAA, are used in describing the analysis conducted:

- **Annual Service Volume (ASV)**. As defined in AC 150/5060-5, *Airport Capacity and Delay*,[4] ASV "is a reasonable estimate of an airport's annual capacity." In estimating ASV, the hourly, daily, and seasonal variations in aircraft demand associated with the airfield are considered, as well as the occurrence of

[4] Federal Aviation Administration, Advisory Circular 150/5060-5 – Change 2, *Airport Capacity and Delay*, September 23, 1983.

low visibility and/or cloud ceiling heights in which ATC procedures are modified to maintain aircraft operational safety, as well as runway use configurations.

- **Average Annual Delay per Operation**. This is an estimate of the average delay that each aircraft operation is expected to experience over the year. Some aircraft operations, such as those occurring during peak operating hours, would likely experience higher delays, while others, such as nighttime operations, would likely experience little or no delay.

An airfield demand/capacity analysis was conducted as part of the RIM Study to assess the capability of the airfield facilities to accommodate future aircraft operations. Two methods were used to assess the capacity of the airfield as described in the following subsections.

4.2.3.1 STATIC MODELS

The airfield capacity was documented in the RIM Study using two ASV calculation methodologies—FAA Advisory Circular (AC) 150/5060-5 and the Prototype Airfield Capacity Spreadsheet Model in Airport Cooperative Research Program (ACRP) Report 79, *Evaluating Airfield Capacity*.[5] These methodologies and the overall ASV are described in the following paragraphs.

Federal Aviation Administration Advisory Circular 150/5060-5

The FAA's methodology in AC 150/5060-5 uses a formula for calculating ASV consisting of three variables: Cw (weighted hourly capacity), D (the ratio of annual demand to average daily demand in the peak month), and H (the ratio of average daily demand to average peak hour demand during the peak month). These variables are determined for different runway use configurations and multiplied and added together to obtain the ASV for the Airport.

The latter two metrics (D and H) were derived from a 2025 DDFS developed as part of the RIM Study. A forecast prepared in 2015 served as the basis for the DDFS.[6] The forecast of annual operations is 501,986 and the average daily demand during the peak month is forecast to be 1,455 operations per day, with 139 average peak hour operations in 2025. The ratio of annual demand to average daily demand (the D factor) is therefore 345.0 (501,986 divided by 1,455). The ratio of average daily demand during the peak month to average peak hour demand during the peak month (the H factor) is 10.5 (1,455 divided by 139). These factors combined with the weighted hourly runway capacity (Cw) of 143.9 result in an ASV of 519,011 operations.

The PAL 3 activity forecast developed for CAMP projects 526,508 annual operations, 1,563 PMAD operations, and 125 peak hour operations, resulting in D and H factors of 336.8 and 12.5, respectively. These factors, along with assuming a Cw of 143.9 hourly operations, result in an ASV of 608,028 operations. The reason for the increase in the ASV is largely driven by an increase in the ratio of forecast daily operations to peak hour operations, indicating that the peak hour grows at a slower rate than daily activity and demand is spread more evenly throughout the PMAD.

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[5] Airport Cooperative Research Program, Report 79, *Evaluation Airfield Capacity*, 2012.

[6] Landrum & Brown, *Aviation Activity Demand Forecast for Phoenix Sky Harbor International Airport*, March 2015.

Airport Cooperative Research Program, Report 79

The ACRP spreadsheet model was created to better understand and calculate airfield capacity at a higher fidelity than the FAA methodology but with less effort than what is required to use simulation models. The ACRP model was intended to better reflect operating conditions at an airport but was intended for use by airports with one or two runways. Since PHX has three runways, the model was configured as a single Runway 8-26 and a set of closely-spaced parallel runways, Runways 7L-25R and 7R-25L. Due to noise abatement procedures, east flow departure runways are dependent as there is only a single initial departure fix. Because the model can only analyze one or two runways, the model was configured to reduce the theoretical capacity in east flow. This noise abatement procedure does not apply to west flow.

The results of the single runway and dual parallel runway were combined to calculate an overall ASV for each runway use configuration under both Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC). The estimated ASV for the Airport was 472,150 operations using the 98 percent mix index for 2017 and 457,050 operations for the 107 percent mix index for in the 2025 Landrum & Brown forecast.[7]

4.2.3.2 SIMULATION MODEL

The simulation modeling tool, AirTOp, was used in the RIM Study to model airfield and airspace aircraft movements. The simulation model is intended to reflect real world conditions and variability and was numerically validated with FAA ATC and PHX AVN staff. The simulation model was used to calculate hourly throughput and average delay per aircraft operation.

A total of eight simulation models were created for the east and west flows under VMC and IMC for the 2017 and 2025 schedules developed as part of the RIM Study. The RIM Study team estimated that the 2025 average delay per aircraft operation would be 4.1 minutes. This is considered an acceptable level of delay in AC 150/5070-6B, *Airport Master Plans*[8] and ACRP Report 109, *Defining and Measuring Aircraft Delay and Airport Capacity Thresholds*.[9]

4.2.3.3 AIRFIELD CAPACITY SUMMARY

Table 4-3 summarizes the hourly capacity and ASV of the airfield associated with the 2025 DDFS (RIM Study) and 2037 DDFS (CAMP) assumptions. The ACRP methodology does not have the ability to incorporate the Airport's three-runway airfield configuration without making some operational and calculation assumptions. It should be noted that both methodologies provide a reasonable estimate of an airport's annual capacity and daily and hourly peaking characteristics could affect airfield capacity.

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[7] Mix index is the mathematical sum of the percentage of large aircraft (between 12,500 and 300,000 pounds) operations and three times the percentage of heavy aircraft (greater than 300,000 pounds) operations.

[8] Federal Aviation Administration, Advisory Circular 150/5070-6B, *Airport Master Plans*, July 29, 2005.

[9] Airport Cooperative Research Program, Report 109, *Defining and Measuring Aircraft Delay and Airport Capacity Thresholds*, 2014.

TABLE 4-3 AIRFIELD CAPACITY SUMMARY

METRIC	ACRP (RIM STUDY, 2025 DDFS)	FAA AC 150/5060-5 (RIM STUDY, 2025 DDFS)	FAA AC 150/5060-5 (CAMP, 2037 DDFS)
VMC Hourly Capacity	129	150	150
IMC Hourly Capacity	106	83	83
Annual Service Volume	457,050	519,011	608,028

SOURCES: HNTB, Runway Incursion Mitigation Study, February 2018 (2025 ASV); Ricondo & Associates, Inc., June 2018 (2037 ASV).

It should be noted that the average number of seats per aircraft operation is anticipated to increase over the planning horizon. This is forecast to result in minimal increases in aircraft operations in the peak hour of the PMAD, reaching 125 peak hour aircraft operations in 2037.

4.2.3.4 RECOMMENDED CAPACITY IMPROVEMENTS

The RIM Study provides recommendations for two airfield improvements to improve the flow of aircraft on the airfield.

Crossfield Taxiways

The PHX ALP has historically included future crossfield Taxiways U and V connecting Runways 7L and 8 on the west side of the airfield (as shown on Exhibit 2-16 in Section 2). The RIM Study simulation models demonstrated that the existing crossfield Taxiways R, S, and T allow for the efficient movement of aircraft departing on Runway 25R during west flow as aircraft form two queues on Taxiway E and crossfield Taxiway R. The two departure queues provide ATC with the ability to sequence aircraft onto Runway 25R for takeoff. Conversely, aircraft arriving to Runway 26 in west flow must backtrack to Taxiways S or T to cross the airfield to reach the south concourses. Aircraft arriving on Runway 25L must backtrack to Taxiways S and T to reach the north concourses or the West and Center Hold Pads adjacent to Taxiway C. The AirTOp simulation models showed that crossfield Taxiways U and V would reduce congestion on Taxiways, B, C, D, and E along the north and south concourses and decrease taxi times.

In east flow, aircraft arriving on Runways 8 and 7R cross the airfield on crossfield Taxiways R and T which allows for an efficient flow of aircraft to the concourses and hold pads. East flow is restricted to one departure stream due to established noise abatement procedures. All aircraft departing Runway 7L queue on Taxiway E and the simulation models showed aircraft queues extending along the entire length of the runway. A crossfield taxiway on the west side of the airfield would provide ATC with greater flexibility and allow for two queues for aircraft departing on Runway 7L.

The RIM Study indicated that one of the two planned new crossfield taxiways would provide operational benefits at 2017 demand levels. The second new crossfield taxiway would be needed to facilitate the movement of aircraft between the north and south portions of the airfield if a west terminal complex is constructed west of Terminal 3.

Hold Bays

The Airport has three hold bays (west, center, and east) located adjacent to Taxiway C (see Exhibit 2-1 in Section 2) which together have approximately 3,000 linear feet of taxiway centerline to park approximately

20 narrowbody aircraft. The hold bays are often used by inbound aircraft waiting for their gate to become available. During the morning arrival peak, all three hold bays are often fully occupied. The RIM Study 2025 simulation models identified a need to accommodate four additional aircraft in the hold bays. It is recommended that the Airport maintain a similar number of hold bays and look for opportunities to expand the number of aircraft that can be accommodated within the hold bays to reduce airfield congestion.

Runways

The single departure stream for east flow departures, which is part of airport noise abatement procedures, has the biggest effect on airfield capacity. Noise abatement procedures route jet aircraft departing to the east over the Salt River for 5 miles before turning to minimize noise exposure to residential areas. The noise abatement procedures are unlikely to be modified throughout the planning horizon.

The pavement prior to the Runway 26 threshold is an aligned taxiway with a length of 415 feet. The RIM Study recommended converting this taxiway into runway pavement allowing pilots to use the additional length for takeoff. This additional runway length would assist airlines in minimizing payload reductions often required for heavy aircraft during hot summer days.

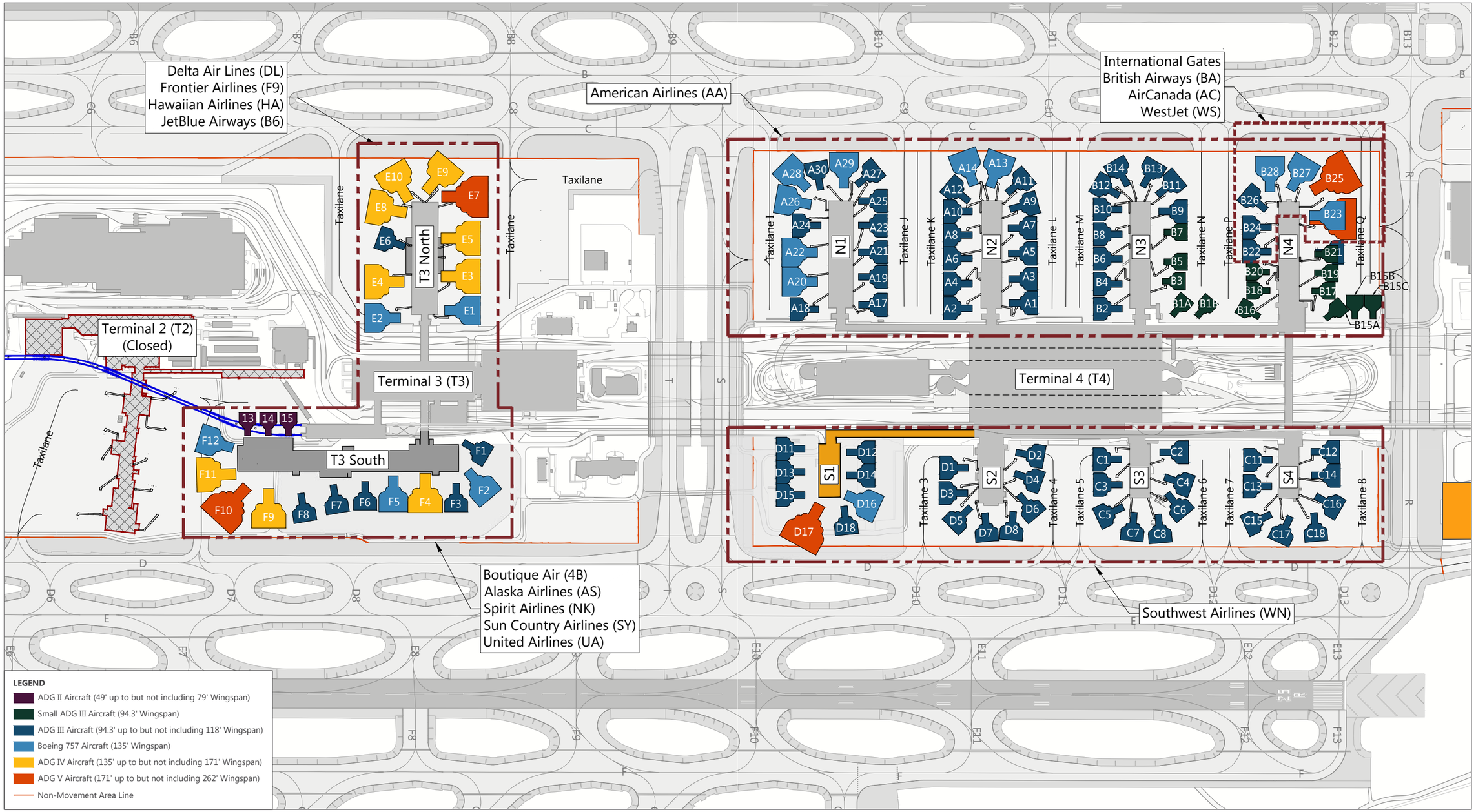
4.3 TERMINAL AND CONCOURSE FACILITY REQUIREMENTS

As described in Section 2.6, the Terminal 3 Modernization Program was underway at the time of this study, along with the design of Terminal 4 Concourse S1. The terminal and gate requirements were developed assuming that the Terminal 3 Modernization and subsequent Terminal 2 closure would be complete and that Concourse S1 would be fully operational and leased to Southwest Airlines by PAL 1, which is expected to occur in 2022. **Exhibit 4-1** represents the planned airline locations and available gates assumed for PAL 1. Facility requirements were generated for all three PALs and for three terminal groups identified in **Table 4-4**: Terminal 3 (including those carriers operating out of Terminal 2 in 2017), Terminal 4–North, and Terminal 4–South.

TABLE 4-4 ANTICIPATED AIRLINE LOCATIONS FOR TERMINAL AND GATE PLANNING

TERMINAL 3	TERMINAL 4–NORTH	TERMINAL 4–SOUTH
Delta Air Lines	American Airlines	Southwest Airlines
Frontier Airlines	British Airways	
Hawaiian Airlines	WestJet Airlines	
JetBlue Airways	Air Canada	
United Airlines	Other Airlines Requiring International Facilities	
Sun Country Airlines		
Spirit Airlines		
Alaska Airlines		
Boutique Air		

SOURCE: City of Phoenix Aviation Department, December 2017.



SOURCES: Woolpert Airports Geographic Information System (AGIS) for Phoenix Sky Harbor International Airport, flown May 28 and September 29, 2017 (basemap); City of Phoenix Aviation Department, December 2017 (airline assignments).

EXHIBIT 4-1

Assumed Apron Layouts and Airline Locations

4.3.1 AIRCRAFT GATE AND HOLDROOM REQUIREMENTS

The following subsections identify the facility requirements for aircraft gates and associated holdrooms.

4.3.1.1 AIRCRAFT GATE REQUIREMENTS

A gating analysis was conducted to determine the number of gates and remote aircraft parking positions needed to accommodate future passenger aircraft operations at each of the PALs. Gate capability for planning purposes is typically defined by the maximum allowable wingspan and length of aircraft that can be accommodated at a particular gate, identified by either ADG or a specific aircraft model (e.g., Boeing 757-300W).[10] **Table 4-5** summarizes the assumed existing gate capabilities for the gating analysis. A small ADG III category was introduced to identify regional jet aircraft with wingspans less than 94 feet, 3 inches (Embraer E195 and smaller) from larger ADG III narrowbody aircraft. ADG II gates are sized for aircraft smaller than regional jets such as the Pilatus PC-12 used by Boutique Air. Several gates at the Airport are limited to Boeing 757-300W (wingspan of 135 feet, technically an ADG IV aircraft) and are not able to accommodate larger ADG IV aircraft (wingspans of up to 171 feet).

TABLE 4-5 GATE INVENTORY

TERMINAL GROUP	ADG II	SMALL ADG III[4]	ADG III	BOEING 757-300W[5]	ADG IV	ADG V	ADG VI	TOTAL
Terminal 3[1]	3	--	6	4	9	3	--	25
Terminal 4–North[2]	--	13	35	9	--	1	1	59
Terminal 4–South[3]	--	--	30	1	--	1	--	32
Total	3	13	71	14	9	5	1	116

NOTES:
1 Includes gates in Terminal 3 South Concourse.
2 Existing MARS gate B23 is included as one ADG VI gate at Terminal 4–North (identified in ramp chart as B23 and B23W).
3 Includes planned Concourse S1.
4 Small ADG III includes aircraft with wingspans less than 94 feet, 3 inches (Embraer E195 and smaller).
5 "W" indicates aircraft with blended winglets (e.g., Boeing 757-300W.).
SOURCE: Ricondo & Associates, Inc., June 2018.

Methodology and Assumptions

vGates is a proprietary gate-scheduling software developed by Ricondo. This software was used to establish aircraft gate requirements based on appropriate configurations and operational characteristics. A vGates model of the Airport was developed to assist with the analysis of gate requirements by assigning flights in each DDFS to gates based on the following:

- Gate Characteristics
  - Aircraft size limits
  - Airline gate assignments
  - Time required between flights ("intergate" time)
  - Type of flights accommodated (e.g., domestic or international)

[10] "W" indicates aircraft with blended winglets (e.g., Boeing 757-300W.)

- Aircraft Characteristics
  - Aircraft size/model
  - Airline and/or aircraft operator
  - International arrival status

The vGates program utilizes a hierarchal decision tree methodology to assign gates iteratively by (1) time available based on flight arrival and departure times and intergate requirements, (2) airline assignment, (3) aircraft size, and (4) flight type (typically domestic or international). The program processes a schedule and attempts to assign all flights to a gate. Unaccommodated flights are identified as unassigned. After the initial automated gating, subsequent manual iterations are completed to reassign flights to increase or decrease gate utilization. Specific assumptions were incorporated into the vGates program to reflect the unique physical and operational environment at the Airport:

- To optimize gate utilization, flights were first assigned to a gate of similar wingspan (e.g., a Boeing 737-700 is assigned first to an ADG III gate rather than a gate that could accommodate a larger aircraft). An aircraft was assigned to a gate that can accommodate a larger aircraft only after all of the largest aircraft that could be accommodated at the gate were gated. For example, an ADG III aircraft could be assigned to an ADG IV sized gate if all ADG IV aircraft remaining in the schedule have been assigned gates.
- Concourse N4 contains CBP facilities for processing arriving international passengers. International arrivals from airports that do not maintain preclearance facilities are given priority followed by all other international arrivals or departures, and then American Airlines domestic flights.

When warranted, aircraft parked at a gate for an extended period could be towed to a remote parking position allowing other arrivals or departures to use the gate. In these instances, the aircraft would be towed from the remote parking position back to a gate prior to departure. **Table 4-6** identifies the minimum gate occupancy for aircraft being towed off a gate after arrival and towed to a gate prior to departure for three aircraft categories: regional jet, narrowbody, and widebody. For example, a narrowbody aircraft is assumed to be towed off a gate to a remote parking position 30 minutes after arrival. The same narrowbody aircraft would later be towed to a gate 45 minutes before departure to allow for the loading of passengers, baggage, and cargo. The required number of remote parking positions was quantified and is presented for each PAL.

TABLE 4-6 AIRCRAFT TOW ASSUMPTIONS – MINIMUM GATE OCCUPANCY

	REGIONAL JET	NARROWBODY	WIDEBODY
Time After Arrival (minutes)	30	30	45
Time Prior to Departure (minutes)	30	45	60

SOURCE: Ricondo & Associates, Inc., June 2018.

The amount of time a gate is unoccupied between a departure and subsequent arrival (intergate time) reflects airline practices/operations and/or aircraft types. Since airlines use different scheduling parameters

and strategies, there can be variations in intergate times. For this gating analysis, a minimum intergate time of 30 minutes was assumed.

Aircraft turns per gate is a metric that defines the number of times an aircraft arrives and subsequently departs or is towed to or from a gate and is used to assess the overall utilization of a gate on the design day. Average turns per gate for each airline on a concourse were limited through manual iteration to eight turns per gate for Southwest Airlines and seven turns per gate for all other airlines and international-capable gates. These thresholds are typical of hub airports in the United States. Exceeding these levels may introduce operational challenges such as the inability to respond to delays or irregular operations. Adjustments were performed during the analysis if the average turns per gate on a concourse exceeded these thresholds. Airlines utilizing common use gates in Terminal 3 were consolidated to as few gates as possible to maintain consistency throughout their daily schedule.

A sample ramp chart is shown on **Exhibit 4-2**. A ramp chart illustrates aircraft activity on each gate, including aircraft type, operator, flight number, origination airport, destination airport, and arrival and departure times. Complete ramp charts for this analysis are provided in **Appendix B**.

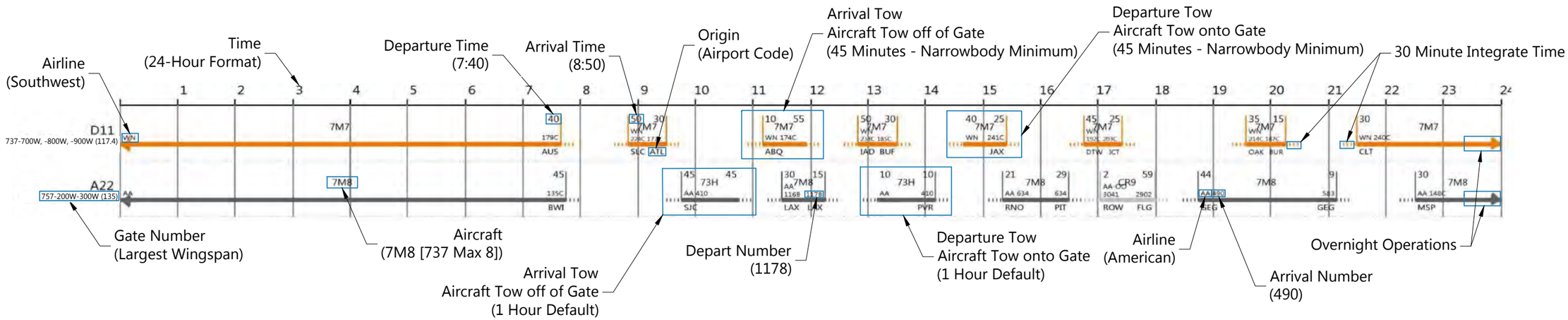
PAL 1 (49 MAP) Aircraft Gate and Remote Parking Position Requirements

Table 4-7 provides a summary of the number of existing and required gates for each terminal group for the PAL 1 DDFS. The calculation for the number of additional gates assumed that larger gates could be used by smaller aircraft to address a gate deficit. As part of the alternatives analysis, opportunities for adjusting gate sizes to accommodate forecast aircraft fleet mix will be investigated to fully utilize existing concourses. The average turns per gate for the three terminal groups is listed in **Table 4-8**.

The following summarizes the gate and remote parking position requirements for PAL 1:

- Terminal 3: One additional small ADG III gate and one additional ADG III gate is required. These two gates should be configured as ADG III gates to accommodate gate requirements in PAL 2. The two ADG III gates may be accommodated by reconfiguring existing underutilized ADG IV gates within the north and south concourses.
- Terminal 4 –North:
  - Two additional ADG V gates are required.
  - ADG III and Boeing 757-300W capable gates (on Concourses N1, N2, and N3) have an average of 5.1 turns per gate while ADG II and small ADG III gates (on Concourses N3 and N4) are underutilized with an average of 2.5 turns per gate, indicating an opportunity to adjust gate sizes to increase utilization.
  - No additional international-capable gates are required.
- Terminal 4–South: No additional gates are required.[11]
- Remote Parking Positions: Ten remote aircraft parking positions are required (1 small ADG III, 8 ADG III, and 1 ADG V).

[11] Assumes that Terminal 4-South includes future Concourse S1 for a total of 32 gates.



SOURCE: Ricondo & Associates, June 2018.

EXHIBIT 4-2

Example Ramp Chart

TABLE 4-7 PLANNING ACTIVITY LEVEL 1 GATE REQUIREMENTS

TERMINAL GROUP	ADG II	SMALL ADG III[1]	ADG III	BOEING 757-300W	ADG IV	ADG V	ADG VI
Terminal 3[2]							
Existing	3	--	6	4	9	3	--
Requirement	3	1	14	6	2	1	0
Surplus/(Deficit)	0	(1)	(8)	(2)	7	2	0
Additional Gates Required – PAL 1	0	1	1	0	0	0	0
Terminal 4–North[3]							
Existing	--	13	35	9	--	1	1
Requirement	2	11	43	1	0	3	1
Surplus/(Deficit)	(2)	2	(8)	8	0	(2)	0
Additional Gates Required – PAL 1	0	0	0	0	0	2	0
Terminal 4–South[4]							
Existing	--	--	30	1	--	1	--
Requirement	0	0	24	0	0	0	0
Surplus/(Deficit)	0	0	6	1	0	1	0
Additional Gates Required – PAL 1	0	0	0	0	0	0	0

NOTES:
1 Small ADG III includes aircraft with wingspans less than 94 feet, 3 inches (Embraer E195 and smaller).
2 Includes Terminal 3 South Concourse.
3 Existing MARS gate B23 is included as one ADG VI gate at Terminal 4–North (identified in ramp chart as B23 and B23W).
4 Includes planned Concourse S1.
Exhibit B-1 in Appendix B presents a gated ramp chart for the PAL 1 gating analysis.
SOURCE: Ricondo & Associates, Inc., June 2018.

TABLE 4-8 PLANNING ACTIVITY LEVEL 1 AVERAGE TURNS PER GATE

TERMINAL GROUP	TOTAL OPERATIONS	TOTAL UTILIZED GATES	AVERAGE TURNS PER GATE
3	118	27	4.4
4–North	285	61	4.7
4–South	189	24	7.9

NOTE:
1 Existing MARS Gate B23 is included as one ADG VI gate at Terminal 4–North (identified in ramp chart as B23 and B23W).
SOURCE: Ricondo & Associates, Inc., June 2018.

PAL 2 (55 MAP) Aircraft Gate and Remote Parking Position Requirements

Table 4-9 provides a summary of the number of existing and required gates for each terminal group for the PAL 2 DDFS.

TABLE 4-9 PLANNING ACTIVITY LEVEL 2 GATE REQUIREMENTS

TERMINAL GROUP	ADG II	SMALL ADG III[1]	ADG III	BOEING 757-300W	ADG IV	ADG V	ADG VI
Terminal 3[2]							
Existing	3		6	4	9	3	
Requirement	3	0	16	5	0	3	0
Surplus/(Deficit)	0	0	(10)	(1)	9	0	0
Additional Gates Required – PAL 1	0	0	2	0	0	0	0
Additional Gates Required – PAL 2	0	0	0	0	0	0	0
Terminal 4–North[3]							
Existing		13	35	9		1	1
Requirement	1	11	43	0	0	6	1
Surplus/(Deficit)	(1)	2	(8)	9	0	(5)	0
Additional Gates Required – PAL 1	0	0	0	0	0	2	0
Additional Gates Required – PAL 2	0	0	0	0	0	3	0
Terminal 4–South[4]							
Existing			30	1		1	
Requirement	0	0	25	0	0	0	0
Surplus/(Deficit)	0	0	5	1	0	1	0
Additional Gates Required – PAL 1	0	0	0	0	0	0	0
Additional Gates Required – PAL 2	0	0	0	0	0	0	0

NOTES:
1 Small ADG III includes aircraft with wingspans less than 94 feet, 3 inches (Embraer E195 and smaller).
2 Includes Terminal 3 South Concourse.
3 Existing MARS gate B23 is included as one ADG VI gate at Terminal 4–North (identified in ramp chart as B23 and B23W).
4 Includes planned Concourse S1.
Exhibit B-2 in Appendix B presents a gated ramp chart for the PAL 2 gating analysis.
SOURCE: Ricondo & Associates, Inc., June 2018.

The average turns per gate for the three terminal groups are listed in **Table 4-10**. The following summarizes the gate and remote parking position requirements for PAL 2 beyond those required in PAL 1:

- Terminal 3: No additional gates are required beyond the two ADG III gates required in PAL 1.
- Terminal 4–North
  - Three additional ADG V gates are required beyond the two additional ADG V gates required in PAL 1.
  - ADG III and Boeing 757-300W capable gates (on Concourses N1, N2, and N3) have an average of 5.7 turns per gate while ADG II and small ADG III gates (on Concourses N3 and N4) are underutilized

with an average of 1.9 turns per gate, indicating an opportunity to adjust gate sizes to increase utilization.

  - One additional international-capable ADG III gate is required.

- Terminal 4–South: No additional gates are required.[12]
- Remote Parking Positions: No additional positions are required beyond the 10 needed for PAL 1 (1 small ADG III, 8 ADG III, and 1 ADG V).

TABLE 4-10 PLANNING ACTIVITY LEVEL 2 AVERAGE TURNS PER GATE

TERMINAL GROUP	TOTAL OPERATIONS	TOTAL UTILIZED GATES	AVERAGE TURNS PER GATE
3	123	27	4.6
4–North[1]	301	62	4.9
4–South	195	25	7.8

NOTE:
1 Existing MARS Gate B23 is included as one ADG VI gate at Terminal 4–North (identified in ramp chart as B23 and B23W).
SOURCE: Ricondo & Associates, Inc., June 2018.

PAL 3 (68 MAP) Aircraft Gate and Remote Parking Position Requirements

Table 4-11 provides a summary of the number of existing and required gates for each terminal group for the PAL 3 DDFS.

The average turns per gate for the three terminal groups are listed in **Table 4-12**. The following summarizes the gate and remote parking position requirements for PAL 3 beyond those required for PALs 1 and 2:

- Terminal 3: One additional ADG V gate and one additional small ADG III gate are required beyond the two ADG III gates required in PAL 1. The two gates may be accommodated by reconfiguring existing ADG IV gates within the north and south piers.
- Terminal 4–North:
  - Four additional ADG V gates are required beyond the five additional ADG V gates required in PALs 1 and 2.
  - ADG III and Boeing 757-300W capable gates (on Concourses N1, N2, and N3) have an average of 6.1 turns per gate while ADG II and small ADG III gates (on Concourses N3 and N4) are underutilized with an average of 2.7 turns per gate.
  - Two additional ADG III and one additional ADG V international capable gates beyond the one ADG III gate in PAL 2 are required.
- Terminal 4–South: No additional gates are required.[13]
- Remote Parking Positions: No additional positions are required beyond the 10 needed for PALs 1 and 2 (1 small ADG III, 8 ADG III, and 1 ADG V).

[12] Assumes that Terminal 4-South includes future Concourse S1 for a total of 32 gates.

[13] Assumes that Terminal 4-South includes future Concourse S1 for a total of 32 gates.

TABLE 4-11 PLANNING ACTIVITY LEVEL 3 GATE REQUIREMENTS

TERMINAL GROUP	ADG II	SMALL ADG III[1]	ADG III	BOEING 757-300W	ADG IV	ADG V	ADG VI
Terminal 3[2]							
Existing	3		6	4	9	3	
Requirement	3	1	16	5	0	4	0
Surplus/(Deficit)	0	(1)	(10)	(1)	9	(1)	0
Additional Gates Required – PAL 1	0	0	2	0	0	0	0
Additional Gates Required – PAL 2	0	0	0	0	0	0	0
Additional Gates Required – PAL 3	0	1	0	0	0	1	0
Terminal 4–North[4]							
Existing		13	35	9		1	1
Requirement	0	10	43	0	0	10	1
Surplus/(Deficit)	0	3	(8)	9	0	(9)	0
Additional Gates Required – PAL 1	0	0	0	0	0	2	0
Additional Gates Required – PAL 2	0	0	0	0	0	3	0
Additional Gates Required – PAL 3	0	0	0	0	0	4	0
Terminal 4–South[5]							
Existing			30	1		1	
Requirement	0	0	29	0	0	0	0
Surplus/Deficit	0	0	1	1	0	1	0
Additional Gates Required – PAL 1	0	0	0	0	0	0	0
Additional Gates Required – PAL 2	0	0	0	0	0	0	0
Additional Gates Required – PAL 2	0	0	0	0	0	0	0

NOTES:
1 Small ADG III includes aircraft with wingspans less than 94 feet, 3 inches (Embraer E195 and smaller).
2 Includes Terminal 3 South Concourse.
3 Existing MARS gate B23 is included as one ADG VI gate at Terminal 4–North (identified in ramp chart as B23 and B23W).
4 Includes planned Concourse S1.
Exhibit B-3 in Appendix B presents a gated ramp chart for the PAL 3 gating analysis.
SOURCE: Ricondo & Associates, Inc., June 2018.

TABLE 4-12 PLANNING ACTIVITY LEVEL 3 AVERAGE TURNS PER GATE

TERMINAL GROUP	TOTAL OPERATIONS	TOTAL UTILIZED GATES	AVERAGE TURNS PER GATE
Terminal 3	135	29	4.7
Terminal 4–North[1]	337	64	5.3
Terminal 4–South	229	29	7.9

NOTE:
1 Existing MARS Gate B23 is included as one ADG VI gate at Terminal 4–North (identified in ramp chart as B23 and B23W).
SOURCE: Ricondo & Associates, Inc., June 2018.

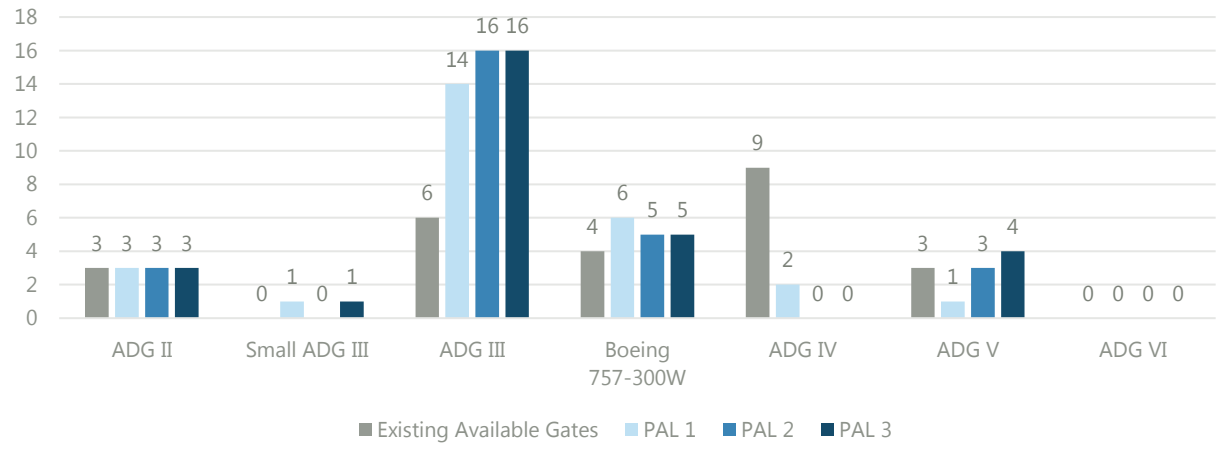
As indicated in Section 4.1, a PAL 3 international peak design day arrival schedule was developed. A gate analysis was completed using this peak international schedule and no additional international capable gates are required beyond those identified for the PMAD in PAL 3.

Aircraft Gate and Remote Aircraft Parking Position Requirements Summary

The following summarizes gate requirements for each terminal group and PAL. The charts in this subsection show the number of gates required by aircraft size category for each PAL.

- Terminal 3 (see **Exhibit 4-3**)
  - PAL 1: two additional ADG III gates (consider reconfiguration of existing ADG IV gates)
  - PAL 2: no additional gates required beyond those reconfigured in PAL 1
  - PAL 3: one additional small ADG III and one additional ADG V gate beyond those added in PAL 1 (consider reconfiguration of existing ADG IV gates)

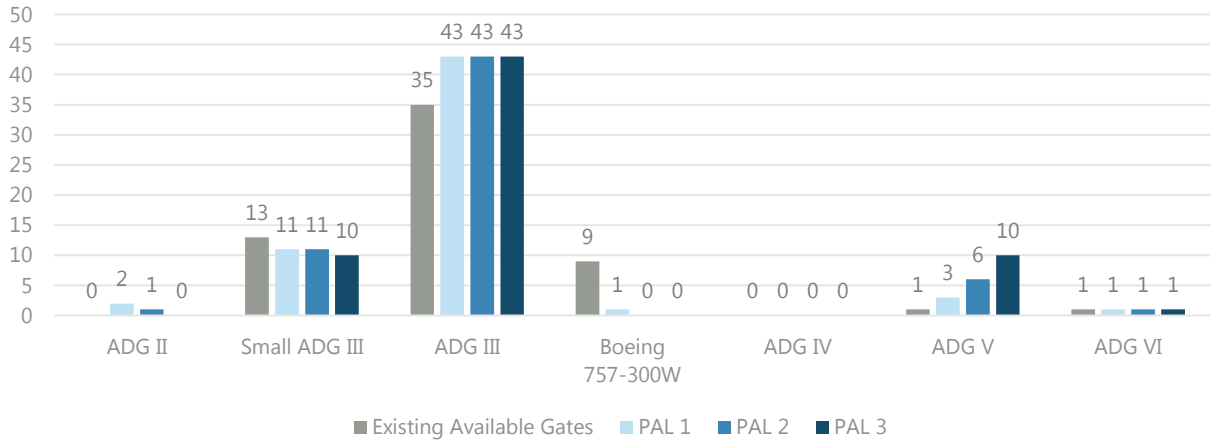
EXHIBIT 4-3 TERMINAL 3 GATE REQUIREMENTS



SOURCE: Ricondo & Associates, Inc., June 2018.

- Terminal 4–North (see **Exhibit 4-4**)
  - PAL 1: two additional ADG V gates (consider reconfiguration of Boeing 757-300W gates)
  - PAL 2: three additional ADG V gates beyond those required in PAL 1 (consider reconfiguration of Boeing 757-300W gates)
  - PAL 3: four additional ADG V gates beyond those required in PALs 1 and 2.

EXHIBIT 4-4 TERMINAL 4-NORTH GATE REQUIREMENTS



SOURCE: Ricondo & Associates, Inc., June 2018.

- Terminal 4–North International-Capable:
  - PAL 1: one additional ADG III gate
  - PAL 2: no additional gates required beyond those in PAL 1
  - PAL 3: two additional ADG III gates beyond that required for PAL 1 and one additional ADG V gate (consider reconfiguration of existing ADG IV gates)
- Terminal 4–South
  - No additional gates required through all PALs
- Remote Aircraft Parking Positions:
  - PAL 1: one additional small ADG III, eight additional ADG III, and one additional ADG V remote parking positions
  - PAL 2: no additional positions required beyond those in PAL 1
  - PAL 3: no additional positions required beyond those in PAL 1

4.3.1.2 HOLDROOM REQUIREMENTS

Holdrooms provide space for passenger preboarding activities, including seating and standing areas, airline agent gate podiums, boarding/deplaning queuing spaces, and access/egress aisleways to and from the gate portal. Holdroom seating and standing area requirements were based on the seating capacity of the largest aircraft capable of using the gate. Holdroom factors based on LOS for each ADG were developed from ACRP recommendations for LOS C and based on the following assumptions for the ratio of standing, seated, and queued passengers. The existing holdroom requirements were based on the existing DDFS average seat size by ADG, whereas the holdroom requirements for PALS 1, 2, and 3 were based on the industry average airplane design group seats.

- **Load Factor**. A 95 percent load factor was applied to the total number of aircraft seats for the largest ADG aircraft accommodated at each gate to determine the number of enplaning passengers within the holdroom.
- **Seated Passengers versus Standing Passengers**.
  - Assumes 60 percent seated passengers at 16.2 (minimum) to 18.3 (maximum) square feet per passenger
  - Assumes 20 percent standing passengers at 10.8 (minimum) to 12.9 (maximum) square feet per passenger
  - Assumes 20 percent standing passengers in preboarding areas arriving immediately prior to aircraft boarding at 10.8 (minimum) to 12.9 (maximum) square feet per passenger
- **Airline Podium**. The average area occupied by a gate agent position is 100 square feet. For this analysis, one podium was assumed for all aircraft sizes ADG V or less and two podiums were assumed for ADG VI gates (200 square feet total).
- **Boarding/Egress Aisle**. A single 6-foot-wide boarding and egress aisle was provided for gates accommodating ADG V aircraft or smaller. Two 6-foot-wide aisles are provided for gates accommodating ADG VI aircraft.

Holdrooms are often situated as pairs or grouped. Locating holdrooms near one another allows the total amount of seating and standing space to be shared, reducing the total space required for the composite area. A 10 percent adjacency reduction is applied to the total seating and standing area for a contiguous holdroom configuration. **Table 4-13** presents the average number of seats per aircraft by terminal group for the existing and future PALs used in the holdroom analysis. ADG II aircraft were omitted from this analysis due to their small size (less than 76 seats) and few operations.

TABLE 4-13 AVERAGE SEATS PER AIRPLANE DESIGN GROUP FOR EXISTING AND PLANNING ACTIVITY LEVELS

TERMINAL	SMALL ADG III	ADG III	ADG IV	ADG V / ADG VI
Existing Terminal 3	N/A	163	260	293
Existing Terminal 4-North	76	161	260	383
Existing Terminal 4-South	N/A	180	N/A	N/A
Future Planning Activity Levels	90	180	280	400

SOURCE: Ricondo & Associates, Inc., June 2018.

Table 4-14 presents the existing and future holdroom requirements by terminal group. The T3 available holdroom area was derived from layout plans for T3 Modernization Program. The T4-North and T4-South available holdroom areas were derived from the existing concourse layouts and plans for future Concourse S1. The existing holdroom area requirements were developed from the existing apron capacity (maximum aircraft at a gate by ADG) and existing average seats per aircraft category from Table 4-13. Future holdroom requirements were based on the future gate requirements defined in Section 4.3.1.1 and the future planning activity level average seats per aircraft category from Table 4-13.

TABLE 4-14 EXISTING AND FUTURE HOLDROOM REQUIREMENTS

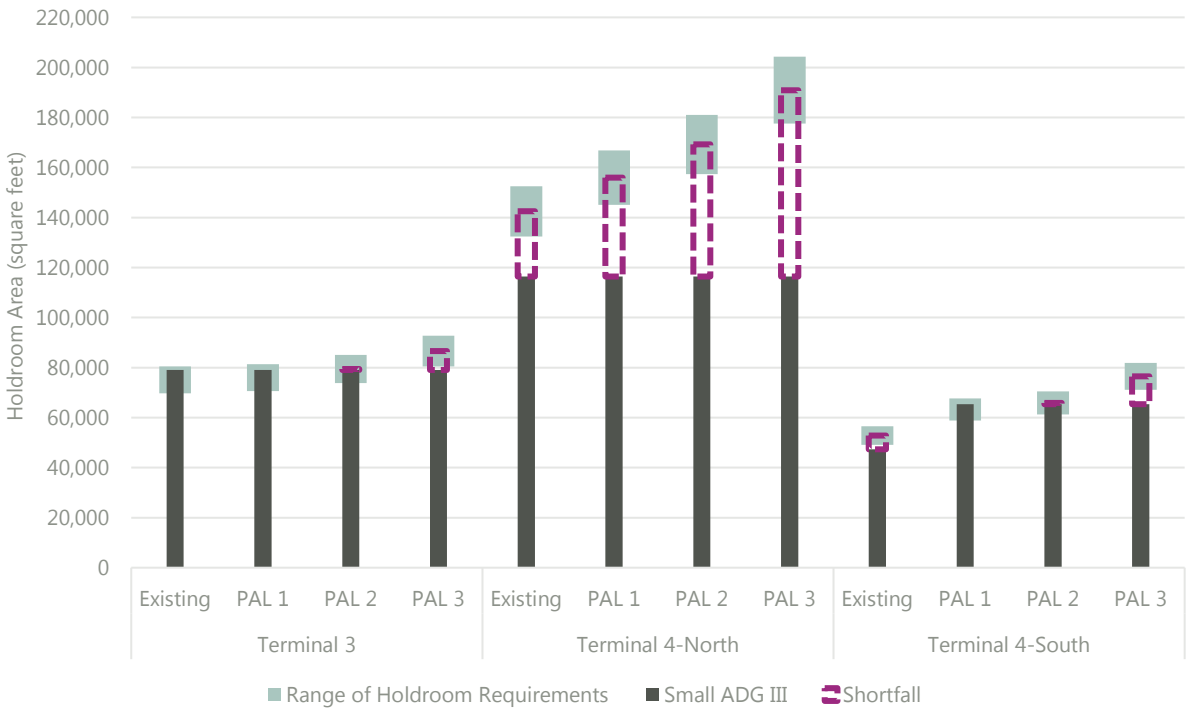
TERMINAL	PLANNING ACTIVITY LEVEL	AVAILABLE HOLDROOM AREA (SQ FT)	HOLDROOM AREA REQUIREMENT		HOLDROOM AREA SHORTFALL	
			MINIMUM (SQ FT)	MAXIMUM (SQ FT)	MINIMUM (SQ FT)	MAXIMUM (SQ FT)
Terminal 3[1]	Existing	79,051	69,720	80,490	0	1,439
	PAL 1	79,051	70,590	81,370	0	2,319
	PAL 2	79,051	73,790	85,040	0	5,989
	PAL 3	79,051	80,460	92,710	1,409	13,659
Terminal 4-North	Existing	116,404	132,450	152,440	16,046	36,036
	PAL 1	116,404	145,010	166,770	28,606	50,366
	PAL 2	116,404	157,380	181,020	40,976	64,616
	PAL 3	116,404	177,500	204,230	61,096	87,826
Terminal 4-South	Existing	47,376	49,100	56,490	1,724	9,114
	PAL 1[2]	65,381	58,840	67,690	0	2,309
	PAL 2	65,381	61,290	70,520	0	5,139
	PAL 3	65,381	71,100	81,800	5,719	16,419

NOTES:
1 Includes improvements to North Concourse as part of the T3 Modernization Program.
2 Terminal 4-South assumes that planned Concourse S1 is constructed prior to PAL 1 and increases available holdroom by 18,005 sq ft.
SOURCES: City of Phoenix Aviation Department, Phoenix Sky Harbor International Airport Tenant Lease Space Books, July 1, 2017 (available areas); Airbiz Aviation Strategies Pty Ltd., Phoenix Sky Harbor International Airport Project Definition Report FINAL, November 14th, 2017 (available area for Concourse S1); City of Phoenix Aviation Department, September 2018 (available area for T3 Modernization Program); Ricondo & Associates, Inc., June 2018 (requirements).

Exhibit 4-5 illustrates the data shown in Table 4-14. The Terminal 3 Modernization Program provides sufficient gate and holdroom area capacity through PAL 3 with some modifications to the apron and minor expansion of holdroom areas. For Terminal 4-South, the opening of the Concourse S1 provides sufficient holdroom area through PAL 2. By PAL 3, Terminal 4-South will require additional holdroom space. The existing gates areas for Terminal 4-North are deficient in holdroom area and this continues through PAL 3 as the number of gates required increases.

Terminal facility requirements are derived from planning criteria that include forecast peak-period activity, industry standard LOS metrics, passenger attributes, and facility operating procedures. The resulting requirements represent the functional area and unit count to accommodate peak period activity at a prescribed LOS and provide balanced capacity throughout the sequential process of each discrete terminal system.

EXHIBIT 4-5 HOLDROOM REQUIREMENTS AND SHORTFALLS



NOTES:
1 Terminal 3 includes the South Concourse and improvements to North Concourse as part of the T3 Modernization Program.
2 Terminal 4-South assumes that planned Concourse S1 is constructed prior to PAL 1.
3 Shortfalls are based on the midpoint of the range of holdroom requirements.

SOURCES: City of Phoenix Aviation Department, Phoenix Sky Harbor International Airport Tenant Lease Space Books, July 1, 2017 (available areas); Airbiz Aviation Strategies Pty Ltd., *Phoenix Sky Harbor International Airport Project Definition Report FINAL*, November 14th, 2017 (available area for Concourse S1); City of Phoenix Aviation Department, September 2018 (available areas for T3 Modernization); Ricondo & Associates, Inc., June 2018 (requirements).

4.3.2 PASSENGER PROCESSING FACILITY REQUIREMENTS

The following subsections outline the methodologies and planning criteria used in determining facility requirements for processing passengers and baggage and supporting airline facilities. Planning criteria are the specific methodologies, level of service framework, activity levels, passenger attributes, and operating procedures used to determine facility requirements.

4.3.2.1 METHODOLOGIES

Each facility element requires a different method for determining requirements based on individual processes, its relationship to other sequential elements, and configuration criteria. The methodology used for each terminal element is detailed below:

- Peak period passenger volumes and attributes were generated from historical data and forecast DDFSs. The schedules provide flight-by-flight descriptions of service routes, aircraft equipment types, load factors, and transfer passenger percentages. Activity profiles were derived using passenger attributes such as the passenger show-up (airport arrival) profile for check-in, percentage of passengers checking bags, and class of service, among other factors.
- Facility requirements were developed using methodologies that are generally consistent with the International Air Transport Association (IATA) Airport Development Reference Manual (ADRM). Discrete process modeling was used to synthesize factors that generate demand and correlate that demand to facilities required to achieve prescribed LOS standards. IATA's LOS framework, along with other industry-accepted standards, address passenger experience in terms of transaction (processing) times, comfort while in process, and transition between processes. Each processing element was analyzed separately because LOS standards vary among processes.
- For comparison purposes, facility requirements were determined using optimized operating conditions (fully-staffed and utilized positions; appropriately-allocated passenger traffic) and without configurational limitations. This assumption was maintained throughout the analysis unless otherwise noted.
- Facility space templates were used to determine minimum area and dimensional requirements for each processing function. These templates define minimum spatial clearances for safe and efficient operations around equipment, as well as relationships between different process areas within a facility, and represent the optimal operating condition. Each space template represents an indicative configuration, highlighting critical dimensions and suggested passenger flows. Actual layouts may vary.
- The functional efficiency, and actualized throughput capacity of a processing area was determined by the comparison of allocated area to the space that would be required for optimized operation.
- Passenger simulation technology was used to derive activity profiles at check-in and security screening to more accurately reflect the critical relationship of sequential processes. A predictive probability distribution for average transaction times was utilized to analyze potential variances and more accurately reflect real-world conditions.

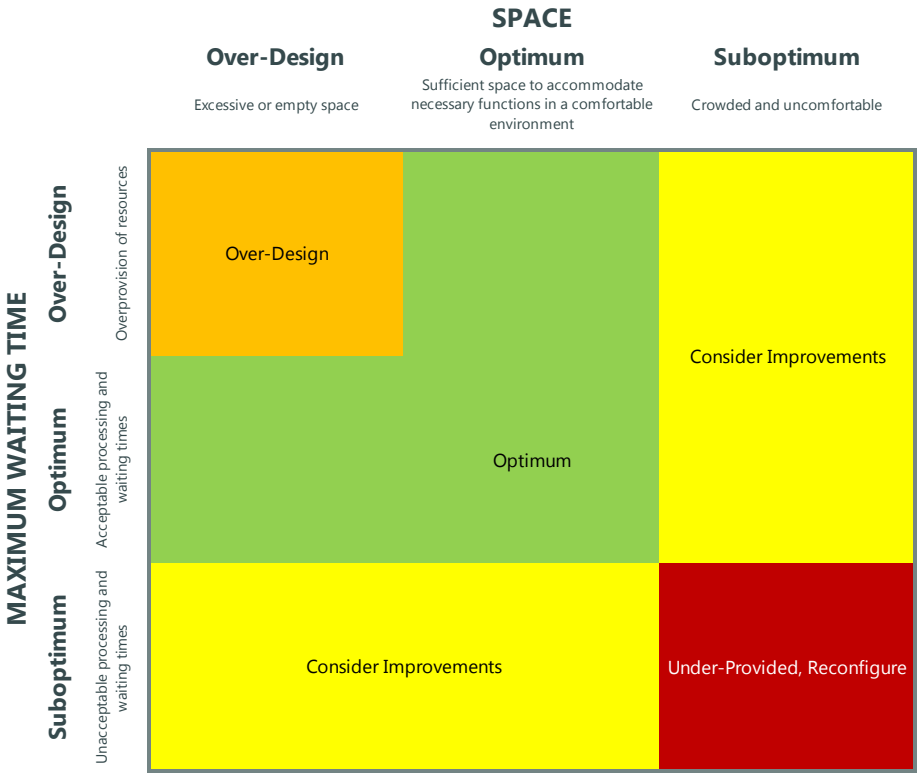
4.3.2.2 LEVEL-OF-SERVICE FRAMEWORK

The LOS framework consists of variables related to space and time, and is defined by efficiency of flow, delay, and level of comfort. **Exhibit 4-6** illustrates the relationship between these variables for both the current LOS framework (ADRM, 10th edition) and the framework presented in the previous ADRM, 9th edition.[14] A table of space standards and waiting times and a graphic of indicative LOS is illustrated on **Exhibit 4-7**. Under the IATA's framework, Optimum LOS represents an acceptable LOS characterized by adequate queuing space and reasonable waiting times during periods of peak activity. Optimum LOS equates to good service at reasonable cost, similar to metrics previously indicated as LOS C. Short periods

[14] International Air Transport Association, *Airport Development Reference Manual*, 9th ed., January 2004.

of diminished LOS during the highest peak activity are considered acceptable to avoid over-designed facilities.

EXHIBIT 4-6 INTERNATIONAL AIR TRANSPORT ASSOCIATION'S LEVEL OF SERVICE SPACE-TIME RELATIONSHIP DIAGRAM

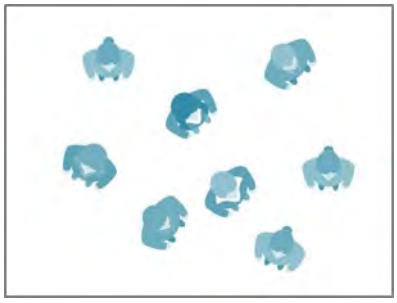


LEVEL OF SERVICE ADRM 10TH EDITION	LEVEL OF SERVICE ADRM 9TH EDITION	FLOWS	DELAYS	LEVEL OF COMFORT
Over-Design	A - Excellent	Free	None	Excellent
Over-Design	B - High	Stable	Very Few	High
Optimum	C - Good	Stable	Acceptable	Good
Suboptimum	D - Adequate	Unstable	Passable	Adequate
Suboptimum	E - Inadequate	Unstable	Unacceptable	Inadequate
Under-Provided	F - Failure	System Breakdown	System Breakdown	Unacceptable

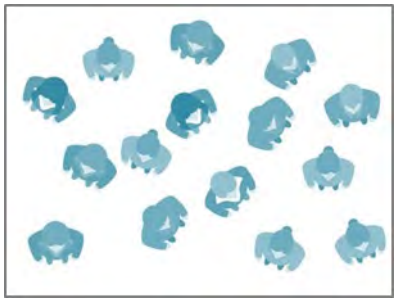
NOTE: ADRM – Airport Development Reference Manual

SOURCES: International Air Transport Association, *Airport Development Reference Manual*, 10th ed., 4th release, October 2016; International Air Transport Association, *Airport Development Reference Manual*, 9th ed., January 2004.

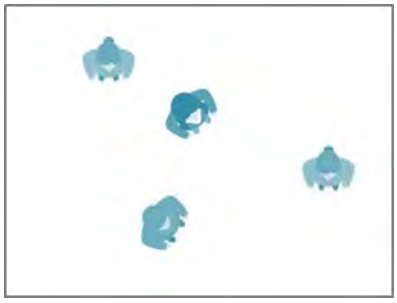
EXHIBIT 4-7 INTERNATIONAL AIR TRANSPORT ASSOCIATION'S LEVEL OF SERVICE METRICS



Optimum: Acceptable level of service; conditions of adequate to above-average space and reasonable to very few delays; appropriate level of comfort.



Suboptimum: Unsatisfactory level of service; conditions that provide crowded and uncomfortable spaces and present unacceptable processing and waiting times; inadequate level of comfort.



Over-Design: Poor level of service; conditions of either excessive or empty space and over provision of resources; immoderate or unacceptable level of comfort.

PASSENGER TERMINAL PROCESSOR	SPACE STANDARDS (SQ FT/PASSENGER)					WAITING TIME (MINUTES)				
ADRM 9th Edition	A	B	C	D	E	A	B	C	D	E
ADRM 10th Edition	Over-Design		Optimum	Suboptimum	Under-Provided	Over-Design		Optimum	Suboptimum	Under-Provided
Check-in										
Self-Service Kiosk	> 19.4		14.0-19.4	< 14.0		< 0		0-2	> 2	
Bag Drop Desk	> 19.4		14.0-19.4	< 14.0		< 0		0-5	> 5	
Check-in Desk	> 19.4		14.0-19.4	< 14.0		< 10		10-20	> 20	
Security Checkpoint	> 12.9		10.8-12.9	< 10.8		< 5		5-10	> 10	
Immigration Control	> 12.9		10.8-12.9	< 10.8		< 5		5-10	> 10	
Baggage Claim Area	> 18.3		16.2-18.3	< 16.2		< 0		0-15	> 15	

NOTE: ADRM - Airport Development Reference Manual

SOURCES: International Air Transport Association, Airport Development Reference Manual, 10th ed., 4th release, October 2016; International Air Transport Association, Airport Development Reference Manual, 9th ed., January 2004.

4.3.2.3 PLANNING ACTIVITY LEVELS

Peak period demand was derived from DDFSs (2017, PAL 1, PAL 2, and PAL 3) developed to correlate with forecast annual passenger activity. Peak period enplaning and deplaning passenger activity represent the principal demand on concourses and gate facilities. Originating and destination (O&D) passengers were also derived from the total activity and represent the demand on terminal processing facilities.

The 2017 DDFS was modeled using Comprehensive Airport Simulation Technology (CAST) simulation software and application of criteria assumptions and air service attributes to derive peak period demand. The resulting demand profiles were validated against known daily and peak period passenger volumes. **Table 4-15** lists the LF and O&D percentages identified in the 2017 DDFS and used in the simulation. Table

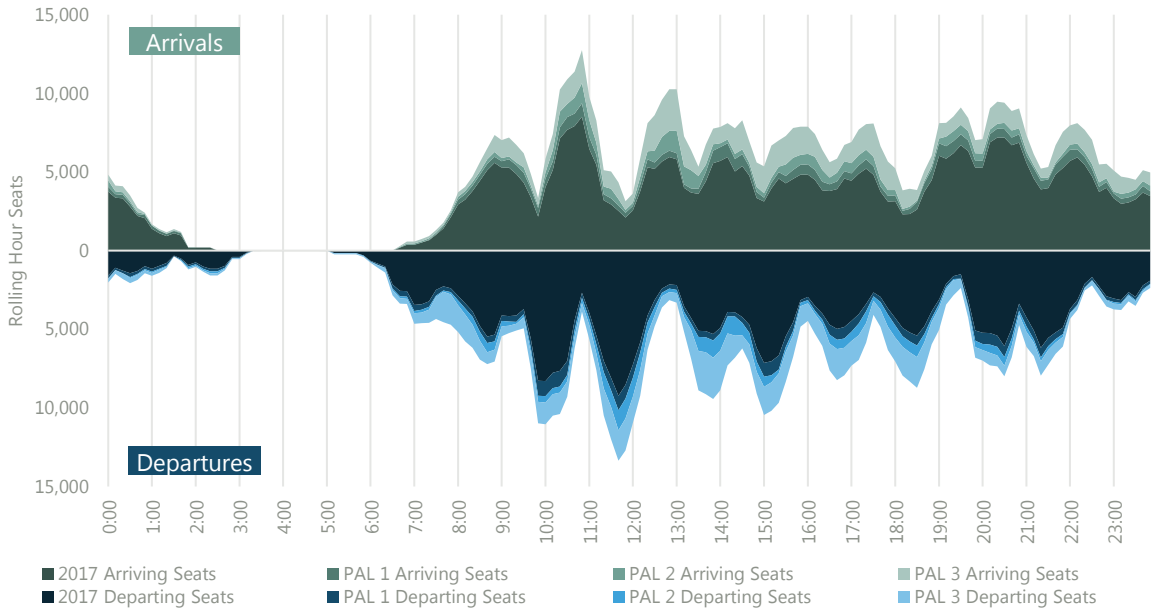
4-1 summarizes daily and peak-hour activity and characteristics associated with the DDFS for each terminal. **Exhibit 4-8** illustrates the number of departing and arriving seats throughout the design day for 2017 and PALs 1, 2, and 3.

TABLE 4-15 EXISTING AVERAGE LOAD FACTOR AND AVERAGE ORIGIN AND DESTINATION

AIRLINE	AVERAGE LOAD FACTOR	AVERAGE O&D
Boutique Air	65.9%	100.0%
American Airlines	86.5%	47.0%
Air Canada	95.3%	93.4%
Alaska Airlines	97.7%	96.4%
JetBlue Airways	93.9%	96.5%
British Airways	91.0%	94.0%
Delta Air Lines	94.6%	96.5%
Frontier Airlines	94.8%	96.6%
Hawaiian Airlines	98.3%	96.5%
Spirit Airlines	95.8%	96.6%
Sun Country Airlines	95.2%	97.0%
United Airlines	93.8%	96.6%
Southwest Airlines	97.1%	69.4%
WestJet Airlines	98.0%	93.6%
Great Lakes Airlines	19.3%	100.0%

SOURCE: Ricondo & Associates, Inc., May 2018.

EXHIBIT 4-8 DAILY DEPARTING AND ARRIVING SEATS



SOURCE: Ricondo & Associates, Inc., May 2018.

4.3.2.4 PASSENGER ATTRIBUTES

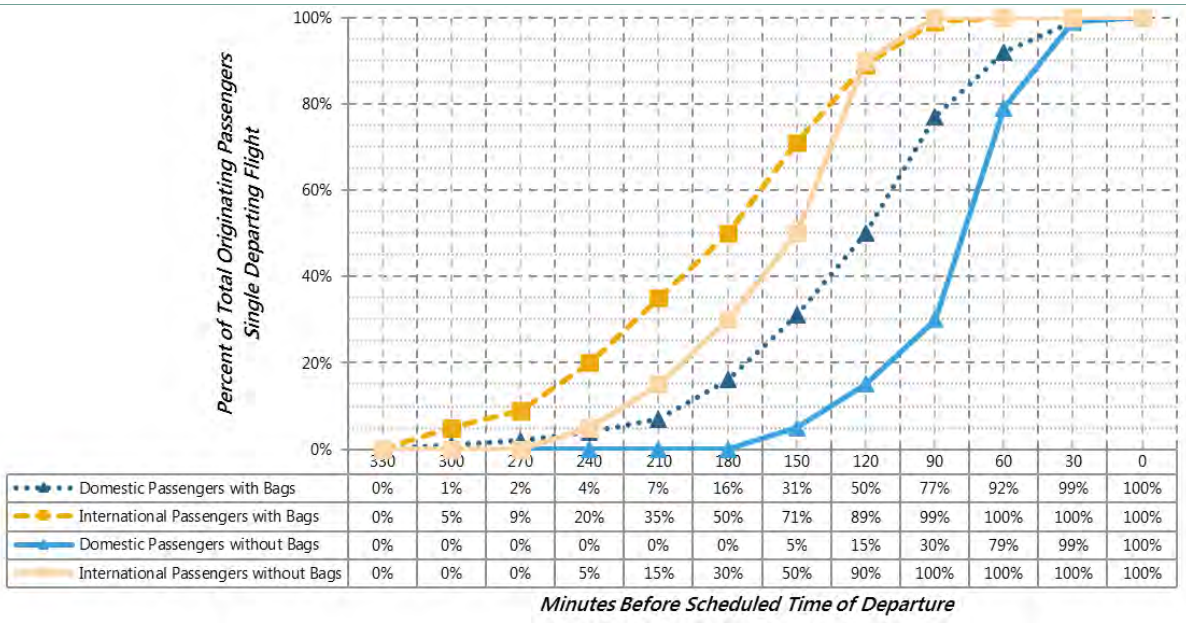
Passenger attributes are characteristics and assumptions related to passenger types and behaviors and how they are expected to use Airport facilities. These characteristics include show-up profiles and individual traveler attributes, such checked bags per passenger. Attributes incorporate airport- and airline-specific factors as well, typically obtained through research of current industry standards and similar facility benchmarking, on-site observations, surveys, and other historical data.

Show-up (Airport Arrival) Profiles

A show-up profile is an earliness distribution curve that represents the amount of time passengers arrive at the terminal before their scheduled flight departure. Several factors affect show-up profiles, including the type of travel (business or leisure), destination (domestic or international), class of service, whether the passenger is checking baggage, and time of day. This results in a metering of passengers entering the check-in and security processes, directly influencing passenger demand throughout the system.

Exhibit 4-9 illustrates the show-up profiles used in the analysis. Show-up profiles for passengers with checked bags were based on benchmarks and calibrated to baggage handling system (BHS) input data. Other profiles were based on industry benchmarks and observations.

EXHIBIT 4-9 SHOW-UP PROFILES



	330	300	270	240	210	180	150	120	90	60	30	0
Domestic Passengers with Bags	0%	1%	2%	4%	7%	16%	31%	50%	77%	92%	99%	100%
International Passengers with Bags	0%	5%	9%	20%	35%	50%	71%	89%	99%	100%	100%	100%
Domestic Passengers without Bags	0%	0%	0%	0%	0%	0%	5%	15%	30%	79%	99%	100%
International Passengers without Bags	0%	0%	0%	5%	15%	30%	50%	90%	100%	100%	100%	100%

SOURCES: City of Phoenix Aviation Department, Phoenix Sky Harbor International Airport (BHS data), April 2018; Ricondo & Associates, Inc., May 2018.

Checked Baggage

Table 4-16 lists the assumed average checked bags per passenger. The percentage of passengers with checked bags applies to both departing (originating) and arriving (destination) passengers. These metrics were considered in the analysis of check-in, baggage screening, bag make-up, and baggage claim facilities.

For comparison, the average number of bags per passenger checking a bag is indicated and excludes passengers who do not check baggage.

TABLE 4-16 PASSENGERS CHECKING BAGS

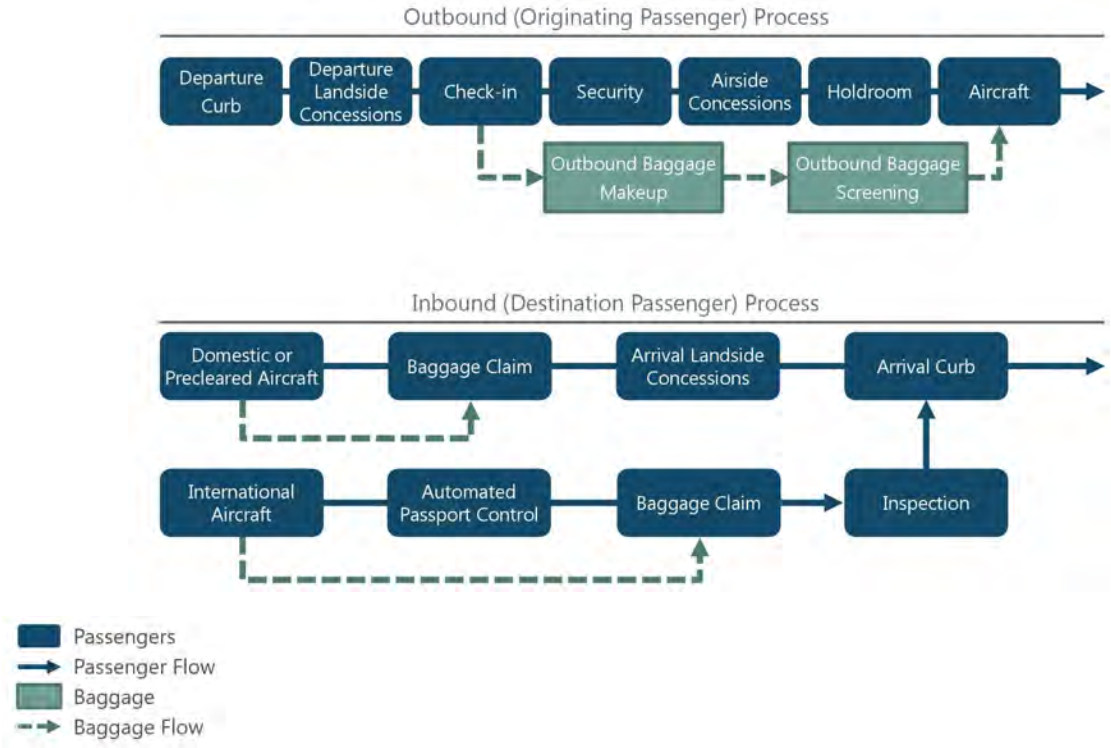
	UNITS	SOUTHWEST AIRLINES	AMERICAN AIRLINES & OTHER AIRLINES	INTERNATIONAL
Percentage of passengers not checking bags	percent	30	40	10
Percentage of passengers checking bags	percent	70	60	90
Overall average bags per passenger	Bags	0.8	0.7	1.0
Average bags per passenger checking a bag	Bags	1.1	1.1	1.2

SOURCE: City of Phoenix Aviation Department, Phoenix Sky Harbor International Airport (BHS data), April 2018.

4.3.2.5 PASSENGER, BAGGAGE, AND AIRLINE FACILITY PLANNING ASSUMPTIONS

Operating parameters are the protocols, procedures, and attributes that influence requirements at an individual process and define the sequence by which a passenger and their luggage are processed. **Exhibit 4-10** illustrates outbound and inbound processes for originating and destination passengers and baggage. Operating parameters and LOS standards, along with forecast demand, were the primary factors used to determine Airport facility requirements.

EXHIBIT 4-10 OVERALL PASSENGER AND BAGGAGE PROCESS



SOURCE: Ricondo & Associates, Inc., May 2018.

This subsection describes the assumptions used to establish passenger and baggage process and rates within each facility at the Airport, using previously identified assumptions and metrics.

The amount of time required to complete a task is a critical component of LOS. Processor requirements were derived using parameters for time in process, rather than transaction times for individual tasks due to the variability of duration for discrete tasks within a sequenced process such as check-in or passenger security screening.

Time in process is a metric representing a passenger's total time from point of entry to process completion. Transaction time refers to the time period when a passenger is actively interacting with a processing agent, or processing unit, to complete a task. In addition to the specific transaction time metric for each discrete activity, total time in process accounts for entry into and waiting time in queue, movement between queue and transaction area(s), and movement between sequential transactions in a process. The time in process metric mitigates the impact of variability in specific transaction time assumptions and provides an accurate assessment of actual processing sequences and passenger activity metering, allowing for variance in waiting times and transaction rates while still meeting overall LOS goals.

Check-in

Check-in is defined as the process by which passengers obtain boarding passes and/or baggage tags and transfer baggage to airline custody prior to going through passenger security screening checkpoints (SSCP). As technology advances and evolves, the individual check-in counter is becoming less critical. Requirements were based on spatial requirements that preserve flexibility and circulation required for evolving processing protocols and self-service technologies, rather than individual unit counts for kiosks and agent positions. Unit counts for kiosks were included for indicative purposes only.

Baggage acceptance points (BAPs) are defined as areas where agents or passengers introduce checked baggage into the baggage handling system (BHS). The need for this functional area remains consistent regardless of how check-in protocols evolve in the future given the physical constraints of mechanically transporting baggage. Therefore, space requirements for check-in facilities are driven largely by the number of BAPs required to induct bags into the BHS, and the processing areas associated with the BAPs. Each BAP has spatial requirements for queueing, equipment, circulation, and active processing to accommodate passenger demand at a given LOS.

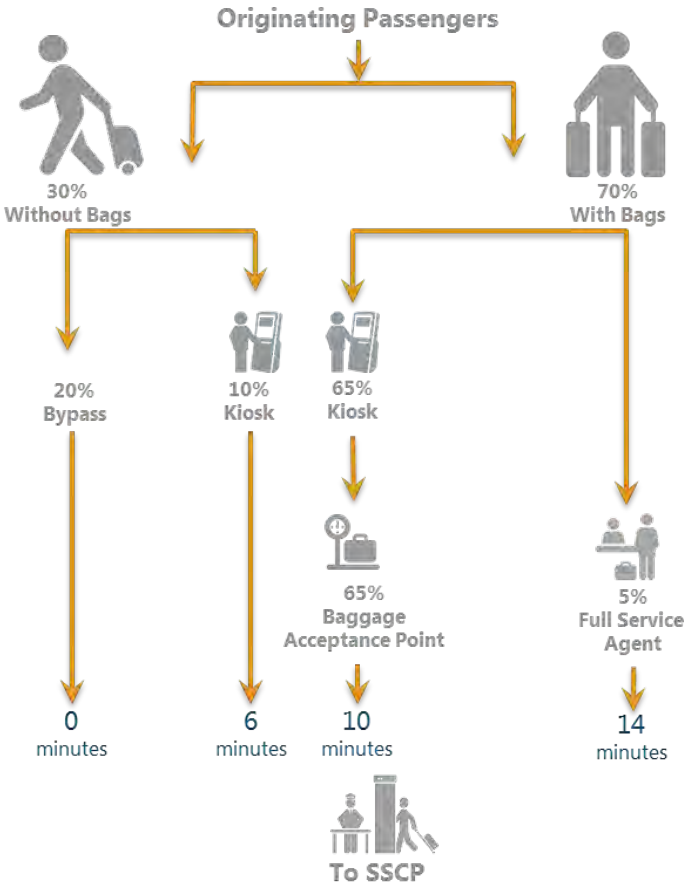
Passenger check-in types are segmented into four categories that reflect the different facilities used in the process:

- **Bypass (Internet/Mobile Device) Check-in**. Passengers who do not check bags and check-in remotely prior to showing up at the terminal and, consequently, do not need to use terminal check-in facilities.
- **Kiosk/No Bags**. Passengers receiving boarding passes at stand-alone kiosks located in front of in-line positions or located remotely from the check-in counter.
- **Kiosk/BAP**. Passengers acquiring boarding passes and printing baggage tags at stand-alone kiosks located in front of in-line positions and providing baggage to airline staff at a BAP.

- **Full-Service Agent Positions**. Passengers using full-service agent positions where airline staff assist passengers needing extra time or additional services, or where airlines wish to provide product differentiation/concierge services for premium passengers.

Exhibits 4-11 through **4-13** illustrate passenger check-in operating parameters, including passenger check-in types, and time in process goals for Southwest Airlines, American Airlines and other domestic airlines, and international passengers, respectively.

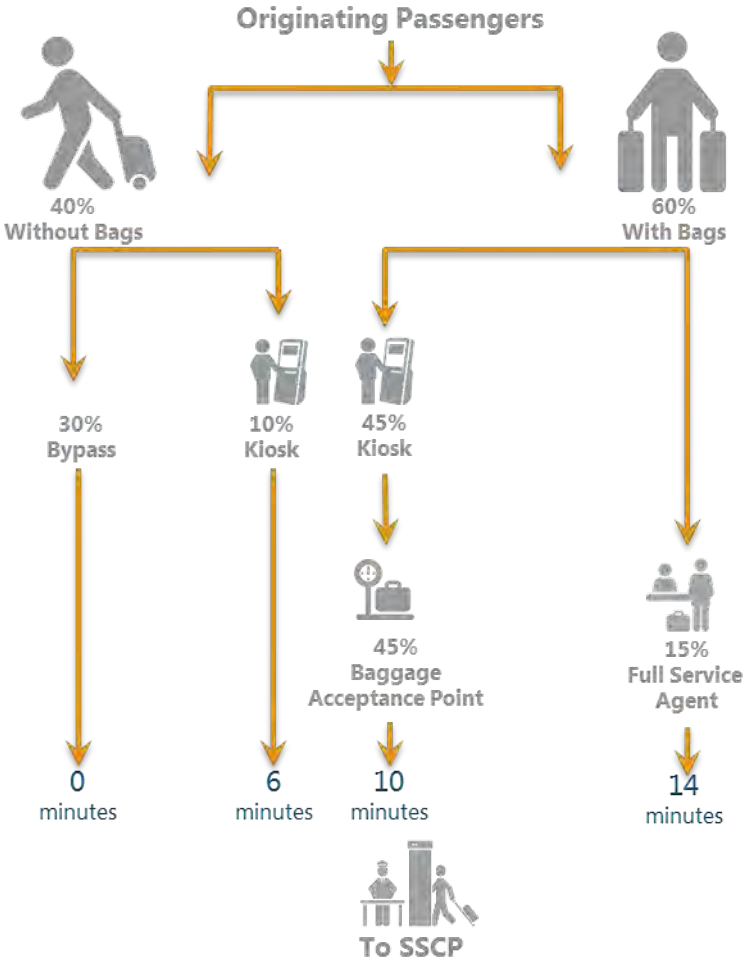
EXHIBIT 4-11 PASSENGER CHECK-IN OPERATING PARAMETERS: SOUTHWEST AIRLINES



CHECK-IN TYPE	PERCENTAGE	AVERAGE TOTAL TIME IN PROCESS
Bypass	20%	0 minutes
Kiosk	10%	6 minutes
Baggage Acceptance Point	65%	10 minutes
Full Service Agent	5%	14 minutes

SOURCES: City of Phoenix Aviation Department, April 2018 (process parameters); Trace Consultants, May 2018 (processing rates); Ricondo & Associates, Inc. May 2018 (analysis).

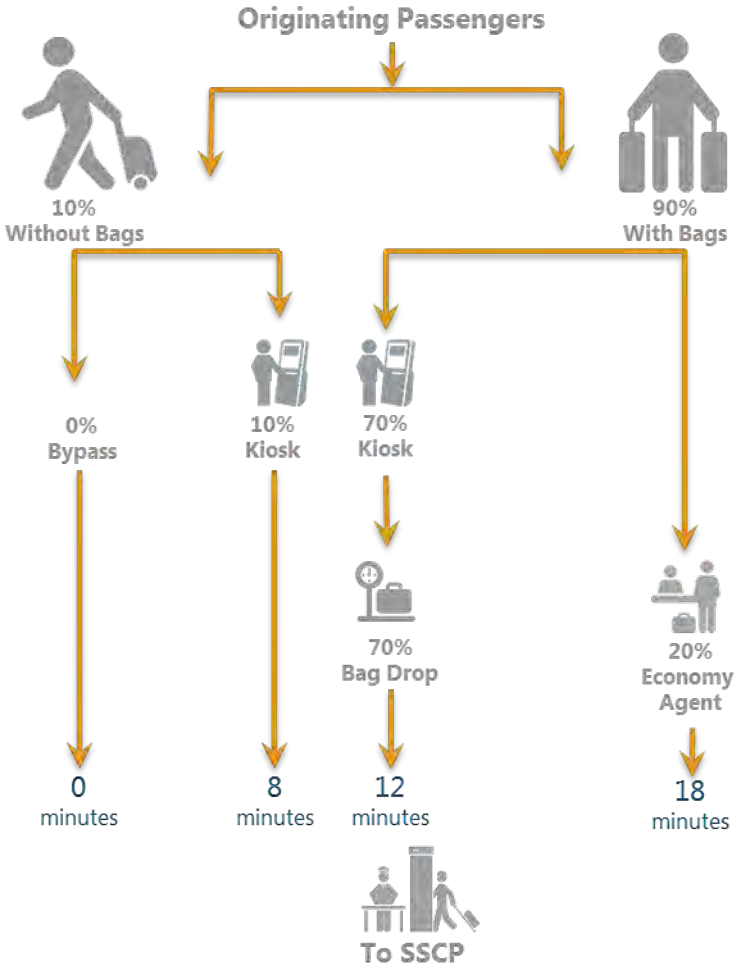
EXHIBIT 4-12 PASSENGER CHECK-IN OPERATING PARAMETERS: AMERICAN AIRLINES AND OTHER DOMESTIC AIRLINES



CHECK-IN TYPE	PERCENTAGE	AVERAGE TOTAL TIME IN PROCESS
Bypass	30%	0 minutes
Kiosk	10%	6 minutes
Baggage Acceptance Point	45%	10 minutes
Full Service Agent	15%	14 minutes

SOURCES: City of Phoenix Aviation Department, April 2018 (process parameters); Trace Consultants, May 2018 (processing rates); Ricondo & Associates, Inc. May 2018 (analysis).

EXHIBIT 4-13 PASSENGER CHECK-IN OPERATING PARAMETERS: INTERNATIONAL AIRLINES



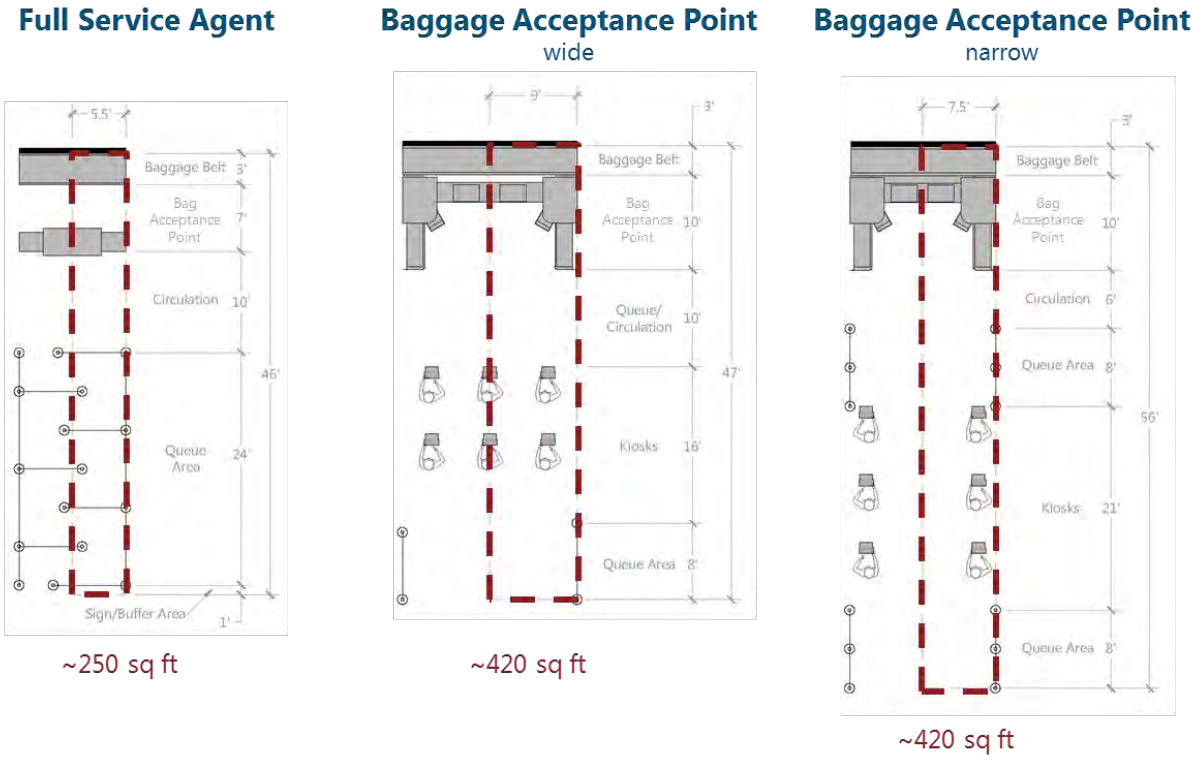
CHECK-IN TYPE	PERCENTAGE	AVERAGE TOTAL TIME IN PROCESS
Bypass	0%	0 minutes
Kiosk	10%	6 minutes
Baggage Acceptance Point	70%	10 minutes
Full Service Agent	20%	14 minutes

SOURCES: City of Phoenix Aviation Department, April 2018 (process parameters); Trace Consultants, May 2018 (processing rates); Ricondo & Associates, Inc. May 2018 (analysis).

Check-in facilities can be configured in different ways and are often dependent on airline operational preferences. The configurations may include traditional linear agent counters, with or without built-in self-service devices, island counters, or a mix of remote self-service devices and baggage tag check-in positions.

Advances in check-in and self-service technology may allow for fewer stationary agents through use of an automated bag-drop position. This configuration utilizes the depth of the hall for more self-service kiosks or roaming agents in lieu of standard queue stanchions with linear baggage induction belts. Space requirements among check-in configurations may differ depending on the size of the equipment. **Exhibit 4-14** shows indicative in-line processing configurations and spatial requirements for full service and kiosks with BAPs used in this analysis.

EXHIBIT 4-14 INDICATIVE CHECK-IN SPACE TEMPLATE



SOURCES: International Air Transport Association, *Airport Development Reference Manual,* 10th Edition, 4th Release, October 2016 (LOS); Airport Cooperative Research Program, *Report 25: Air Passenger Terminal Planning and Design, Volume 1: Guidebook*, 2010 (critical dimensions); Benchmarking studies from comparable airports, Ricondo & Associates, Inc., May 2018 (throughput and space template).

Baggage Handling System

The BHS is a network of baggage sortation, delivery, and storage systems. Requirements for the BHS include outbound baggage storage devices, cart staging areas, active loading areas, inbound baggage induction piers and the estimated area for tug cart circulation around the make-up devices. Requirements for baggage screening facilities operated by the TSA are detailed in Section 4.3.2.6.

Much like a mechanical system, the spatial requirements for BHS represent individual processing areas and do not include area requirements for equipment chases or horizontal rights-of-way for conveyance elements.

Outbound

Outbound baggage make-up devices at the Airport currently consist of carousels. Carousels can be flat plate units or slope plate units. Slope plate units provide greater capacity while flat plate units provide better ergonomics for workers. Make-up devices can also be configured as piers or chutes which have less storage capacity, but greater flexibility for sortation of individual flights. Carts can be staged either parallel to make-up devices or perpendicularly if the aisles between devices have sufficient width. Parallel staging reduces the need to decouple individual carts and provides a more efficient operation, and therefore was assumed for this study.

Bag make-up requirements were based on the maximum number of carts staged for all flights during individual airline peak periods, and the minimum area required per cart, including the outbound baggage device. Cart requirements by flight were based on recommended metrics for staged carts per aircraft type provided in **Table 4-17**. Operational parameter assumptions for baggage make-up carts are listed in **Table 4-18**.

TABLE 4-17 EXAMPLE NUMBER OF CARTS PER AIRCRAFT

EXAMPLE AIRCRAFT TYPE	MAXIMUM CARTS STAGED
Airbus A319	3
Airbus A320/A321	4
Airbus A330	6
Airbus A350	8
Airbus A380	10
Boeing 737-300/400/500	3
Boeing 737-700/800/900	4
Boeing 757-200	5
Boeing 767-200/300	6
Boeing 787	8
Canadair Regional Jet CRJ700/900	2
Embraer 190	2
McDonnell Douglas MD-82/-83/-88	4

SOURCES: Benchmarking studies of comparable airports, Ricondo & Associates, Inc., May 2018.

TABLE 4-18 OUTBOUND BAGGAGE MAKE-UP OPERATING PARAMETERS

MINUTES PRIOR TO SCHEDULED DEPARTURE TIME	PERCENT OF TOTAL CARTS STAGED	AREA PER CART (SQ FT)
120-100	50%	450
90-30	100%	450

SOURCE: Benchmarking studies of comparable airports, Ricondo & Associates, Inc., May 2018.

Exhibit 4-15 illustrates the template used to develop space requirements for a typical outbound baggage area. Critical outbound make-up dimension clearances include:

- **Baggage Carts**. Baggage carts have lengths between 11 and 15 feet (with the tow bar down) and widths of between 5 feet 7 inches to 5 feet 9 inches.
- **Baggage Containers/Dollies**. Containers/dollies are commonly used for widebody aircraft flights. Containers are carried on dollies that typically have a length of 13 feet 6 inches (with the tow bar down) and width of approximately 6 feet.
- **Work Area**. The area between the carousel and the staged carts is used by workers to load bags and should provide a work aisle that is 3 feet wide and 7 feet of vertical clearance.

Inbound

A minimum of one inbound baggage pier per baggage claim device is required. For large individual operations or shared facilities, two independent inbound piers are recommended to optimize utilization of available bag claim capacities and reduce congestion and delay in the offload areas. **Table 4-19** lists inbound baggage offload operating parameters. **Exhibit 4-16** illustrates the inbound baggage claim device space template used for developing space requirements.

TABLE 4-19 INBOUND BAGGAGE OFFLOAD DEVICE OPERATING PARAMETERS

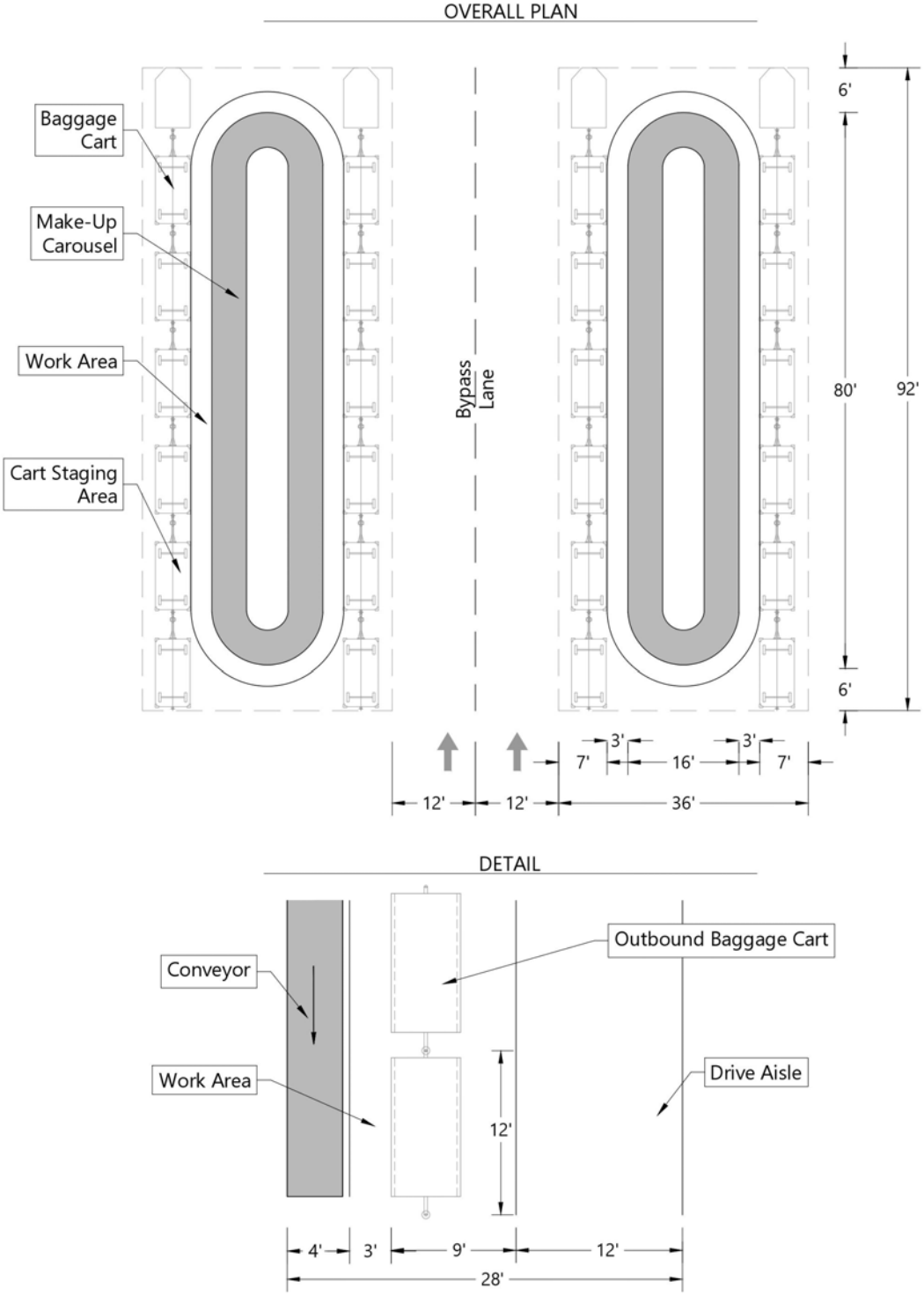
	UNITS	OPERATING PARAMETER
Number of Inbound Piers per Claim Device	each	2
Area per Pier	sq ft	1,200

SOURCES: Benchmarking studies of comparable airports, Ricondo & Associates, Inc. May 2018.

The inbound baggage pier area includes the following components:

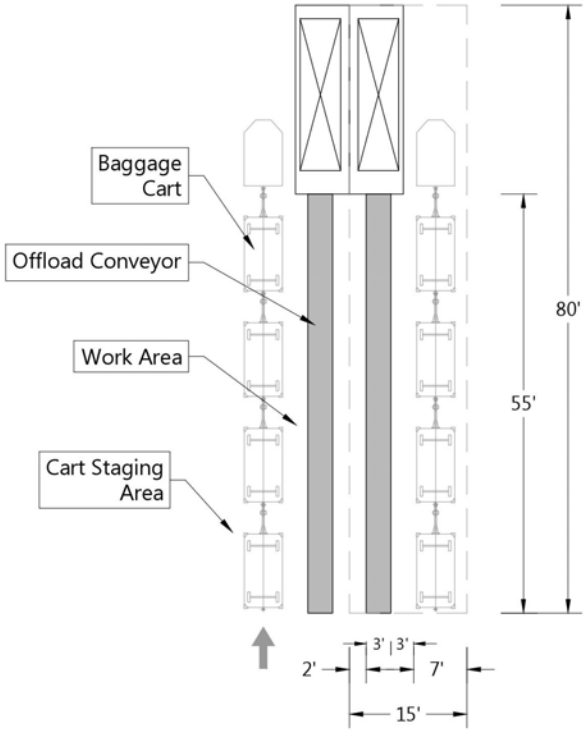
- **Offload Conveyor**. Conveyor equipment is used to transport bags from the baggage carts onto the baggage claim device. Conveyor length can vary to accommodate different numbers of carts.
- **Cart Parking**. This area is typically the width of a tug road, approximately 10 feet to 12 feet wide, and is required for carts to park and bags to be unloaded; carts usually park parallel to the induction belt.
- **Work Area**. This area is for bag agents to unload bags onto the belt and is located directly between cart staging and the induction belt with a typical clearance of 3 feet.

EXHIBIT 4-15 OUTBOUND BAGGAGE MAKE-UP SPACE TEMPLATE



SOURCE: Airport Cooperative Research Program, Report 25: *Air Passenger Terminal Planning and Design, Volume 1: Guidebook*, 2010 (critical dimensions).

EXHIBIT 4-16 INBOUND BAGGAGE PIER SPACE TEMPLATE



SOURCE: Airport Cooperative Research Program, Report 25: *Air Passenger Terminal Planning and Design, Volume 1: Guidebook*, 2010 (critical dimensions).

Domestic Baggage Claim

Baggage claim requirements include the carousel device, associated retrieval areas and circulation area between devices. Baggage claim requirements are based on the peak accumulation of terminating passengers that have checked bags. The peak number of passengers is based on the time required for baggage to travel from the aircraft to the belt, which is assumed to be 20 minutes. The number of devices is dependent on carousel configuration, building configuration, and aircraft equipment being served. **Table 4-20** summarizes baggage claim operating parameters for domestic baggage claim.

TABLE 4-20 DOMESTIC BAGGAGE CLAIM OPERATING PARAMETERS

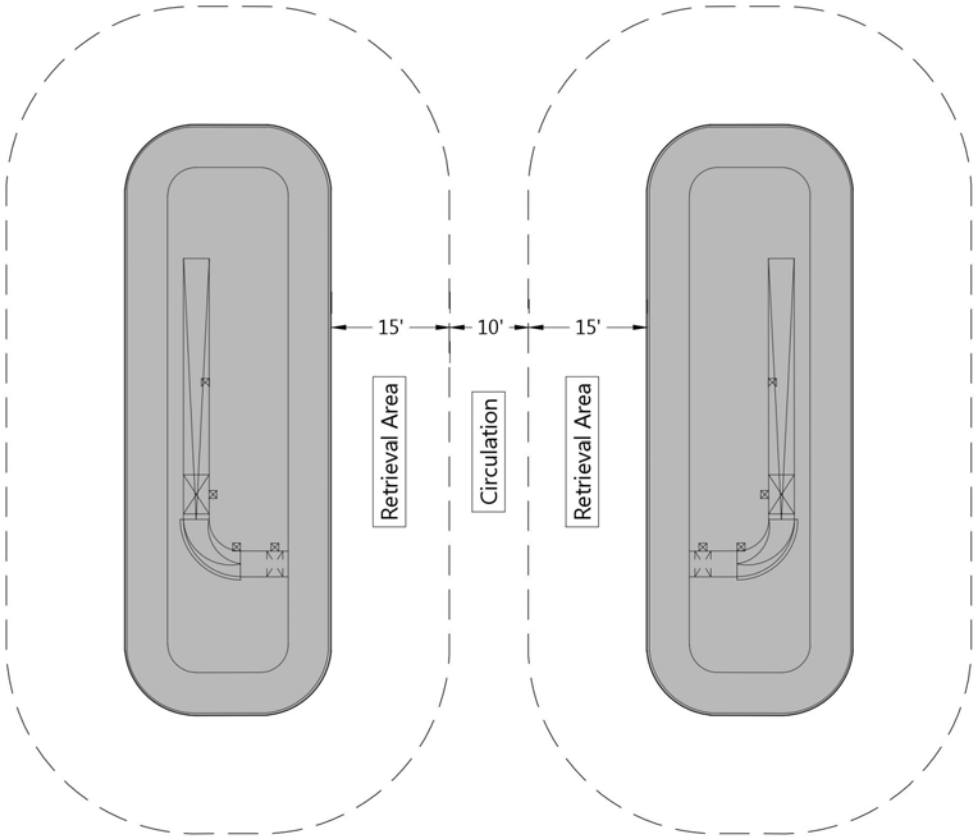
ASSUMPTION	OPERATING PARAMETER
Load Factor	varies by flight
Passengers with Checked Bags	48%
Typical Claim Device Length	190 ft
Typical Claim Device Area	2,740 sq ft
Area per Passenger	16 sq ft
Passenger Accumulation	70%-90% of Passengers Checking Bags

SOURCE: Benchmarking studies of comparable airports, Ricondo & Associates, Inc. May 2018.

Requirements for the number of baggage claim devices have been based on a common, indicative unit size to allow for flexible future facility configuration and utilization. Baggage claim device size and utilization may vary based on air service characteristics (aircraft size, terminating percentage), building configuration/constraints and number of airlines using a baggage claim area. **Exhibit 4-17** depicts an indicative baggage claim device for illustrative purposes. Elements illustrated on the exhibit include:

- **Baggage Claim Device and Retrieval Area**. Spatial area allocated for a single claim device includes the area occupied by the equipment and minimum recommended clearance between the equipment and the adjoining devices, walls, or general circulation corridors. A minimum of 15 feet of clearance from the face of the device is required to allow appropriate retrieval access and acceptable LOS.
- **Circulation**. A circulation corridor of 10 feet between active retrieval areas is provided for passengers and non-passengers moving between baggage claim devices and must be free of any obstructions to allow access and egress to and from individual claim units.

EXHIBIT 4-17 INDICATIVE DOMESTIC BAGGAGE CLAIM DEVICE SPACE TEMPLATE



SOURCE: Airport Cooperative Research Program, Report 25: *Air Passenger Terminal Planning and Design, Volume 1: Guidebook*, 2010 (critical dimensions).

Airline Support Spaces

Airline support areas include airline ticketing offices (ATO), baggage service offices (BSO), crew space, ramp operations and storage. The following summarizes the planning parameters for airline support spaces.

- **ATO** – Area requirements for ATOs are based on a direct ratio to check-in area requirements. Requirements were based on ACRP recommendation and adjusted to reflect an industry trend for remote offices and advances in technology, which equate to 90 square feet per BAP or about 15 square feet per linear foot of check-in counter.
- **BSO** – Area requirements for BSOs are based on the number of baggage claim devices in a given area but may vary based on the number of airlines and scale of air service. Industry guidelines suggest 150 square feet per claim device and includes bag storage and lockers located near the claim devices. Future requirements were based on proportional increases in baggage claim requirements.
- **Airline Clubs/Lounges** – The area for airline clubs/lounges is based on the number of narrowbody equivalent gates (NBEG).[15] Requirements were based on 930 square feet per NBEG.
- **Airline Operations and Support** - Non-specific airline operations and support areas are based on the number of NBEGs. Requirements were based on 2,430 square feet per NBEG.

4.3.2.6 DEPARTMENT OF HOMELAND SECURITY PLANNING ASSUMPTIONS

As a result of the November 2001 Aviation and Transportation Security Act, the Department of Homeland Security (DHS) maintains in-terminal facilities to conduct airline security screening principally related to the passenger security screening checkpoints (SSCPs), baggage screening areas, and Port of Entry (POE) security. DHS terminal facility requirements are based on the following design guidelines and standards:

- Transportation Security Administration, Recommended Security Guidelines for Airport Planning, Design and Construction, June 15, 2006.
- Transportation Security Administration, *Checkpoint Design Guide (CDG)*, Revision 5.1, May 7, 2014.
- U.S. Customs and Border Protection, *Airport Technical Design Standards,* June 2012.

The Transportation Security Administration (TSA) is responsible for enforcing and regulating passenger and baggage screening at the Airport. Facility templates and guidelines published by DHS were referenced to develop space requirements for accommodating equipment as well as passenger queuing and support areas. Although the TSA has direct responsibility for determining the size and configuration of the passenger SSCPs and baggage screening facilities at the Airport, it typically collaborates with airport management to plan locations and passenger screening programs.

Transportation Security Administration - Passenger Screening Checkpoint

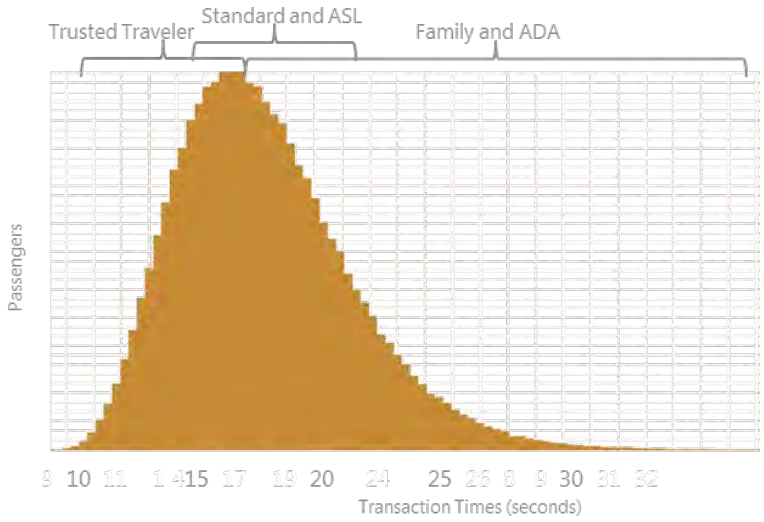
Unit requirements for SSCPs were based on TSA goals for expected passenger processing rates. Currently, the Airport operates standard/legacy, the Trusted Traveler Program (Pre✓®), and CLEAR® screening lanes.

[15] NBEG is a metric used to normalize gate demand to that of a typical narrowbody aircraft gate.

DHS offers Trusted Traveler Programs to enhance security and system efficiency while improving the passenger experience.

Screening technology and passenger eligibility for these programs will continue to evolve. Future processing rates and program utilization percentages are unknown. To simplify processing variables and provide a realistic assessment of lane and area requirements over time, an average throughput rate was adopted to represent a blended rate for advanced technologies, Pre✓®, family, oversize carry-on, and Americans with Disabilities Act (ADA) passengers. This methodology allows for the randomization of processing times for individual passengers and Trusted Traveler Program distributions that result in a blended average throughput rate of a collective checkpoint based on TSA goals and objectives and observed performance of each lane type. **Exhibit 4-18** identifies the distribution for security screening processing rates by different passenger types. **Table 4-21** presents the assumed TSA operating parameters.

EXHIBIT 4-18 PROCESSING RATE DISTRIBUTION EXAMPLE



NOTES: ADA: Americans with Disabilities Act passengers; ASL: Automated Security Lanes.
SOURCE: Benchmarking studies of comparable airports, Ricondo & Associates, Inc. May 2018.

TABLE 4-21 PASSENGER SECURITY SCREENING CHECKPOINT OPERATING PARAMETERS

ASSUMPTION	UNITS	OPERATING PARAMETER
Average Throughput Rate (passengers/hour/lane)	passengers	205
Waiting Time Goal	minutes	10
Queue Capacity	minutes	20
Area per Passenger in Queue	sq ft	10.8
Employee or Crew	lanes	1 additional lane

NOTE: Area per lane excludes information technology and support functions.
SOURCES: International Air Transport Association, *Airport Development Reference Manual*, 10th Edition, 4th Release, October 2016 (LOS); Airport Cooperative Research Program, Report 25: *Air Passenger Terminal Planning and Design, Volume 1: Guidebook*, 2010 (Critical dimensions); Transportation Security Administration, *Planning Guidelines and Design Standards for Checked Baggage Inspection Systems*, pages 6-1 through 6-2, November 27, 2009 (baggage screening); Benchmarked from comparable airports; Ricondo & Associates, Inc., February 2018 (rates).

Airport employees and flight crews were assumed to have a nominal impact on checkpoint demand and would use Trusted Traveler Program lanes or a supplemental employee lane. Further study may be required to evaluate future employee access at the Airport.

Exhibit 4-19 illustrates the space template for the current SSCP configuration and the Automated Screening Lane (ASL) configuration for future checkpoints. TSA protocols and lane configurations continue to evolve. The key metric for SSCP templates is the depth and width of available area per lane. Adequate area and building infrastructure to accommodate new technologies, protocols, and configurations must be considered. This functional area should be open, flexible, and incrementally expandable. The template module used to derive space requirements for passenger security screening includes:

- **Queue Area and Document Check Podiums**. There is one ticket and document check podium for each lane. While the waiting time goal is 10 minutes, the TSA recommends preserving a queue capacity of 20 minutes to account for delays in opening lanes and surges in the peak period.
- **Security Screening Area**. This area consists of divesting tables, metal detectors, X-ray equipment, advanced imaging technology (AIT) devices, secondary search/examination space, and a recompose area.

The template does not include the TSA administrative areas or corollary areas for AIT workstations, technical support space, or common exit circulation corridors beyond the recompose area. The TSA support area requirements are based on the TSA's CDG, which recommends 150 square feet per screening lane.

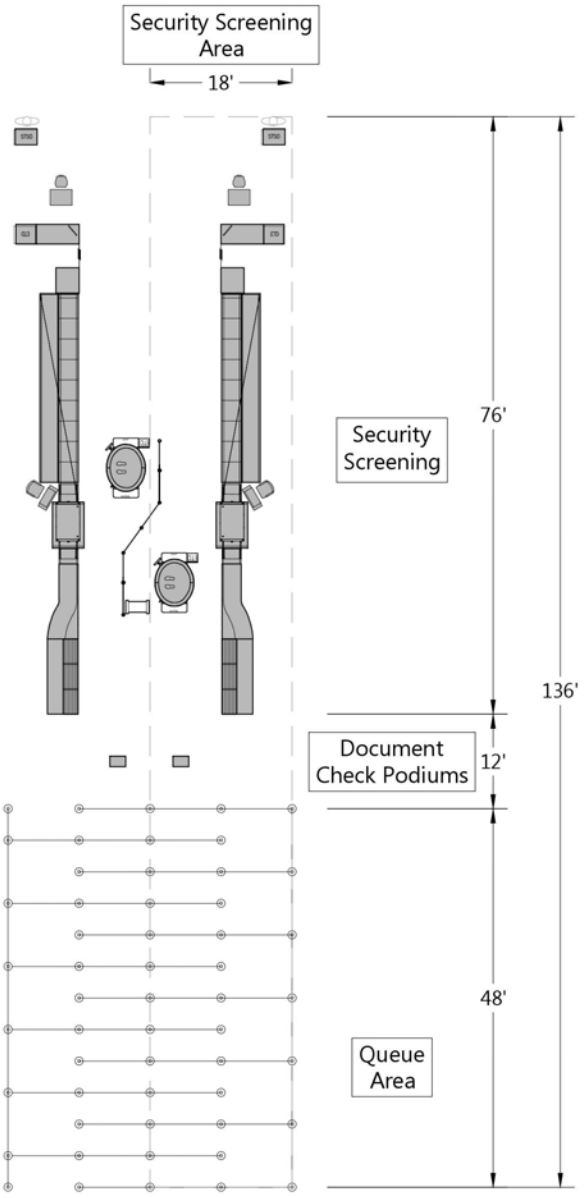
Transportation Security Administration – Checked Baggage Screening

The Aviation and Transportation Security Act requires that all checked baggage be screened for explosives through EDS machines. The TSA recommends baggage screening rooms to be located away from critical services, utilities, and distribution systems. Facility requirements were based on the Airport's reported average hourly throughput by device type.[16] An in-line baggage system consists of an integrated conveyor system that provides sufficient bag queuing capacity for on-screen resolution while maintaining high throughput and accurate bag tracking.

The baggage screening facility requirements were sized for each terminal's activity using simulation modeling. Equipment requirements are based on surged flows obtained by multiplying the baggage flow by a surge factor. The use of a surge factor is recommended to capture the intrinsic variance of baggage demand and ensure that equipment requirements are not undersized. **Table 4-22** summarizes the baggage screening facility operating parameters.

[16] City of Phoenix Aviation Department, Phoenix Sky Harbor International Airport, Baggage Statistics received April 26, 2018.

EXHIBIT 4-19 PASSENGER SECURITY SCREENING CHECKPOINT SPACE TEMPLATE



SOURCE: Transportation Security Administration, *Checkpoint Design Guide*, Revision 5.1, May 7, 2014.

TABLE 4-22 CHECKED BAGGAGE SCREENING OPERATING PARAMETERS

ASSUMPTION	UNITS	OPERATING PARAMETER
Screening Rate per Device	bags per hour	400-680
Number of EDS Devices	devices	number of devices + 1
Area per Device	sq ft	6,500

SOURCES: Transportation Security Administration, *Planning Guidelines and Design Standards for Checked Baggage Inspection Systems* Version 5.0, July 2016; City of Phoenix Aviation Department, Phoenix Sky Harbor International Airport (operating parameter assumptions).

U.S. Customs and Border Protection

All international arriving passengers must be processed at a POE prior to entering the United States, whether they are terminating their journey at the Airport or connecting to a domestic flight. The POE at the Airport is a fully independent facility, with CBP administrative offices and facilities capable of processing terminating and connecting passengers. These requirements are based on current CBP published standards and accepted practices for 800 peak hour passengers. As technologies emerge and screening methods improve, any new or expanded facility will require extensive coordination with local and national CBP to bring the POE into compliance. A POE currently includes the following facilities:

- **Sterile Corridor**. This is a secure corridor for deplaned international passengers entering the primary processing area.
- **Primary Processing**. The initial passenger screening to process passports consists primarily of staffed screening booths, Automated Passport Control (APC) kiosks, and Global Entry (GE) kiosks. Global Entry is part of CBP's Trusted Traveler program; it allows the expedited clearance of pre-approved, low-risk travelers into the United States.
- **International Baggage Claim**. This baggage claim hall is for international passengers; all passengers must reclaim their bags prior to exiting the POE.
- **Exit Control**. This represents the final stages of the POE process. Typically, passengers with reclaimed baggage are inspected by officers at podiums before proceeding to exit the POE into U.S. territory. However, if an officer recommends further search of a passenger or baggage, the designated party must be processed through secondary screening.
- **Secondary Processing**. Secondary screening areas accommodate the screening of passengers and baggage for goods, narcotics, or perishables not permitted into the United States.

Exhibit 4-20 and **Tables 4-23** and **4-24** outline the CBP flows and operating parameters related to passport types, equipment utilization, transaction rates, wait-time goals, and area per position or device.

EXHIBIT 4-20 CUSTOMS AND BORDER PROTECTION PASSENGER FLOWS

CBP Goal:
100% of passengers processed through FIS within 45 minutes of entering the FIS. Not inclusive of passengers selected for secondary screening.

Legend:
Percentage of Passengers at Facility
Type of Service
(Device)
Level of Service: Wait Time Goal
Level of Service: Area/Passenger
Process Cycle Time (see Sources below)

Assumptions Notes:
USC: United States Citizen
LPR: Legal Permanent Resident
CAN: Canadian Citizen
ESTA: Electronic System for Travel Authorization eligible visitor
VW: Visa Waiver Program participating country citizen
CSR: Customer Service Representative
PG: Passage Granted
X: Passenger receives "X" on receipt at APC Kiosk

1. Percentage at Triage includes kiosk error reads and declarations.
2. International Bag Claim Assumptions:

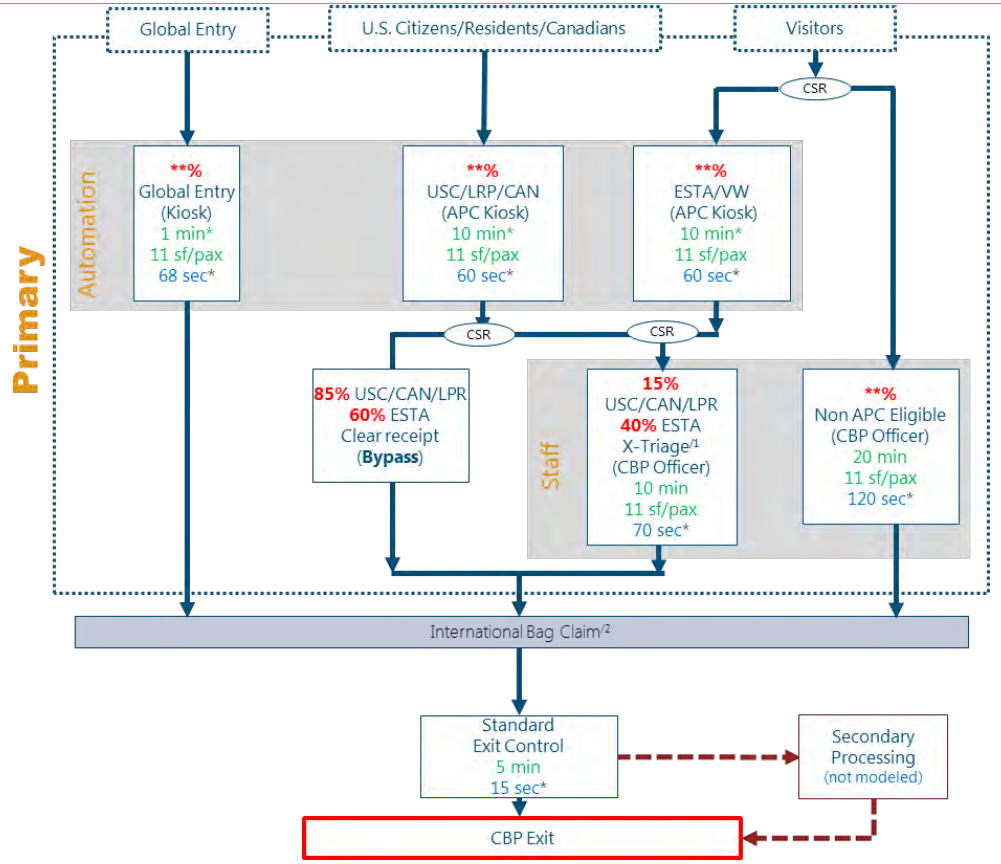
Average bags per international passenger: 1.2 bags
First bag at claim: 10 min after scheduled time of arrival
Bag uploading rate: 15 bags per minute

First passenger off aircraft: 3 minutes after block time
Aircraft unload rate:
Narrowbody: 18 pax/min
Widebody: 25 pax/min

**Passport Types by Origin (All Carriers)

Origin	USC/LPR/CAN	ESTA	NVW	GE
Europe	53%	30%	16%	1%
Mexico	97%	1%	1%	1%

NOTE:
*Other comparable airport CBP



NOTE: ESTA: Electronic System for Travel Authorization.
SOURCE: Ricondo & Associates, Inc., May 2018.

TABLE 4-23 PASSPORT TYPES BY ORIGIN (ALL CARRIERS)

ORIGIN	U.S./LEGAL PERMANENT RESIDENT/ CANADIAN	ELECTRONIC SYSTEM FOR TRAVEL AUTHORIZATION (ESTA)	NON-VISA WAIVER	GLOBAL ENTRY
Mexico	97%	1%	1%	1%
Europe	53%	30%	16%	1%

SOURCE: Benchmarking studies of comparable airports, Ricondo & Associates, Inc., May 2018.

TABLE 4-24 CUSTOMS AND BORDER PROTECTION OPERATING PARAMETERS

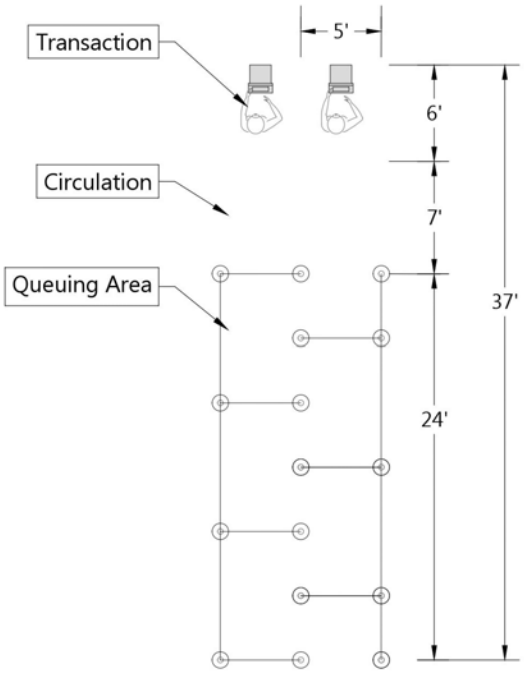
	PERCENTAGE	WAITING TIME GOAL	AVERAGE TRANSACTION TIME
Global Entry	see Table 4-23 Global Entry	1 minute	68 seconds
Customs and Border Protection Officer	see Table 4-23 Non-Visa Waiver	20 minutes	120 seconds
Automated Passport Control	see Table 4-23 U.S./Legal permanent Resident/Canadian/ESTA	10 minutes	60 seconds
Automated Passport Control Clear Receipts			
U.S./Canadian/Legal Permanent Resident	85%	bypass	Not Applicable
ESTA	60%	bypass	Not Applicable
Automated Passport Control Triage Receipts			
U.S./Canadian/Legal Permanent Resident	15%	10 minutes	70 seconds
ESTA	40%	10 minutes	70 seconds

NOTE: Waiting time goal represents the longest average time a passenger will wait for service during the peak period.
SOURCE: Benchmarking studies of comparable airports, Ricondo & Associates, Inc., May 2018.

Primary Passport Inspection

Facility requirements for primary passport inspection were developed using simulation modeling to correlate forecast arriving international passenger demand to passenger attributes, which included passenger nationality, applicable processing rates, and LOS goals. Spatial requirements for the APCs and GE kiosks were derived from space templates depicted in **Exhibit 4-21**.

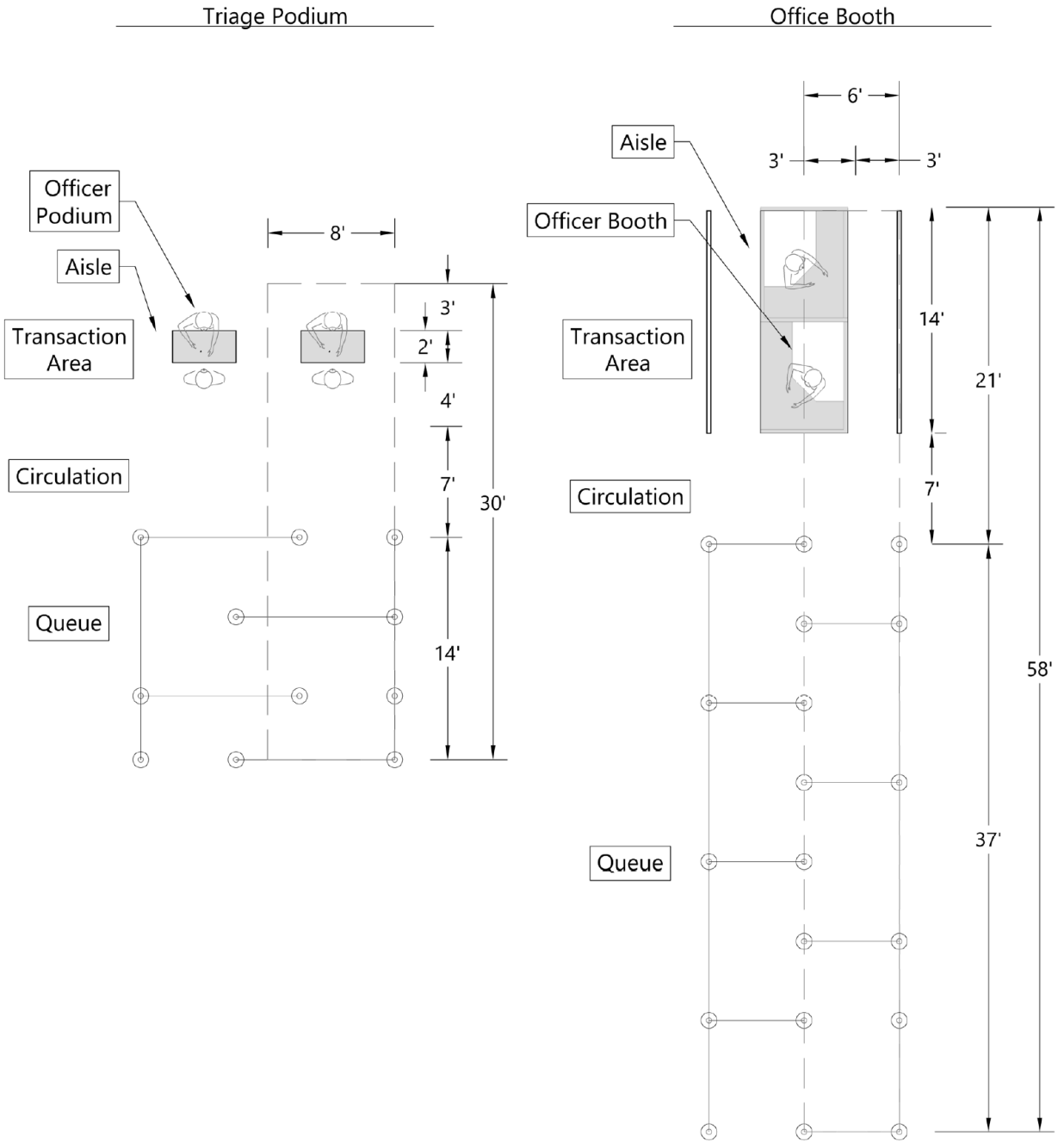
EXHIBIT 4-21 KIOSK SPACE TEMPLATE



SOURCES: Airport Cooperative Research Program, Report 25, *Airport Passenger Terminal Planning and Design, Volume 1: Guidebook*, 2010 (critical dimensions); Ricondo & Associates, Inc., May 2018.

Passengers were segregated into four categories to appropriately reflect the different processes of the CBP screening protocol: Global Entry-or previously vetted passengers, passengers cleared at APCs, flagged for additional screening, and non-APC eligible visitors to process through a traditional agent position. **Exhibit 4-22** shows the space templates for a triage podium and an officer booth. A provision of a single position dedicated to crew is included in the program requirements. Officers process passengers from any of the adjacent queues when their own queue is underutilized.

EXHIBIT 4-22 CUSTOMS AND BORDER PROTECTION OFFICER POSITION SPACE TEMPLATE



SOURCES: Airport Cooperative Research Program, Report 25, *Airport Passenger Terminal Planning and Design, Volume 1: Guidebook,* 2010 (critical dimensions); Ricondo & Associates, Inc., May 2018.

International Baggage Claim

After clearing primary processing, arriving international passengers must reclaim checked baggage prior to exiting the POE. International baggage claim consists of the following:

- **Principal Baggage Claim Area**. This represents the space occupied by the baggage claim carousels and an 18-foot band of space shown in **Exhibit 4-23** that corresponds to the presentation length of the carousel. This space, where passengers actively retrieve baggage, provides circulation between adjoining claim units or other fixtures.
- **Ancillary Baggage Claim Area**. This represents the space occupied by restrooms, the general circulation space between upstream and downstream functions, and the storage space for baggage carts. Also included are the baggage offload facilities that the airlines use to deliver bags onto baggage claim carousels and load rechecked bags.

Static spreadsheet modeling determined the international baggage claim requirements. Because of short processing times associated with APCs, it is assumed that 90 percent of passengers from an arriving international flight wait for bags at the device. Therefore, it is assumed that facility requirements range from 90 to 100 percent of passengers with checked bags at the claim device during the peak 20-minute period, which is the average time for baggage to be transported from the aircraft to the baggage claim unit.

Exit Control

Simulation modeling determined the exit control requirements, which incorporated the metering from upstream primary processing and international baggage claim. **Exhibit 4-24** illustrates a space template for an exit control lane.

Secondary Inspection

If an officer recommends further search of a passenger or baggage, the party must be processed through secondary screening. Secondary screening areas may consist of holdrooms for each gender, interview rooms, canine rooms, and other screening support spaces.

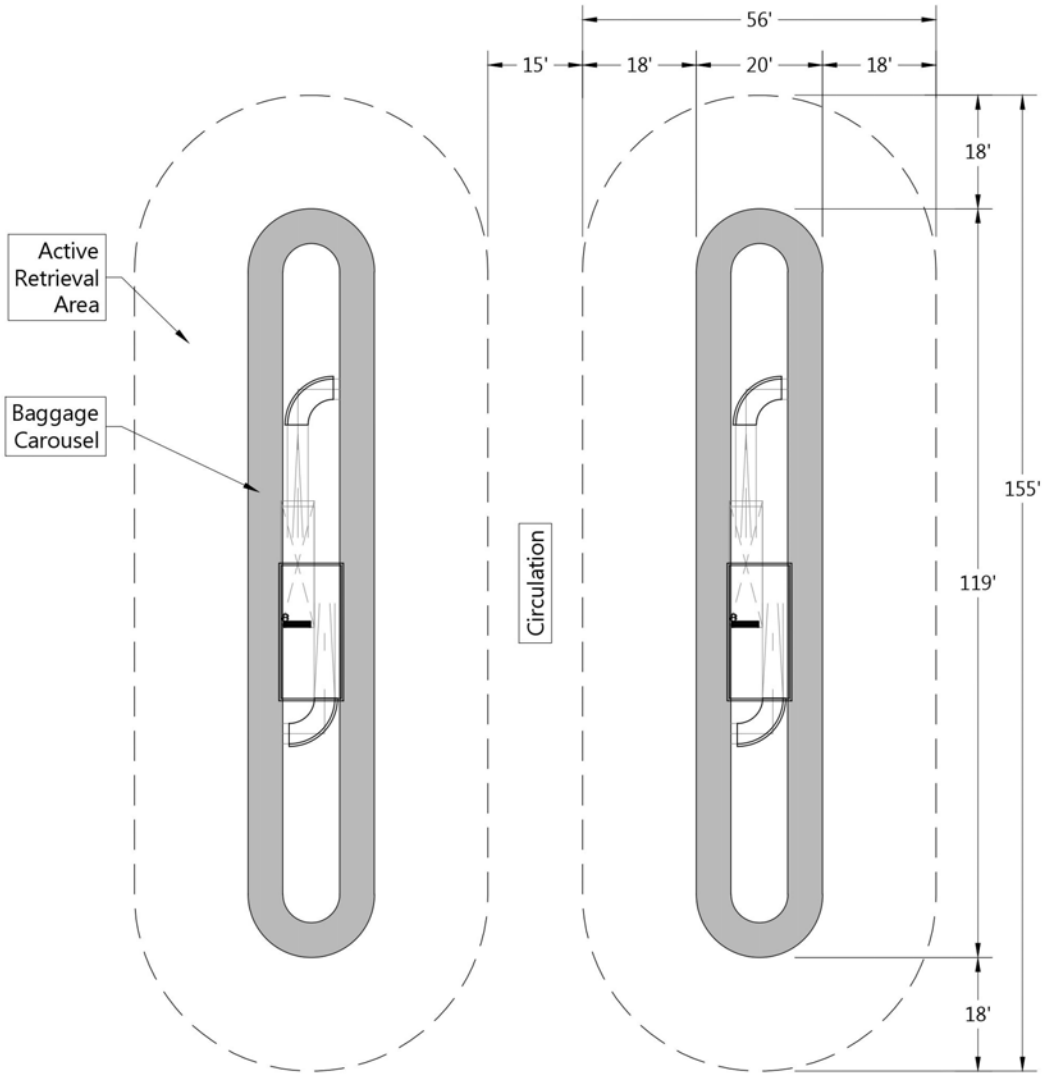
CBP Offices/Support Areas

CBP offices and support areas include administrative offices, supervisors' offices, information technology support offices, break rooms, locker rooms, training rooms, and other support functions. These space requirements are sized proportionally to the current levels of demand as specified in the CBP's Airport Technical Design Standards.

4.3.2.7 SUPPORT SPACES AND BUILDING SERVICES PLANNING ASSUMPTIONS

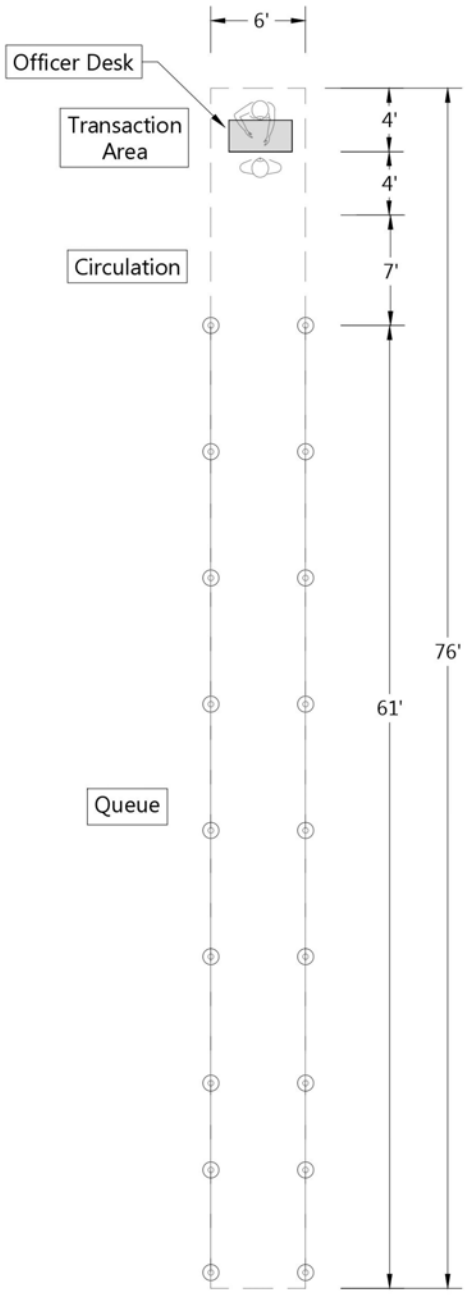
The following details how requirements were determined for building services such as restrooms, commercial programs, operational support spaces, building systems, and circulation. Support space includes airport offices and operations areas, and Airport support areas such as maintenance closets, storage, and workshops. Requirements were developed from parameters and planning factor ratios consistent with industry guidelines and stakeholder input.

EXHIBIT 4-23 INDICATIVE INTERNATIONAL CLAIM DEVICE SPACE TEMPLATE



SOURCES: Airport Cooperative Research Program, Report 25, *Airport Passenger Terminal Planning and Design, Volume 1: Guidebook*. 2010 (Critical Dimensions); Ricondo & Associates, Inc., May 2018.

EXHIBIT 4-24 EXIT CONTROL SPACE TEMPLATE



SOURCES: Airport Cooperative Research Program, Report 25, *Airport Passenger Terminal Planning and Design, Volume 1: Guidebook,* 2010 (critical dimensions); Ricondo & Associates, Inc., May 2018.

Public Restrooms

Public restrooms should be conveniently distributed throughout the public areas of the terminal and spaced no further than 400 feet apart, providing for a maximum walking distance of 200 feet to a restroom. Each location should include men's and women's restrooms, and a separate family, companion care, or gender-neutral restroom. Restroom assumptions reflect metrics provided in ACRP Report 130.[17] Restroom requirements were based on 70 square feet per fixture. Future restroom requirements were incrementally increased based on future gate requirements.

Support Spaces and Other Amenities

Support spaces include those facilities supporting the operation and maintenance of the Airport. **Table 4-25** summarizes the planning assumptions for each space defined below and do not reflect individual airline or tenant needs.

TABLE 4-25 SUPPORT SPACE PARAMETERS

	VALUE	UNIT	NOTE
Commercial Program	10.0	square feet	per 100,000 annual enplaned passengers
Airport Offices and Support	96,420	square feet	per 10 million annual passengers
Building Services	10	percent	of functional area subtotal
Circulation	30	percent	of functional area subtotal

SOURCE: Benchmarking studies of comparable airports, Ricondo & Associates, Inc., May 2018.

- **Commercial Program** – The existing ratio of commercial area (food, beverage, specialty retail, services, convenience retail, and duty free) to passengers is 6.9 square feet per 100,000 annual enplaned passengers. A commercial program planning factor of 10.0 square feet per 100,000 annual enplaned passengers was assumed are based on comparisons to peer airports. Requirements for commercial support and storage were assumed to be 20 percent of the leasable commercial program space based on a recommendation in ACRP Report 54.[18]
- **Airport Offices and Support** – The planning factor used to extrapolate Airport office space was based on existing office space. Airport office and support areas were increased proportionally with enplaning passenger growth through the planning horizon.
- **Building Services –** Requirements for mechanical, electrical, and plumbing are based on 10 percent of the subtotal of functional areas not including circulation or design configuration contingency.
- **Circulation –** Requirements are based on 30 percent of the subtotal of functional areas not including building services or design configuration contingency.

[17] Airport Cooperative Research Program, Report 130, *Guidebook for Airport Terminal Restroom Planning and Design*, 2015.

[18] Airport Cooperative Research Program, Report 54, *Resource Manual for Airport In-Terminal Concessions*, 2011.

4.3.3 TERMINAL PROGRAM REQUIREMENTS

Table 4-26 summarizes the terminal facility area requirements for the three terminal groups. Specific airline assignments between terminals will influence whether space deficiencies occur in a given terminal and when that would occur. The fluid nature of airline assignments and various forecast scenarios will influence individual facility requirements over the planning horizon.

The following subsections describes the facility requirements for individual functional areas based on the planning parameters described earlier in this section.

4.3.3.1 PASSENGER, BAGGAGE, AND AIRLINE FACILITIES

Requirements for airline-operated facilities were developed from methodologies consistent with IATA's *Airport Development Reference Manual*, 10th edition ,[19] and ACRP Report 25, *Airport Passenger Terminal Planning and Design, Volume 1: Guidebook*.[20]

Check-in

Dynamic modeling was used to generate peak check-in activity for passengers and baggage based on the DDFS and the Airport-specific operational parameters and passenger attributes outlined in Section 4.3.2.4. Requirements represent the number of units needed to process passenger and baggage demand within the predefined LOS objectives.

Exhibit 4-25 illustrates demand at the check-in facility with the applied passenger show-up profiles at each terminal. **Table 4-27** outlines the overall check-in program requirements.

Baggage Handling System

The BHS requirements were derived from the operating parameters specific to each terminal's system outlined in Section 4.3.2.5. **Table 4-28** summarizes the BHS requirements for the Airport. These figures do not include general circulation to and from the BHS areas which is typically included in Circulation (see Section 4.3.3.3).

[19] International Air Transport Association, *Airport Development Reference Manual*, 10th ed., 4th release, October 2016.

[20] Airport Cooperative Research Program, Report 25, *Airport Passenger Terminal Planning and Design, Volume 1: Guidebook*. 2010.

TABLE 4-26 TERMINAL FACILITY AREA REQUIREMENTS

		TERMINAL 3				TERMINAL 4 - NORTH				TERMINAL 4 – SOUTH			
FUNCTIONAL AREA	UNITS	EXISTING	PAL 1	PAL 2	PAL 3	EXISTING	PAL 1	PAL 2	PAL 3	EXISTING	PAL 1	PAL 2	PAL 3
Holdroom Requirements[1]	sq ft	79,051	75,980	79,415	86,585	116,404	155,890	169,200	190,865	65,381	63,265	65,905	76,450
Passenger, Baggage, and Airline Facilities													
Check-in	sq ft	12,180	12,180	13,440	15,540	28,140	31,080	34,440	41,580	11,340	12,600	13,440	15,120
Baggage Handling System	sq ft	29,400	29,850	30,750	39,900	91,500	96,450	103,200	120,750	40,950	46,350	48,600	57,300
Domestic Baggage Claim	sq ft	17,240	18,560	18,830	26,680	29,480	31,510	32,060	35,410	22,620	24,100	25,470	29,260
Airline Support	sq ft	130,410	104,340	111,330	123,020	207,040	217,900	241,130	277,270	117,600	83,940	87,480	101,430
Department of Homeland Security Facilities													
Transportation Security Administration													
Checkpoint Total Area	sq ft	16,800	16,410	16,350	21,450	39,780	40,890	46,240	51,500	29,420	31,320	33,810	36,460
Checked Baggage Screening	sq ft	19,500	26,000	26,000	32,500	45,500	45,500	45,500	52,000	26,000	26,000	26,000	32,500
Customs and Border Protection	sq ft	0	0	0	0	51,461	55,607	55,607	111,276[2]	0	0	0	0
Other Public and Support Spaces													
Public Restrooms	sq ft	19,300	18,330	19,460	22,350	33,770	35,950	38,760	43,880	17,410	18,330	19,960	23,190
Commercial Program	sq ft	52,500	52,760	57,580	69,170	82,560	109,740	124,310	155,520	47,230	42,070	44,860	56,650
Support Spaces[3]	sq ft	313,890	305,030	330,030	391,590	545,740	668,640	747,720	921,870	298,120	267,880	285,080	346,920
Design Configuration Contingency (20%)	sq ft	138,054	131,888	140,637	165,757	254,275	297,831	327,633	396,582	135,214	123,171	130,121	155,056
TOTAL	sq ft	828,325	791,328	843,822	994,542	1,525,650	1,786,988	1,965,800	2,398,503	811,285	739,026	780,726	930,336

NOTES:

1 Assumes average of minimum and maximum holdroom area requirements. Existing for Terminal 4-South assumes Concourse S1 is completed. Existing for Terminal 3 assumes improvements to North Concourse as part of the T3 Modernization Program are completed.

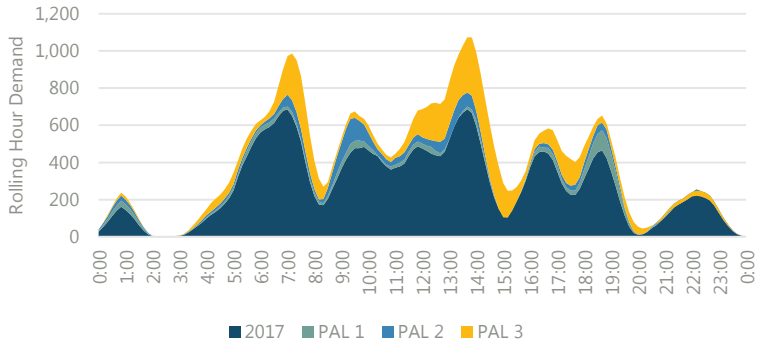
2 Customs and Border Protection area under PAL 3 reflects peak international design day flight schedule.

3 Support spaces includes airport support, building services (mechanical, electrical, and plumbing) and circulation spaces.

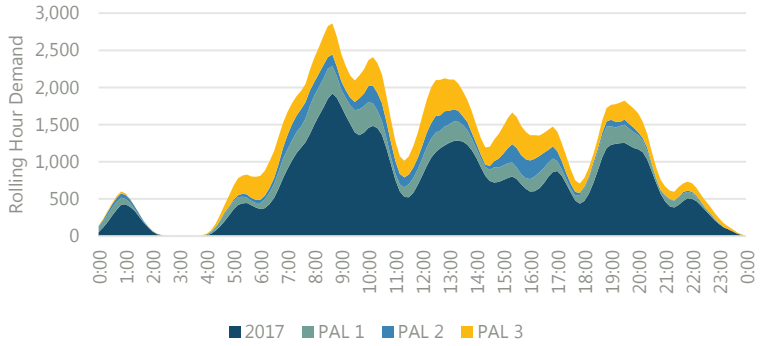
SOURCE: Ricondo & Associates, Inc., June 2018.

EXHIBIT 4-25 CHECK-IN DEMAND

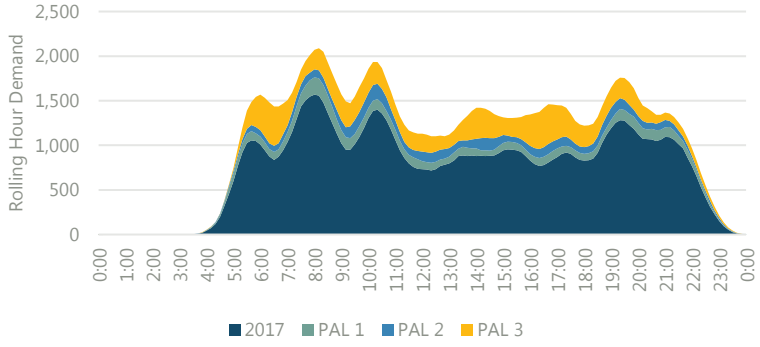
Terminal 3



Terminal 4–North



Terminal 4–South



SOURCE: Ricondo & Associates, Inc., May 2018.

TABLE 4-27 CHECK-IN REQUIREMENTS

	UNITS	EXISTING	PAL 1	PAL 2	PAL 3
Terminal 3 Total Check-in Area	**sq ft**	**12,180**	**12,180**	**13,440**	**15,540**
Baggage Acceptance Points	each	29	29	32	37
Kiosks	each	28	30	31	36
Total Queue Area	sq ft	4,640	4,640	5,120	5,920
Total Passenger Processing Area	sq ft	7,540	7,540	8,320	9,620
Terminal 4 North Total Check-in Area	**sq ft**	**28,140**	**31,080**	**34,440**	**41,580**
Baggage Acceptance Points	Each	67	74	82	99
Kiosks	Each	57	65	70	87
Total Queue Area	sq ft	10,720	11,840	13,120	15,840
Total Passenger Processing Area	sq ft	17,420	19,240	21,320	25,740
Terminal 4 South Total Check-in Area	**sq ft**	**11,340**	**12,600**	**13,440**	**15,120**
Baggage Acceptance Points	each	27	30	32	36
Kiosks	each	40	40	46	52
Total Queue Area	sq ft	4,320	4,800	5,120	5,760
Total Passenger Processing Area	sq ft	7,020	7,800	8,320	9,360

SOURCE: Ricondo & Associates, Inc., May 2018.

TABLE 4-28 BAGGAGE HANDLING SYSTEM REQUIREMENTS

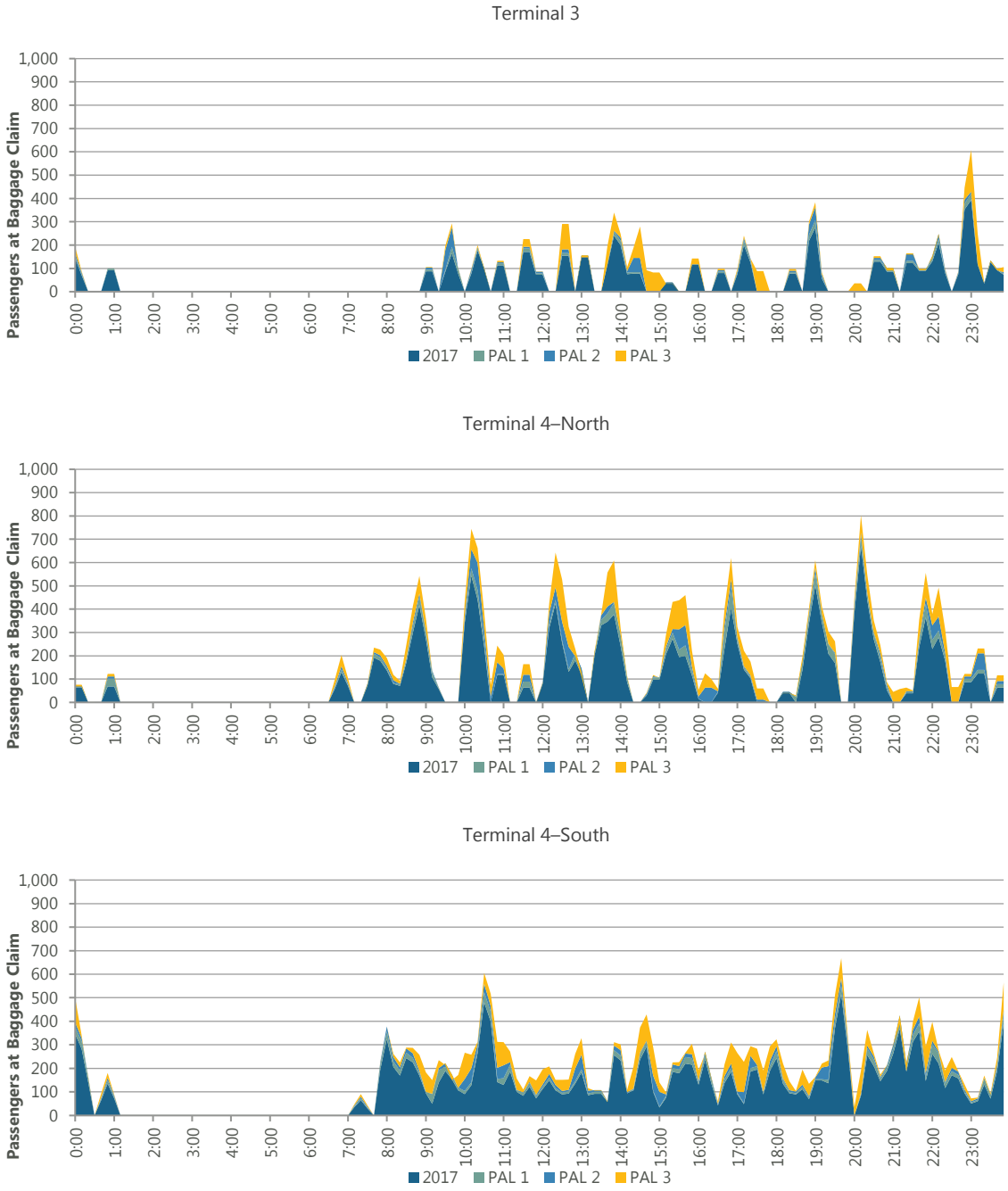
	Units	Existing	PAL 1	PAL 2	PAL 3
Terminal 3 Total Baggage Handling System Area	**sq ft**	**29,400**	**29,850**	**30,750**	**39,900**
Peak Departing Flights	each	9	8	9	11
Outbound Carts Required	each	44	45	47	62
Outbound Baggage Handling Area	sq ft	19,800	20,250	21,150	27,900
Inbound Offload Devices	each	8	8	8	10
Inbound Baggage Handling Area	sq ft	9,600	9,600	9,600	12,000
Terminal 4 North Total Baggage Handling System Area	**sq ft**	**91,500**	**96,450**	**103,200**	**120,750**
Peak Departing Flights	each	60	61	62	62
Outbound Carts Required	each	182	193	208	247
Outbound Baggage Handling Area	sq ft	81,900	86,850	93,600	111,150
Inbound Offload Devices	each	8	8	8	8
Inbound Baggage Handling Area	sq ft	9,600	9,600	9,600	9,600
Terminal 4 South Total Baggage Handling System Area	**sq ft**	**40,950**	**46,350**	**48,600**	**57,300**
Peak Departing Flights	each	25	25	26	31
Outbound Carts Required	each	75	87	92	106
Outbound Baggage Handling Area	sq ft	33,750	39,150	41,400	47,700
Inbound Offload Devices	each	6	6	6	8
Inbound Baggage Handling Area	sq ft	7,200	7,200	7,200	9,600

SOURCE: Ricondo & Associates, Inc., May 2018.

Domestic Baggage Claim

Baggage claim requirements were derived based on accommodation of estimated passengers in the active retrieval area at an acceptable LOS and operating parameters outlined in Section 4.3.2.5. **Exhibit 4-26** shows the peak 20-minute passenger demand for all PALs for 90 percent occupation by passengers checking bags at baggage claim throughout the day for all operations at each terminal. Baggage claim requirements are outlined in **Table 4-29**.

EXHIBIT 4-26 PASSENGERS AT DOMESTIC BAGGAGE CLAIM



NOTE: Passenger demand assumes 90 percent occupancy of passenger that check bags.
SOURCE: Ricondo & Associates, Inc., May 2018.

TABLE 4-29 BAGGAGE CLAIM REQUIREMENTS

	UNITS	EXISTING	PAL 1	PAL 2	PAL 3
Terminal 3 Total Domestic Baggage Claim Area	**sq ft**	**17,240**	**18,560**	**18,830**	**26,680**
Rolling 20-minute Operations	aircraft	5	5	5	6
Rolling 20-minute Passengers 90% Occupation	occupants	315	340	345	485
Device Requirement	each	3	4	4	5
Terminal 4 North Total Domestic Baggage Claim Area	**sq ft**	**29,480**	**31,510**	**32,060**	**35,410**
Rolling 20-minute Operations	aircraft	22	22	23	23
Rolling 20-minute Passengers 90% Occupation	occupants	535	575	585	645
Device Requirement	each	5	6	6	6
Terminal 4 South Total Domestic Baggage Claim Area	**sq ft**	**22,620**	**24,100**	**25,470**	**29,260**
Rolling 20-minute Operations	aircraft	11	11	11	12
Rolling 20-minute Passengers 90% Occupation	occupants	410	440	465	535
Device Requirement	each	4	4	4	5

SOURCE: Ricondo & Associates, Inc., May 2018.

It is important to recognize that the baggage claim requirements were based on current passenger baggage-check characteristics, which are highly dependent on airline practices related to checked-bag fees. Changes in checked-bag fees by individual or multiple airlines could significantly affect these requirements and should be monitored closely.

Airline Support

Airline support areas include but are not limited to ATOs, BSOs, and operational space. Airline support space requirements were derived using a direct ratio to the requirements of the associated primary facility (i.e., check-in area, baggage claim devices) and the number of NBEG. The requirements listed in **Table 4-30** are aggregated and do not reflect individual airline needs.

TABLE 4-30 AIRLINE SUPPORT AREA REQUIREMENTS

	UNITS	EXISTING	PAL 1	PAL 2	PAL 3
Terminal 3 Total Airline Support Area	**sq ft**	**130,560**	**104,340**	**111,330**	**123,020**
Airline Ticketing Offices	sq ft	2,610	2,610	2,880	3,330
Airline Clubs/Lounges	sq ft	35,250	27,990	29,850	32,920
Baggage Service Offices	sq ft	600	600	600	750
Operations and Support	sq ft	92,100	73,140	78,000	86,020
Terminal 4 North Total Airline Support Area	**sq ft**	**206,890**	**217,600**	**240,830**	**277,120**
Airline Ticketing Offices	sq ft	6,030	6,660	7,380	8,910
Airline Clubs/Lounges	sq ft	55,430	58,220	64,450	74,030
Baggage Service Offices	sq ft	600	600	600	750
Operations and Support	sq ft	144,830	152,120	168,400	193,430
Terminal 4 South Total Airline Support Area	**sq ft**	**117,450**	**83,790**	**87,330**	**101,280**
Airline Ticketing Offices	sq ft	2,430	2,700	2,880	3,240
Airline Clubs/Lounges	sq ft	31,710	22,320	23,250	26,970
Baggage Service Offices	sq ft	450	450	450	600
Operations and Support	sq ft	82,860	58,320	60,750	70,470

SOURCE: Ricondo & Associates, Inc., May 2018.

4.3.3.2 DEPARTMENT OF HOMELAND SECURITY FACILITIES

Requirements for the DHS security facilities were developed using DHS-published facility templates and guidelines, as well as specific operating parameters outlined in Section 4.3.2.6.

Transportation Security Administration – Passenger Screening Checkpoing

In running the simulations, passengers were metered through an appropriately sized airline check-in process prior to security, providing a more accurate assessment of sequenced demand at the checkpoint. This approach resulted in lane and queue requirements that are balanced to upstream processor components. Space requirements necessary to accommodate TSA equipment, support facilities, passenger processing, and queueing areas are listed in **Table 4-31**.

TABLE 4-31 PASSENGER SECURITY SCREENING CHECKPOINT REQUIREMENTS

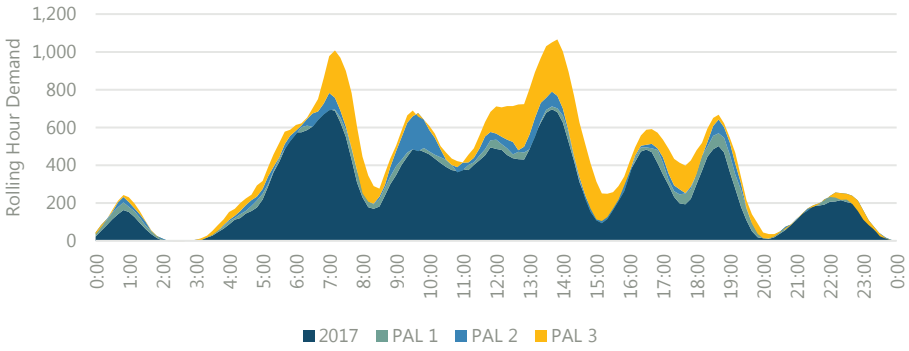
	UNITS	EXISTING	PAL 1	PAL 2	PAL 3
Terminal 3 Total Checkpoint Area	**sq ft**	**16,800**	**16,410**	**16,350**	**21,450**
Checkpoint Lanes	each	5	5	5	7
Total Queue Area	sq ft	4,325	4,325	4,325	6,055
Total Passenger Processing Area	sq ft	7,925	7,925	7,925	11,095
Support Facilities and Offices	sq ft	750	750	750	1,050
Loading Dock Screening Area	sq ft	3,800	3,410	3,350	3,250
Terminal 4 North Total Checkpoint Area	**sq ft**	**39,780**	**40,890**	**46,240**	**51,500**
Checkpoint Lanes	each	13	13	15	17
Total Queue Area	sq ft	11,245	11,245	12,975	14,705
Total Passenger Processing Area	sq ft	20,605	20,605	23,775	26,945
Support Facilities and Offices	sq ft	1,950	1,950	2,250	2,550
Loading Dock Screening Area	sq ft	5,980	7,090	7,240	7,300
Terminal 4 South Total Checkpoint Area	**sq ft**	**29,420**	**31,320**	**33,810**	**36,460**
Checkpoint Lanes	each	10	11	12	13
Total Queue Area	sq ft	8,650	9,515	10,380	11,245
Total Passenger Processing Area	sq ft	15,850	17,435	19,020	20,605
Support Facilities and Offices	sq ft	1,500	1,650	1,800	1,950
Loading Dock Screening Area	sq ft	3,420	2,720	2,610	2,660

SOURCE: Ricondo & Associates, Inc., May 2018.

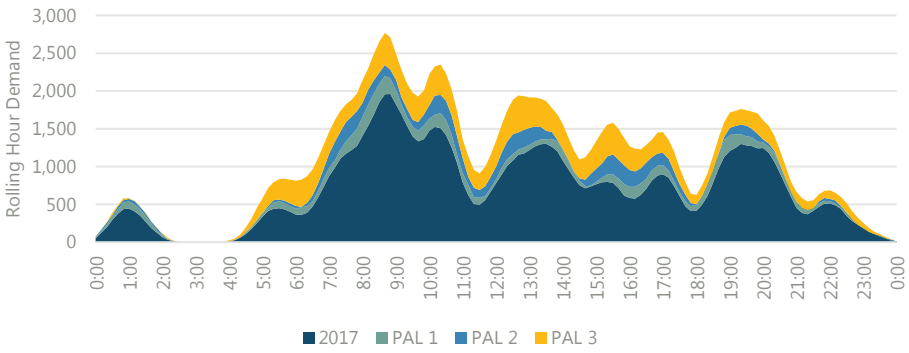
Exhibit 4-27 illustrates originating passenger demand at the SSCP facilities in each Terminal.

EXHIBIT 4-27 ORIGINATING PASSENGER DEMAND AT SECURITY SCREENING CHECKPOINTS

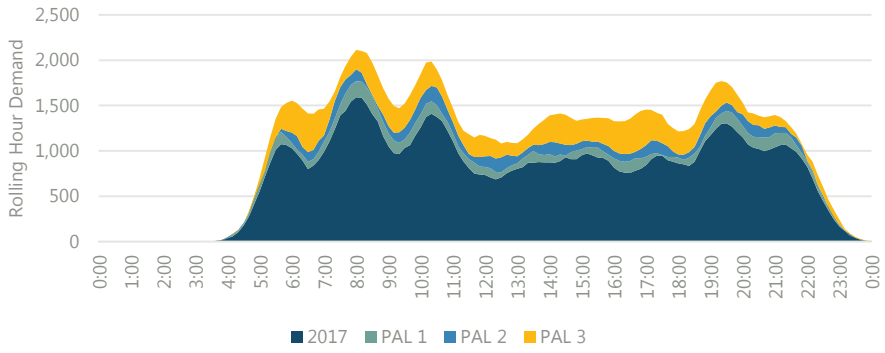
Terminal 3



Terminal 4–North



Terminal 4–South



SOURCE: Ricondo & Associates, Inc., May 2018.

Transportation Security Administration – Checked Baggage Screening

Checked baggage screening requirements were based on the average hourly throughput by device type reported by PHX AVN.[21] Equipment requirements are based on surged flows obtained by multiplying the baggage flow by a surge factor. The use of a surge factor is recommended by the TSA Planning Guidelines and Design Standards for checked baggage inspection systems to capture the intrinsic variance of baggage demand and ensure that equipment requirements are not undersized.[22] **Table 4-32** summarizes the baggage screening facility requirements.

TABLE 4-32 CHECKED BAGGAGE SECURITY SCREENING REQUIREMENTS

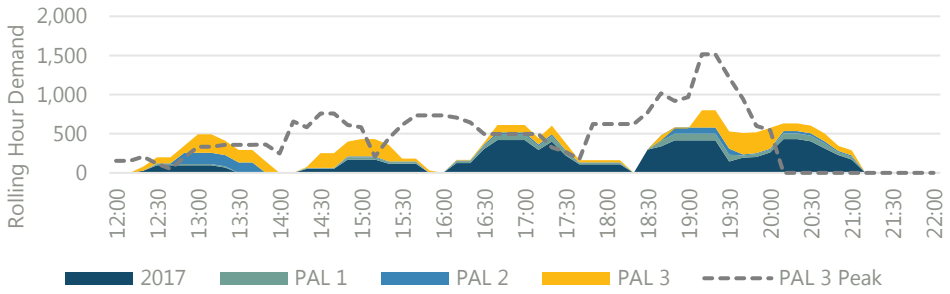
	UNITS	EXISTING	PAL 1	PAL 2	PAL 3
Terminal 3 Total Checked Baggage Security Screening Area	**sq ft**	**19,500**	**26,000**	**26,000**	**32,500**
Checked Baggage Screening Devices	each	3	4	4	5
Terminal 4 North Total Checked Baggage Security Screening Area	**sq ft**	**45,500**	**45,500**	**45,500**	**52,000**
Checked Baggage Screening Devices	each	7	7	7	8
Terminal 4 South Total Checked Baggage Security Screening Area	**sq ft**	**26,000**	**26,000**	**26,000**	**32,500**
Checked Baggage Screening Devices	each	4	4	4	5

SOURCE: Ricondo & Associates, Inc., May 2018.

U.S. Customs and Border Protection

Exhibit 4-28 shows the peak hour deplaning passenger demand at CBP based on each DDFS for PMAD of March 9, 2017 and the peak international arrival for PAL 3. Area requirements are listed in **Table 4-33**. Recent renovations have increased CBP processing to 800 passengers per hour. Requirements are based on current technology and passport characteristics, which are highly dependent on current CBP security practices and flight origin. Changes in passenger profiles, airline forecasts or CBP protocols by PAL 3 could significantly affect these requirements and should be monitored closely.

EXHIBIT 4-28 CUSTOMS AND BORDER PROTECTION DEMAND



SOURCE: Ricondo & Associates, Inc., May 2018.

[21] City of Phoenix Aviation Department, Baggage Handling System Data, April 2018.

[22] Transportation Security Administration, Planning Guidelines and Design Standards for Checked Baggage Inspection Systems, Version 6.0, September 29, 2017.

TABLE 4-33 CUSTOMS AND BORDER PROTECTION PROGRAM REQUIREMENTS

	UNITS	EXISTING	PAL 1	PAL 2	PAL 3	PAL 3 INTERNATIONAL PEAK[1]
Primary Inspection						
Automated Passport Control Kiosks	Each	19	22	23	28	39
Global Entry Kiosks	Each	1	1	1	1	1
Agent Booth	each	9	10	12	10	14
International Baggage Claim	**sq ft**	**34,720**	**34,720**	**34,720**	**34,720**	**43,400**
Baggage Claim Devices	each	4	4	4	4	5
Total Active Retrieval Area	sq ft	22,800	22,800	22,800	22,800	28,500
Total Baggage Claim Device Area	sq ft	11,920	11,920	11,920	11,920	14,900
Exit Control						
Podium	each	4	4	4	4	5
Total CBP Area	**sq ft**	**51,461**	**55,607**	**55,607**	**63,742**	**111,276**

NOTE:

1 A international peak design day arrival schedule was developed for PAL 3 to determine peak international day requirements. The estimated number of arriving passengers on the international peak day for PALs 1 and 2 was not sufficient enough to require additional Customs and Border Protection facilities.

SOURCE: Ricondo & Associates, Inc., May 2018.

As described in Section 4.1, a PAL 3 international peak day arrival schedule was developed to determine processing requirements for a peak international day. Due to an increase in peak period international arriving passengers in PAL 3, additional CBP processing facility space is required, as shown in the last column in Table 4-33. The estimated number of arriving passengers on the international peak day for PALs 1 and 2 was not sufficient enough to require additional Customs and Border Protection facilities.

4.3.3.3 OTHER PUBLIC AND SUPPORT SPACES

This section summarizes existing conditions and future area requirements for restrooms, commercial program areas, airline and airport support spaces, building systems, and circulation.

Public Restrooms

Restroom unit and area requirements listed in **Table 4-34** were determined for airside and landside facilities to reflect needs in secured and unsecured areas, as well as specific operating parameters outlined in Section 4.3.2.7.

TABLE 4-34 PUBLIC RESTROOMS

	Units	Existing	PAL 1	PAL 2	PAL 3
Terminal 3 Total Restroom Area	**sq ft**	**19,300**	**18,330**	**19,460**	**22,350**
Concourse Restrooms	sq ft	14,520	13,050	13,470	15,020
Terminal Restrooms	sq ft	4,780	5,280	5,990	7,330
Terminal 4 North Total Restroom Area	**each**	**33,770**	**35,950**	**38,760**	**43,880**
Concourse Restrooms	each	27,730	27,310	29,200	32,560
Terminal Restrooms	sq ft	6,040	8,640	9,560	11,320
Terminal 4 South Total Restroom Area	**each**	**17,410**	**18,330**	**19,960**	**23,190**
Concourse Restrooms	each	10,950	10,950	11,870	13,550
Terminal Restrooms	sq ft	6,460	7,380	8,090	9,640

SOURCE: Airport Cooperative Research Program, *Guidebook for Airport Terminal Restroom Planning and Design*, 2015.

Commercial Program

Requirements for the commercial program space include food, beverage, specialty retail, services, convenience retail, and duty free. Support and storage areas for the commercial program were based on a ratio equal to 20 percent of the commercial program space requirement. **Table 4-35** summarizes the estimated facility requirements for each type of commercial program space.

TABLE 4-35 COMMERCIAL PROGRAM AREA REQUIREMENTS

	UNITS	EXISTING	PAL 1	PAL 2	PAL 3
Terminal 3 Total Commercial Area	**sq ft**	**52,500**	**52,760**	**57,580**	**69,170**
Food and Beverage	sq ft	26,630	26,770	29,210	35,090
Retail, News, and/or Gift	sq ft	10,780	10,830	11,820	14,200
Services	sq ft	6,340	6,370	6,950	8,350
Concession Support and Storage	sq ft	8,750	8,790	9,600	11,530
Terminal 4 North Total Commercial Area	**sq ft**	**82,560**	**109,740**	**124,310**	**155,520**
Food and Beverage	sq ft	41,880	55,670	63,060	78,890
Retail, News, and/or Gift	sq ft	16,950	22,530	25,520	31,930
Services	sq ft	9,970	13,250	15,010	18,780
Concession Support and Storage	sq ft	13,760	18,290	20,720	25,920
Terminal 4 South Total Commercial Area	**sq ft**	**47,230**	**42,070**	**44,860**	**56,650**
Food and Beverage	sq ft	23,960	21,340	22,750	28,740
Retail, News, and/or Gift	sq ft	9,700	8,640	9,210	11,630
Services	sq ft	5,700	5,080	5,420	6,840
Concession Support and Storage	sq ft	7,870	7,010	7,480	9,440

SOURCE: Ricondo & Associates, Inc., May 2018.

Support Spaces

Support spaces include those facilities supporting the operation and maintenance of the Airport. **Table 4-36** summarizes the estimated facility requirements for each space defined below and do not reflect individual airline or tenant needs.

- **Airport Support** – These areas were assumed to increase proportionally with MAP demand.
- **Building Services** – Requirements for mechanical, electrical, plumbing (MEP), open to below, and open unenclosed spaces will be determined during overall building design; values listed below are indicative placeholder values to estimate the overall scale of the building and inform concept cost estimates. Actual size and configuration may vary.
- **Circulation** – Requirements for public, secure, and sterile circulation are directly related to the overall building design; values listed below are subject to change due to actual configuration.

TABLE 4-36 SUPPORT SPACES REQUIREMENTS

	UNITS	EXISTING	PAL 1	PAL 2	PAL 3
Terminal 3 Total Other Area	**sq ft**	**316,650**	**307,210**	**332,090**	**392,910**
Airport Support	sq ft	122,180	121,860	134,680	161,180
Building Services (MEP)	sq ft	48,620	46,340	49,350	57,930
Circulation	sq ft	145,850	139,010	148,060	173,800
Terminal 4 North Total Other Area	**sq ft**	**543,490**	**665,520**	**744,380**	**919,640**
Airport Support	sq ft	192,140	253,440	290,750	362,430
Building Services (MEP)	sq ft	87,840	103,020	113,410	139,300
Circulation	sq ft	263,510	309,060	340,220	417,910
Terminal 4 South Total Other Area	**sq ft**	**296,210**	**265,390**	**282,020**	**344,760**
Airport Support	sq ft	109,930	97,160	104,890	132,040
Building Services (MEP)	sq ft	46,570	42,060	44,280	53,180
Circulation	sq ft	139,710	126,170	132,850	159,540

MEP – Mechanical, electrical, and plumbing
SOURCE: Ricondo & Associates, Inc., May 2018.

4.4 LANDSIDE TRANSPORTATION FACILITIES

This section identifies ground transportation and vehicle parking requirements that are predominantly based on peak forecasts of activity, assumptions from previous studies, and transportation model outputs. Facilities that are addressed in this section include:

- Vehicle parking requirements
- Passenger terminal curbside and lane requirements
- Airport roadway requirements

4.4.1 VEHICLE PARKING REQUIREMENTS

Previous analyses were consulted to identify the validity of assumptions and outputs for vehicle parking requirements. These included the 2012 Parking Master Plan[23] and the 2016 Parking Master Plan Update,[24] which analyzed existing and forecast vehicle parking needs at the Airport for all public and employee parking facilities for Terminals 2, 3, and 4, the 44th Street lot, and East and West Economy lots.

The 2012 Plan estimated that in the base year (2011) there was a surplus of 3,393 public parking spaces and surplus of 510 employee parking spaces. The study projected that by 58 MAP there would be a deficit of 3,184 public parking spaces and a deficit of 1,162 employee parking spaces.

[23] HNTB, *Parking Master Plan for Phoenix Sky Harbor International Airport*, August 1, 2012.

[24] HNTB, *Parking Master Plan Update for Phoenix Sky Harbor International Airport,* Addendum 1, April 2016

The 2016 Plan estimated that in the base year (2015) there was a surplus of 2,646 public parking spaces and surplus of 861 employee parking spaces. The study projected that by 62 MAP there would be a deficit of 5,069 public parking spaces and a deficit of 1,217 employee parking spaces.

Parking and ground transportation facility requirements are partially based on updated assumptions from these studies and are summarized into public and employee parking needs. The requirements incorporate previously identified parking facilities as well as other existing and potential facilities such as cell phone lots, vehicle inspection stations, and others.

Vehicle parking requirements have been updated to reflect changes in passenger forecasts and airline operations, as well as to account for an increasing proportion of TNC activity and future autonomous vehicle activity. As of February 2018, the Airport had 20,047 public parking spaces and 4,742 employee parking spaces, for a total of 24,789 parking spaces. Existing public and employee parking spaces by location and type are presented in **Tables 4-37** and **4-38**. The existing parking supply presented in the tables account for spaces temporarily or permanently lost to construction at Terminal 3, the West Economy and Overflow Lots, and the 44th Street Lot. These estimates also delineated spaces that were available for both public and employee use. As such, the total number of public and employee spaces available does not match on-Airport parking facilities presented in Section 2.

TABLE 4-37 PUBLIC PARKING FACILITIES

PARKING FACILITY	GENERAL (LONG TERM, ADA, MISC.)	SHORT TERM	MOTORCYCLE SPACES	VALET	TOTAL VEHICLE SPACES (EXCLUDING MOTORCYCLES)
Terminal 2	1,977	232	26	0	2,209
Terminal 3	1,001	56	0	0	1,057
Terminal 4	6,037	259	0	74	6,370
West Economy Lot	1,047	0	3	0	1,047
East Economy Lot	3,516	0	6	0	3,516
Garage A (Economy)	2,343	0	0	0	2,343
Garage B (Economy)	3,505	0	0	0	3,505
Sub-Total Economy Spaces	10,411	0	9	0	10,411
Total Public Spaces	19,426	547	35	74	20,047

NOTE: Parking spaces account for lost spaces attributed to construction and shared public/employee spaces.
SOURCES: HNTB, *Parking Master Plan Update for Phoenix Sky Harbor International Airport,* Addendum 1, April 2016; Kimley-Horn and Associates, Inc., February 2018.

TABLE 4-38 EMPLOYEE PARKING FACILITIES

PARKING FACILITY	GENERAL PARKING	CITY SPACES	RENTAL CAR	MEDIA	TOTAL VEHICLE SPACES
44th Street	2,190	0	0	0	2,190
Terminal 4 RAC	553	9	19	5	586
Terminal 4 Level 9	461	0	0	0	461
South Air Cargo	396	0	0	0	396
West Air Cargo	216	0	0	0	216
Terminal 3	0	0	0	0	0
West Economy Lot	195	0	0	0	195
Facilities Complex	209	0	0	0	209
COB Lot	250	20	0	0	270
Operations Lot	109	12	11	0	132
Police Lot	87	0	0	0	87
Total Employee Spaces	4,666	21	30	5	4,742

NOTE: Parking spaces account for lost spaces attributed to construction and shared public/employee spaces.
SOURCES: HNTB, *Parking Master Plan Update for Phoenix Sky Harbor International Airport,* Addendum 1, April 2016; Kimley-Horn and Associates, Inc., February 2018.

4.4.1.1 PUBLIC VEHICLE PARKING REQUIREMENTS

Public vehicle parking requirements were developed based on anticipated demand of annual originating passengers. Between 2017 and PAL 3, annual originating passengers are projected to increase from 14.2 million to 21.1 million, which represents a 48 percent increase. Based on requirements presented in the 2016 Parking Master Plan Update a ratio of 1,364 public parking spaces per million annual originating passengers was calculated.

A progressive ratio reduction was applied to the projected parking demand to account for the increased use of TNCs and the introduction of autonomous vehicles. Since TNCs only became widely available in 2014, empirical data to provide a full understanding of the impacts to future parking demand at airports is limited. However, it is widely thought that if TNC use continues to increase and autonomous vehicles become available, parking demand will increase at a slower rate than originating passenger demand. Based on these trends, it was assumed that by PAL 1, total parking demand would be reduced by 5 percent due to an increase in use of TNCs and autonomous vehicles. By PAL 2, this reduction was assumed to be 10 percent, and by PAL 3, this reduction was assumed to be 15 percent.

Based on these assumptions, public parking demand at the Airport (adjusted for TNCs and autonomous vehicles) is anticipated to increase from 19,390 spaces in 2017, to 24,424 spaces by PAL 3 (see **Table 4-39**). Based on 20,047 existing public spaces and the results of this analysis, the Airport is anticipated to have an adequate supply of parking through PAL 1, with additional parking needed by PAL 2 and beyond. As noted, existing parking supply was adjusted for shared public/employee spaces and losses associated with construction at the Airport. For long-term planning, the adjusted parking demand should be used to determine future requirements.

TABLE 4-39 PUBLIC VEHICLE PARKING REQUIREMENTS

ITEM	2017	PAL 1	PAL 2	PAL 3
Forecast Annual Originating Passengers	14,215,718	15,226,001	18,410,533	21,066,255
Parking Demand[1]	19,390	20,768	25,112	28,734
Ratio Reduction	0%	5%	10%	15%
Adjusted Parking Demand[2]	19,390	19,730	22,601	24,424
Supply[3]	20,047	20,047	20,047	20,047
Surplus/(Deficit)	657	317	(2,554)	(4,377)

NOTES:

1 Based on the parking requirement of 1,364 spaces per one million originating passengers calculated from the 2016 HNTB Parking Master Plan Update.

2 Adjusted public parking demand accounts for a reduction in parking demand caused by an assumed increase in TNCs and autonomous vehicles.

3 Parking supply accounts for lost spaces attributed to construction and shared public/employee spaces.

SOURCES: HNTB, Parking Master Plan Update for Phoenix Sky Harbor International Airport, Addendum 1, April 2016 (inventory); Kimley-Horn and Associates, Inc., May 2018 (analysis).

4.4.1.2 EMPLOYEE VEHICLE PARKING REQUIREMENTS

Employee parking requirements were developed based on the anticipated demand of airline operations. While there may be slight variations, in general, the ancillary services and staffing needs at a commercial airport are largely contingent on the level of commercial activity that is experienced there. It was assumed that the number of employees at the Airport was and will continue to be commensurate with the volume of airline aircraft operations.

The 2016 Parking Master Plan identified that the number of employee parking spaces required was equal to 1 space per 3.3 employees and identified a demand of 4,016 employee spaces and supply of 4,877 spaces in 2015. Facility requirements developed for CAMP assumed that the change in demand for employee parking spaces in 2017 was equivalent to the rate of change in the number of annual airline operations between 2015 (base year for 2016 Parking Master Plan Update) and 2017.

In 2015, the Airport accommodated approximately 376,000 airline operations, corresponding to a demand of 4,016 employee parking spaces. Applying the same ratio, in 2017, the Airport accommodated approximately 380,000 airline operations, which corresponds to an employee parking demand of 4,059 spaces. This ratio was applied to the annual airline operations forecasts developed for PALs 1, 2, and 3 and the parking requirements results are summarized in **Table 4-40**.

As shown, demand for employee parking spaces is anticipated to increase from 4,059 in 2017 to 5,343 by PAL 3. Based on 4,742 existing employee parking spaces, the Airport is anticipated to experience a shortage of 601 employee parking spaces by PAL 3.

TABLE 4-40 EMPLOYEE VEHICLE PARKING REQUIREMENTS

ITEM	2015 (HNTB PARKING MPU)	2017	PAL 1 (2022)	PAL 2 (2027)	PAL 3 (2037)
Annual Airline Operations[1]	376,000	380,000	387,000	404,000	462,000
Parking Demand	4,016	4,059	4,134	4,395	5,343
Supply[2]	4,742	4,742	4,742	4,742	4,742
Surplus/(Deficit)	726	683	608	347	(601)

NOTES:

1 CAMP Activity Forecast reflected for PAL 1, PAL 2, and PAL 3

2 Parking supply accounts for lost spaces attributed to construction and shared public/employee spaces.

SOURCES: HNTB, *Parking Master Plan Update for Phoenix Sky Harbor International Airport*, Addendum 1, April 2016 (inventory); Kimley-Horn and Associates, Inc., May 2018 (analysis).

4.4.2 PASSENGER TERMINAL CURBSIDES AND AIRPORT ROADWAYS

Passenger terminal curbside and terminal area roadway requirements were developed by analyzing on-site traffic data with methodologies described in ACRP Report 40, *Airport Curbside and Terminal Area Roadway Operations*.[25]

ACRP Report 40 describes the adequacy of curbsides and terminal area roadways in terms of LOS ranging from "A" to "F" with "A" representing the highest LOS and "F" representing the lowest. LOS A represents operations where free-flow speeds prevail and the ability of each driver to maneuver unimpeded by other vehicles because of low traffic densities. LOS B represents conditions in which free-flowing speeds are maintained and the ability of each driver to maneuver is only slightly restricted by the presence of other vehicles. LOS C represents traffic flow with speeds at or near the free-flow speeds of the roadway and freedom to maneuver within the traffic stream is noticeably restricted because of high traffic densities. LOS D represents the level at which speeds begin to decline slightly with increasing flows, and density begins to increase somewhat more quickly and freedom to maneuver is noticeably limited. LOS E represents operations at or near capacity. Operations at this level are volatile because usable gaps may be unavailable in the traffic stream. LOS F represents breakdowns in vehicular flow and such conditions generally exist within queues forming behind bottleneck points.

On airport roadways, LOS C is generally considered the desirable target for planning new facilities. LOS D is generally considered acceptable for existing roadways at large hub airports such as PHX, recognizing that on some peak days of the year, the level of service may decrease to LOS E or F.

For the purposes of this analysis, curbside and terminal area roadways that achieve LOS A, B, C, or D are considered acceptable, while those that experience LOS E or F are considered unacceptable and may require improvements or mitigation measures.

[25] Airport Cooperative Research Program, Report 40, *Airport Curbside and Terminal Area Roadway Operations*, 2010.

4.4.2.1 PASSENGER TERMINAL CURBSIDES

Terminal curbside requirements for Terminals 3 and 4 were developed using demand from the Advanced Land-Transportation Performance Simulation (ALPS) modeling tool,[26] on-site data obtained from tube counts over a span of seven days in October 2017, and methodologies described in ACRP Report 40. This approach provided a detailed assessment of requirements that reflect the desired LOS standards, allowed for adequate roadway operations, and accommodated forecast roadway traffic volumes.

In accordance with ACRP methodology, a curbside is evaluated by obtaining both its curb LOS and road LOS. Typically, the worst of the two is the reported LOS for a given curbside.

- Curb LOS is determined by comparing peak hour vehicular curbing demand to the capacity of the curbside. The demand consists of vehicles that stop at the curbside and their associated dwell times and lengths, while the capacity is determined by the available curbing length and lane configuration. This analysis produces a Curb Utilization Ratio (CUR) for a given curbside. The CUR translates to curb LOS designations (A through F) in accordance with thresholds outlined in ACRP Report 40.
- Road LOS is determined by comparing peak hour vehicular demand traveling through the curbside section to the capacity of the through lanes. The demand consists of total vehicle volume, while the capacity is determined by considering the number of through lanes and the CUR, as outlined in ACRP Report 40. This analysis produces a volume-to-capacity ratio (v/c ratio) for a given curbside. The v/c ratio translates to Road LOS designations (A through F) in accordance with thresholds outlined in ACRP Report 40.

A total of 10 curbside segments serving Terminals 3 and 4 were analyzed for the purposes of determining curbside requirements. Vehicular demand by travel mode was grown to reflect the originating and terminating passenger activity forecast in the DDFSs for PALs 1, 2, and 3. For this analysis, the curb LOS and road LOS were both considered. The segments that were evaluated included arrival and departure curbs serving private vehicles, taxis, TNCs, shuttle vans, prearranged vehicles, and other modes. Shuttle buses serving the RCC were removed from future curbside demand calculations for all PALs, because the PHX Sky Train will transport rental car customers when PHX Sky Train Stage 2 is completed.

Table 4-41 summarizes the curbsides, travel modes, existing linear curbing lengths, projected curb LOS, and the anticipated minimum linear curbing lengths required to maintain curb LOS D at PALs 1, 2, and 3. As shown in the table, the analysis indicates three terminal curbsides are projected to operate at an unacceptable LOS in the future: Terminal 3 South Inner by PAL 3, Terminal 4 North Departures by PAL 3, and Terminal 4 South Departures by PAL 1. To maintain curb LOS D for these curbsides at PAL 3, the need for an additional 30 feet, 50 feet, and 220 feet of two-lane curbing space is anticipated at Terminal 3 South Inner, Terminal 4 North Departures, and Terminal 4 South Departures, respectively.

[26] ALPS is a proprietary simulation software developed by Kimley-Horn and Associates, Inc.

TABLE 4-41 PASSENGER TERMINAL CURBSIDE REQUIREMENTS – CURBING LENGTH

TERMINAL	CURBSIDE	TRAVEL MODES	EXISTING LINEAR CURBING LENGTH [1]	CURB LOS WITH EXISTING GEOMETRY			MINIMUM LINEAR CURBING LENGTH ANTICIPATED TO MAINTAIN LOS D [2]		
				PAL 1	PAL 2	PAL 3	PAL 1	PAL 2	PAL 3
3	North Inner	Private Auto, Taxi, TNC	1,090′	C	D	D	-	-	-
3	North Outer	Taxi, Courtesy, Intercity	760′	A	A	A	-	-	-
3	South Inner	Private Auto, Taxi, TNC	820′	D	D	E	-	-	880′
3	South Outer	TNC, Van, Prearranged	725′	A	A	A	-	-	-
4	North Inner Arrivals	Private Auto	1,000′	D	D	D	-	-	-
4	North Outer Arrivals	TNC, Taxi, Intercity, Prearranged, Courtesy	925′	A	A	A	-	-	-
4	South Inner Arrivals	Private Auto	1,220′	B	B	D	-	-	-
4	South Outer Arrivals	TNC, Taxi, Van, Charter	980′	A	A	A	-	-	-
4	North Departures	Private Auto, Taxi, TNC	1,060′	D	D	E	-	-	1,160′
4	South Departures	Private Auto, Taxi, TNC	1,370′	E	E	F	1,450′	1,550′	1,810′

NOTES:

1 Represents total linear curbing space currently available. If two curbing lanes are provided, the end-to-end curb zone length was doubled.

2 Represents minimum linear curbing space anticipated to maintain Curb LOS D for a given curbside in accordance with ACRP methodology. If two curbing lanes are provided, the indicated lengths may be halved to obtain end-to-end curb zone length. Lengths do not include curb space potentially needed for commercial vehicle staging on outer curbs.

LOS A through D

LOS E

LOS F

SOURCES: Airport Cooperative Research Program, Report 40, *Airport Curbside and Terminal Area Roadway Operations*, 2010 (methodology); Kimley-Horn and Associates, Inc., February 2018 (analysis).

Table 4-42 summarizes the curbsides, travel modes, existing curbside lane configurations, projected road LOS, and the anticipated curbside lane configurations necessary to maintain Road LOS D at PALs 1, 2, and 3. Note that the road LOS considers vehicular demand for curbing, non-curbing, and cut-thru traffic. As shown in the table, the analysis indicates three terminal curbsides are projected to operate at an unacceptable LOS in the future: Terminal 3 North Outer by PAL 1, Terminal 3 South Outer by PAL 1, and Terminal 4 South Departures by PAL 3. To maintain Road LOS D for these curbsides at PAL 3 (except where otherwise noted), the need for one additional through lane is anticipated where indicated in the table. Terminal 4 South Departures may not need an additional through lane if additional curbing length can be provided as identified in the curbing length requirements table (a reduced CUR provides additional capacity for a given number of through lanes due to reduced friction).

TABLE 4-42 PASSENGER TERMINAL CURBSIDE REQUIREMENTS – THROUGH CAPACITY

TERMINAL	CURBSIDE	TRAVEL MODES	EXISTING CURBSIDE LANE CONFIGURATION (CURB + THROUGH) [1]	ROAD LOS WITH EXISTING GEOMETRY			LANE CONFIGURATION ANTICIPATED TO MAINTAIN LOS D [2] (CURB + THROUGH)		
				PAL 1	PAL 2	PAL 3	PAL 1	PAL 2	PAL 3
3	North Inner	Private Auto, Taxi, TNC	2 + 2	B	C	C	-	-	-
3	North Outer	Taxi, Courtesy, Intercity	1 + 2	E	E	E	1 + 3	1 + 3	1 + 3
3	South Inner	Private Auto, Taxi, TNC	2 + 2	A	B	B	-	-	-
3	South Outer	TNC, Van, Prearranged	1 + 2	E	E	F	1 + 3	1 + 3	1 + 3 [4]
4	North Inner Arrivals	Private Auto	2 + 2	C	C	D	-	-	-
4	North Outer Arrivals	TNC, Taxi, Intercity, Prearranged, Courtesy	2 + 3	C	C	D	-	-	-
4	South Inner Arrivals	Private Auto	2 + 2	B	B	C	-	-	-
4	South Outer Arrivals	TNC, Taxi, Van, Charter	2 + 3	C	C	C	-	-	-
4	North Departures	Private Auto, Taxi, TNC	2 + 2	B	B	B	-	-	-
4	South Departures	Private Auto, Taxi, TNC	2 + 2	C	D	E [3]	-	-	- [3]

NOTES:

1 Represents curbside lane configuration; i.e. number of curbing lanes + number of through (non-curbing or bypass) lanes.

2 Represents curbside lane configuration anticipated to maintain Road LOS D for through (non-curbing or bypass) lanes except where otherwise noted.

3 Road LOS D is anticipated to be maintained if the curbside is lengthened as identified in the Curbing Length requirements table. A reduced CUR provides additional capacity for a given number of though (non-curbing or bypass) lanes.

4 Road LOS may continue to experience LOS E with the 1 + 3 configuration during peak times. Factors such as construction feasibility, motorist perception of continuity along Sky Harbor Boulevard, and future variations in vehicular demand should be considered prior to constructing additional through lanes beyond the recommended 1 + 3 configuration.

LOS A through D

LOS E

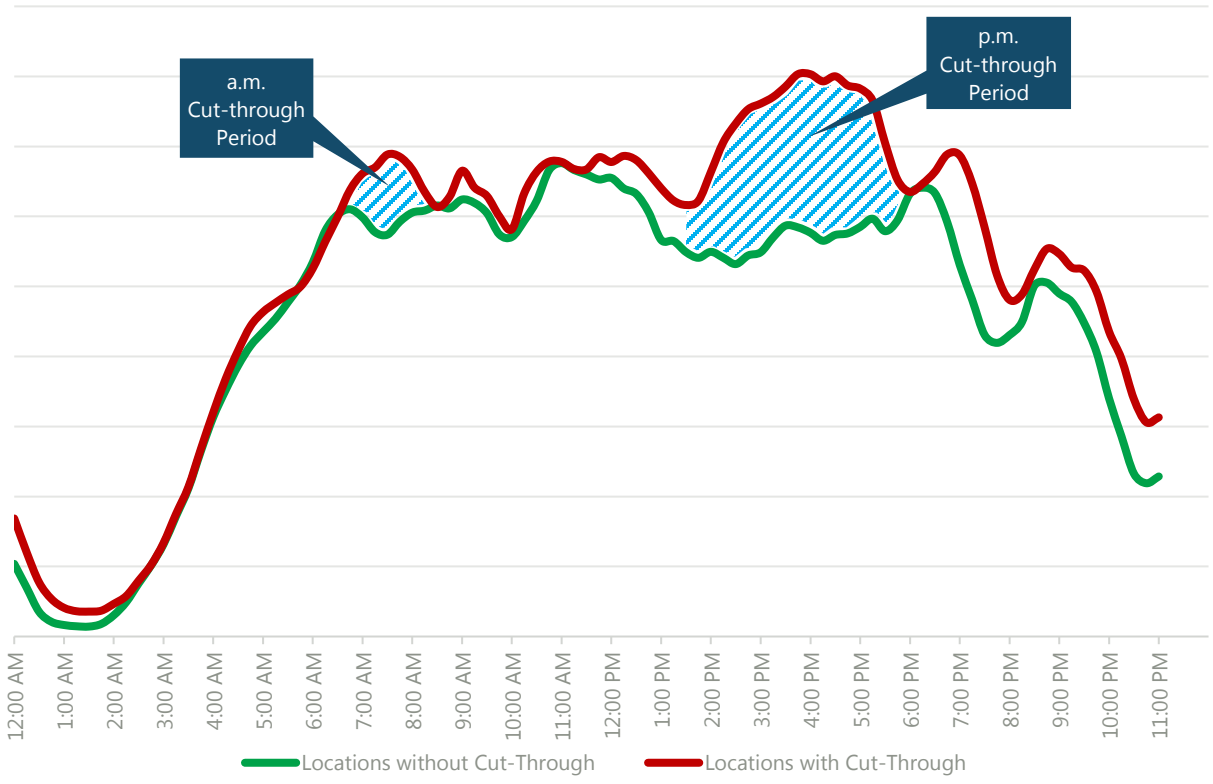
LOS F

SOURCES: Airport Cooperative Research Program, Report 40, *Airport Curbside and Terminal Area Roadway Operations*, 2010 (methodology); Kimley-Horn and Associates, Inc., February 2018 (analysis).

4.4.2.2 CUT-THROUGH TRAFFIC

Cut-through traffic is a known issue at the Airport. Excessive delays on busy commuter routes, such as the I-10 freeway and Arizona State Route Loop 202, have resulted in a trend of commuters using Sky Harbor Boulevard to bypass the congestion, especially during morning and evening weekday peak hours. This additional traffic creates unnecessary demand on Sky Harbor Boulevard, which increases Airport congestion and reduces the LOS. Based on a review of vehicular traffic counts conducted in October 2017, a comparison of traffic volumes for locations along Sky Harbor Boulevard that include cut-through traffic versus locations along Sky Harbor Boulevard that do not include cut-through traffic demonstrates the existence and duration of the cut-through traffic. This volume trend comparison is shown in **Exhibit 4-29**.

EXHIBIT 4-29 EXISTING CUT-THROUGH TRAFFIC COMPARISON



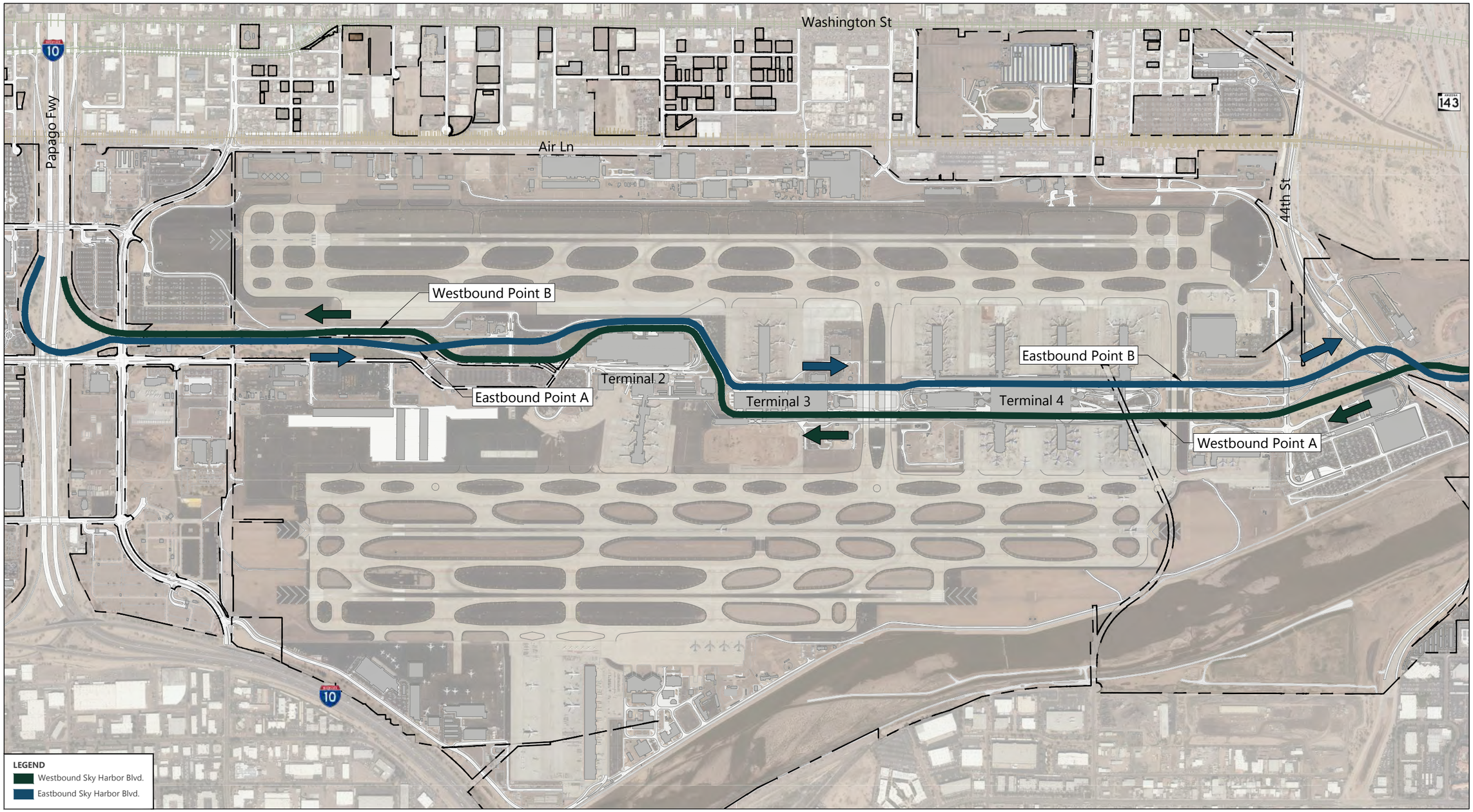
SOURCES: Traffic Research and Analysis, 2017 and 2018 (traffic data); Kimley-Horn and Associates, Inc., 2018 (analysis).

To help quantify the magnitude of this problem, Bluetooth traffic monitoring sensors were used to collect media access control (MAC) addresses from electronic devices between April 12, 2018 and May 4, 2018. Data were collected continuously, except between the dates of April 17th through April 21st and April 30th through May 1st, due to equipment failure. A total of 18 days of data were collected, including data for 11 weekdays (Monday-Friday) and 7 weekend days (Saturday and Sunday).

Average Daily Traffic (ADT) volumes were also collected during this general timeframe. These counts were used to identify average peak periods and peak hours, as follows:

- Morning Peak Period: 6:00 a.m. to 9:00 a.m.
- Morning Peak Hour: 7:00 a.m. to 8:00 a.m.
- Evening Peak Period: 4:00 p.m. to 7:00 p.m.
- Evening Peak Hour: 5:00 p.m. to 6:00 p.m.

As shown on **Exhibit 4-30**, Bluetooth sensors were placed at three locations around the Airport to capture ingress and egress traffic along eastbound and westbound Sky Harbor Boulevard. These locations were selected to ensure all traffic on Sky Harbor Boulevard was captured.



SOURCES: Woolpert Airports Geographic Information Systems (AGIS) for Phoenix Sky Harbor International Airport, flown May 28 and September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Kimley-Horn and Associates, Inc., February 2018 (data collection locations).

NORTH

0 1,200 ft.

EXHIBIT 4-30

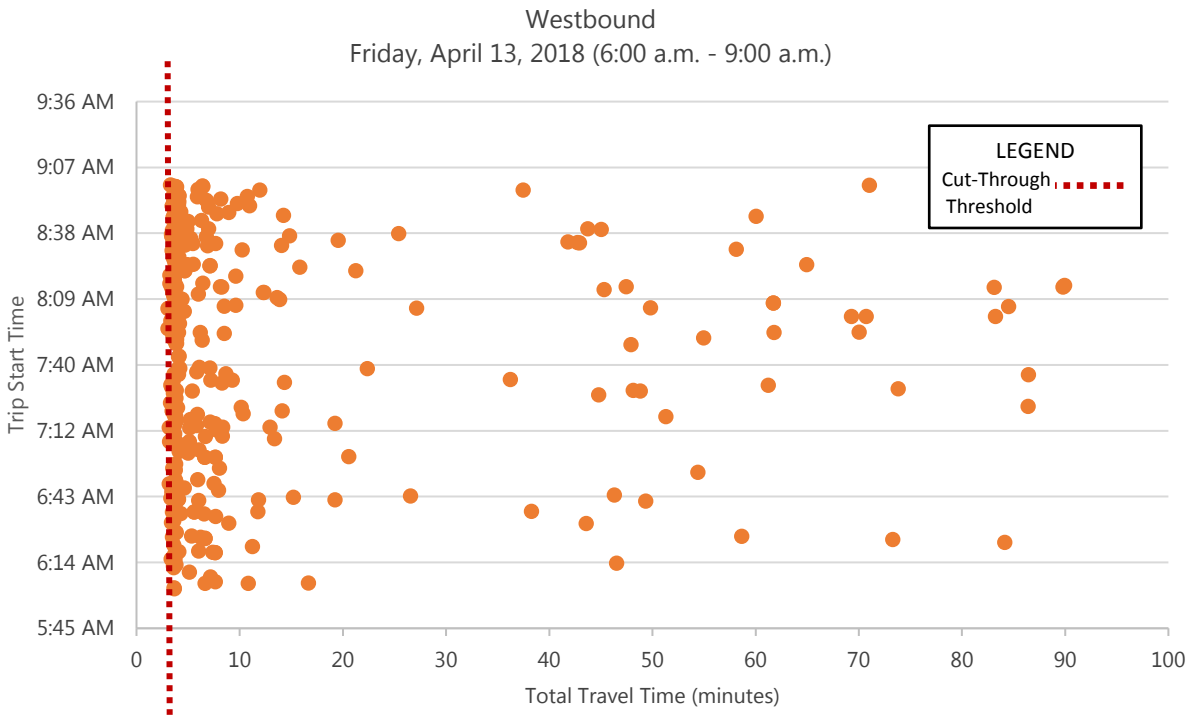
Bluetooth Data Collection Location

Each time a vehicle passed a known point within the system, a time stamp was logged. The time elapsed between the first time a vehicle passed Point A and the last time the vehicle passed Point B (in the same direction) was recorded as the total travel time for that vehicle.

For purposes of this analysis, only traffic traveling eastbound or westbound through the Airport was recorded. Traffic entering and exiting from one side of the Airport (i.e., to/from the east and to/from the west) was not captured or evaluated. This means that the cut-through percentages presented in this section of the report are the cut-through percentages relative to the volume of traffic that passes through the Airport along the same origin-destination route versus total Airport traffic.

Cut-through traffic was evaluated separately for weekdays and weekends, by direction, to determine an average peak hour and peak period cut-through percentage. Since cut-through traffic does not stop at a curbside to pick up or drop off passengers, the travel time for a cut-through trip tends to be shorter than the travel time for a non-cut-through trip starting around the same time on a given day. A sample graph is shown on **Exhibit 4-31**.

EXHIBIT 4-31 TRAFFIC TRIP DURATION DATA SAMPLE – MORNING PEAK



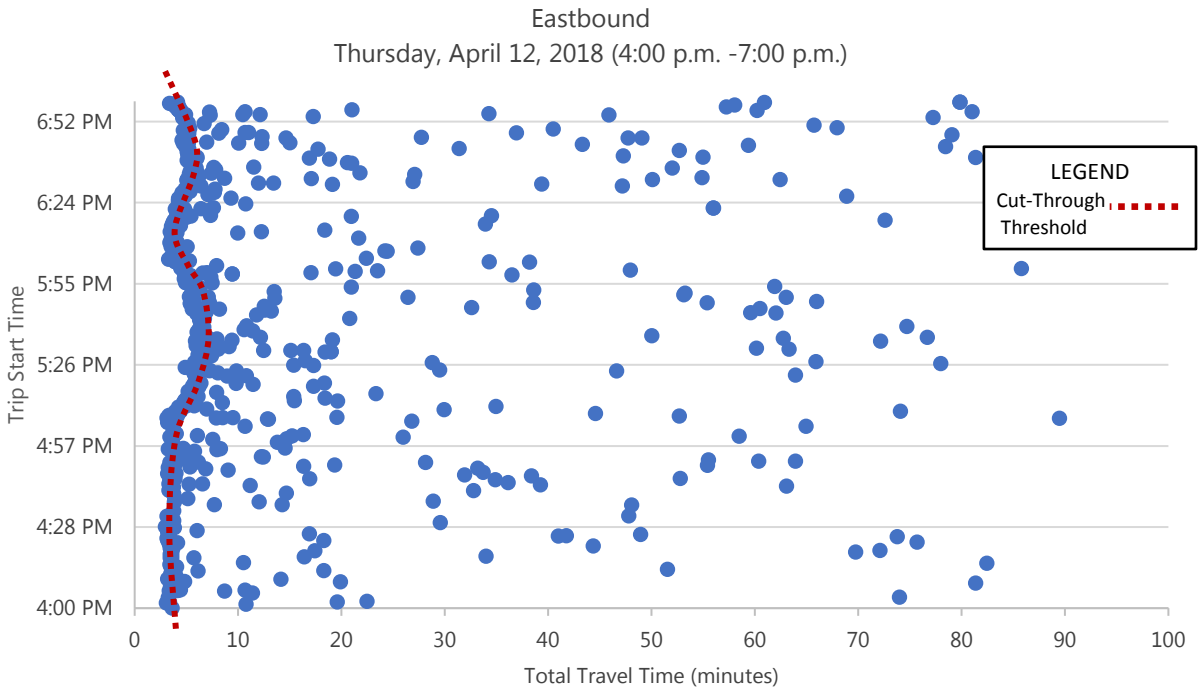
SOURCES: Traffic Research and Analysis, April 2018 (traffic data); Kimley-Horn and Associates, Inc, May 2018 (analysis).

As shown on Exhibit 4-31, a distinct "cluster" of trips typically occurs under a certain travel time threshold. This threshold changes based on the time of day and Airport activity but is assumed to represent the portion of trips that are cut-through traffic. From the data, the average cut-through trip is typically about 4.0 to 4.5 minutes during low-to-moderately congested times. This threshold was validated in the field.

A scatter plot was created for each day, direction, peak period, and peak hour. The cut-through threshold was identified separately for each time period to account for day-to-day variations in Airport congestion and travel time. This threshold was identified by finding a "break" in the data after the cluster of low travel times. This "break" is representative of the additional delay encountered by legitimate Airport traffic as they load, unload, and wait for airport passengers.

During the p.m. peak period, Airport activity was found to be more variable than during the weekday morning or weekends. As a result, the cut-through threshold changed significantly throughout the course of the peak period. To account for this variation in travel times, only vehicles that were part of the cut-through "cluster" were counted toward the cut-through percentage. Likewise, any outlying data that were considered too low were removed. A sample graph for the weekday p.m. peak period is shown on **Exhibit 4-32**.

EXHIBIT 4-32 TRAFFIC TRIP DURATION DATA SAMPLE – EVENING PEAK



SOURCES: Traffic Research and Analysis, April 2018 (traffic data); Kimley-Horn and Associates, Inc, May 2018 (analysis).

Based on the Bluetooth data, average cut-through percentages were estimated. These results are summarized in **Tables 4-43** through **4-46**.

TABLE 4-43 ESTIMATED WEEKDAY WESTBOUND AVERAGE CUT-THROUGH TRAFFIC

	MORNING		EVENING	
DATE	PERIOD %	PEAK HOUR %	PERIOD %	PEAK HOUR %
Thursday, April 12, 2018	N/A	N/A	57%	55%
Friday, April 13, 2018	54%	51%	62%	56%
Monday, April 16, 2018	47%	43%	57%	59%
Monday, April 23, 2018	49%	44%	43%	38%
Tuesday, April 24, 2018	58%	57%	45%	43%
Wednesday, April 25, 2018	57%	46%	52%	49%
Thursday, April 26, 2018	60%	62%	56%	58%
Friday, April 27, 2018	47%	46%	49%	57%
Wednesday, May 2, 2018	56%	52%	61%	52%
Thursday, May 3, 2018	57%	56%	53%	58%
Friday, May 4, 2018	55%	47%	48%	47%
Average	54%	50%	53%	52%

SOURCES: Traffic Research and Analysis, April 2018 (traffic data); Kimley-Horn and Associates, Inc, May 2018 (analysis).

TABLE 4-44 ESTIMATED WEEKEND WESTBOUND AVERAGE CUT-THROUGH TRAFFIC

	MORNING		EVENING	
DATE	PERIOD %	PEAK HOUR %	PERIOD %	PEAK HOUR %
Saturday, April 14, 2018	37%	48%	32%	37%
Sunday, April 15, 2018	32%	35%	29%	36%
Saturday, April 28, 2018	36%	44%	32%	23%
Sunday, April 29, 2018	38%	35%	21%	16%
Average	36%	40%	28%	28%

SOURCES: Traffic Research and Analysis, April 2018 (traffic data); Kimley-Horn and Associates, Inc, May 2018 (analysis).

TABLE 4-45 ESTIMATED WEEKDAY EASTBOUND AVERAGE CUT-THROUGH TRAFFIC

DATE	MORNING		EVENING	
	PERIOD %	PEAK HOUR %	PERIOD %	PEAK HOUR %
Thursday, April 12, 2018	N/A	N/A	57%	48%
Friday, April 13, 2018	20%	19%	57%	54%
Monday, April 16, 2018[1]	17%	26%	N/A	N/A
Monday, April 23, 2018	29%	33%	59%	64%
Tuesday, April 24, 2018	25%	25%	63%	65%
Wednesday, April 25, 2018	21%	21%	62%	72%
Thursday, April 26, 2018	21%	18%	60%	57%
Friday, April 27, 2018	24%	23%	57%	53%
Wednesday, May 2, 2018	25%	27%	50%	46%
Thursday, May 3, 2018	39%	38%	54%	55%
Friday, May 4, 2018	16%	14%	54%	55%
Average	24%	24%	57%	57%

NOTE:
[1] Data for Monday, April 16, 2018 was determined to be an outlier and was removed from the dataset.
SOURCES: Traffic Research and Analysis, April 2018 (traffic data); Kimley-Horn and Associates, Inc, May 2018 (analysis).

TABLE 4-46 ESTIMATED WEEKEND EASTBOUND AVERAGE CUT-THROUGH TRAFFIC

DATE	MORNING		EVENING	
	PERIOD %	PEAK HOUR %	PERIOD %	PEAK HOUR %
Saturday, April 14, 2018	16%	17%	24%	24%
Sunday, April 15, 2018	14%	17%	15%	18%
Saturday, April 28, 2018	10%	14%	23%	24%
Sunday, April 29, 2018	10%	9%	13%	13%
Average	13%	14%	19%	20%

SOURCES: Traffic Research and Analysis, April 2018 (traffic data); Kimley-Horn and Associates, Inc, May 2018 (analysis).

As shown, weekend cut-through traffic is generally lower than weekday traffic but is still present. Weekday cut-through traffic is higher and is dependent upon direction and time of day. Weekday westbound cut-through traffic is approximately 50 to 55 percent of westbound traffic during both the morning and evening peak periods. This corresponds to heavy westbound traffic on surrounding freeways, including I-10, during these times.

Weekday eastbound cut-through traffic was determined to be approximately 25 percent of eastbound traffic during the morning peak and 57 percent during the evening peak. This corresponds to the general

traffic patterns on surrounding freeways during these times. For example, eastbound is not the primary travel direction on I-10 south of the Airport during the morning peak hour, but it is a primary travel direction during the evening peak hour due to commuter traffic headed toward the East Valley.

It should be noted that the Bluetooth reader on the west end captured traffic generated by staff and visitors at the Airport Operations Center as well as travelers that return rental cars by driving through the Airport. Therefore, a portion of the reported cut-through traffic for the westbound direction included staff and rental car trips. Additionally, private vehicles carrying multiple passengers or high-occupancy vehicles such as busses could be "over-counted" based on the data collection methodology that was used. This may explain why westbound cut-through percentages are high in both the morning and evening peaks, while eastbound cut-through traffic peaks only during the evening peak. This may also explain why westbound cut-through traffic is higher than eastbound cut-through traffic on the weekend.

To understand the comprehensive impacts of cut-through traffic, the ALPS modeling tool was also used to estimate existing cut-through traffic. The ALPS modeling tool results showed that the morning peak hour cut-through volume was highest in the westbound travel direction, while the evening peak hour cut-through volume was highest in the eastbound travel direction. The total traffic volume on Sky Harbor Boulevard was highest between Terminals 2 and 4. A summary of cut-through modeling results by travel direction and time of day is presented in **Table 4-47**. A graphical summary of the data is also shown on **Exhibit 4-33**.

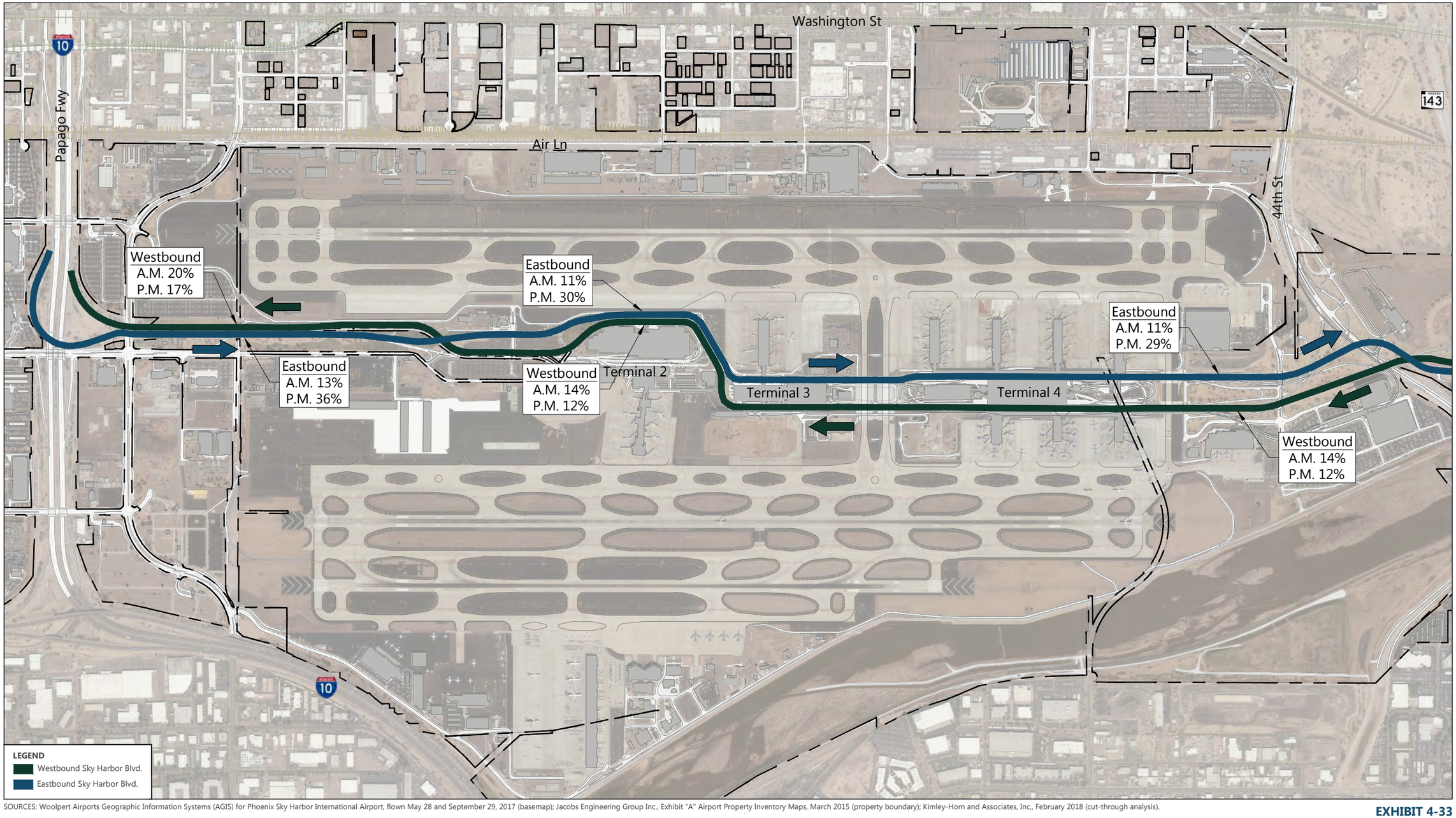
TABLE 4-47 AVERAGE CUT-THROUGH TRAFFIC USING ADVANCED LAND TRANSPORTATION PERFORMANCE SIMULATION MODEL RESULTS

	MORNING PEAK HOUR			EVENING PEAK HOUR		
TRAVEL DIRECTION	TOTAL TRAFFIC	CUT-THROUGH TRAFFIC	% CUT-THROUGH	TOTAL TRAFFIC	CUT-THROUGH TRAFFIC	% CUT-THROUGH
Eastbound	2,150	240	11%	2,180	670	31%
Westbound	2,140	320	15%	1,810	240	13%

SOURCE: Kimley-Horn and Associates, Inc., May 2018.

4.4.2.3 AIRPORT ROADWAYS

Airport roadways provide connectivity between Airport facilities and the surrounding external roadway network. As noted in Section 2.4.3, 7-day vehicle counts were conducted at 77 locations on and around the Airport in October 2017. These data, in conjunction with DDFS information and expected cut-through traffic for PALs 1, 2, and 3 were input into the ALPS modeling tool to identify roadway requirements. Terminal area roadway requirements were developed by analyzing on-site traffic data with methodologies described in ACRP Report 40.



SOURCES: Woolpert Airports Geographic Information Systems (AGIS) for Phoenix Sky Harbor International Airport, flown May 28 and September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Kimley-Horn and Associates, Inc., February 2018 (cut-through analysis).

NORTH

0 1,200 ft.

EXHIBIT 4-33

Existing Cut-Through Percentages Using
Advanced Land Transportation Performance Simulation Model Results

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\04-Facility Requirements\Ex-4-30,33,35-Landside Exhibits.dwgLayout: 4-33 Plotted: Sep 6, 2019, 10:59AM

The most significant impact on roadway requirements are peaking characteristics of passenger departures and arrivals. O&D passenger activity is anticipated to increase 49 percent between 2017 and PAL 3. DDFS model data indicate that increases in arriving passengers will be most significant in the evening (2.6 percent average annual increase), and increases in passenger departures will be most significant during mornings (3.5 percent average annual increase). Projected hourly originating departures and terminating arrivals for 2017, PAL 1, PAL 2, and PAL 3 are graphically depicted on **Exhibit 4-34**. As shown, peak passenger arrivals at the Airport are forecast to occur at or around 10:00 a.m. and peak passenger departures are forecast to occur at or around 09:00 a.m. and 11:00 a.m.

Peak hour arrival and departure data were input into the ALPS modeling tool to identify roadway demand and lane requirements to achieve LOS D or better in accordance with ACRP Report 40. The results of the model identified eight locations on Sky Harbor Boulevard where LOS failed to achieve v/c ratios that indicate a LOS D or better designation and where lane enhancements are required, as shown on **Exhibit 4-35**. As shown, single-lane improvements will be needed in four locations by PAL 1, one additional location by PAL 2, and three additional locations by PAL 3.

4.5 AIRPORT TENANT AND SUPPORT FACILITIES

Requirements for support facilities were determined by forecasting demand for the various applicable components of the tenant and support facilities: building (footprint), aircraft apron, vehicle parking, truck dock, and staging area. When totaled, these components provide a total site area for each facility, a quantification which is useful in understanding land needs and developing alternatives.

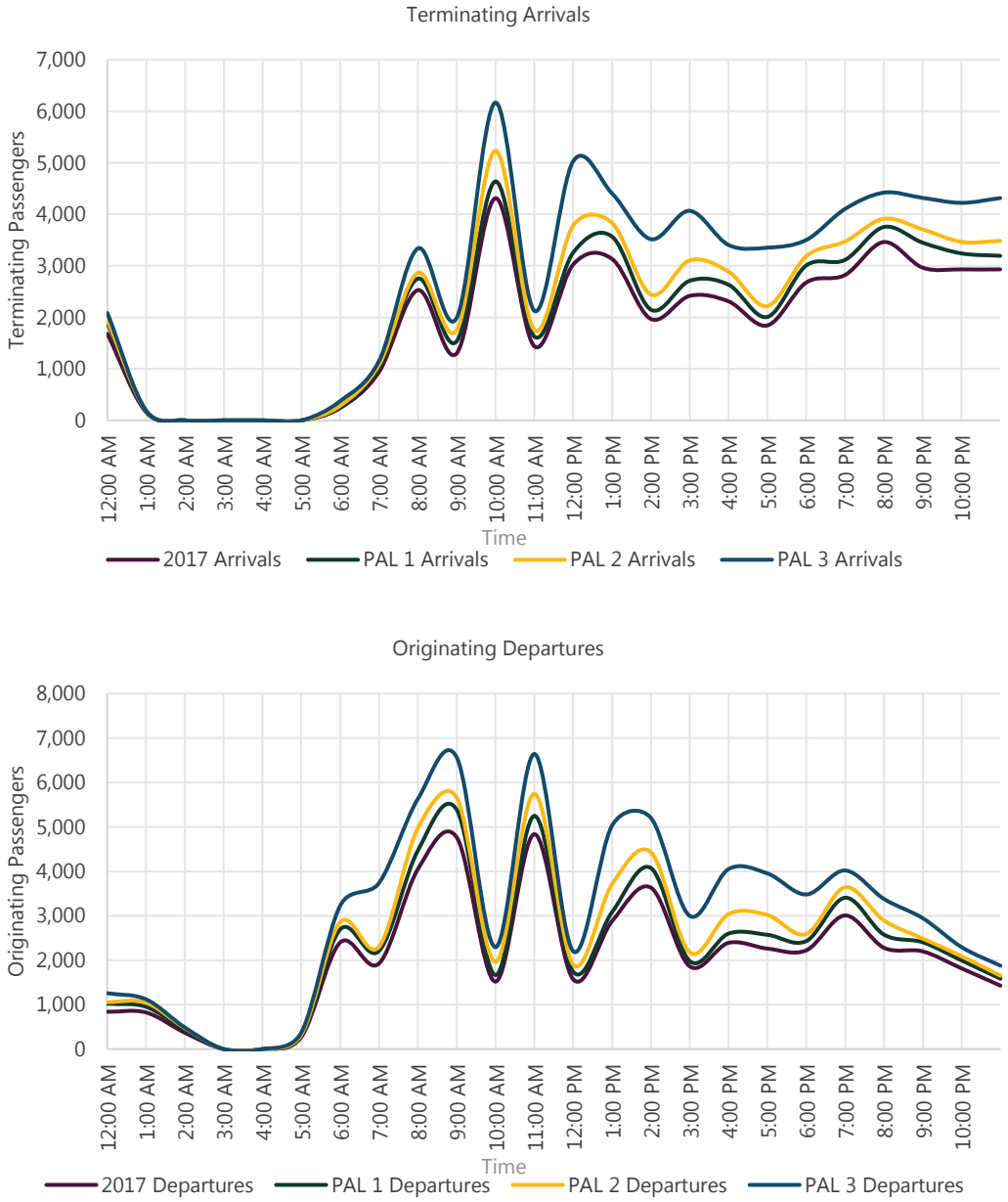
4.5.1 CARGO FACILITIES

Cargo activity forecasts and assumed planning standards were used to determine the required facilities to meet air cargo demand at the Airport through PAL 3. The following components were considered: cargo building, airside apron and equipment staging and storage, landside access/truck docks, and employee and customer parking.

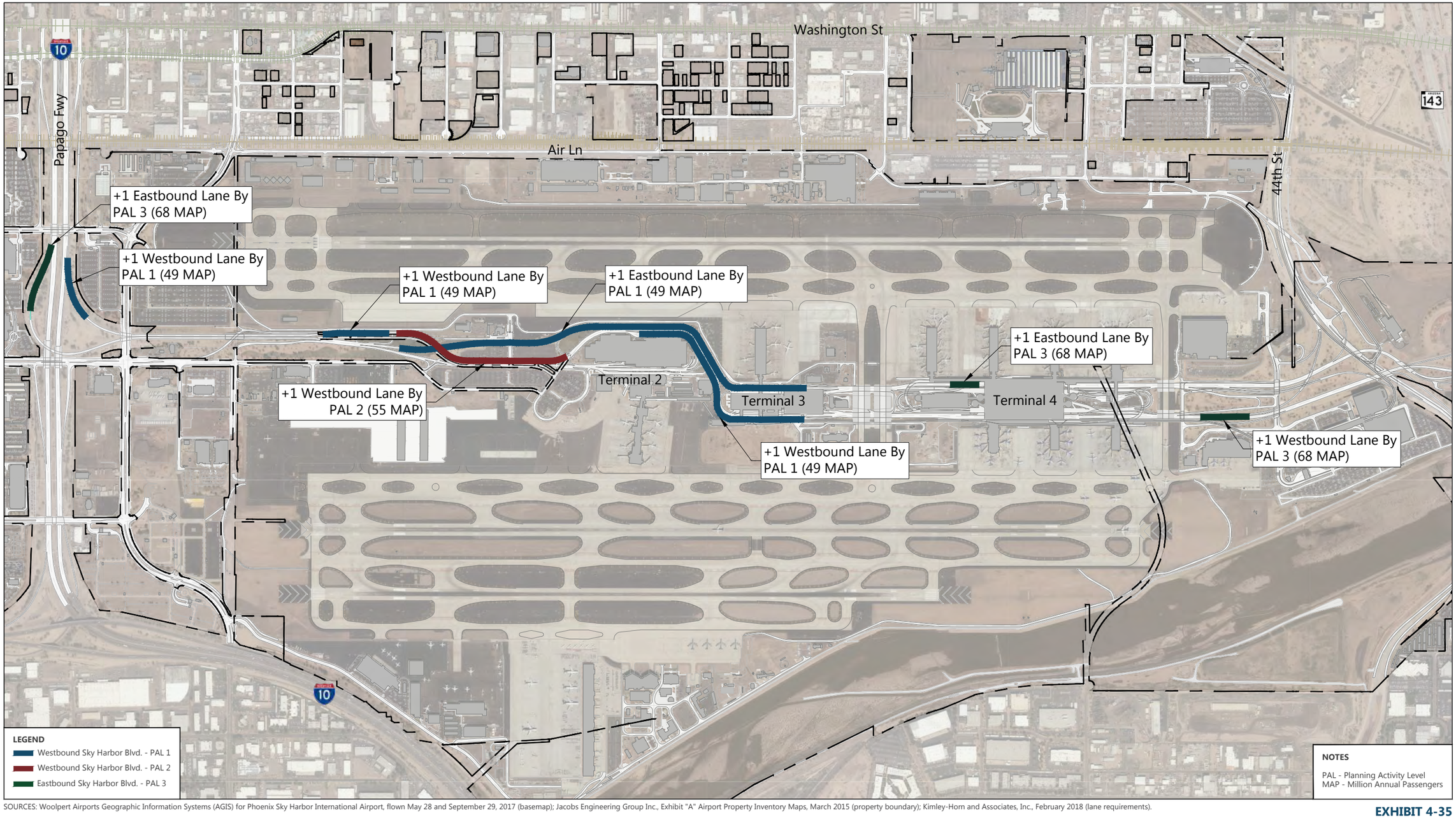
Cargo activity at the Airport is currently accommodated in two main locations–the South Air Cargo and West Air Cargo Complexes. The South Air Cargo Complex has one building that accommodates the integrated carriers (FedEx and UPS) as well as space for the CBP and PHX AVN. The West Air Cargo Complex consists of three buildings (West Air Cargo Buildings A, B, and C) that are occupied by all-cargo carriers, cargo handling companies, passenger airlines, TSA, and PHX AVN. As outlined in Section 2.6, Crossfield Taxiways U and V are planned and will require the demolition of a majority of West Air Cargo Building A and associated apron.

Cargo volume and the amount of building used to process cargo are listed in **Table 4-48**. Each major cargo carrier group (integrated, all-cargo, and passenger) was analyzed separately for the baseline and high cargo forecasts presented in Section 3. The future facility requirements of the cargo carrier groups are described in the following sections.

EXHIBIT 4-34 DESIGN DAY FLIGHT SCHEDULE TERMINATING ARRIVALS AND ORIGINATING DEPARTURES



SOURCE: Kimley-Horn and Associates, Inc., April 2018.



SOURCES: Woolpert Airports Geographic Information Systems (AGIS) for Phoenix Sky Harbor International Airport, flown May 28 and September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Kimley-Horn and Associates, Inc., February 2018 (lane requirements).

EXHIBIT 4-35

Airport Additional Lanes Required

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TABLE 4-48 EXISTING CARGO FACILITY THROUGHPUT

FACILITY	CARGO VOLUME IN 2016 (U.S. TONS)	PERCENTAGE OF AIRPORT CARGO VOLUME	BUILDING (SQ FT)	BUILDING UTILIZATION RATE (U.S. TONS/SQ FT)
South Air Cargo Complex				
Integrated Carriers	219,991	62%	165,329	1.33
U.S. Customs and Border Protection and PHX AVN			7,806	
Subtotal South Air Cargo Complex			173,135	
West Air Cargo Complex				
All-Cargo Carriers	72,873	21%	49,075	1.48
Passenger	61,221	17%	51,840	1.18
Vacant or Non-Cargo Use			77,645	
Subtotal West Air Cargo Complex			178,560	
Total Occupied Cargo Facilities	354,085	100%	266,244[1]	1.33

NOTE:
1 Excludes U.S. Customs and Border Protection and PHX AVN uses in the South Air Cargo Complex and vacant and non-cargo use in the West Air Cargo Complex.
SOURCES: City of Phoenix Aviation Department, March 2018 (facilities and activity); Ricondo & Associates, Inc., May 2018 (utilization analysis).

4.5.1.1 INTEGRATED CARGO CARRIERS

Integrated cargo carriers are companies that use their own aircraft, trucks, and other vehicles to transport cargo. FedEx and UPS are the only two integrated cargo carriers serving the Airport; together they accommodated approximately 62 percent of the total Airport cargo volume in 2016 with 219,991 tons of cargo handled in 165,329 square feet of building space. The building utilization rate in 2016 was 1.33 tons per square foot.

The requirements for integrated cargo carrier facilities are summarized in **Table 4-49**. The baseline forecast for the integrated cargo carriers group reaches approximately 418,000 annual tons by PAL 3. A building utilization rate of 1.5 tons per square foot was assumed for future requirements resulting in the need for an additional 110,000 square feet of building by PAL 3 for the Baseline Forecast.[27]

[27] Airport Cooperative Research Program, Report 143, *Guidebook for Air Cargo Facility Planning and Development*, 2015 suggests a building utilization rate of between 0.46 and 1.84 tons per square foot for integrated carries. A building utilization rate of 1.5 was used based on utilization rates at comparable cargo operations and airports.

TABLE 4-49 INTEGRATED CARGO FACILITY REQUIREMENTS

PLANNING ACTIVITY LEVEL	FORECAST (U.S. TONS)	BUILDING (SQ FT)[1]	APRON/ EQUIPMENT (SQ FT)[2]	LANDSIDE ACCESS/TRUCK DOCKS (SQ FT)[3]	EMPLOYEE PARKING (SQ FT)[4]	CUSTOMER PARKING (SQ FT)[5]
2016 (Occupied)[6]		165,329				
Baseline Forecast						
PAL 1	265,884	177,256	886,280	236,341	71,789	4,786
PAL 2	310,333	206,889	1,034,443	275,851	83,790	5,586
PAL 3	418,116	278,744	1,393,720	371,659	112,891	7,526
High Forecast						
PAL 1	282,656	188,437	942,185	251,249	76,317	5,088
PAL 2	336,030	224,020	1,120,100	298,693	90,728	6,049
PAL 3	462,677	308,451	1,542,256	411,268	124,923	8,328

NOTES:

1 1.5 U.S. tons of cargo per square foot of cargo building.

2 5.0 square feet per square foot of cargo building.

3 1.3 square feet per square foot of cargo building.

4 1.5 spaces per 1,000 square feet of cargo building and 270 square feet per parking space.

5 1.0 space per 10,000 square feet of cargo building and 270 square feet per parking space.

6 Area occupied by integrated cargo carriers. The total area of the South Air Cargo Complex building is 173,135 sq ft.

7 Table excludes areas for taxiways.

SOURCES: Airport Cooperative Research Program, Report 143, *Guidebook for Air Cargo Facility Planning and Development*, 2015 (building and apron guidelines); Airports Council International-North America, *Airport Cargo Guide*, 2013 (landside access/docks, employee and customer parking guidelines); Ricondo & Associates, Inc., June 2018 (requirements).

Requirements for cargo facilities other than buildings are developed using ratios based on the amount of available building area. Planning guidelines for apron requirements assumes approximately 5 square feet of apron for every square foot of available cargo building area. This represents all facilities on the airside including service roads, marshalling areas, aircraft parking positions, and equipment storage.

Planning for docks and landside access should provide approximately 200 feet from the face of the cargo building for truck parking and maneuvering areas. Assuming an industry typical building width of 150 feet, the area need for landside access and truck docks is 1.3 square feet per square foot of cargo building. A minimum of 1.5 employee parking spaces was assumed for every 1,000 square feet of building. Additional parking spaces may be required during peak periods and alternative locations for employee parking, such as remote lots that utilize shuttle services, may be required. Cargo buildings located on-Airport do not typically have a high number of customers visiting the facility. Planning guidelines indicate a requirement of one space per 10,000 square feet of cargo building.

4.5.1.2 ALL-CARGO

The all-cargo carrier group is generally defined by airlines that focus solely on airport to airport cargo transportation delivered on freighter aircraft. This industry segment relies on business partners like freight forwarders, cargo handlers, trucking companies, and other companies to help with administrative paperwork and processing (insurance, custom documents, etc.) to conduct their daily activities. The Airport's current all-cargo activity is accommodated by this type of operation with all-cargo airlines and outsourced handling and trucking companies processing the cargo volumes.

All-cargo carrier building utilization rates are typically lower than integrated carriers due to the handling requirements of pallet building/breakdown areas, storage and racking systems, and the general longer dwell times of cargo within the facility associated with all-cargo carriers. The rapid increases in all cargo activity at the Airport over the past several years is the result of the rapid expansion of the e-commerce market and the introduction of Amazon air cargo activity. All-cargo activity at the Airport is dominated by Amazon and its corporate partners (ABX Air, Atlas, Air Transport International). In 2016, the utilization rate for the building the all-cargo carriers occupied was 1.48 tons per square foot of building space. This building utilization rate is similar to the integrated carriers because of the rapid transfer of containers to off-Airport sort facilities and Amazon's development of a delivery system from their sort facilities to a parcel's delivery address.

The all-cargo carrier group has the most demanding future facility requirements at PHX. This group is expected to experience the strongest growth rates. Assuming a building utilization rate of 1.5 tons per square foot, 104,000 square feet of building will be required by PAL 3 for the Baseline Forecast and nearly 230,000 square feet of building will be required for the High Forecast.[28] **Table 4-50** summarizes the requirements for all-cargo facilities.

TABLE 4-50 ALL-CARGO FACILITY REQUIREMENTS

PLANNING ACTIVITY LEVEL	FORECAST (U.S. TONS)	BUILDING (SQ FT)[1]	APRON/ EQUIPMENT (SQ FT)[2]	LANDSIDE ACCESS/DOCKS (SQ FT)[3]	EMPLOYEE PARKING (SQ FT)[4]	CUSTOMER PARKING (SQ FT)[5]
2016 (Occupied)[6]		49,075				
Baseline Forecast						
PAL 1	97,406	64,937	324,687	86,583	26,300	2,630
PAL 2	114,407	76,271	381,357	101,695	30,890	3,089
PAL 3	156,766	104,511	522,553	139,348	42,327	4,233
High Forecast						
PAL 1	148,939	99,292	496,462	132,390	40,213	4,021
PAL 2	218,784	145,856	729,279	194,474	59,072	5,907
PAL 3	342,930	228,620	1,143,100	304,827	92,591	9,259

NOTES:
1 1.5 U.S. tons of cargo per square foot of cargo building.
2 5.0 square feet per square foot of cargo building.
3 1.3 square feet per square foot of cargo building.
4 1.5 spaces per 1,000 square feet of cargo building and 270 square feet per parking space.
5 1.5 spaces per 10,000 square feet of cargo building and 270 square feet per parking space.
6 Area occupied by all-cargo carriers. The total area of the West Air Cargo Complex buildings is 178,560 sq ft.
7 Table excludes areas for taxiways.
SOURCES: Airport Cooperative Research Program, Report 143, *Guidebook for Air Cargo Facility Planning and Development*, 2015 (building and apron guidelines); Airports Council International-North America, *Airport Cargo Guide*, 2013 (landside access/docks, employee and customer parking guidelines); Ricondo & Associates, Inc., June 2018 (requirements).

[28] Airport Cooperative Research Program, Report 143, *Guidebook for Air Cargo Facility Planning and Development*, 2015 suggests a building utilization rate of between 0.41 and 1.63 tons per square foot for all-cargo carries. A building utilization rate of 1.5 was assumed based on the existing utilization rate of 1.48 and level of activity associated with Amazon.

4.5.1.3 PASSENGER AIRLINE CARGO

Passenger airline cargo refers to air cargo carried in the baggage compartments of commercial passenger airline aircraft and is often referred to as belly cargo. **Table 4-51** summarizes the requirements for passenger airline cargo facilities.

TABLE 4-51 PASSENGER AIRLINE CARGO FACILITY REQUIREMENTS

PLANNING ACTIVITY LEVEL	FORECAST (U.S. TONS)	BUILDING (SQ FT)[1]	APRON/ EQUIPMENT (SQ FT)[2]	LANDSIDE ACCESS/DOCKS (SQ FT)[3]	EMPLOYEE PARKING (SQ FT)[4]	CUSTOMER PARKING (SQ FT)[5]
2016 (Occupied)[6]		51,840				
Baseline Forecast						
PAL 1	69,148	46,099	92,197	61,465	18,670	1,867
PAL 2	76,270	50,847	101,693	67,796	20,593	2,059
PAL 3	91,165	60,777	121,553	81,036	24,615	2,461
High Forecast						
PAL 1	70,239	46,826	93,652	62,434	18,964	1,896
PAL 2	77,625	51,750	103,500	69,000	20,959	2,096
PAL 3	94,625	63,083	126,166	84,111	25,549	2,555

NOTES:
1 0.75 U.S. tons of cargo per square foot of cargo building when assuming 50 percent of cargo is handled on the terminal apron.
2 2.0 square feet per square foot of cargo building.
3 1.3 square feet per square foot of cargo building.
4 1.5 spaces per 1,000 square feet of cargo building and 270 square feet per parking space.
5 1.0 space per 10,000 square feet of cargo building and 270 square feet per parking space.
6 Area occupied by passenger airlines. The total area of the West Air Cargo Complex buildings is 178,560 sq ft.
SOURCES: Airport Cooperative Research Program, Report 143, Guidebook for Air Cargo Facility Planning and Development, 2015 (building and apron guidelines); Airports Council International-North America, Airport Cargo Guide, 2013 (landside access/docks, employee and customer parking guidelines); Ricondo & Associates, Inc., June 2018 (requirements).

In 2016, passenger airline cargo accounted for 17 percent of the total air cargo processed at the Airport, with over 61,000 tons handled in 51,840 square feet of building space. This results in a building utilization rate of 1.18 tons per square foot. It should be noted that both American Airlines and Southwest Airlines sort a portion of their cargo on the terminal apron. Detailed data on the volume of cargo transferred on the terminal apron are not available, but it is estimated that approximately 50 percent of cargo volume is transferred directly between aircraft.[29] This transfer of cargo on the terminal apron is assumed to reduce the building utilization rate by 50 percent to 0.75 tons per square foot from the assumed building utilization rate of 1.5 tons per square foot.

[29] Intervistas, *Phoenix Regional Air Cargo Planning Study*, January 2014.

Although carriers like Southwest Airlines have made corporate decisions to make cargo activity and revenue a higher priority, most of the Airport's passenger airlines fleet mix and route networks do not lend themselves to achieving large growth rates and therefore the pressure for more space is less prominent.

4.5.1.4 SUMMARY OF REQUIREMENTS

The acreage requirements, not considering existing facilities, for integrated, all-cargo, and passenger airline cargo are summarized in **Table 4-52**. Overall there is a need for approximately 106 acres of cargo facilities by PAL 3 for the baseline forecast. This increases to 146 acres by PAL 3 for the high forecast.

TABLE 4-52 SUMMARY OF AIR CARGO FACILITY REQUIREMENTS

	BASELINE FORECAST			HIGH FORECAST		
FACILITY	PAL 1 (ACRES)	PAL 2 (ACRES)	PAL 3 (ACRES)	PAL 1 (ACRES)	PAL 2 (ACRES)	PAL 3 (ACRES)
Integrated Cargo						
Building Area	4.1	4.7	6.4	4.3	5.1	7.1
Apron/Equipment	20.3	23.7	32.0	21.6	25.7	35.4
Landside Access/Docks	5.4	6.3	8.5	5.8	6.9	9.4
Employee Parking	1.6	1.9	2.6	1.8	2.1	2.9
Customer Parking	0.1	0.1	0.2	0.1	0.1	0.2
Taxilane[1]	14.2	16.6	22.4	15.1	18.0	24.7
Subtotal	45.8	53.5	72.1	48.7	57.9	79.7
All-Cargo						
Building Area	1.5	1.8	2.4	2.3	3.3	5.2
Apron/Equipment	7.5	8.8	12.0	11.4	16.7	26.2
Landside Access/Docks	2.0	2.3	3.2	3.0	4.5	7.0
Employee Parking	0.6	0.7	1.0	0.9	1.4	2.1
Customer Parking	0.1	0.1	0.1	0.1	0.1	0.2
Taxilane[1]	5.2	6.1	8.4	8.0	11.7	18.4
Subtotal	16.8	19.7	27.1	25.7	37.8	59.2
Passenger Airline Cargo						
Building Area	1.1	1.2	1.4	1.1	1.2	1.4
Apron/Equipment	2.1	2.3	2.8	2.1	2.4	2.9
Landside Access/Docks	1.4	1.6	1.9	1.4	1.6	1.9
Employee Parking	0.4	0.5	0.6	0.4	0.5	0.6
Customer Parking	0.0	0.0	0.1	0.0	0.0	0.1
Subtotal	5.1	5.6	6.7	5.1	5.7	6.9
Total	67.7	78.8	105.8	79.6	101.4	145.8

NOTE:

1 Land requirement for taxilanes is dependent on the layout of the facility. For planning purposes, land requirements were calculated by assuming taxilanes would require 45 percent of the total area for building, apron/equipment, landside access/dock, and employee and customer parking

SOURCE: Ricondo & Associates, Inc., June 2018.

4.5.2 GENERAL AVIATION

GA facilities at PHX are predominantly located in the northwest and southwest corners of the airfield. PHX AVN leases space in the northwest corner to individual tenants, while FBOs Cutter Aviation (Cutter) and Swift Aviation (Swift) maintain larger leaseholds in the southwest corner of the airfield. The FBOs typically cater to transient aircraft.

The GA facility requirements for PHX were determined for both based and transient activities using the forecast GA annual operations and existing and forecast based aircraft fleet mix. The forecast annual GA operations (see Table 3-28 in Section 3) was used to establish the peak month, design day, and design hour operations and to estimate the required common space needed for GA pilots and passengers within the planning period. Existing and forecast based aircraft fleet mix was used to establish requirements for hangar and apron storage through the planning period.

4.5.2.1 COMMON SPACE REQUIREMENTS

At most GA facilities, common space includes any nonexclusive areas that are accessible to the public (e.g., lobby/waiting areas, restrooms, meeting rooms, etc.). Common space requirements were calculated for the FBOs for each of PAL. As summarized in **Table 4-53**, the existing common space of 21,000 square feet is adequate throughout the planning horizon.

TABLE 4-53 GENERAL AVIATION COMMON SPACE REQUIREMENTS

PAL	GA PEAK MONTH OPERATIONS	DESIGN DAY OPERATIONS	DESIGN HOUR OPERATIONS[1]	PEAK HOUR PILOTS & PASSENGERS (GA)[2]	COMMON SPACE (SQ FT)[3]
2017 (Existing)					21,000[4]
Baseline Forecast					
2017	2,260	75.33	11.30	28	4,200
PAL 1 (2022)	2,300	76.67	11.50	29	4,350
PAL 2 (2027)	2,336	77.87	11.68	29	4,350
PAL 3 (2037)	2,412	80.40	12.06	30	4,500

NOTES:

1 The design hour is the estimate of the peak hour of the average day of the busiest month in terms of operations.

2 The peak hour pilot and passenger throughput is the number of design hour operations multiplied by 2.5. The outcome of these calculations was rounded to the nearest whole number for simplicity.

3 An average of 150 square feet per peak hour pilots and passengers was used to determine common space requirement.

4 Includes only nonexclusive areas that are accessible to the public at the FBOs (Cutter Aviation and Swift Aviation).

SOURCES: Ricondo & Associates, Inc., *Comprehensive Asset Management Plan – Phoenix Sky Harbor International Airport, Draft Activity Forecasts*, January 2018 (activity forecasts); Cutter Aviation, 2018 (existing facility space); Swift Aviation, 2018 (existing facility space); C&S Engineers, Inc., May 2018 (analysis).

4.5.2.2 HANGAR AND APRON REQUIREMENTS

The existing and forecast based aircraft fleet mix and based aircraft storage locations were analyzed to determine whether the existing GA hangar and apron facilities are adequate to meet forecast demand. **Table 4-54** provides the current and forecast based aircraft fleet mix for PHX.

TABLE 4-54 BASED AIRCRAFT FLEET MIX FORECAST

AIRCRAFT BY ENGINE TYPE	2017	PAL 1 (2022)	PAL 2 (2027)	PAL 3 (2037)
Single-Engine Piston	13	12	12	11
Multi-Engine Piston	4	4	4	4
Turboprop	11	11	11	12
Jet	38	44	49	61
Rotorcraft	11	12	13	15
Total	77	83	89	103

SOURCES: Federal Aviation Administration, FAA Aerospace Forecasts for Fiscal Years 2018-2038, January 2018 (based aircraft forecast); City of Phoenix Aviation Department, March 2018 (based aircraft); Cutter Aviation, April 2018 (based aircraft); Swift Aviation, April 2018 (based aircraft); C&S Engineers, Inc., May 2018 (analysis).

The based aircraft fleet mix for the northwest and southwest GA areas were forecast individually to determine requirements. **Table 4-55** summarizes the existing and forecast based aircraft fleet mix by engine type for both GA areas.

TABLE 4-55 BASED AIRCRAFT FLEET MIX FORECAST BY AREA AND ENGINE TYPE

	NORTHWEST AREA				SOUTHWEST AREA (FBOS)			
AIRCRAFT BY ENGINE TYPE	2017	PAL 1 (2022)	PAL 2 (2027)	PAL 3 (2037)	2017	PAL 1 (2022)	PAL 2 (2027)	PAL 3 (2037)
Single-Engine Piston	13	12	12	11	0	0	0	0
Multi-Engine Piston	2	2	2	2	2	2	2	2
Turboprop	7	7	7	8	4	4	4	4
Jet	3	3	4	5	35	41	45	56
Rotorcraft	9	10	11	12	2	2	2	3
Total	34	34	36	38	43	49	53	65

NOTE: In 2017, the Southwest Area (FBOs) accommodated 76 percent of based jet and rotorcraft aircraft. The percentage of forecast based jet and rotorcraft aircraft accommodated in the Southwest Area was assumed to be similar throughout planning period.

SOURCES: City of Phoenix Aviation Department, March 2018 (based aircraft); Cutter Aviation, April 2018 (based aircraft at FBO); Swift Aviation, April 2018 (based aircraft at FBO); C&S Engineers, Inc., May 2018 (analysis).

To provide a baseline for determining future facility requirements, the quantity of storage locations by each storage type were identified for existing based aircraft for the northwest and southwest areas. **Table 4-56** summarizes the existing type of aircraft storage for each by aircraft engine type.

TABLE 4-56 EXISTING BASED AIRCRAFT STORAGE TYPE BY AREA

STORAGE LOCATION/TYPE	AIRCRAFT ENGINE TYPE			
	SINGLE-ENGINE	MULTI-ENGINE[1]	JET	ROTORCRAFT
Northwest Area				
Apron/Tie-downs	46%	33%		33%
Conventional Hangar		67%	100%	67%
T-Hangar	54%			
Total	100%	100%	100%	100%
Southwest Area (FBOs)				
Apron/Tie-downs		17%	3%	100%
Conventional Hangar		83%	97%	
T-Hangar				
Total		100%	100%	100%

NOTE:
1 Includes turboprop aircraft.
SOURCE: C&S Engineers, Inc., May 2018 (analysis).

These percentages were then applied to the numbers of forecast single-engine, multi-engine/turboprop, jet, and rotorcraft-based aircraft provided in Tables 4-54 and 4-55 to determine the requirements for different types of aircraft storage. For example, it was assumed that 46 percent single-engine aircraft based in the northwest area would be stored at tie-down spots and the remaining 54 percent would be stored in T-hangars. Once the total based aircraft per engine type were allocated to a specific storage type (conventional, hangar, T-hangar, apron) based on the percentages identified in Table 4-56, standard space requirements for each aircraft engine type were then applied over the planning horizon.

ACRP Report 113, *Guidebook on General Aviation Facility Planning*, which includes recommended space requirements unique to the type of aircraft engine typical for most GA aircraft, was used as the basis for determining GA facility space requirements.[30] Since jet aircraft vary in size, the space requirements for this aircraft category were aligned to represent the models of aircraft typically accommodated at PHX. For general planning purpose, the following were assumed for apron and hangar area requirements for each aircraft by engine type:

- 1,200 square feet per single-engine aircraft
- 1,800 square feet per multi-engine/turboprop aircraft
- 6,500 square feet per jet engine aircraft
- 1,800 square feet per rotorcraft engine aircraft

Table 4-57 illustrates the forecast distribution of based aircraft stored in conventional hangars, T-hangars, and apron tie-downs and the total square feet required to accommodate future based aircraft in the northwest area. The apron calculations represent the area required for an aircraft's overall footprint based

[30] Airport Cooperative Research Program, Report 113, *Guidebook on General Aviation Facility Planning*, 2014.

on the industry guidelines, and do not include the additional apron required for taxilanes and associated object free areas, or other apron pavement.

TABLE 4-57 NORTHWEST GENERAL AVIATION AREA HANGAR AND APRON REQUIREMENTS

CATEGORY/ACTIVITY LEVEL	DEMAND (AIRCRAFT/SQUARE FEET)				
	SINGLE-ENGINE	MULTI-ENGINE[1]	JET	ROTORCRAFT	TOTAL
Conventional Hangar					
2017	0/0	6/10,800	3/19,500	6/10,800	15/41,100
PAL 1 (2022)	0/0	6/10,800	3/19,500	7/12,000	16/42,300
PAL 2 (2027)	0/0	6/10,800	4/26,000	7/13,200	17/50,000
PAL 3 (2037)	0/0	7/12,000	5/32,500	8/14,400	20/58,900
T-Hangar					
2017	7/8,400	0/0	0/0	0/0	7/8,400
PAL 1 (2022)	6/7,200	0/0	0/0	0/0	6/7,200
PAL 2 (2027)	6/7,200	0/0	0/0	0/0	6/7,200
PAL 3 (2037)	6/7,200	0/0	0/0	0/0	6/7,200
Apron/Tie-Down					
2017	6/7,200	3/5,400	0/0	3/5,400	12/18,000
PAL 1 (2022)	6/7,200	3/5,400	0/0	3/5,400	12/18,000
PAL 2 (2027)	6/7,200	3/5,400	0/0	4/7,200	13/19,800
PAL 3 (2037)	6/7,200	3/5,400	0/0	4/7,200	13/19,800

NOTE:
1 Includes turboprop aircraft.
SOURCE: C&S Engineers, Inc., May 2018.

The forecast hangar and apron demand for the northwest GA facilities were then compared to the existing space. **Table 4-58** illustrates the estimated existing hangar and apron space, while **Table 4-59** summarizes facility requirements through the planning period.

TABLE 4-58 EXISTING NORTHWEST GENERAL AVIATION HANGAR AND APRON SPACE

STORAGE TYPE/DESCRIPTION	AREA (SQ FT)	AREA (ACRES)
Hangars		
Executive/Corporate	211,700	
T-Hangars	12,800	
Subtotal Hangars	224,500	5.2
Apron[1]		
Non-exclusive	141,300	
Exclusive	154,125	
Taxilanes/Additional Pavement	881,663	
Subtotal Apron[2]	1,177,088	27.0
Total Hangar and Apron	1,401,588	32.2

NOTES:
1 Nonexclusive aircraft parking apron are areas that are open for rent and are not associated with an executive or corporate hangar, which includes the covered and uncovered tie-downs and two large open areas; exclusive apron are areas provided to tenants as a part of their executive/corporate lease.
2 The aircraft parking apron areas were measured using aerial photography and are approximate.
SOURCES: City of Phoenix Aviation Department, March 2018 (existing areas); C&S Engineers, Inc., May 2018 (analysis).

TABLE 4-59 NORTHWEST GENERAL AVIATION AREA HANGAR AND APRON REQUIREMENTS

ACTIVITY LEVEL	HANGARS (SQ FT)[1]	AIRCRAFT PARKING APRON (SQ FT)[2]	TAXILANES (SQ FT)[3]	TOTAL AREA (SQ FT/ACRES)
PAL 1 (2022)	49,500	18,000	127,700	195,200/4.5
PAL 2 (2027)	57,200	19,800	145,700	222,700/5.1
PAL 3 (2037)	66,100	19,800	162,500	248,400/5.7

NOTES:
1 Includes both conventional hangars and T-hangars.
2 Total includes aircraft parking footprint only and correlates to the amounts shown in Table 4-57.
3 Includes the minimum amount of additional apron required for wingtip clearance separation, taxilane safety area requirements, and other apron otherwise required for general aircraft maneuvering. Additional apron requirements are site specific and could include additional area depending on the location or layout of the facilities.
SOURCE: C&S Engineers, Inc., May 2018.

The results indicate that the existing PHX AVN GA facilities in the northwest area are underutilized and the layout includes more apron area than is likely needed. Approximately 6 acres of hangar and apron space should be adequate to accommodate based aircraft over the planning period based on the above analysis.

The FBOs provide only large conventional hangar storage, the majority of which store transient aircraft. However, several full-time tenants base aircraft in the FBO hangars. Both FBOs maintain transient aircraft parking aprons and have indicated that additional hangar space has been requested by GA users. **Tables 4-60** and **4-61** show the conventional hangar and aircraft parking apron requirements for the FBOs at PHX.

TABLE 4-60 SOUTHWEST AREA FIXED BASE OPERATOR HANGAR REQUIREMENTS

	CONVENTIONAL HANGAR (AIRCRAFT/SQUARE FEET)				
ACTIVITY LEVEL	SINGLE-ENGINE	MULTI-ENGINE[1]	JET	ROTORCRAFT	TOTAL[2]
PAL 1 (2022)	0/0	5/9,000	40/260,000	0/0	45/269,000
PAL 2 (2027)	0/0	5/9,000	44/286,000	0/0	49/295,000
PAL 3 (2037)	0/0	5/9,000	54/351,000	0/0	59/360,000

NOTES:
1 Includes turboprop aircraft.
2 Calculations have been rounded to the nearest whole number.
SOURCES: City of Phoenix Aviation Department, March 2018; Cutter Aviation, April 2018; Swift Aviation, April 2018; C&S Engineers, Inc., May 2018

TABLE 4-61 SOUTHWEST AREA FIXED BASE OPERATOR TRANSIENT APRON REQUIREMENTS

ACTIVITY LEVEL	AIRCRAFT SIMULTANEOUSLY PARKED AT FBOS[1]	AIRCRAFT PARKING APRON (SQ FT)[2 3]
PAL 1 (2022)	17	59,500
PAL 2 (2027)	17	59,500
PAL 3 (2037)	19	66,500

NOTES:

1 Based on the GA design hour forecast operations for PHX. Assumes 90 percent of total aircraft parked are transient aircraft utilizing the FBOs and is held constant through the planning horizon.

2 Existing aircraft parking apron is approximate and does not include additional existing pavement for wingtip clearance separation and taxilanes. Forecast aircraft parking apron totals are assumed to be the minimum required apron parking space on an average day in the peak month and represent the aircraft footprint only. Calculations were determined using an average aircraft space requirement of 3,500 square feet, calculated by taking the average of the standard space requirements for multi-engine, turboprop, jet, and rotorcraft aircraft. Calculations have been rounded to the nearest whole number.

3 Approximately 12,000 square feet of the Cutter Aviation apron is used by based aircraft. Swift Aviation indicated that they do not have any apron used by based aircraft.

SOURCES: City of Phoenix Aviation Department, March 2018; Cutter Aviation, April 2018; Swift Aviation, April 2018; C&S Engineers, Inc., May 2018.

The aircraft parking apron calculations represent the minimum amount of apron required on the average busy day in the peak month. These calculations represent the apron space required for an aircraft's overall footprint, and do not include the additional apron space required for wingtip clearance, taxilanes, or other associated apron pavement. Management for Cutter Aviation[31] and Swift Aviation[32] indicated their existing aircraft parking aprons meet demand on a regular basis; however, both FBO aprons are often constrained during special events (e.g., sporting events, national conventions, etc.).

The total existing conventional hangar space between the two FBOs totals approximately 201,000 square feet. The forecast demand for conventional hangar space as shown in Table 4-60 assumes an increase in the number of customers who wish to store, or base, their aircraft within a hangar at one of the FBOs on a full-time basis. It does not consider the demand to store transient aircraft on a short-term basis, which fluctuates. Assuming the demand to store aircraft (turboprops and corporate jets) within conventional hangars at either FBO continues, an estimated 159,000 square feet of additional hangar space is anticipated for these needs by PAL 3.

The existing southwest GA area is approximately 45 acres and includes the aircraft parking aprons, common spaces, hangars, and other ancillary facilities and space. The existing 45 acres is fully utilized by both Cutter Aviation and Swift Aviation and additional land would be needed to accommodate the construction of future conventional hangars and the associated apron and maneuvering area. **Table 4-62** summarizes the additional space requirements beyond the existing 45 acres for the southwest GA area through PAL 3.

[31] Cutter Aviation, Interviewed by C&S Engineers, Inc., April 2018.

[32] Swift Aviation, Interviewed by C&S Engineers, Inc., April 2018.

TABLE 4-62 SOUTHWEST GENERAL AVIATION AREA HANGAR AND APRON REQUIREMENTS

ACTIVITY LEVEL	ADDITIONAL HANGAR (SQ FT)[1]	ADDITIONAL AIRCRAFT PARKING APRON (SQ FT)[2]	ADDITIONAL APRON FOR TAXILANES (SQ FT)[3]	TOTAL ADDITIONAL AREA (SQ FT/ACRES)
PAL 1 (2022)	68,000	59,500	57,500	184,900/4.2
PAL 2 (2027)	94,000	59,500	69,100	222,600/5.1
PAL 3 (2037)	159,000	66,500	101,500	327,000/7.5

NOTES:

1 There is 201,000 square feet of existing conventional hangar. The additional hangar requirement is calculated by subtracting the existing from the future conventional hangar requirements in Table 4-60.

2 Assumes a minimum amount of aircraft parking apron would likely accompany any new hangar construction based on typical FBO configurations; amounts shown correlate to the minimum transient apron demand found in Table 4-61.

3 Includes the minimum amount of additional apron required for wingtip clearance separation, taxilane safety area requirements, and other apron otherwise required for general aircraft maneuvering.

SOURCES: Cutter Aviation, April 2018; Swift Aviation, April 2018; C&S Engineers, Inc., May 2018.

4.5.3 GROUND SUPPORT EQUIPMENT

GSE is currently staged and stored by the various airlines and contracted service providers (including Swissport International Ltd. and Menzies Aviation) on designated aprons located primarily in three areas; on the north side of Terminal 3, on the south side of Terminal 4, and in the West Cargo area near Gate 220. Additionally, equipment is often stored adjacent to the aircraft parking gates, frequently competing for space with airline maintenance parts and other equipment.

In response to the GSE storage constraints, a designated GSE storage area is incorporated into the ongoing Terminal 3 Modernization project. Forecast activity levels indicate that approximately 5 to 6 acres would be needed (potentially less depending on the area preserved as part of the Terminal 3 Modernization Program).

All airlines and contracted service providers conduct routine maintenance on their GSE at the Airport. Southwest Airlines and American Airlines utilize their aircraft maintenance hangars for the majority of their GSE maintenance activities, while other airlines and contracted service providers use designated maintenance shops primarily located within the West Cargo area. UPS and FedEx utilize space at their facilities on the South Cargo apron for GSE maintenance and storage.

Approximately 9,000 square feet of West Air Cargo Buildings A and B are leased and used for GSE maintenance. As outlined in Section 2.6, Crossfield Taxiways U and V are planned and will require the demolition of a majority of West Air Cargo Building A and GSE maintenance functions in this building will need to be relocated. The existing area of one of the cargo buildings (50,000 square feet) and associated landside vehicle parking and airside apron (66,000 square feet) totaling approximately 2.7 acres is needed to accommodate future GSE facility requirements for PAL 3.

4.5.4 IN-FLIGHT CATERING SERVICES

LSG Sky Chefs currently operates the in-flight catering services facility (flight kitchen) at the Airport and provides meals and catering services to airlines with first/business class or international service. Its facility will be displaced by the development of the PHX Sky Train Stage 2 extension and West Ground

Transportation Center. LSG Sky Chefs will temporarily relocate off-Airport to a 97,500-square foot facility until a long term on-Airport site is identified.

LSG Sky Chef's operating requirements include adequate configurable real estate for efficient landside and airside truck movements and vehicle parking and building space sufficient for processing materials from nonsecure to secure environments including dock space, cold and dry storage, screening, office space, and other supporting functions. Approximately 75,000 square feet of building space on up to 7 acres is required through PAL 3. The flight kitchen's customers (i.e., airlines) prefer that the facility be located on-Airport and as close as possible to passenger terminal gate areas to increase overall efficiency of final delivery.

4.5.5 AIRLINE MAINTENANCE

American Airlines, Southwest Airlines, and Mesa Airlines operate maintenance facilities at PHX. Each facility consists of a hangar and associated apron space to conduct routine and scheduled maintenance such as engine and gear changes, as well as aircraft maintenance checks.

American Airlines' existing leasehold is adequately sized for current operations, but expansion of the hangar to include one additional service bay within the next 5 years may be necessary if activity at PHX continues to increase.[33] This expansion would occur within the airline's existing leasehold.

Southwest Airlines' maintenance hangar facility is inadequately sized for existing demand, as it is only able to accommodate two simultaneously parked aircraft. Plans for expansion of the facility within their current leasehold have been approved and are anticipated to be complete sometime in 2020. The expansion includes a new 75,000 square foot hangar with three maintenance bays and GSE storage/maintenance space and approximately 10,000 square feet of additional aircraft apron. Any further maintenance facility needs within the 20-year planning period are not foreseen.[34]

Representatives from Mesa Airlines indicate their existing maintenance facility meets their basic needs, although there is room for improvement with the hangar's infrastructure and overall size. Mesa Airlines has no immediate plans for expansion or refurbishment and any expansion would be contained within the airline's existing leasehold.[35]

Although the existing sites for aircraft maintenance do not require any additional land for expansion, if possible, a site of approximately 15 acres should be preserved for a future aircraft maintenance facility to allow other air carriers to provide these services if required as part of their operation at the Airport.

4.5.6 AIRCRAFT FUELING AND FUEL STORAGE

Swissport International Ltd. provides aircraft fueling services for commercial airlines at PHX. FBOs Cutter Aviation and Swift Aviation provide aircraft fueling services for GA operators.

[33] American Airlines, Interviewed by C&S Engineers, Inc., April 26, 2018.

[34] Southwest Airlines, Interviewed by C&S Engineers, Inc., April 10, 2018.

[35] Mesa Airlines, Interviewed by C&S Engineers, Inc., May 31, 2018.

The on- and off-Airport fuel farms and associated transfer pipeline and hydrant system are adequate to handle the existing and future fueling needs at PHX.[36] The six fuel pumps at the on-Airport fuel farm supply the terminal gate areas via a hydrant system. Piping is in place to add two additional pumps, if needed. The five above-ground storage tanks can accommodate storage of up to 4 days of fuel supply while off-Airport fuel tanks accommodate storage for up to 21 days. No additional tanks are planned at this time. If needed, the most likely preferred location would be directly west of the existing tanks, and therefore 1.8 acres should be preserved for expansion purposes. As the Airport's requirements evolve, it will be important to protect the transfer pipeline, both on- and off-Airport, from future development to ensure the transfer of fuel between the off-Airport facility remains intact and operational at all times.

Both of the FBOs' current fueling needs are met and there are no plans for expansion of Cutter Aviation or Swift Aviation's fueling facilities. This is consistent with the forecast of GA operations reflecting conservative growth over the planning period.

4.5.7 AIRCRAFT RESCUE AND FIRE FIGHTING

Based on the size of aircraft and number of daily departures at PHX, the Airport meets the requirements for ARFF Index D (aircraft at least 159 feet but less than 200 feet in length). The aircraft fleet mix forecast, as shown on Table 3-26 in Section 3, indicates daily departures of aircraft greater than 200 feet in length (for example the Boeing 777-200) may reach a minimum of five daily departures by 2037 (PAL 3). Should this occur, PHX would be required to meet operational requirements of ARFF Index E, which requires an increase in firefighting agents. No additional equipment is required through PAL 3.

4.5.8 AVIATION DEPARTMENT FACILITIES

PHX AVN employees mainly occupy the COB, the Facilities and Services Complex, the Airport Operations Center, and the Parking Operations/PHX Sky Train Design Team Annex. Various facilities for Operations and Facilities and Services are located throughout the Airport.

PHX AVN Operations staff have indicated a need for additional space and portions of the Facilities and Services complex require relocation due to future airfield projects. A campus consolidating Operations, Facilities and Services, and the Airport Police Bureau may allow for better coordination of activities and sharing of building and other spaces. Due to imbalanced staffing throughout the day and week and ability to cross utilize shared-use spaces, the area requirement for a consolidated building is less than three separate buildings for Operations, Facilities and Services, and the Airport Police Bureau.

Discussions with Operations staff indicated a need for a facility with both airside and landside access that is in proximity to the passenger terminal area. Operations often works closely the Airport Police Bureau and combining these functions into a single building could reduce response times. Locating Operations near a PHX Sky Train station would allow for staff to respond to incidents in the terminals without using Airport roadways and vehicles. It is also anticipated that collocating or placing Operations near Facilities and Services would increase staff communication and reduce the number of vehicle trips between these facilities.

[36] PHX AVN Operations and Swissport International Ltd., Interviewed by C&S Engineers, Inc., September 6, 2018.

Additional opportunities may exist for consolidating security badging, ground transportation, parking, and other Airport permitting functions. Such a facility could provide efficiencies through certain shared-use areas as well as improved access to its customers if located near a PHX Sky Train station. This facility would require customer counters, back-office space, and automobile parking. These functions and facilities could be accommodated in the consolidated facilities mentioned above or in a separate facility. A separate facility would require approximately 2 acres to accommodate anticipated activity.

Some facilities may not contribute to an increased site efficiency (e.g., vehicle maintenance yard, fueling station, storage). **Table 4-63** shows the site area requirements for a collocated building/campus solution and for non-collocated facilities. **Table 4-64** shows the building area requirements for the same. If Facilities and Services have a split operation, slightly more than half the building should be located at the maintenance yard while the remainder collocated with Operations and Police.

The COB occupies a site of approximately 5 acres. The facility opened in 2017 and is fully utilized. An area of approximately 5 acres should be preserved to accommodate a second office building and associated parking for PHX AVN staff.

TABLE 4-63 OPERATIONS, POLICE, FACILITIES AND SERVICES, AND BADGING/PERMITTING SITE REQUIREMENTS

FACILITY	EXISTING FACILITIES (ACRES)	COLLOCATED (ACRES)	NON-COLLOCATED (ACRES)
Operations	2	Shared	2.5
Police	1	Shared	1.5
Facilities and Services	10	Shared	13
Consolidated Badging/Permitting	--[1]	Shared	2
Total	13	13	19

NOTE:

1 The current badging and permitting facilities are included with existing facilities above.

SOURCES: City of Phoenix Aviation Department, April 2018; and Google Earth, June 2018 (existing facilities); C&S Engineers, Inc., July 2018 (requirements).

TABLE 4-64 OPERATIONS, POLICE, FACILITIES AND SERVICES, AND BADGING/PERMITTING BUILDING REQUIREMENTS

FACILITY	EXISTING FACILITIES (SQ FT)	COLLOCATED (SQ FT)	NON-COLLOCATED (SQ FT)
Operations	17,676	21,700	28,000
Police	8,334	8,334	11,000
Facilities and Services	61,150	61,150	79,000
Consolidated Badging/Permitting	--[1]	10,000	10,000
Total	87,160	91,184	128,000

NOTE:

1 The current badging and permitting facilities are included with existing facilities above.

SOURCES: City of Phoenix Aviation Department, April 2018; Google Earth June 2018 (existing facilities); C&S Engineers, Inc., July 2018 (requirements).

4.5.9 CENTRALIZED RECEIVING AND DISTRIBUTION CENTER

Many benefits for a Centralized Receiving and Distribution Center (CRDC) exist and include enhanced security and safety, streamlined operations, reduced terminal roadway and AOA congestion, reduced passenger security checkpoint congestion, increased revenues and reduced costs, improved traveler experience, and positive environmental impacts. However, prior to planning for a CRDC can begin, a business case would need to be performed to analyze potential facility locations, security screening measures, airside vehicle operations, tenant operations, environmental impacts, and implementation costs.

Through a benchmarking analysis of CRDCs at other airports, it is assumed a CRDC at PHX would require a building of approximately 40,000 to 50,000 square feet on a site up to 6 acres.

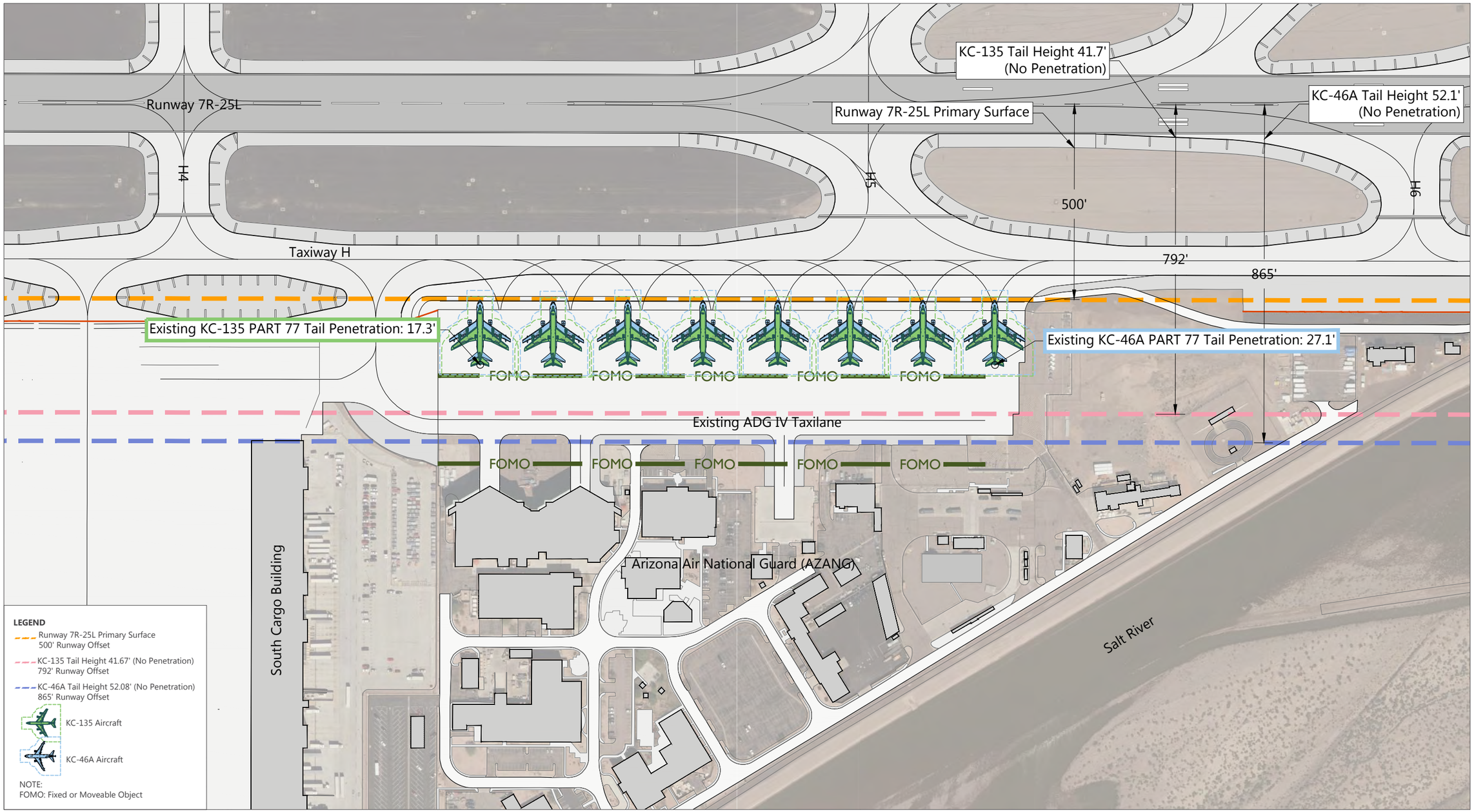
4.5.10 ARIZONA AIR NATIONAL GUARD

The 60-acre AZANG facility located east of the South Cargo area supports over 800 airmen and is the base for eight Boeing KC-135 Stratotanker military refueling aircraft. These aircraft were produced from 1955 through 1965 and are based on the Boeing 707-120B airliner. The aircraft has a wingspan of 130.8 feet, a tail height of 41.7 feet (ADG IV) and a length of 136.3 feet. The KC-135 aircraft are typically parked pointed to the north and serviced on the AZANG ramp, as shown in **Exhibit 4-36**. The KC-135 aircraft parked in this orientation penetrate the Part 77 transitional surfaces[37] by 17.3 feet; however, a waiver has been documented with the FAA allowing for continued parking of these aircraft with the penetration. At the time of this study, the AZANG was seeking to add four KC-135 aircraft to their fleet, which would require expansion of their apron to the east.

The U.S. Air Force has ordered the Boeing KC-46A Pegasus aircraft (developed from the Boeing 767 airliner [ADG IV]) to replace the KC-135. The KC-46A has a wingspan of 157.7 feet, a tail height of 52.1 feet, and 165.5 feet. Several National Guard and Air Force Reserve stations throughout the United States are applying to base KC-46A aircraft at their installations with deliveries occuring in 2028.

For the existing AZANG to accommodate the larger KC-46A aircraft, changes to the existing apron, taxilanes, and maintenance hangars would be required. If the KC-46A aircraft are parked in the same position as the existing KC-135 aircraft, the penetration to Part 77 transitional surfaces is 27.1 feet. This would require revising the existing FAA wavier to accommodate the new penetrations. The AZANG has also requested additional acerage for facilities to provide additional training and alert functions. If the AZANG is awarded the eight KC-46A aircraft and land were available to accommodate other facilities, AZANG personnel has requested an additional 20 to 40 acres of developable space.

[37] Title 14 Code of Federal Regulations (CFR) Part 77, *Safe, Efficient Use and Preseveration of Navigable Airspace.*



SOURCES: Woolpert Airports Geographic Information Systems (AGIS) for Phoenix Sky Harbor International Airport, flown May 28 and September 29, 2017 (basemap); Ricondo & Associates, Inc., July 2018 (analysis).

EXHIBIT 4-36

Existing Arizona Air National Guard (AZANG)
Aircraft Parking Layout

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\04-Facility Requirements\Ex-4-36-AZANG Layout.dwgLayout: 4-36 Plotted: Sep 5, 2019, 09:18AM

4.5.11 SUMMARY OF AIRPORT TENANT AND SUPPORT FACILITY NEEDS

Table 4-65 summarizes the acreage required for all airport tenant and support facilities.

TABLE 4-65 SUMMARY OF AIRPORT TENANT AND SUPPORT FACILITIES

		PAL 1		PAL 2		PAL 3	
FACILITY	EXISTING (ACRES)	BASE (ACRES)	HIGH (ACRES)	BASE (ACRES)	HIGH (ACRES)	BASE (ACRES)	HIGH (ACRES)
Cargo – South (Integrated)	45	46	49	54	58	72	80
Cargo – West (All-Cargo)	17	17	26	20	38	27	59
Cargo – West (Passenger)	6	5	5	6	6	7	7
General Aviation – Southwest Area	45	49	49	50	50	53	53
General Aviation – Northwest Area	32	5	5	5	5	6	6
Airline Ground Support Equipment	3	3	3	3	3	3	3
In-flight Catering	0	7	7	7	7	7	7
Airline Maintenance	50	50	50	65	65	65	65
Aircraft Fuel Storage	3	3	3	4	4	4	4
Airport Facilities & Services/ Operations/Police	13	13	13	13	13	13	13
Consolidated Badging/Permitting	N/A	2	2	2	2	2	2
PHX AVN Offices	5	5	5	5	5	5	5
Centralized Receiving and Distribution Center	0	6	6	6	6	6	6
Arizona Air National Guard	60	60	60	80	100	80	100
Total	279	271	283	320	362	350	410

SOURCES: Ricondo & Associates, Inc., July 2018 (cargo and Arizona Air National Guard); C&S Engineers, Inc., July 2018 (all other facilities).

5. ALTERNATIVES

The primary focus of alternatives development is to identify and evaluate those that:

- Accommodate future aviation-related demand over the planning horizon
- Are responsive to the needs of Airport stakeholders
- Provide flexibility to accommodate the dynamic nature of the aviation industry
- Optimize use of existing airport land resources
- Consider development opportunities/limitations beyond the planning horizon

To satisfy these goals, numerous development alternatives were identified, screened, evaluated, and refined. The approach to developing alternatives was largely influenced by optimizing the use of existing facilities and infrastructure investments.

5.1 METHODOLOGY

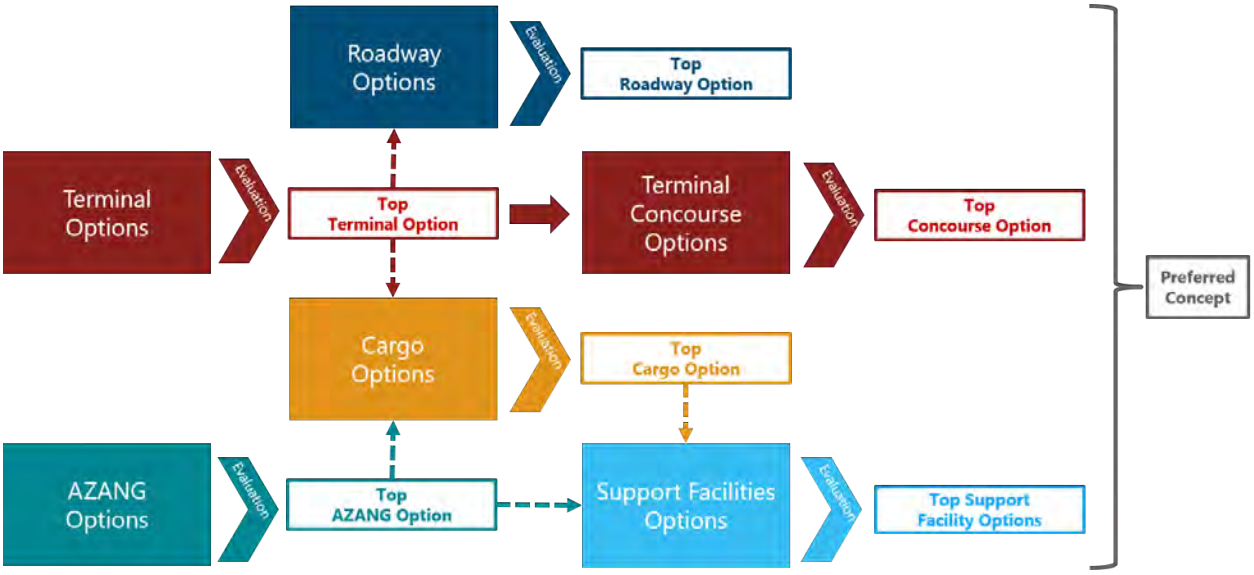
The facility requirements defined in Section 4 provide the quantitative basis for formulating development alternatives to accommodate forecast demand, with the ultimate objective of defining a preferred concept that allows for logical and incremental development of facilities to meet aeronautical need while protecting for future airport development beyond the planning horizon. The alternatives development process was intended to capture a broad range of options at a high level and evaluate and refine these options through a systematic process to arrive at a preferred concept.

The alternatives evaluation process is illustrated on **Exhibit 5-1**. No additional runways are included in the preferred concept and airfield improvements were incorporated from the RIM Study. Given the lack of available land for the expansion of Airport facilities, the alternatives analysis first focused on the identification of options to expand terminal facilities along Sky Harbor Boulevard. Once decisions were made on the preferred terminal concept, concourse options were identified and evaluated.

Separately, options for accommodating expansion of AZANG and cargo facilities in the southern portion of the Airport were explored. This included identifying potential expansion areas to accommodate these facilities. The selection of an AZANG option influenced cargo and support facility options.

Once options for terminal, AZANG, cargo, GA, and other support facilities were identified, options for improving roadways, including Sky Harbor Boulevard and roadways serving expansion areas, were identified. Other non-primary components were also analyzed and incorporated to develop a preferred concept for the Airport.

EXHIBIT 5-1 ALTERNATIVES EVALUATION PROCESS



SOURCE: Ricondo & Associates, Inc., January 2019.

5.2 EVALUATION CRITERIA

Evaluation criteria were developed based on input received from stakeholders and organized into a sustainability framework to reach a balanced alternative. The sustainability framework categories developed by Airports Council International-North America were used:

- Economic viability
- Operational efficiency
- Natural resource conservation
- Social responsibility

Table 5-1 provides a description of each evaluation criterion. Each option within a category (e.g., terminal, cargo, roadways) was assigned a rating of Exceeds, Achieves, Adequate, Challenging, or Deficient based on the criteria identified in the table. These criteria were used to make an objective and measurable comparison of the concepts. Subjective assessments, relying on professional judgment and industry experience, were necessary for some criteria due to the lack of a measurable metric that could be applied.

TABLE 5-1 (1 OF 2) EVALUATION CRITERIA DESCRIPTION AND DESIGNATIONS

SUSTAINABILITY CATEGORY	CRITERIA	DESCRIPTION	EVALUATION DESIGNATIONS				
			EXCEEDS	ACHIEVES	ADEQUATE	CHALLENGING	DEFICIENT
Economic Viability	Development Costs	Costs of development	Minimal construction costs	Low construction cost	Medium construction cost	High construction cost	Excessive construction cost
	Financial Feasibility	Implementation is viable, realistic, and achievable in a manner that does not overburden the financial resources of the Airport, or other funding parties	No impact on financial resources	Minimal impact on financial resources	Moderate impact on financial resources	Significant impact on financial resources	Overburdens financial resources
	Maintenance and Operation Costs	Anticipated post-construction costs (total cost of ownership)	No increase in ownership costs	Slight increase in ownership costs	Moderate increase in ownership costs	High increase in ownership costs	Substantial increase in ownership costs
	Utilization of Existing Infrastructure	Ability to maximize/optimize/reuse existing infrastructure and facilities	Greatly uses existing infrastructure	Moderate use of existing infrastructure	Balance between use of existing and new infrastructure	Moderate replacement of existing infrastructure	Full replacement of existing infrastructure
	Expansion Capability Beyond Planning Horizon	Expansion capability beyond PAL 3 Baseline	Substantial expansion capability beyond the planning horizon	Significant expansion capability beyond the planning horizon	Moderate expansion capability beyond the planning horizon	Minimal expansion capability beyond the planning horizon	No expansion capability beyond the planning horizon
	Revenue Impacts	Impact on revenue-generating activity including new business	Substantial opportunity to increase revenue generating capability	Significant opportunity to increase revenue generating capability	Moderate opportunity to increase revenue generating capability	No change in revenue generating capability	Potential decrease in revenue generating capability
Operational Efficiency	Safety	Ability to maintain or enhance safety and minimize risk, follows industry guidance for safety	Greatly enhances safety	Moderate enhancement of safety	Maintains same level of safety	Limited safety impacts	Creates potentially unsafe condition
	Compatibility	Ability to work within the airport/airfield to avoid delays, inefficiencies, airspace conflicts, etc.	Greatly reduces delays and inefficiencies	Moderate reduction in delays and inefficiencies	Maintains same level of delays and efficiency	Limited increase in delay and inefficiencies	Creates excessive delays and inefficiencies
	Operational Impacts During Construction	Extent to which the alternative impacts operations during construction	No operational impact	Limited operational impact	Slight operational impact	Moderate operational impacts	Substantial operational impacts
	On-Airport Land Use	Prioritizes land use in appropriate locations	Places facility in appropriate and optimal location to protect future growth	Places facility in appropriate and optimal location	Places facilities in appropriate location	Places facilities in location better suited for other facilities	Places facilities in location detrimental to growth of other facilities
	Phasing Complexity/Scalability	Ability of alternative to be phased and/or expanded to meet demand	Multiple options for incremental expansion	Moderate opportunities for incremental expansion	Fewer options for incremental expansion	Low ability to phase incrementally or expand	Inability to phase incrementally or expand
	Flexibility	Ability of the recommended development to be modified to meet changing market conditions or passenger/user demand	Multiple options for modifications	Several opportunities for facility modifications	Some options for facility modifications	Minimal options for facility modifications	No options for facility modifications

TABLE 5-1 (2 OF 2) EVALUATION CRITERIA DESCRIPTION AND DESIGNATIONS

SUSTAINABILITY CATEGORY	CRITERIA	DESCRIPTION	EVALUATION DESIGNATIONS				
			EXCEEDS	ACHIEVES	ADEQUATE	CHALLENGING	DEFICIENT
Natural Resource Conservation	Energy, Air Quality, and Greenhouse Gases	Anticipated change in air quality and emissions considering but not limited to vehicle, aircraft, and equipment travel distances.	Large reduction in energy use and emissions	Slight reduction in energy use and emissions	No reduction in energy use and emissions	Slight increase in energy use and emissions	Significant increase in energy use and emissions
	Historic and Cultural Resources	Potential to adversely impact resources.	No impacts historic and cultural resources	Minimally impacts historic and cultural resources	Impacts historic and cultural resources	Moderately impacts historic and cultural resources	Substantially impacts historic and cultural resources
	Environmental Consequence	Potential for adverse environmental effects	No adverse environmental impacts	Minimal adverse environmental impacts	Limited adverse environmental impacts	Moderate adverse environmental impacts	Substantial adverse environmental impacts
Social Responsibility	Economic Impact to Business Partners and the Community	Ability to enhance business opportunities, employment, economic development, etc.	Provides high level of economic benefit to community	Provides moderate level of economic benefit to community	No change in economic benefit	Slight reduction in economic development	Greatly prohibits economic development
	Airport/Community Experience	Contribution toward an attractive experience/Airport for area visitors, passengers, AVN Staff, tenants and surrounding community	Contributes highly to positive airport experience	Moderate improvement to airport experiences	Slight improvement in same airport experience	Little or no degradation in airport experience	Greatly worsens airport experience
	Level of Service	Ability to accommodate projected levels of activity at desired level of service over the planning horizon	Greatly exceeds level of service criteria	Exceeds level of service criteria	Meets level of service criteria	Does not meet level of service criteria	Results in poor level of service
	Off-Airport Land Use Compatibility	Compatibility with existing and planned land uses off-airport	Enhances land use compatibility	Moderate enhancements to land use compatibility	No changes in land use compatibility	Introduces some incompatibilities	Introduces significant incompatibilities

NOTE:
1 Designations of evaluation terms (EXCEEDS/ACHIEVES/ADEQUATE/CHALLENGING/DEFICIENT) are qualitative descriptors used for evaluating alternatives. These descriptors are defined as relative measures of alternative performance (from strongest [EXCEEDS] to weakest [DEFICIENT]) and are not absolute measures of alternative performance. Each evaluation descriptor is defined in the table to ensure a common understanding.

SOURCE: Ricondo & Associates, Inc., January 2019.

5.3 AIRFIELD

As summarized in Section 4.2.2, the RIM Study identified several recommendations to address design standard deficiencies and enhance airfield capacity. Three consolidated options were developed and based on feedback by a working group and refinement by the RIM Study team, a recommended option was selected that included a combination of geometry, marking, lighting, and signage enhancements. The proposed airfield improvements are depicted on **Exhibit 5-2** and key recommendations are summarized in **Table 5-2**.

Not included in the RIM Study proposed improvements is Taxiway U which further enhances operational flexibility and reduces congestion on taxiways near the existing terminal area and proposed terminal development in the west airfield. Taxiway U is located directed east and parallel to Taxiway V and is shown on Exhibit 5-2.

5.4 TERMINALS AND CONCOURSES

Conceptual terminal options focused on passenger processing capacity and concourse gate expansion opportunities, as well as operational efficiency, aircraft fleet evolution, and flexibility to accommodate advancing technologies and changing airline operational and business models. Consideration was given to terminal and concourse expansion opportunities beyond PAL 3 requirements and the ability to balance ultimate airfield capacity with terminal capacity. Stakeholder input recommended that terminal facilities and passenger airline operations stay within the existing terminal core along Sky Harbor Boulevard and the PHX Sky Train.

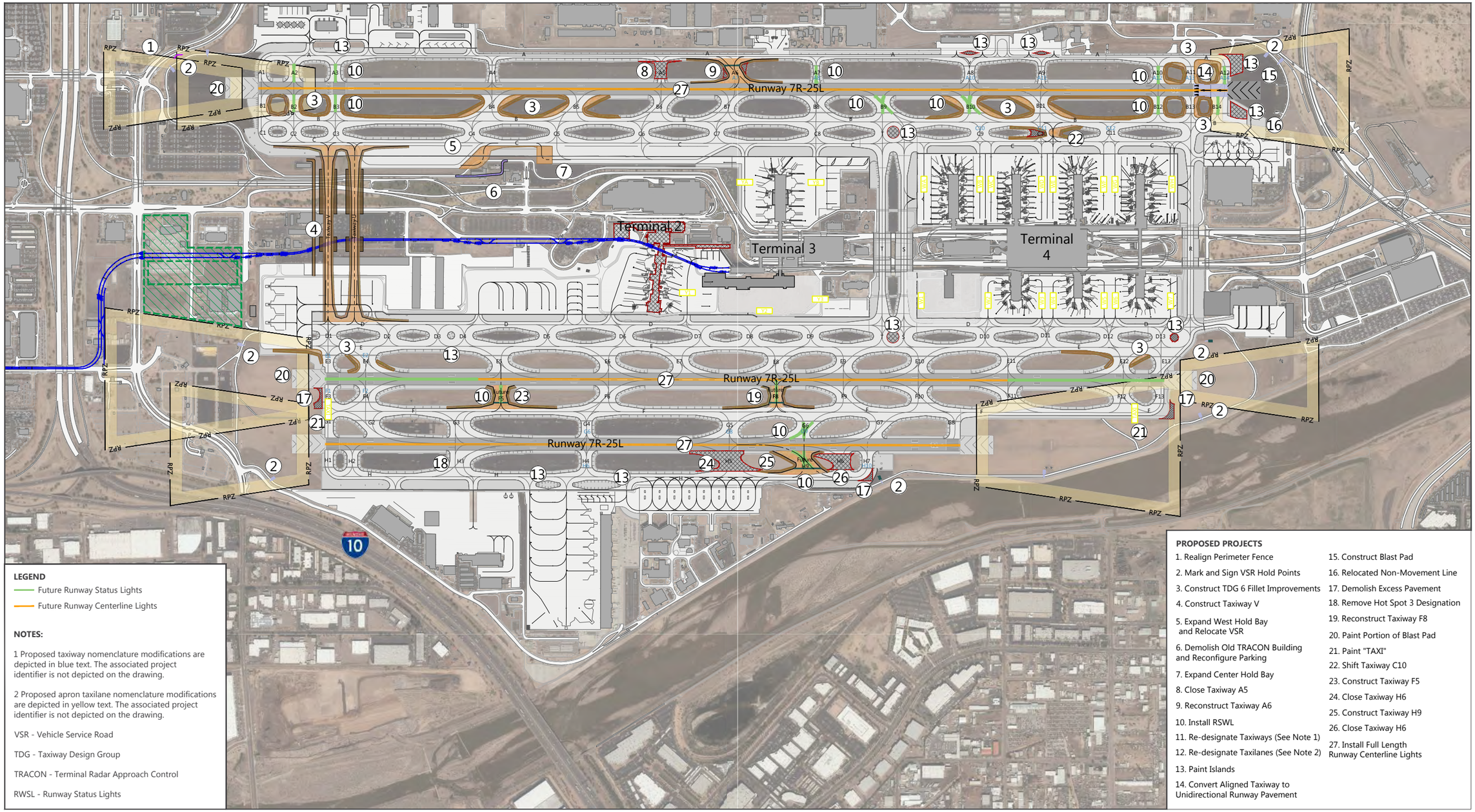
5.4.1 TERMINAL

The focus of the terminal alternatives analysis is the identification of long-range terminal options that would accommodate needs through PAL 3 in a manner that complements the capacity of existing and planned facilities and integrates efficiently with the airfield.

As identified in Section 4, terminal, gate, and holdroom expansion is required to accommodate future passenger demand. Three options were considered to meet PAL 3 requirements:

- Expansion of Terminal 4
- Expansion of Terminal 3
- Construction of a new West Terminal

The following subsections describe these three terminal expansion options.



LEGEND

- Future Runway Status Lights
- Future Runway Centerline Lights

NOTES:

1 Proposed taxiway nomenclature modifications are depicted in blue text. The associated project identifier is not depicted on the drawing.

2 Proposed apron taxilane nomenclature modifications are depicted in yellow text. The associated project identifier is not depicted on the drawing.

VSR - Vehicle Service Road

TDG - Taxiway Design Group

TRACON - Terminal Radar Approach Control

RWSL - Runway Status Lights

PROPOSED PROJECTS

1. Realign Perimeter Fence
2. Mark and Sign VSR Hold Points
3. Construct TDG 6 Fillet Improvements
4. Construct Taxiway V
5. Expand West Hold Bay and Relocate VSR
6. Demolish Old TRACON Building and Reconfigure Parking
7. Expand Center Hold Bay
8. Close Taxiway A5
9. Reconstruct Taxiway A6
10. Install RSWL
11. Re-designate Taxiways (See Note 1)
12. Re-designate Taxilanes (See Note 2)
13. Paint Islands
14. Convert Aligned Taxiway to Unidirectional Runway Pavement
15. Construct Blast Pad
16. Relocated Non-Movement Line
17. Demolish Excess Pavement
18. Remove Hot Spot 3 Designation
19. Reconstruct Taxiway F8
20. Paint Portion of Blast Pad
21. Paint "TAXI"
22. Shift Taxiway C10
23. Construct Taxiway F5
24. Close Taxiway H6
25. Construct Taxiway H9
26. Close Taxiway H6
27. Install Full Length Runway Centerline Lights

SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); HNTB, RIM Study, October 2018 (proposed improvements);

NORTH 0 1,200 ft.

EXHIBIT 5-2

Proposed Airfield Improvements

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-02-Airfield Improvements.dwgLayout: Ex 5-2 Plotted: Sep 5, 2019, 09:36AM

TABLE 5-2 (1 OF 2) PROPOSED AIRFIELD IMPROVEMENTS

NUMBER[1]	IMPROVEMENT	DESCRIPTION
1	Realign Perimeter Fence	Relocate perimeter fence outside of ROFA.
2	Mark and Sign VSR Hold Points	Increase awareness of VSRs within ROFAs.
3	Construct TDG 6 Fillet Improvements	Widen key taxiways serving Runways 8-26 and 7L-25R to accommodate TDG 6 aircraft including the future critical aircraft (Boeing 777-300ER).
4	Construct Taxiway V	Construct Taxiway V to provide ATC with greater operational flexibility and reduce congestion on taxiways near the existing terminal area at the intersection of Taxiways D, E, S, and T.
5	Expand West Hold Bay and Relocate VSR	Provide additional apron for holding aircraft during peak operational periods.
6	Demolish Old TRACON Building and Reconfigure Parking	Enable expansion of West Hold bay.
7	Expand Center Hold Bay	Provide additional apron for holding aircraft during peak operational periods.
8	Close Taxiway A5	Close Taxiway A5 to remove crossing in the middle third of the runway.
9	Reconstruct Taxiway A6	Reduce wide expanse of pavement and remove runway crossing in the middle third of the runway.
10	Install Runway Safety Lights	Enhance situational awareness by providing pilots with an additional visual cue that they are approaching an active runway.
11	Re-Designate Taxiways	Re-designate taxiways to meet FAA design standards and recommendations to enhance pilot and air traffic controller situational awareness.
12	Re-Designate Apron Taxilanes	Re-designate taxilanes in the terminal area to enhance pilot and air traffic controller situational awareness.
13	Paint Islands	Paint taxiway islands to enhance the visual awareness of pavement unavailable for taxi.
14	Convert Aligned Taxiway to Unidirectional Runway Pavement	Convert aligned taxiway pavement into unidirectional Runway 26 pavement (i.e., displaced threshold) to provide an additional 415 feet of takeoff distance to the west. The Runway 26 landing threshold would remain in the same position. The takeoff and landing distances for Runway 8 would remain the same.
15	Construct Blast Pad	Construct blast pad and add paint markings to identify the end of Runway 26.
16	Relocate Non-Movement Line	Relocate non-movement line to prevent aircraft from penetrating instrument departure surface.
17	Demolish Excess Pavement	Remove excess pavements to enhance visual awareness of runways and taxiways.
18	Remove Hot Spot 3 Designation	Remove designation recognizing that there have been no runway incursions at Hot Spot 3 for a long period of time due to previous mitigations of moving a taxilane from direction connection to the runway.

TABLE 5-2 (2 OF 2) PROPOSED AIRFIELD IMPROVEMENTS

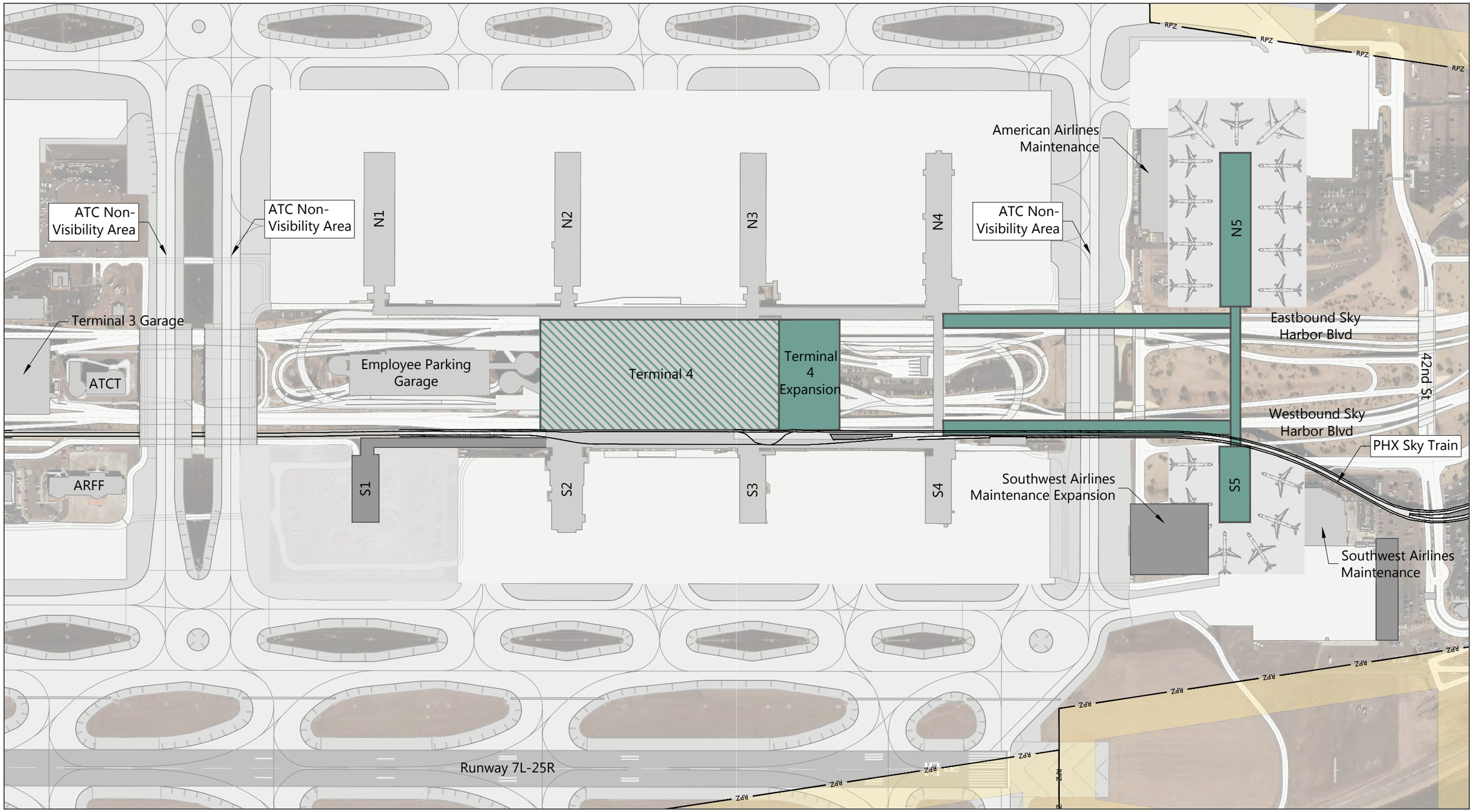
NUMBER[1]	IMPROVEMENT	DESCRIPTION
19	Reconstruct Taxiway F8	Widen Taxiway F8 to accommodate TDG 6 aircraft.
20	Paint Portion of Blast Pad	Paint blast pad up to threshold or displaced thresholds of Runways 7L, 25R, and 8.
21	Paint "Taxi" Marking	Paint "TAXI" marking on the east and west ends of Taxiway F to enhance visual awareness and reduce likelihood of identifying Taxiway F as a runway.
22	Shift Taxiway C10	Shift Taxiway C10 to eliminate direct access between the Terminal 4 North apron and Runway 8-26.
23	Construct Taxiway F5	Construct Taxiway F5 to reduce runway crossings in the middle-third of the runway and shift crossings of Runway 7L-25R in west flow to the western third of the runway.
24	Close Taxiway H5	Close Taxiway H5 to eliminate wide expanse of pavement and direct access to runway from AZANG apron.
25	Construct Taxiway H9	Replace Taxiways H5 and H6 to meet taxiway width design standards and allow signage to be placed closer to the taxiway edge.
26	Close Taxiway H6	Close Taxiway H6 to allow construction of Taxiway H9 which will meet taxiway width design standards and allow signage to be placed closer to taxiway edge.
27	Install Full Length Runway Centerline Lights	Install runway centerline lights on all three runways to improve visibility and reduce the likelihood of an aircraft misidentifying runways.

NOTE:
1 Refer to Exhibit 5-1.
SOURCE: HNTB, RIM Study, October 2018.

5.4.1.1 EXPANSION OF TERMINAL 4

Exhibit 5-3 depicts the expansion of Terminal 4 option. Expansion of Terminal 4 and associated concourses is constrained by existing Taxiways S (west), R (east), C (north), and D (south). Taxiways C and D are fixed by required parallel centerline separations to runways and Taxiways R and S would be challenging to relocate due to existing facility infrastructure. The only option identified for gate expansion is over the American Airlines maintenance hangar and the Southwest Airlines maintenance hangar, which is being expanded. Pier concourses at this location would be connected to Terminal 4 by a passenger connector located below Taxiway R and parallel to Sky Harbor Boulevard. Construction of the concourses would require the relocation of both airline maintenance facilities.

The footprint of the north concourse would be limited to the north by Runway 8-26 obstruction surfaces and 44th Street to the east. This concourse could accommodate up to nine narrowbody and two widebody aircraft (aircraft parked on the northern portion of the concourse would be restricted by aircraft tails heights associated with Runway 8-26 Part 77 surfaces). Aircraft parked along the west side of the concourse would push back onto Taxiway R, a portion of which is identified as an ATC non-visibility area because it is blocked from view from the ATCT by Terminal 4.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., May 2019 (concept).

NORTH

0 400 ft.

EXHIBIT 5-3

Terminal - Option 1
Expansion of Terminal 4

The footprint of the south concourse would be limited to the south by Runway 7L-25R obstruction surfaces and to the east by PHX Sky Train and 42nd Street. This concourse could accommodate up to seven narrowbody gates. Similar to the north concourse, aircraft parked along the west side would push back onto Taxiway R (a portion of which is within the ATC non-visibility area).

Use of the additional gates in the north and south concourses would increase congestion on Taxiway R, most notably during west flow when Taxiway R is used for queuing aircraft for departure on Runway 25R. The additional gates provided by the two concourses would meet PAL 3 requirements for an additional 18 gates, although modifications to the existing Terminal 4 north concourses would be required to provide the required number of widebody gates for American Airlines. Further gate expansion at Terminal 4 would not be feasible without major impacts to existing facilities.

Expansion of the Terminal 4 processor building would be needed to meet passenger demand associated with the additional gates. Expansion of the existing baggage handling area in the basement of Terminal 4 would also be required. Expansion of the Terminal 4 processor building is shown to the east to avoid impacts to the existing Terminal 4 employee parking garage to the west. The east expansion would require the removal of the helices that provide access to the parking garage located above Terminal 4. Modifications to the west parking helices would be required to allow vehicles to enter and exit from both roadway directions.

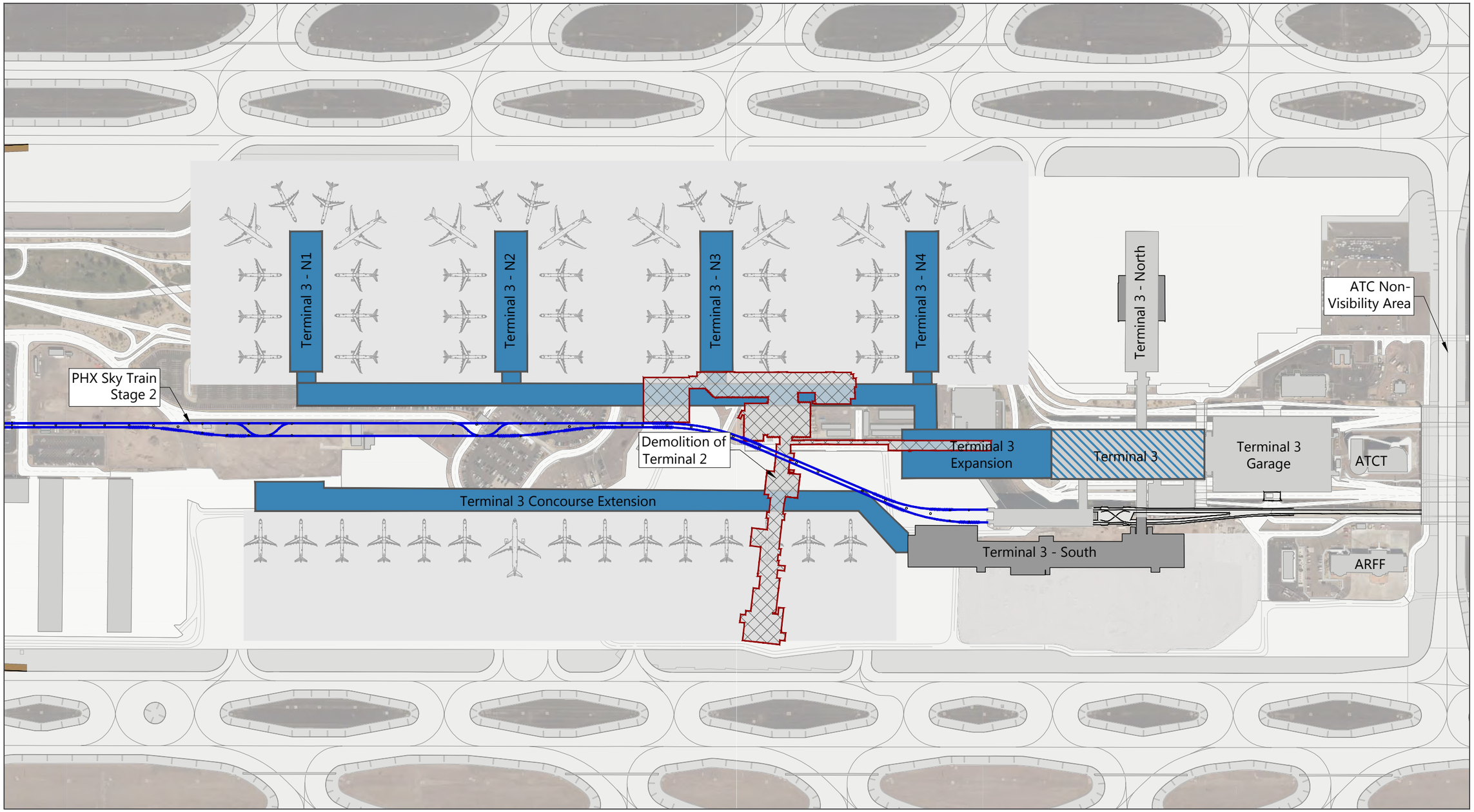
The existing roadway layout limits the ability to expand the curbs serving Terminal 4 to the east. The Terminal 4 northside departure curb lanes diverge 60 feet beyond the end of the terminal building for eastbound exit, westbound exit, parking and oversized vehicles, and recirculation to Terminal 4 and Terminal 3. The Terminal 4 northside arrivals curb lanes also diverge for eastbound or westbound Airport exit, parking, and recirculation to Terminal 4 and Terminal 3. Modifying or relocating any of these roadways east of the existing building would require the reconstruction of multiple bridge structures.

The expansion of Terminal 4 would allow American Airlines and Southwest Airlines to both remain in Terminal 4 and approximately 80 percent of passenger traffic would continue to be accommodated in the eastern portion of the terminal core.

5.4.1.2 EXPANSION OF TERMINAL 3

The Terminal 3 Modernization Program includes a reconfiguration of the terminal processor, updating the north concourse, and full reconstruction of the south concourse. With Terminal 4 remaining in its current configuration, American Airlines or Southwest Airlines would have to relocate from Terminal 4 to Terminal 3 to meet PAL 3 requirements under this option. At a minimum, the existing Terminal 3 processor would need to double in size to accommodate originating and destination passengers. **Exhibit 5-4** illustrates a conceptual expansion of Terminal 3.

Expansion of the Terminal 3 concourses are constrained by the existing taxiways on three sides (Taxiways C, T, and D). The only available area for gate expansion is to the west, requiring realignment of Sky Harbor Boulevard. The expansion includes a series of piers on the north side that would mirror the existing Terminal 3 North Concourse, and a linear extension of the south concourse. Expansion of the concourses to the west would result in long walking and baggage handling distances from the Terminal 3 processor. The westward expansion of the concourses would eventually be adjacent to the planned PHX Sky Train Stage 2 West Terminal station, diminishing future station functionality.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., May 2019 (concept).

NORTH 0 400 ft.

EXHIBIT 5-4

Terminal - Option 2
Terminal 3 and Concourse Expansion

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-03-06-Terminal and Concourse Expansion.dwgLayout: Ex 5-4 Plotted: Sep 5, 2019, 03:47PM

Expanding Terminal 3 would be challenging due to its newly reconfigured layout. As shown on **Exhibit 5-5**, ticketing and baggage claim is located on Level 1 and served by a single-level curb on the north and south sides. Level 2 contains the security screening checkpoint and inbound baggage handling. Most of Level 3 is located post security and contains commercial areas and provides secure passenger connections between the north and south concourses. A non-secure vertical core at the west end of the building connects the three levels and the PHX Sky Train station. The eight-level Terminal 3 Garage is located directly east of the terminal building.

Terminal 3 cannot be configured with a dual-level curb primarily due to bridges used for transporting baggage connections between the terminal and concourses at Level 2. To continue to accommodate ticketing and baggage claim on the same level in a contiguous layout, ticketing would need to be relocated to the west to accommodate a westward expansion of the baggage claim area. This westward expansion would also require realignment of westbound Sky Harbor Boulevard. The security screening checkpoint would need to be relocated to accommodate expansion of the inbound baggage area. The location of the terminal processor relative to the concourses would result in average walking distances that are longer than other expansion options.

There are several deficiencies associated with expanding the single-level terminal curbside at Terminal 3. The long contiguous curbs with arrivals and departures zones require a longer curbside compared to a dual-level curb. The single-level curb also results in added congestion due to vehicles bypassing the departures or arrivals zones. For example, on the south side of the building, the curb would be signed for arrivals first (closest to baggage claim) and departures second (closest to ticket counters). This would require vehicles dropping passengers off at the departures curb to traverse through the lanes adjacent to the arrivals curb, adding congestion. Also, additional vehicle weaving movements would result, further increasing the required curb length.

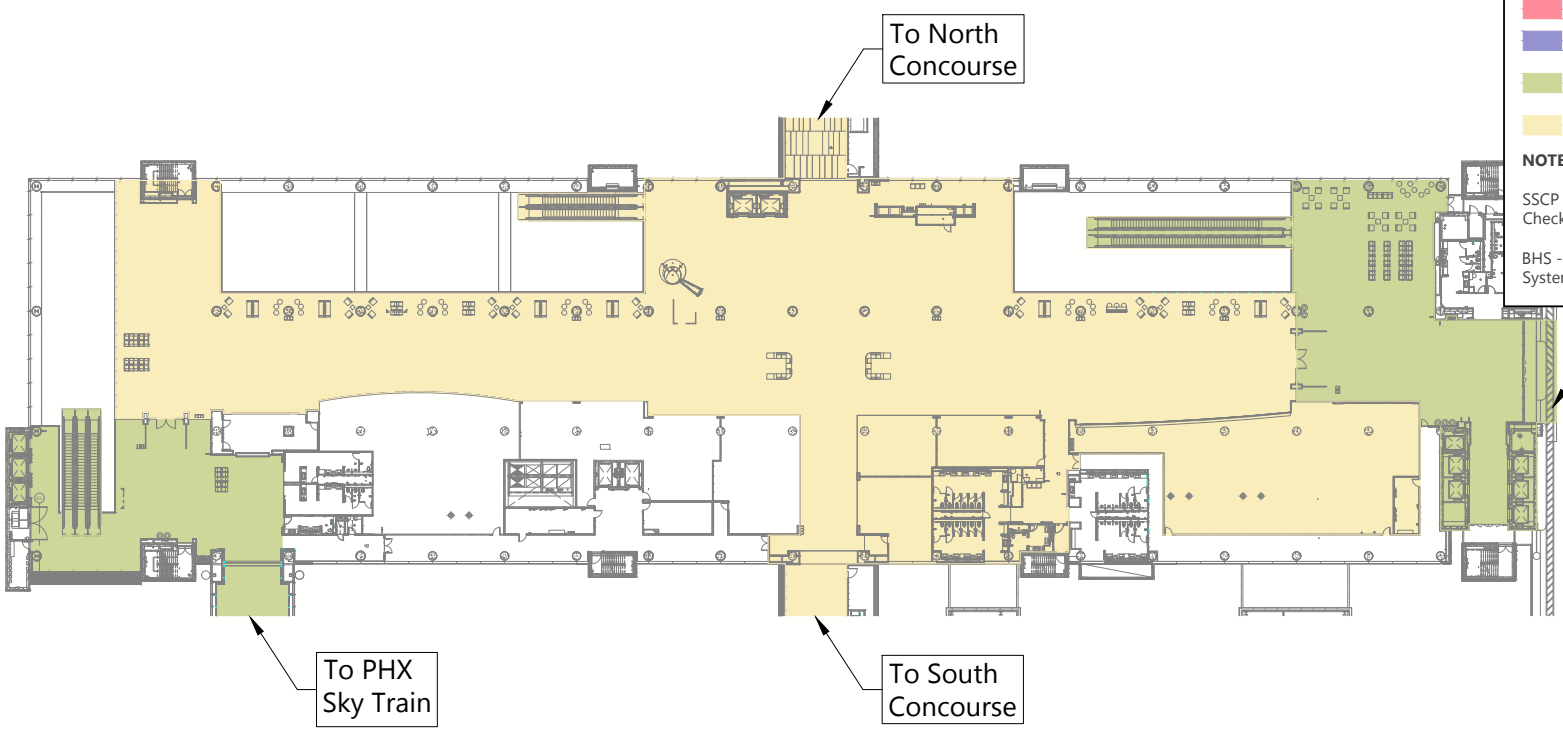
5.4.1.3 CONSTRUCTION OF A NEW WEST TERMINAL

A West Terminal has been considered at the Airport since the early 2000s. As illustrated on **Exhibit 5-6**, this facility would be located adjacent to the planned PHX Sky Harbor Stage 2 West Terminal station and east of planned crossfield Taxiways V and U. It is assumed that Terminal 2 would be demolished prior to construction of the West Terminal or its concourses.

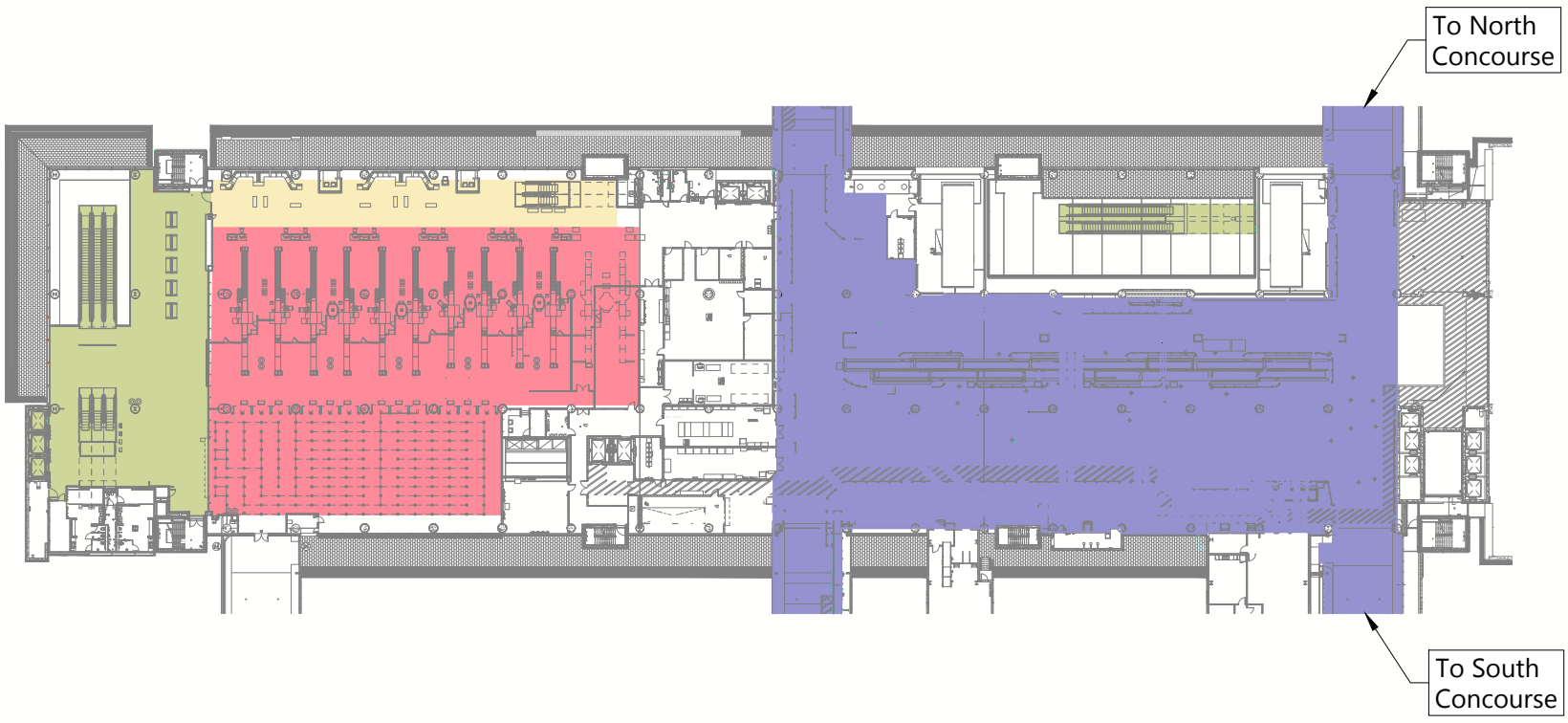
The terminal could support concourses on the north and south sides. These concourses could be connected to the Terminal 3 north and south concourses with a secure passenger walkway. Although the West Terminal concept in Exhibit 5-6 shows pier concourses, it could also be configured with east-west oriented linear concourses or a combination of linear and pier concourses.

A West Terminal could be sized to accommodate varying levels of activity depending on which airlines are relocated to this facility. The site of the West Terminal would allow the facility to be expanded incrementally and would provide expansion capability beyond the planning horizon. Sky Harbor Boulevard would be realigned around the West Terminal, similar to Terminal 3 and Terminal 4.

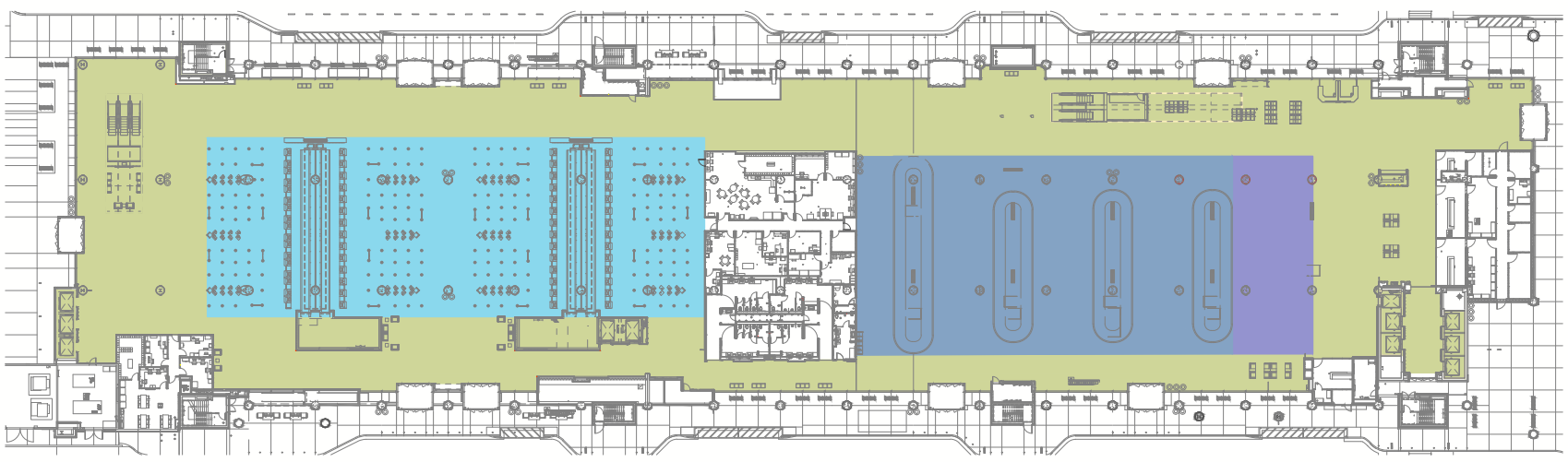
Level 3 - Secured Passenger Level



Level 2 - Security Screening Checkpoint and Baggage Handling System



Level 1 - Ticketing and Baggage Claim

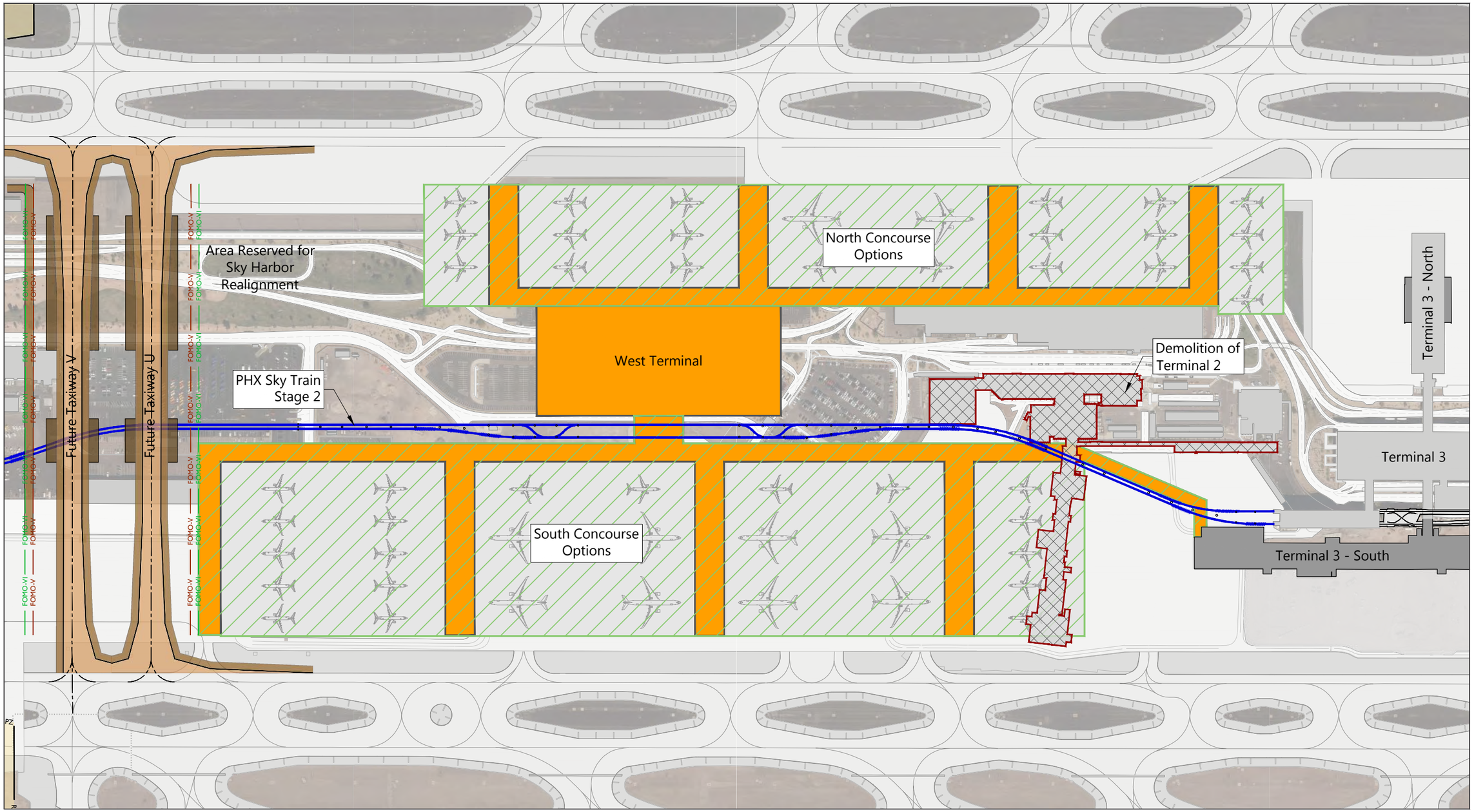


SOURCE: Phoenix Sky Harbor International Airport, February 2019 (Floorplans).

EXHIBIT 5-5

NORTH 0 80 ft.

Existing Terminal 3 Floorplan



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., May 2019 (concept).

NORTH 0 400 ft.

EXHIBIT 5-6

Terminal - Option 3
West Terminal

The location of the West Terminal would distribute passenger and vehicle demand throughout the terminal core. It would also better distribute aircraft movements throughout the airfield and crossfield Taxiways V and U would facilitate the movement of aircraft between the north and south concourses and airfields.

The south concourse area would require relocation of the West Air Cargo facility. The north concourse area would require the demolition of the Terminal 2 parking garage, police station, and former TRACON facility and removal of the Center Hold Bay.

5.4.1.4 TERMINAL EVALUATION

The three terminal options were evaluated using the criteria outlined in Section 5.2 and presented in **Table 5-3**. The evaluation identified a West Terminal as the preferred terminal expansion option. The Terminal 4 expansion was eliminated largely due to the major changes that would be required to the terminal building and roadways, as well as the relocation of both airline maintenance facilities. Another deficiency with the Terminal 4 Expansion option is the inability to expand the number of gates beyond the two new piers. The expansion of Terminal 3 option was eliminated due to long passenger walk distances and the need to reconstruct the newly renovated terminal building.

TABLE 5-3 TERMINAL EVALUATION MATRIX

CATEGORY	CRITERIA	TERMINAL OPTION 1 EXPAND TERMINAL 4	TERMINAL OPTION 2 EXPAND TERMINAL 3	TERMINAL OPTION 3 WEST TERMINAL
Economic Viability	Development Costs	DEFICIENT	CHALLENGING	ACHIEVES
	Financial Feasibility	DEFICIENT	DEFICIENT	CHALLENGING
	Maintenance, Operation, and Deconstruction Costs	ADEQUATE	ADEQUATE	CHALLENGING
	Utilization of Existing Infrastructure	ACHIEVES	ACHIEVES	ADEQUATE
	Expansion Capability Beyond Planning Horizon	DEFICIENT	ADEQUATE	EXCEEDS
	Revenue Impacts	CHALLENGING	CHALLENGING	ADEQUATE
Operational Efficiency	Safety	CHALLENGING	CHALLENGING	EXCEEDS
	Compatibility	CHALLENGING	ADEQUATE	ACHIEVES
	Operational Impacts During Construction	DEFICIENT	DEFICIENT	ACHIEVES
	On-Airport Land Use	DEFICIENT	ACHIEVES	EXCEEDS
	Phasing Complexity/Scalability	DEFICIENT	CHALLENGING	ADEQUATE
	Flexibility	DEFICIENT	ADEQUATE	ACHIEVES
Natural Resource Conservation	Energy, Air Quality, and Greenhouse Gases	CHALLENGING	ADEQUATE	ADEQUATE
	Historic and Cultural Resources	N/A	N/A	N/A
	Environmental Consequence	CHALLENGING	ADEQUATE	ACHIEVES
Social Responsibility	Economic Impact to Business Partners and the Community	CHALLENGING	ACHIEVES	ACHIEVES
	Airport/Community Experience	DEFICIENT	CHALLENGING	EXCEEDS
	Level of Service	DEFICIENT	CHALLENGING	EXCEEDS
	Off-Airport Land Use Compatibility	N/A	N/A	N/A
				Top Option

SOURCE: Ricondo & Associates, Inc., November 2018.

The West Terminal could utilize the planned PHX Sky Train West Terminal station and could be constructed with minimal impacts to the airfield and existing terminal operations while providing the flexibility to expand beyond PAL 3. The West Terminal option also distributes airfield operations through the airfield and passenger demand through the terminal core.

5.4.2 CONCOURSES

Once the West Terminal option was selected, several concourse options with varying widebody and narrowbody gate capability were developed to meet PAL 3 requirements and beyond. Each set of north and south concourse options contains one linear concourse option and multiple pier options. The number of gates provided in the pier options is driven by the length available for the concourses and the apron depth required for widebody aircraft. In developing the options, all widebody gates were configured as MARS gates, allowing two narrowbody aircraft or one widebody aircraft to be accommodated at the gate. **Exhibit 5-7** illustrates the preferred concourse, apron, and taxilane dimension assumptions.

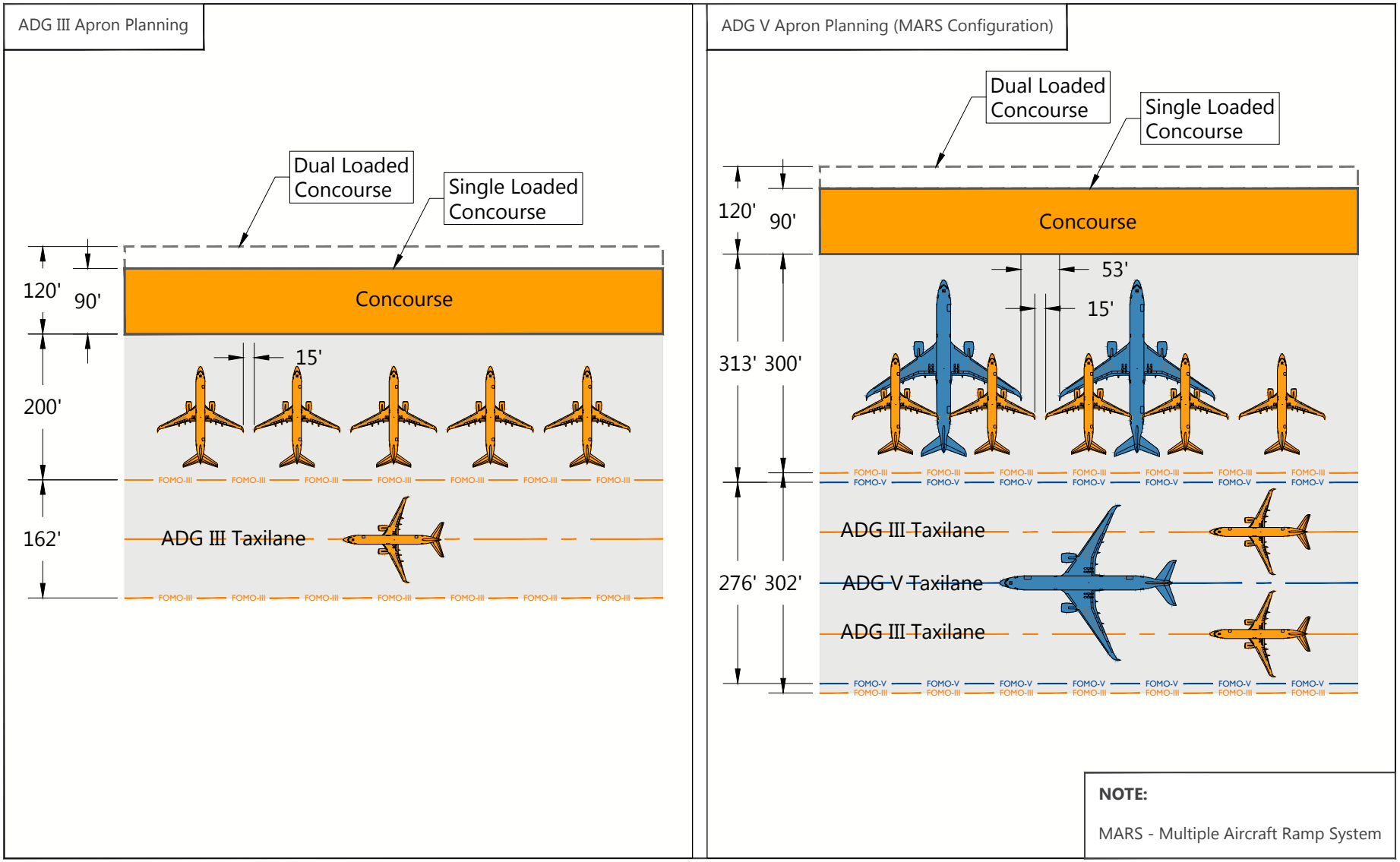
It was also assumed that all aircraft must be pushed back onto a taxilane and not into an ATC movement area (such as an active taxiway). ATC movement areas are under the control of the air traffic controllers and provide for the efficient movement of aircraft on the airfield. When an aircraft is pushed back onto an active taxiway, all other aircraft on the taxiway must be held to wait for the engines of the pushed back aircraft to be started and for the aircraft to be ready to taxi. The taxiway and taxilane separations and Fixed or Movable Object (FOMO) boundaries follow FAA standards for ADG V (widebody) and ADG III (narrowbody) aircraft. Taxilanes between piers or along linear concourses would be configured to accommodate up to two ADG III aircraft or a single ADG V aircraft. Although no ADG VI aircraft parking positions were identified in these concourse options, Taxiway C and Taxiway D were assumed to accommodate up to ADG VI aircraft.

5.4.2.1 NORTH CONCOURSE OPTIONS

Three concourse options were developed for the area north of the West Terminal processor. All north concourse options preserve an area east of the crossfield taxiway bridges for realignment of Sky Harbor Boulevard. A secure connection to the Terminal 3 North Concourse is provided in each option to allow airlines based in the West Terminal or Terminal 3 to use these gates.

Option 1 – North Linear Concourse

Exhibit 5-8 shows a north linear concourse parallel to Taxiway C configured with a parallel ADG V taxilane for aircraft pushback and movement. This option provides the greatest number of widebody gates of the north concourse options. To preserve a larger envelop for the West Terminal and roadways between the concourse and PHX Sky Train, an apron depth of 275 feet for widebody was incorporated, less than the 300-foot preferred apron depth. This option can accommodate up to 26 narrowbody aircraft or 13 widebody aircraft.



SOURCE: Ricondo & Associates, Inc., May 2019 (concept).

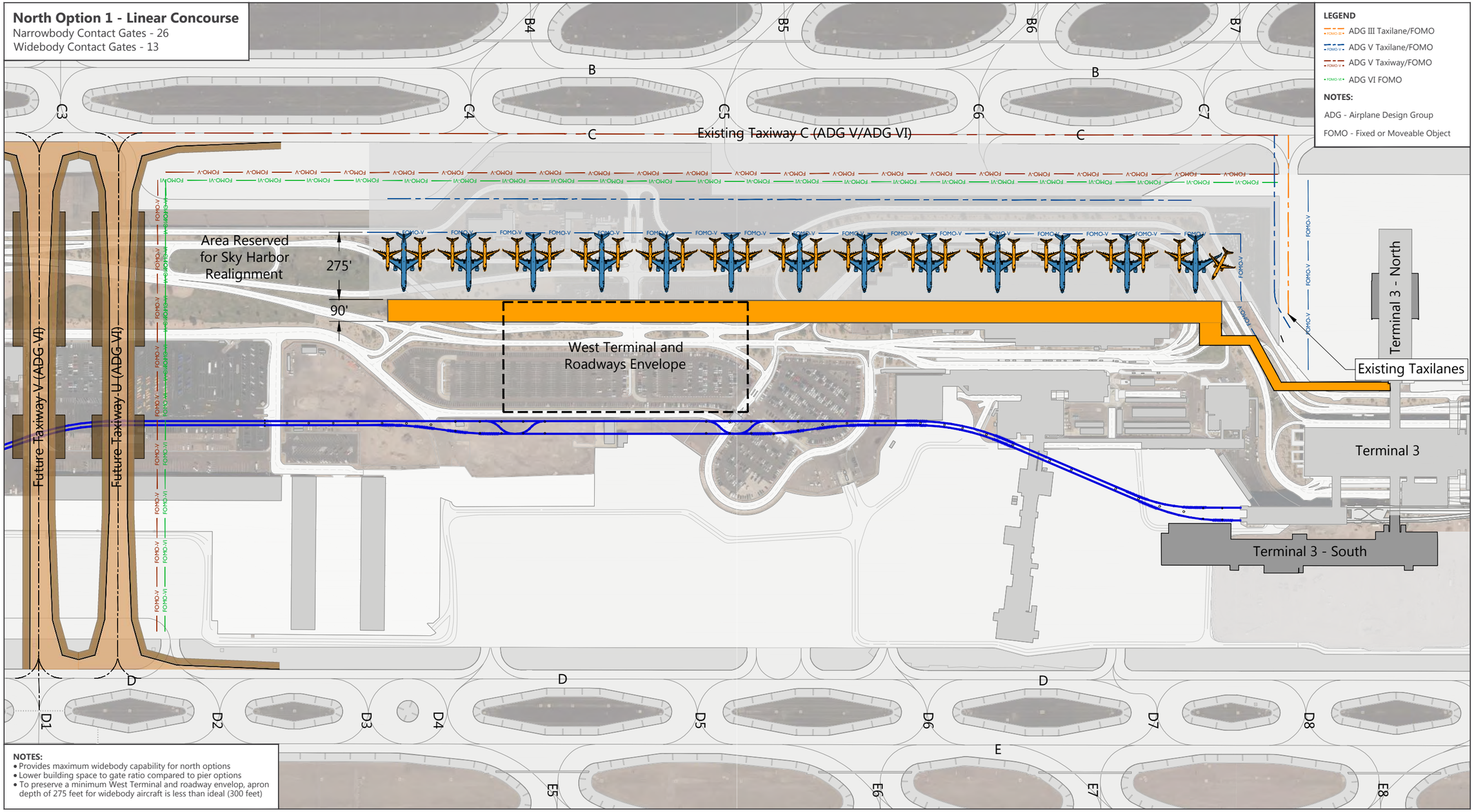
NORTH 0 200'

EXHIBIT 5-7

Single Loaded and Dual Loaded Concourse

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-07-16-West Concourse Options.dwgLayout: Ex-5-7 Plotted: Sep 5, 2019, 10:12AM

North Option 1 - Linear Concourse
Narrowbody Contact Gates - 26
Widebody Contact Gates - 13



LEGEND
- ADG III Taxilane/FOMO
- ADG V Taxilane/FOMO
- ADG V Taxiway/FOMO
- ADG VI FOMO

NOTES:
ADG - Airplane Design Group
FOMO - Fixed or Moveable Object

NOTES:
- Provides maximum widebody capability for north options
- Lower building space to gate ratio compared to pier options
- To preserve a minimum West Terminal and roadway envelop, apron depth of 275 feet for widebody aircraft is less than ideal (300 feet)

SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

NORTH 0 400 ft.

EXHIBIT 5-8

West Terminal North Concourse Options
Option 1 - North Linear Concourse

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-07-16-West Concourse Options.dwgLayout: Ex 5-8 Plotted: Sep 5, 2019, 04:10PM

Option 2 – North Pier Concourse (widebody capability)

Exhibit 5-9 illustrates Option 2 that is configured with four piers and accommodates four widebody positions on piers WN1, WN2, and WN3. (The piers have been labeled for ease of discussion.) The narrowbody gates on the west side of pier WN1 would be configured with a single ADG III taxilane. Aircraft parked on the east side of pier WN4 would share taxilanes with the Terminal 3 North Concourse. This option can accommodate up to 25 narrowbody aircraft, or 4 widebody and 17 narrowbody aircraft.

Option 3 – North Pier Concourse (narrowbody only)

Option 3 shows a north concourse pier option configured with only narrowbody gates, as illustrated in **Exhibit 5-10**. A reduction in apron area from only accommodating narrowbody aircraft results in the ability to accommodate up to 28 narrowbody aircraft on five north piers. Aircraft would only be positioned on the east side of pier WN1.

5.4.2.2 SOUTH CONCOURSE OPTIONS

Four concourse options were developed for the area south of the West Terminal processor with each having a secure connection to the Terminal 3 south concourse. This provides the ability for airlines based in the West Terminal or Terminal 3 to use these gates. Gates F13, F14, and F15 (used for apron loading small aircraft) would be closed due to the concourse connector. Existing Terminal 3 south concourse Gates F12 and F11 were also impacted in some of the options, as discussed below.

Option 1 – South Linear Concourse

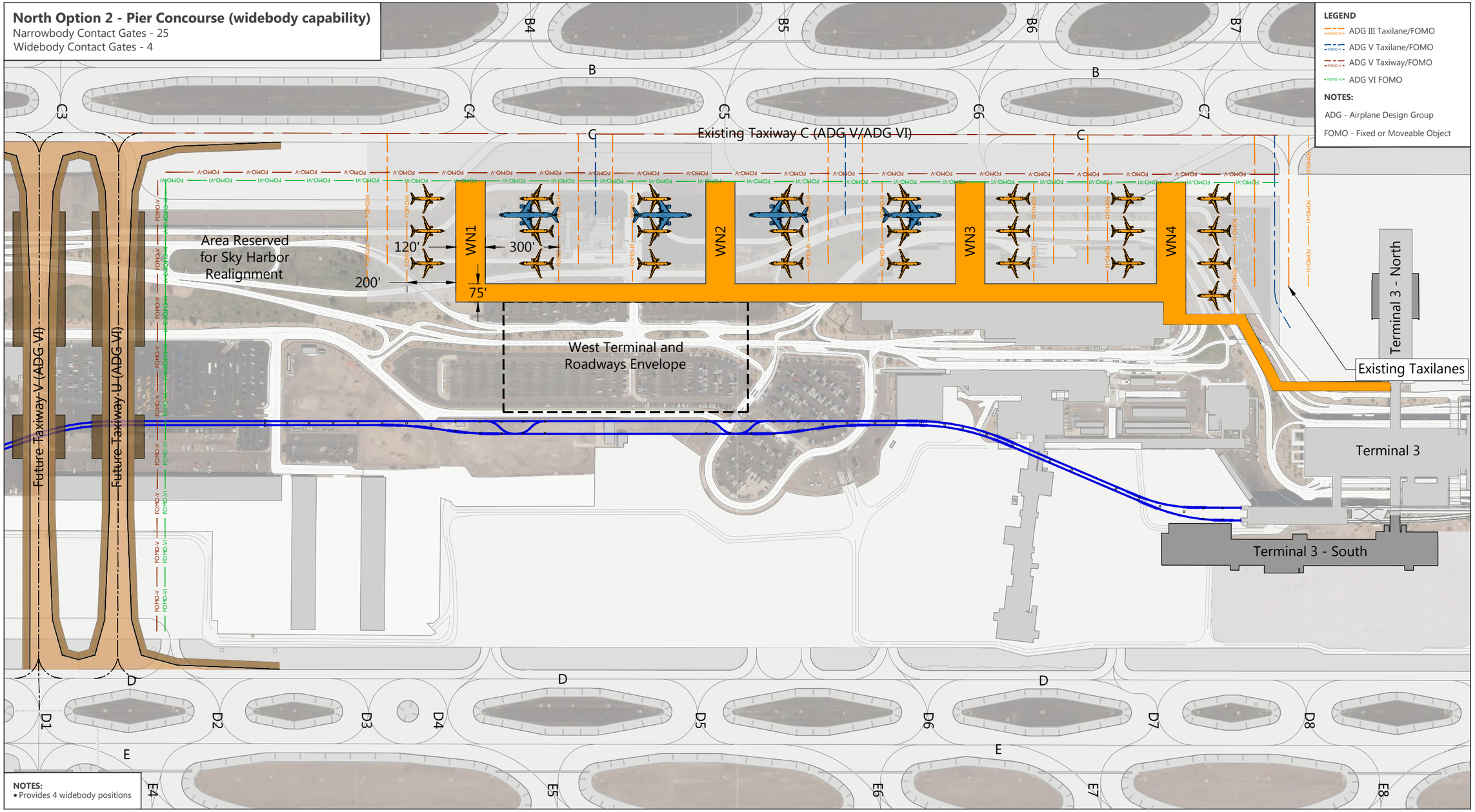
Exhibit 5-11 shows a linear concourse parallel to Taxiway D and extending from the Terminal 3 south concourse. Unlike the existing Terminal 3 south concourse, the eastern portion of the concourse would be served by a single parallel ADG V taxilane (or dual ADG III taxilanes) and would allow for up to nine widebody gates. To maximize the number of narrowbody gates, the western portion would be configured with gates on the north and south sides providing 13 narrowbody gates. The existing Terminal 3 south concourse Gates F11 and F12 would be closed. This option can accommodate up to 33 narrowbody aircraft, or 15 narrowbody and 9 widebody aircraft.

The option would align westbound Sky Harbor Boulevard south of the PHX Sky Train alignment, which provides a larger West Terminal development envelope and incorporates the PHX Sky Train West Terminal station into the terminal facility, instead of a passenger walkway crossing over the roadway curb (as configured in Terminal 3 and Terminal 4).

Option 2 – South Pier Concourse (widebody capability)

Exhibit 5-12 illustrates the south concourse with four piers concourses with 14 total widebody gates. Using the ADG VI taxiway FOMO for the future crossfield Taxiway U as the western boundary, the single-loaded pier (WS1) and three dual-loaded piers (WS2, WS3, and WS4) would accommodate up to ADG V aircraft with a 300-foot apron. The apron depth on the west end of the Terminal 3 south concourse would be increased from 266 feet to 300 feet, providing greater capability to accommodate widebody aircraft. This option can accommodate 35 narrowbody aircraft or 14 widebody and 7 narrowbody aircraft. Gates F11 and F12 on the Terminal 3 south concourse would be unaffected. This option and all pier options require westbound Sky Harbor Boulevard to be placed north of the PHX Sky Train alignment.

North Option 2 - Pier Concourse (widebody capability)
Narrowbody Contact Gates - 25
Widebody Contact Gates - 4



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

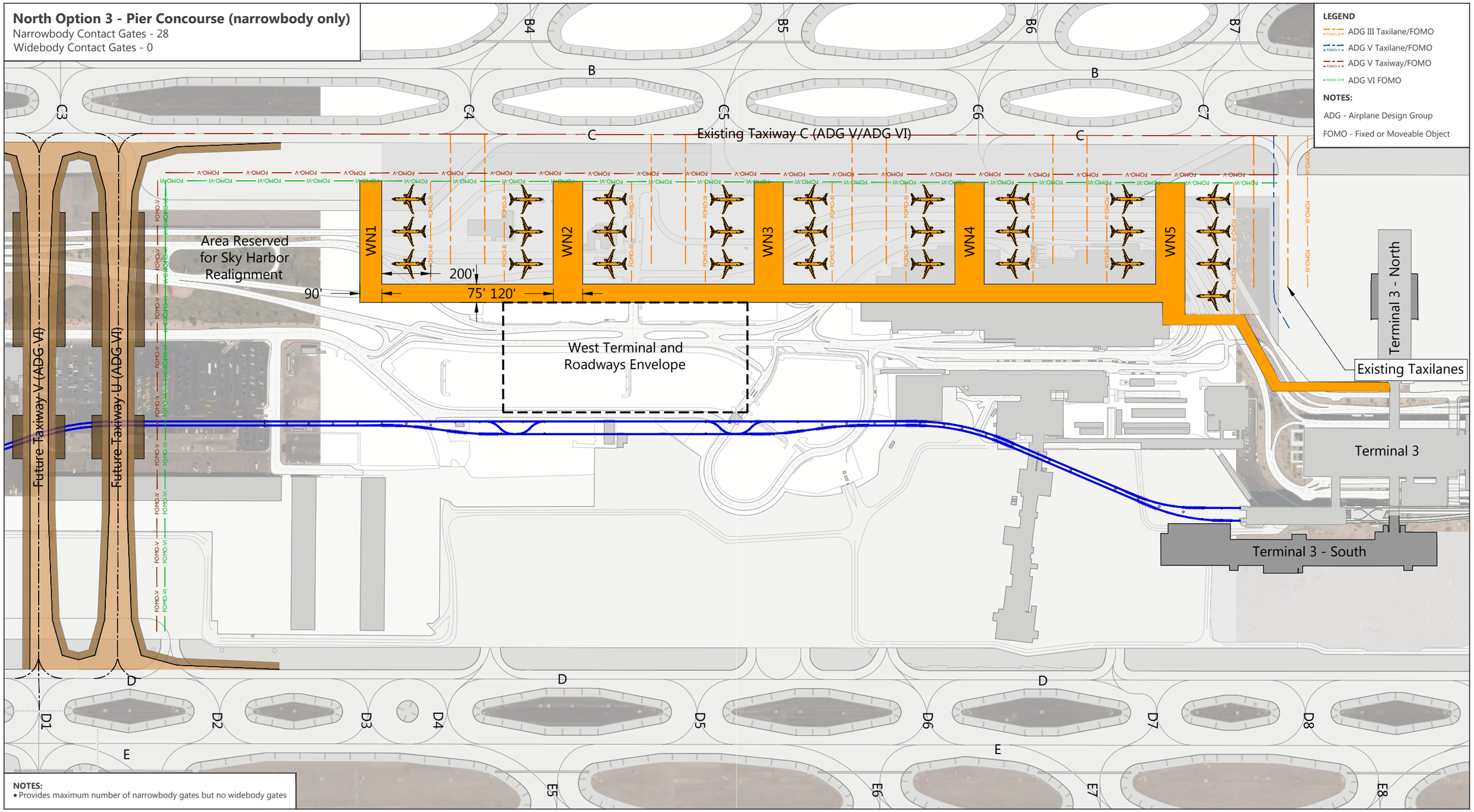
NORTH 0 400 ft.

EXHIBIT 5-9

West Terminal North Concourse Options
Option 2 - North Pier Concourse (Widebody)

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-07-16-West Concourse Options.dwgLayout: Ex 5-9 Plotted: Sep 5, 2019, 04:13PM

North Option 3 - Pier Concourse (narrowbody only)
Narrowbody Contact Gates - 28
Widebody Contact Gates - 0



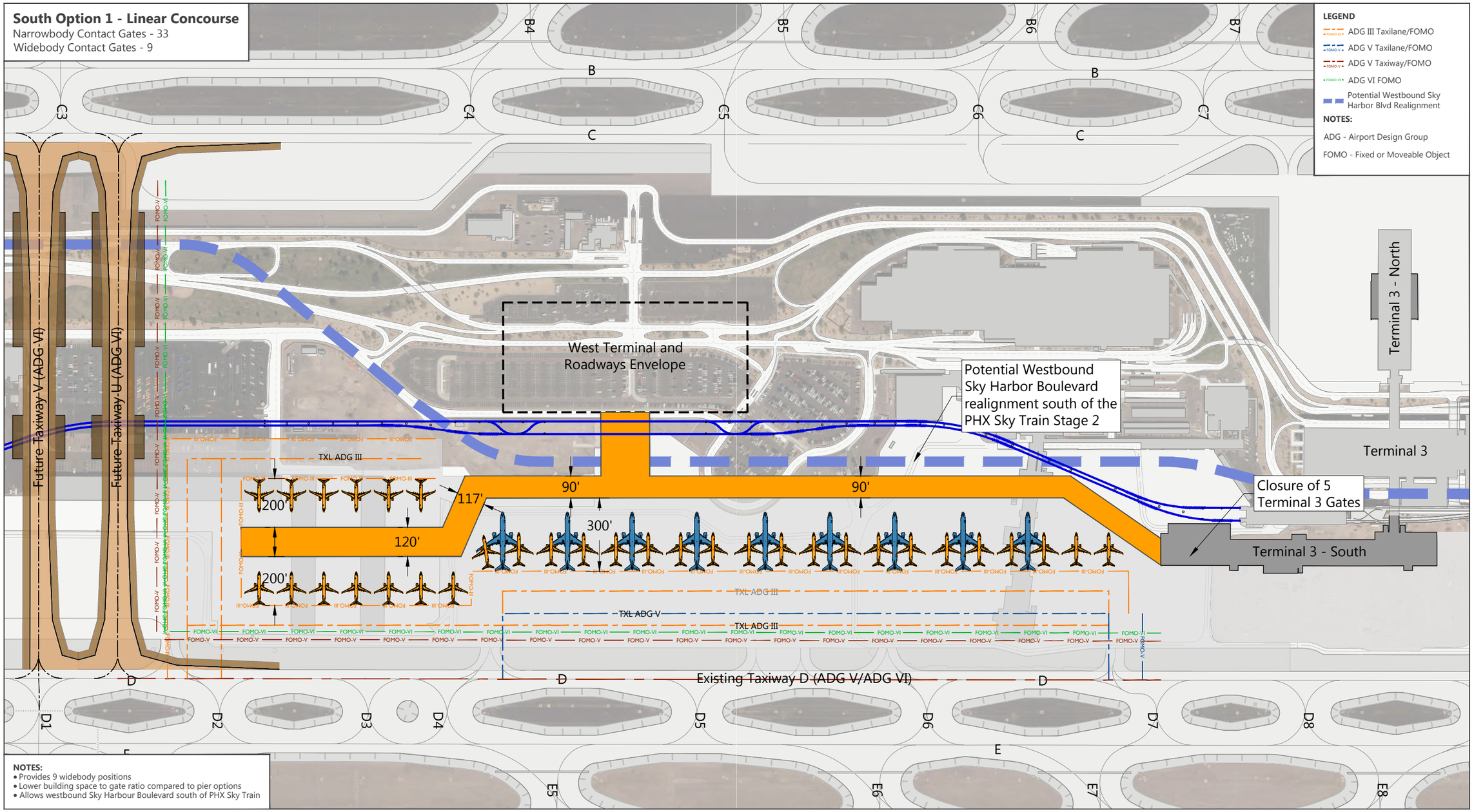
SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

EXHIBIT 5-10

West Terminal North Concourse Options
Option 3 - North Pier Concourse (Narrowbody)

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-07-16-West Concourse Options.dwgLayout: Ex 5-10 Plotted: Sep 5, 2019, 04:14PM

South Option 1 - Linear Concourse
Narrowbody Contact Gates - 33
Widebody Contact Gates - 9



LEGEND
- ADG III Taxilane/FOMO
- ADG V Taxilane/FOMO
- ADG V Taxiway/FOMO
- ADG VI FOMO
- Potential Westbound Sky Harbor Blvd Realignment

NOTES:
ADG - Airport Design Group
FOMO - Fixed or Moveable Object

NOTES:
- Provides 9 widebody positions
- Lower building space to gate ratio compared to pier options
- Allows westbound Sky Harbour Boulevard south of PHX Sky Train

SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

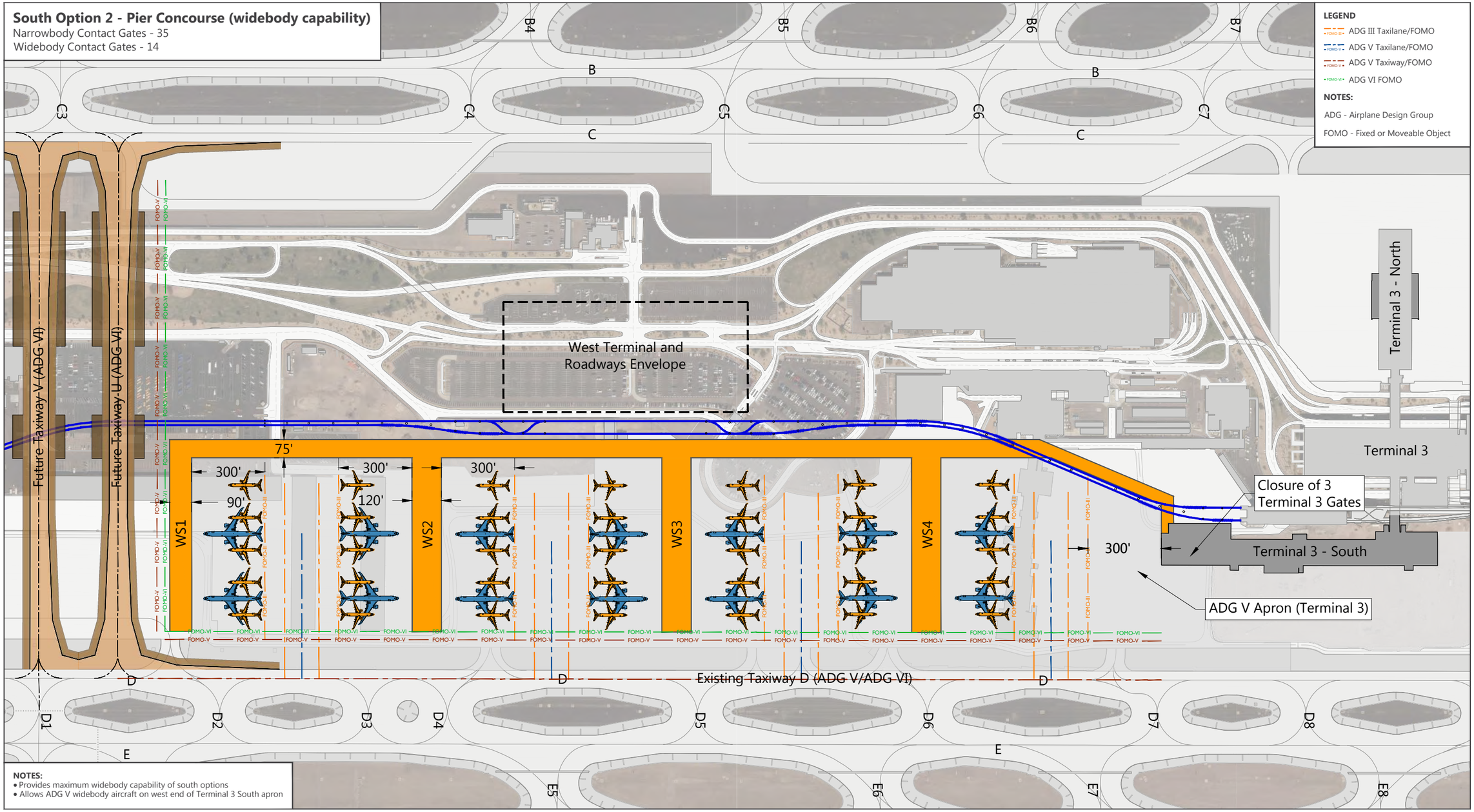
NORTH 0 400 ft.

EXHIBIT 5-11

West Terminal South Concourse Options
Option 1 - South Linear Concourse

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-07-16-West Concourse Options.dwgLayout: Ex 5-11 Plotted: Sep 5, 2019, 04:16PM

South Option 2 - Pier Concourse (widebody capability)
Narrowbody Contact Gates - 35
Widebody Contact Gates - 14



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

NORTH 0 400 ft.

EXHIBIT 5-12

West Terminal South Concourse Options
Option 2 - South Pier Concourse (Widebody)

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-07-16-West Concourse Options.dwgLayout: Ex 5-12 Plotted: Sep 6, 2019, 10:33AM

Option 3 – South Pier Concourse (reduced widebody capability)

As shown on **Exhibit 5-13**, Option 3 reduces the number of widebody capable gates (two gates each on piers WS2 and WS3) and would provide the ability to accommodate narrowbody aircraft on the west side of pier WS1. Gates F12 and F11 on Terminal 3 would be unaffected and would maintain their existing 266-foot apron depth. This option can accommodate 41 narrowbody aircraft or 4 widebody and 33 narrowbody aircraft.

Option 4 – South Pier Concourse (narrowbody only)

Option 4 would configure the south concourse piers as all narrowbody and would provide up to 45 narrowbody gates on five south piers, as illustrated on **Exhibit 5-14**. The total width of this option would reduce the apron depth for Gates F11 and F12 in the Terminal 3 South Concourse to 196 feet, reducing capability to ADG III aircraft.

5.4.2.3 CONCOURSE EVALUATION

The alignment of the PHX Sky Train and the placement West Terminal station relative to the airfield is a constraint to the area available for concourse and terminal development. **Exhibit 5-15** shows four combinations of linear and pier concourse options which result in varying development envelopes available for the West Terminal, associated curbsides, and Sky Harbor Boulevard through lanes.

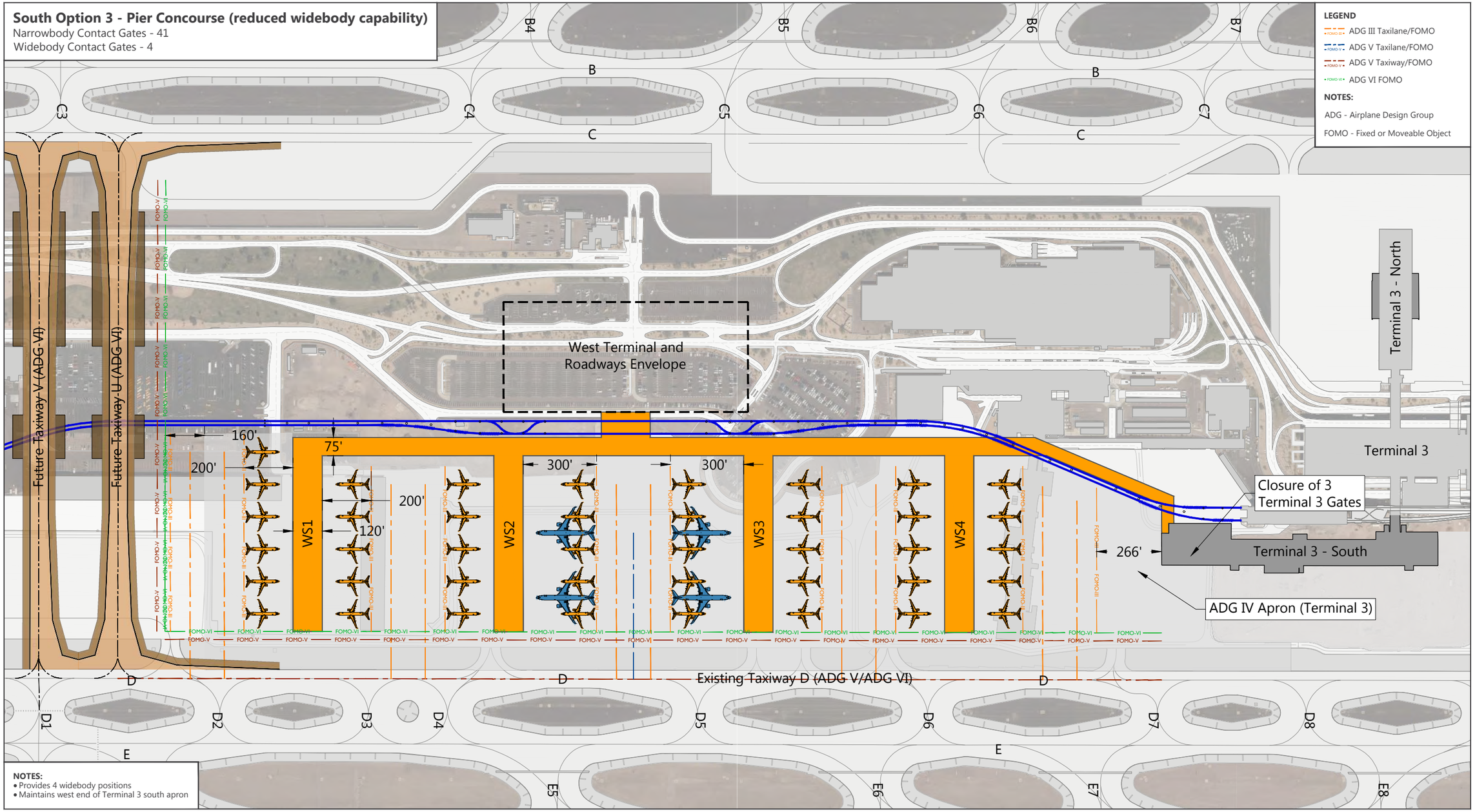
To accommodate a dual-sided terminal and associated roadways (like Terminal 3 and Terminal 4), a development envelope width of 450 feet is preferred and similar to the combined width of Terminal 4 and adjacent roadways. A development envelope width less than 450 feet would require the terminal building to be single-sided, meaning that the terminal curb could only be on the south or north side of the processor building. A development envelope wider than 450 feet may result in a building that is oversized or does not extend the full length of the terminal curbside.

To maximize the number of gates available in the south concourse area, south pier options would utilize the entire area south of the PHX Sky Train alignment. South linear options area able to accommodate a similar number of gates and would allow the placement of roadways in the gap between the PHX Sky Train station and the concourse.

The area north of the PHX Sky Train station needs to be shared between the terminal building and north concourse. Due to the depth required for a north linear concourse accommodating widebody aircraft, the terminal development envelope would be reduced when configured with a south pier concourse, which would limit the terminal to be single sided. A north pier concourse and south linear concourse would provide the greatest terminal development envelope width but with slightly reduced aircraft gate capability.

The three north concourse options and four south concourse options were evaluated in collaboration with PHX AVN using the criteria outlined in Section 5.1. The decision matrix presented in **Table 5-4** summarizes the evaluation of each concourse option. The inefficiencies of the single-loaded linear pier eliminated Options 1 for both the north and south concourses.

South Option 3 - Pier Concourse (reduced widebody capability)
Narrowbody Contact Gates - 41
Widebody Contact Gates - 4



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

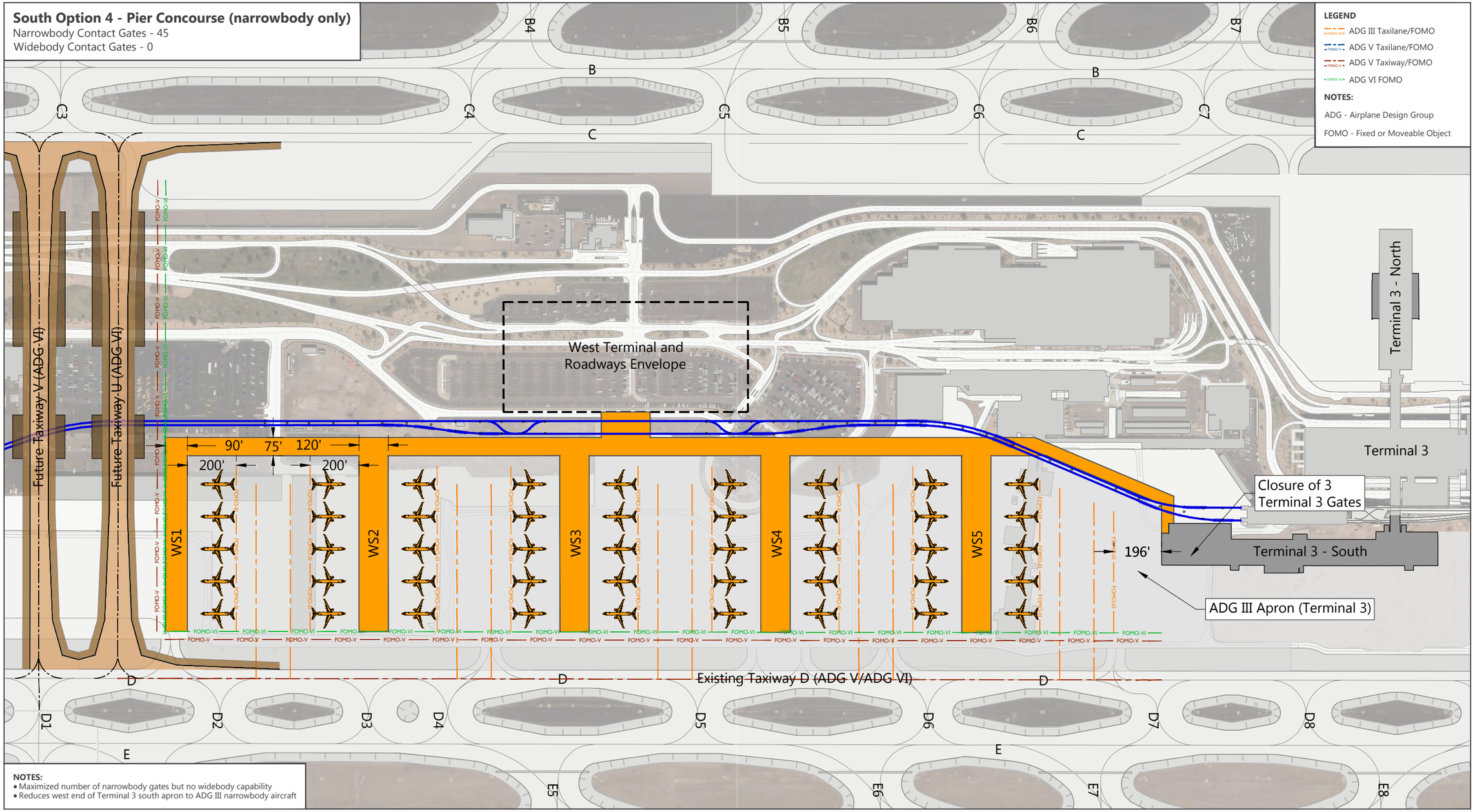
NORTH 0 400 ft.

EXHIBIT 5-13

West Terminal South Concourse Options
Option 3 - South Pier Concourse (Widebody and Narrowbody)

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-07-16-West Concourse Options.dwgLayout: Ex 5-13 Plotted: Sep 5, 2019, 04:31PM

South Option 4 - Pier Concourse (narrowbody only)
Narrowbody Contact Gates - 45
Widebody Contact Gates - 0

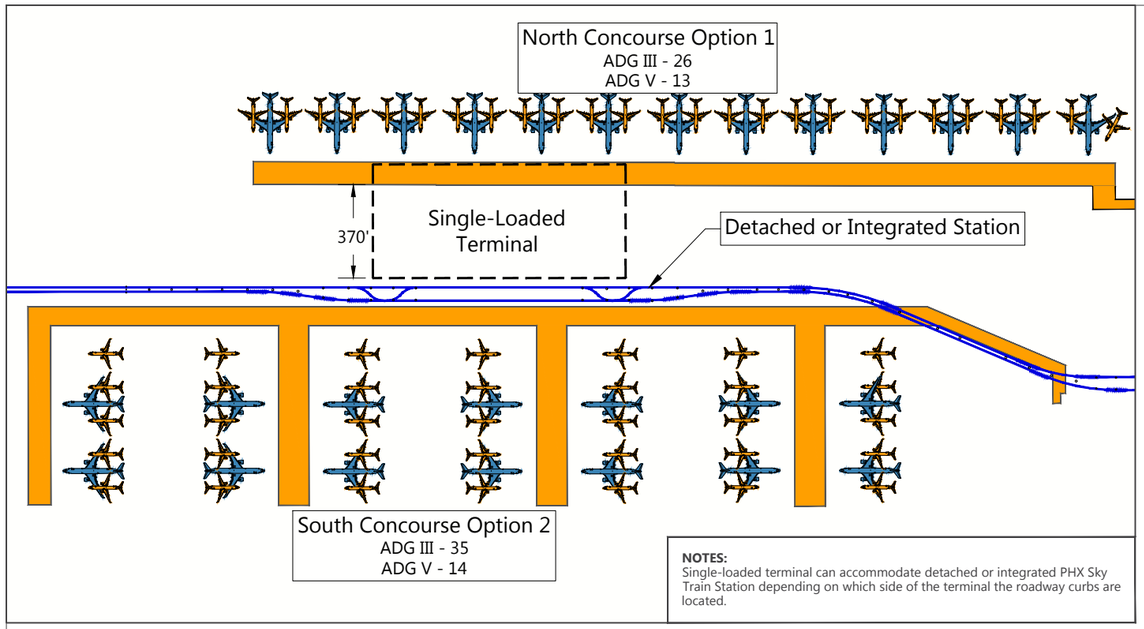


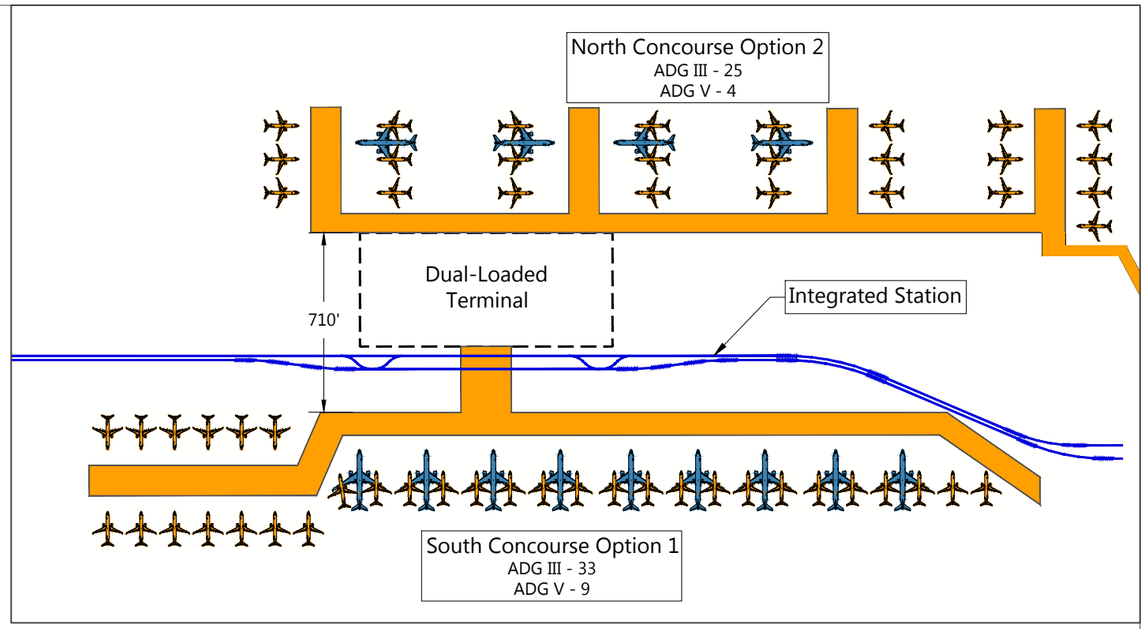
SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

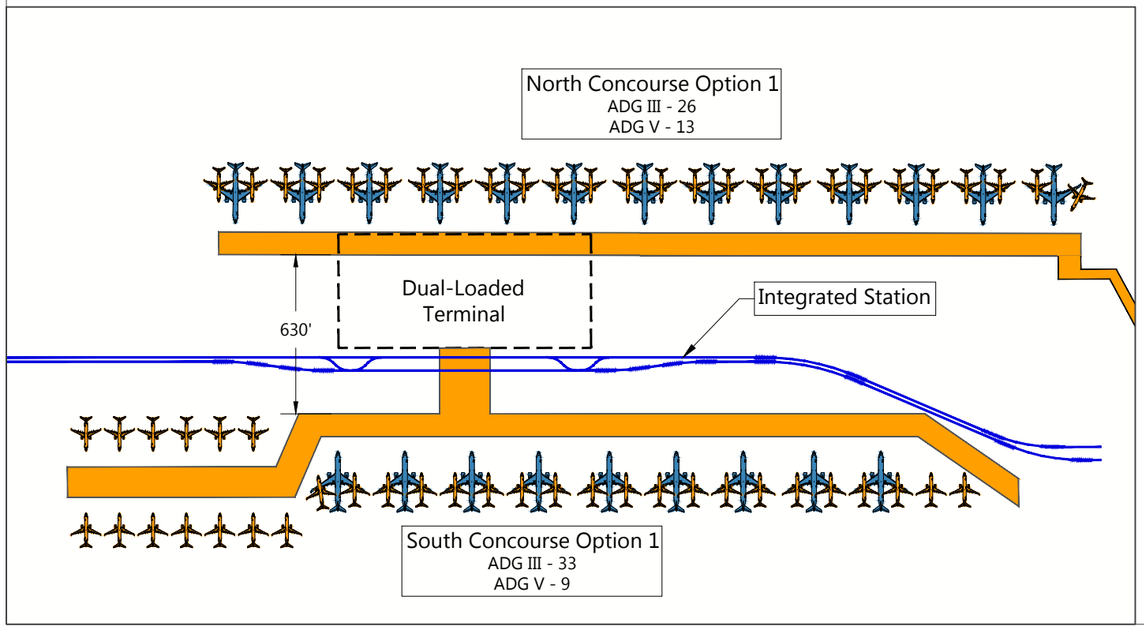
NORTH 0 400 ft.

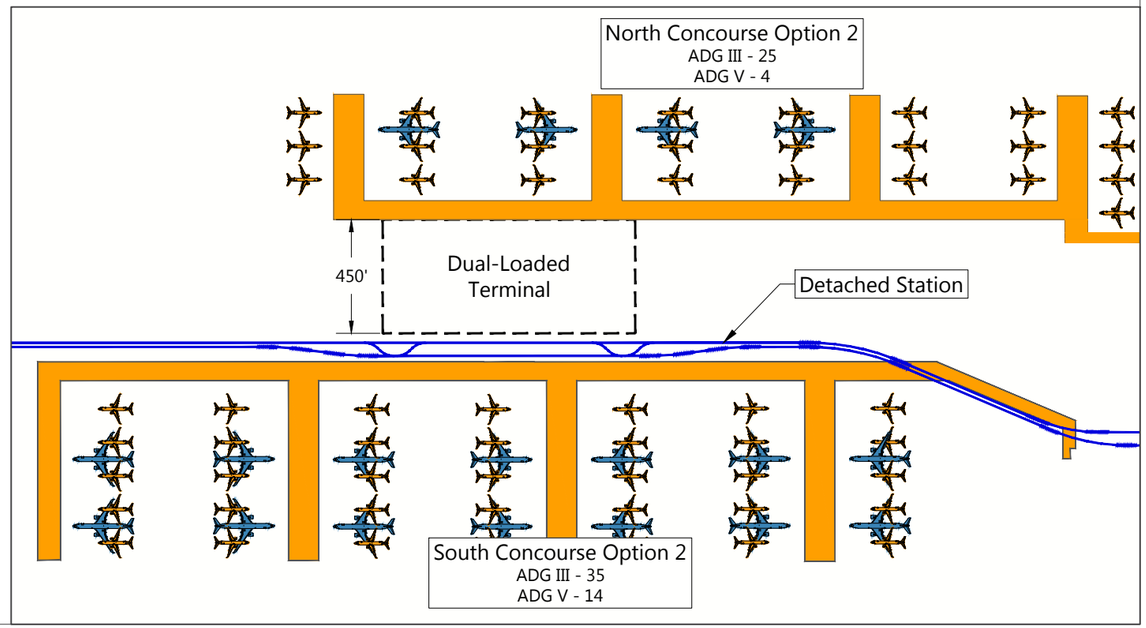
EXHIBIT 5-14

West Terminal South Concourse Options
Option 4 - South Pier Concourse (Narrowbody)









SOURCE: Ricondo & Associates, Inc., May 2019 (concept).

NORTH 0 600 ft.

EXHIBIT 5-15

West Terminal Development Envelope Options

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-07-16-West Concourse Options.dwgLayout: Ex 5-15 Plotted: Sep 5, 2019, 10:41AM

TABLE 5-4 CONCOURSE EVALUATION MATRIX

CATEGORY	CRITERIA	NORTH CONCOURSE			SOUTH CONCOURSE			
		OPTION 1 LINEAR CONCOURSE GATES NB-26/WB-13	OPTION 2 PIERS GATES NB-25/WB-4	OPTION3 PIERS GATES NB-28/WB-0	OPTION 1 LINEAR CONCOURSE GATES NB-33/WB-9	OPTION 2 PIERS GATES NB-35/WB-14	OPTION3 PIERS GATES NB-40/WB-4	OPTION 4 PIERS GATES NB-45/WB-0
Economic Viability	Development Costs	CHALLENGING	ADEQUATE	ADEQUATE	CHALLENGING	ADEQUATE	ADEQUATE	ADEQUATE
	Financial Feasibility	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
	Maintenance, Operation, and Deconstruction Costs	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
	Utilization of Existing Infrastructure	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
	Expansion Capability Beyond Planning Horizon	CHALLENGING	CHALLENGING	CHALLENGING	ADEQUATE	EXCEEDS	ADEQUATE	CHALLENGING
	Revenue Impacts	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS
Operational Efficiency	Safety	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
	Compatibility	ACHIEVES	EXCEEDS	EXCEEDS	ACHIEVES	EXCEEDS	EXCEEDS	EXCEEDS
	Operational Impacts During Construction	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
	On-Airport Land Use	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS
	Phasing Complexity/Scalability	EXCEEDS	ACHIEVES	ACHIEVES	EXCEEDS	ACHIEVES	ACHIEVES	ACHIEVES
	Flexibility	EXCEEDS	ACHIEVES	CHALLENGING	ACHIEVES	EXCEEDS	ACHIEVES	CHALLENGING
Natural Resource Conservation	Energy, Air Quality, and Greenhouse Gases	CHALLENGING	CHALLENGING	CHALLENGING	CHALLENGING	CHALLENGING	CHALLENGING	CHALLENGING
	Historic and Cultural Resources	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Environmental Consequence	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
Social Responsibility	Economic Impact to Business Partners and the Community	ACHIEVES	ACHIEVES	ACHIEVES	ACHIEVES	ACHIEVES	ACHIEVES	ACHIEVES
	Airport/Community Experience	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS
	Level of Service	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS
	Off-Airport Land Use Compatibility	N/A	N/A	N/A	N/A	N/A	N/A	N/A
			Top Option			**Top Option**		

SOURCE: Ricondo & Associates, Inc., November 2018.

North Concourse Option 2 and South Option 2 were evaluated as the preferred options as they provide gate capacity beyond the PAL 3 planning horizon and provide flexibility by accommodating both widebody and narrowbody aircraft. This combination of concourse options would be configured with a dual-sided terminal with two curbs that allow more direct access to the terminal without recirculation and better distributed traffic while being consistent with Terminal 3 and Terminal 4. **Exhibit 5-16** shows the preferred terminal and concourse concept. Following the Terminal 4 concourse nomenclature, north pier concourses were named WN1 through WN4 and south pier concourses were named WS1 through WS4.

5.5 AIRPORT EXPANSION AREAS

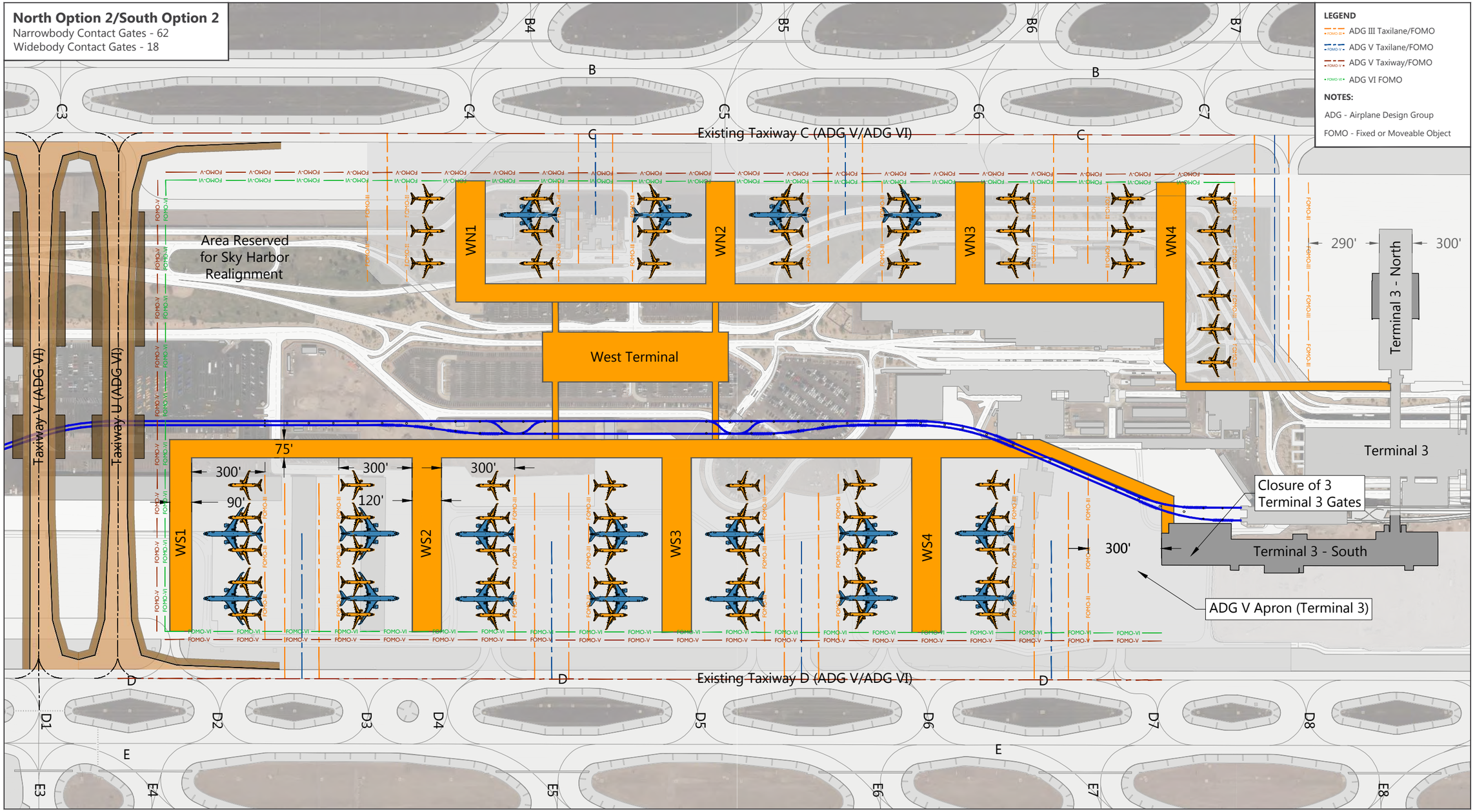
Support facilities play a vital role in the overall operations at PHX. As shown in **Table 5-5**, up to 170 acres of additional land is needed over the planning horizon for the high growth forecast to accommodate the relocation of displaced facilities and to support future growth of support facilities. This land need does not include the need for additional land that can be used to support aeronautical related business or mixed-use development.

TABLE 5-5 SUPPORT FACILITY LAND REQUIREMENTS

FACILITY	EXISTING (ACRES)	DISPLACED (ACRES)	ADDITIONAL ACREAGE REQUIRED		RELOCATION
			BASE FORECAST (ACRES)	HIGH FORECAST (ACRES)	
Cargo – South (Integrated)	45		27	35	
Cargo – West (All-Cargo)	17	17	27	59	To be relocated to accommodate West Terminal
Cargo – West (Passenger)	6	6	7	7	To be relocated to accommodate West Terminal
General Aviation – Southwest Area	45		8	8	
General Aviation – Northwest Area	32		-26	-26	
Airline Ground Support Equipment	3	3	3	3	To be relocated to accommodate West Terminal
In-flight Catering	0		7	7	
Airline Maintenance	50		15	15	
Aircraft Fuel Storage	3		1	1	
Airport Facilities and Services/ Operations/Police	13	13	13	13	To be relocated to accommodate Taxiways U and V and Terminal Expansion
Consolidated Badging/Permitting	0		2	2	
PHX AVN Offices	5		0	0	
Centralized Receiving and Distribution Center	0		6	6	
Arizona Air National Guard	60		20	40	
Total	**279**	**39**	**110**	**170**	

SOURCE: Ricondo & Associates, Inc., January 2019.

North Option 2/South Option 2
Narrowbody Contact Gates - 62
Widebody Contact Gates - 18



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., May 2019 (concept).

NORTH 0 400 ft.

EXHIBIT 5-16

Preferred Terminal and Concourse Concept

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-07-16-West Concourse Options.dwgLayout: Ex 5-16 Plotted: Sep 5, 2019, 04:45PM

Meeting the need for additional land within the existing airport boundary is challenging. **Exhibit 5-17** shows Airport properties and classifies land by the level of difficulty for redevelopment. The terminal core, airfield, Runway Protection Zones (RPZs), and facilities such as airline maintenance and PHX AVN offices were identified has having a high level of difficulty for redevelopment and not available for future support facility needs. Areas with high utilization of land and established with existing facilities (such as the south support area of General Aviation, Cargo, and AZANG) were identified as having a medium level of difficulty for redevelopment. Honeywell and other leasehold tenants along the north airfield would require changes to the existing leases and were identified as medium level of difficulty for redevelopment. Areas with small structures or underutilized facilities (such as the north GA and East Economy surface parking lots) were identified with the lowest level of difficulty for redevelopment.

Although there are lands available on the east and west ends of the Airport for development, they are not large contiguous areas that provide the convenient airfield access required by many support facilities. Expansion to the north is limited by the width of available land between Taxiway A and the Union Pacific Railroad (UPRR) and the proximity of Runway 8-26 and associated obstruction surfaces. The Airport is constrained to the south by Interstate 10 and the Salt River. The only options to expand the Airport that could provide airfield access are to the south (over the Salt River) or to the north (requiring realignment or bridging over the UPRR). These two options are described in the following subsections.

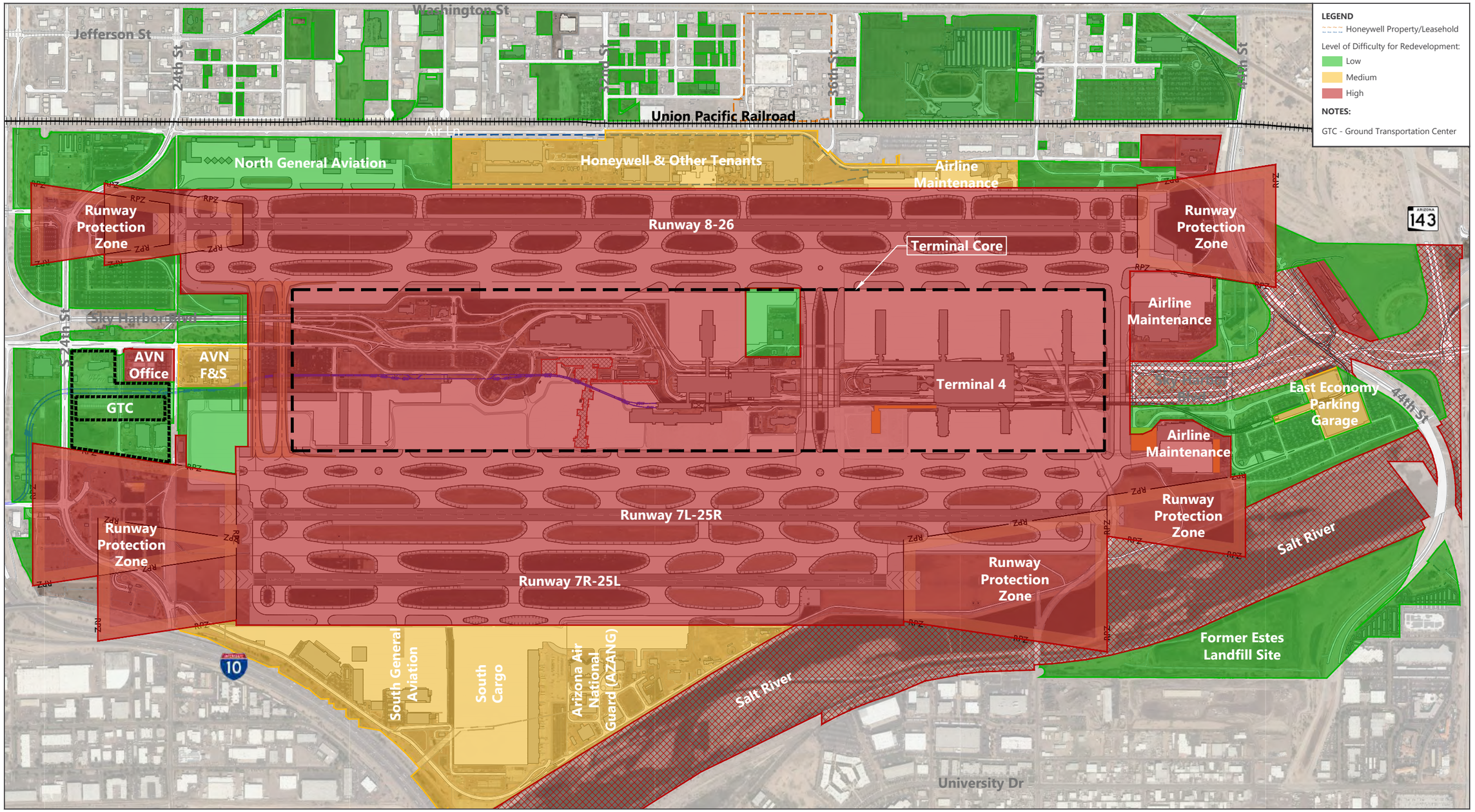
5.5.1 SALT RIVER EXPANSION

The southern Airport property is bound by Interstate 10 and the southern embankment of the Salt River to 40th Street and then extends east to 44th Street and encompasses the former Estes Landfill site. The former landfill site is only accessible via 44th Street as there is no secure roadway or airfield access to Airport property south of the Salt River.

There is a need to expand the AZANG, South Air Cargo, and south GA facilities over the planning horizon. Two expansion options over the Salt River were investigated. The U.S. Army Corps of Engineers HEC-RAS software was used to determine the FEMA 100-year and 500-year flood condition flows on the Salt River between 44th Street and Interstate 10 to ensure expansion options could accommodate potential flood conditions.[1] The analysis also used data from the previously modeled Rio Salado Multi-Use Pathway river geometry.[2]

[1] Premier Engineering Corporation, Feasibility Study Report PHX Comprehensive Asset Management Plan Salt River Infill, August 2018.

[2] Premier Engineering Corporation, *Conditional Letter of Map Revision (CLOMR) Application, Salt River – Rio Salado Pathway: 32nd Street Alignment to SR143/Hohokam Freeway*, December 2015.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., May 2019 (concept); North Area Property Valuation Analysis; C&S Companies, Inc. Oct, 16, 2018.

NORTH 0 1,200 ft.

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-17-Difficulty of Development.dwgLayout: Ex 5-17 Plotted: Sep 5, 2019, 10:53AM

EXHIBIT 5-17

Airport Property
Level of Difficulty for Development

Option 1 on **Exhibit 5-18** shows a portion of the river with earthen fill and a bridge over the entire width of the Salt River to the south bank. The earthen fill would extend approximately 330 linear feet from the north riverbank into the river basin. The remaining width of the river (approximately 600 feet) would be enclosed with a large superstructure supporting aircraft parking and support facilities (a structure similar to the runway superstructure at Madeira International Airport Cristiano Ronaldo in Madeira, Portugal). The river below this structure would flow on a concrete channel bed with sloped concrete embankments (similar to portions of the Los Angeles River in Los Angeles, California). Development within the RPZ is avoided by creating an east and west structure placed on each end of the Runway 25L RPZ. A portion of the eastern structure would be within the Runway 25R RPZ and would not be used by aircraft or for facilities. This option would provide 128 acres on the west structure and 83 acres on the east structure, not including an additional 25 acres that would be accessible on the former Estes Landfill site.

Option 2 on **Exhibit 5-19** shows the southern expansion with the same amount of earthen fill shown in Option 1 along the north embankment, and a 400-foot wide bridged structure, allowing for an open channel along the southern riverbank. This open channel would allow for faster and more even flow during flood events (without the superstructure columns impeding the river flow). Like Option 1, this option would be split into west and east sections to avoid development within RPZs. The open channel would not allow use of the former Estes Landfill site. This option provides 108 acres for development on the west structure and 66 acres on the east structure.

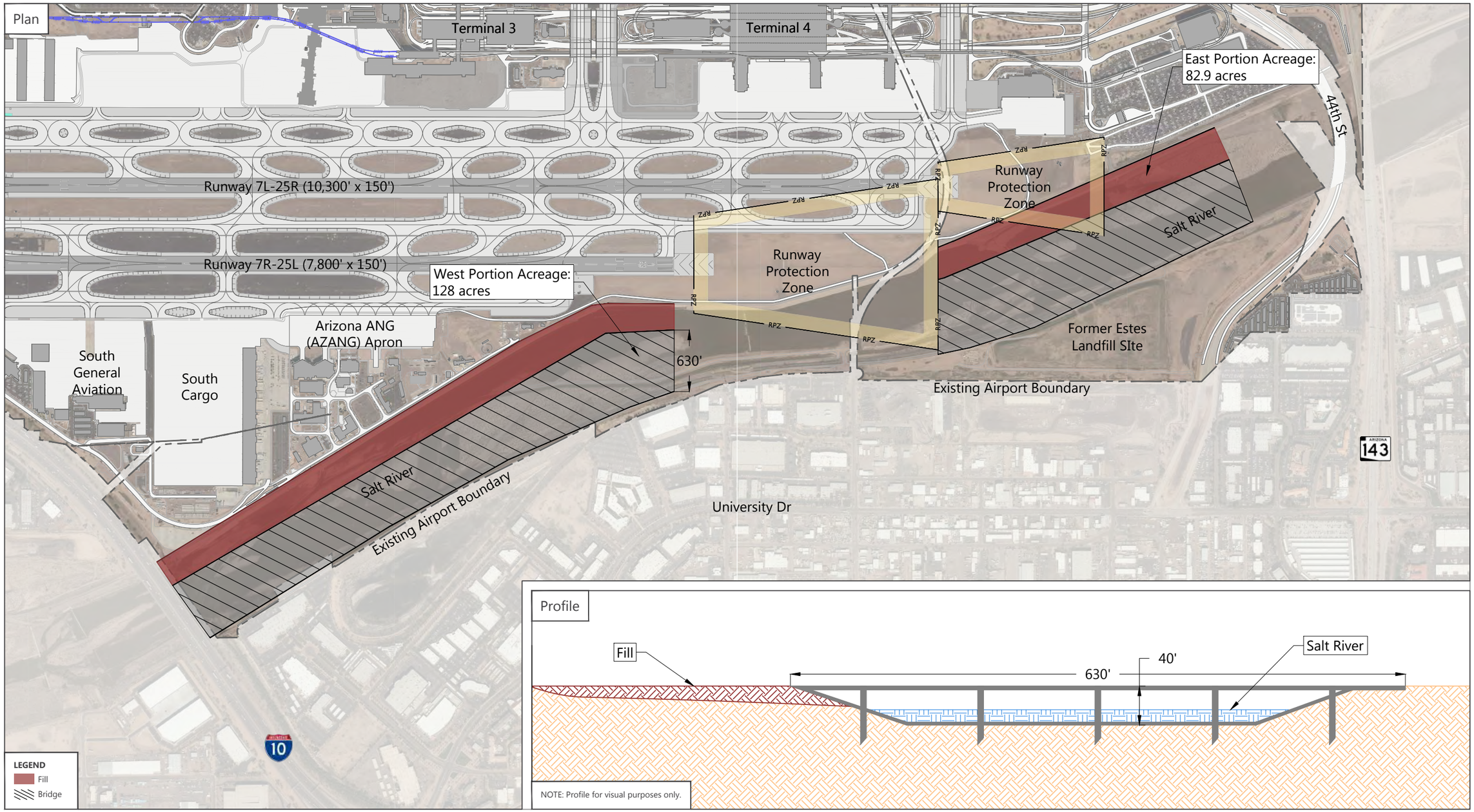
Rough Order of Magnitude (ROM) cost estimates for the two Salt River expansion options were prepared to determine the feasibility of the Salt River infill options. **Table 5-6** summarizes the total cost and cost per acre of each option for the fill and bridged structures. For Option1, the cost with and without the acreage for the Estes Landfill was considered.

TABLE 5-6 SALT RIVER INFILL COST SUMMARY

OPTION	COST[1]	TOTAL ACRES OF DEVELOPMENT AVAILABLE	COST PER ACRE
1	$839,900,000	210.9	$3,980,000
1 (with Estes Landfill)	$839,900,000	236.1	$3,560,000
2	$624,800,000	173.8	$3,600,000

NOTE:
1 Includes only the cost of fill and construction of the bridged structure.
SOURCE: Premier Engineering Corporation, Feasibility Study Report PHX Comprehensive Asset Management Plan Salt River Infill, August 2018.

Beyond the high cost of these options, unknown environmental factors that would make implementation a challenge could exist. There are also risks associated with the Salt River exceeding 500-year flood condition flows and potentially damaging the bridged structure. Furthermore, the former Estes Landfill site would require its own environmental study to determine its potential for development and potentially require remediation.



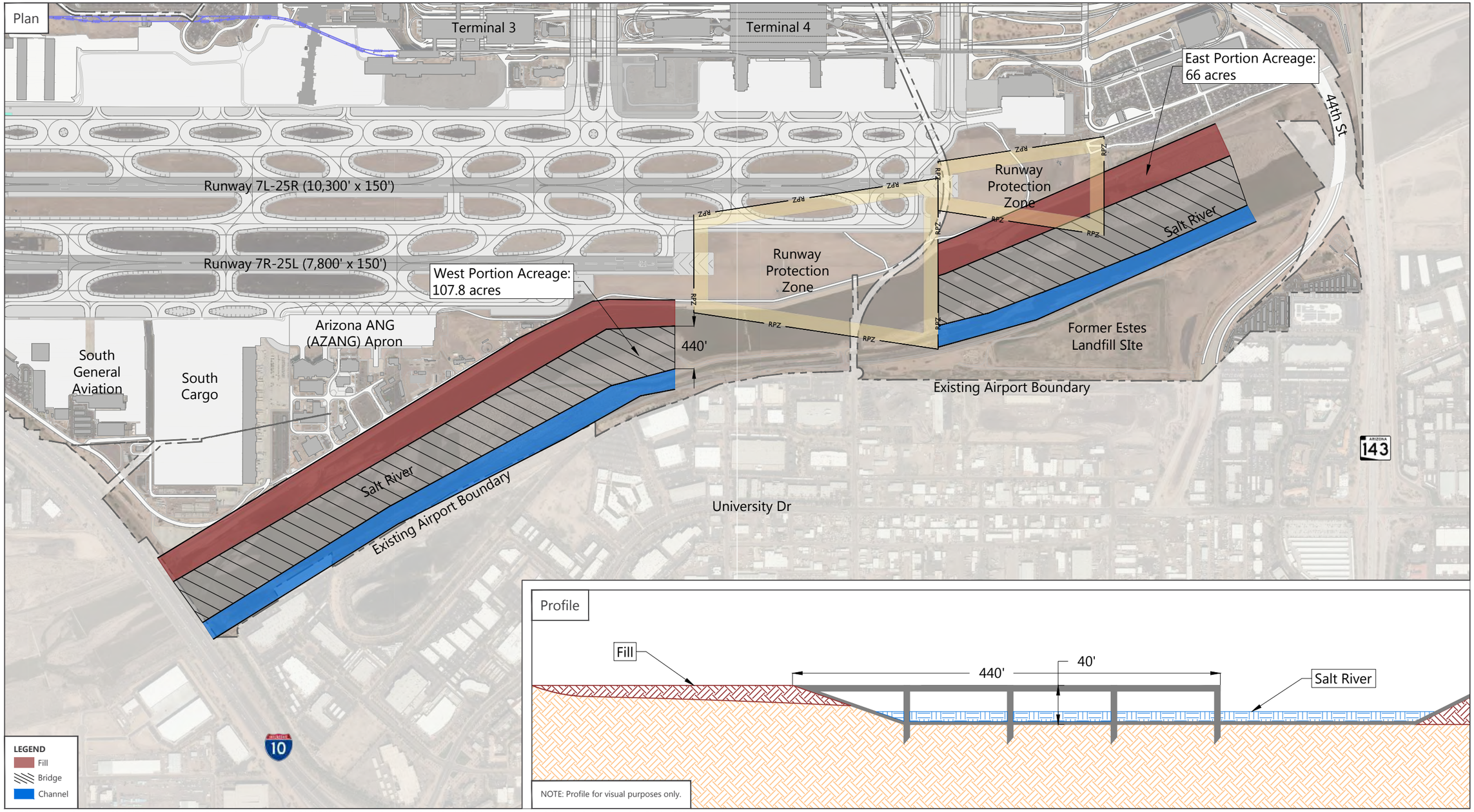
SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

NORTH 0 1,000 ft.

EXHIBIT 5-18

Salt River Expansion
Option 1

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-18-19-Salt River Infill Concepts.dwg,Layout: Ex 5-18 Plotted: Sep 5, 2019, 10:58AM



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

NORTH 0 1,000 ft.

EXHIBIT 5-19

Salt River Expansion
Option 2

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-18-19-Salt River Infill Concepts.dwg Layout: Ex 5-19 Plotted: Sep 5, 2019, 11:08AM

5.5.2 NORTHSIDE EXPANSION

PHX AVN currently owns several properties on the north side of the Airport, including land between the UPRR tracks and Washington Street, as shown on **Exhibit 5-20**. To allow expansion beyond the current Airport boundary, additional northside property acquisition was considered. The northside area is bound by Washington Street to the north, the existing contiguous Airport property to the south, 24th Street to the west, and 44th Street to the east.

The UPRR freight rail line runs east-west along Air Lane north of the contiguous Airport property boundary. A Honeywell facility is located between 34th Street and 36th Street and from Washington Street to the UPRR. This 33-acre facility is on Honeywell-owned property and contains several sensitive testing and manufacturing instruments and would be costly and difficult to relocate. Acquisition of the Honeywell property was not considered for the CAMP.

A second Honeywell facility extends from 29th Street to Air Lane and between the UPRR and Taxiway A. This 65.5-acre property, owned by PHX AVN and leased to Honeywell, includes several office buildings, manufacturing buildings, and equipment storage areas. Utilization is unknown as Honeywell sublets some of these facilities.

Several properties in the area north of the UPRR were purchased by PHX AVN between 1999 and 2016 through the Voluntary Acquisition and Relocation Services (VARS) program for noise mitigation. Since the VARS program ended, additional properties have been purchased for noise and potential Airport expansion opportunities. As of October 2018, PHX AVN owned 170.1 acres, approximately 38 percent of the northside area, not including the 33-acre Honeywell property. City of Phoenix-owned properties (not managed by PHX AVN) within the northside area include utility Right of Ways (ROW) and city streets and total 111.5 acres.

The remainder of the northside area consists of 163 acres of privately-owned land. The majority of the northside area is zoned "A-1 – Light Industrial", with a few parcels between 32nd and 34th Streets zoned "R1-6 – Single-Family Residential 5.3 Dwellings/Acre" and "R-5 – Multi-Family Residential 43.50 Dwellings/Acre" and two parcels near Jefferson and 26th Street zoned "C-3 – General Commercial".

The northside area equates to approximately 445 acres (not including the 33-acre Honeywell property). **Table 5-7** summarizes the northside area ownership.

TABLE 5-7 NORTHSIDE AREA OWNERSHIP

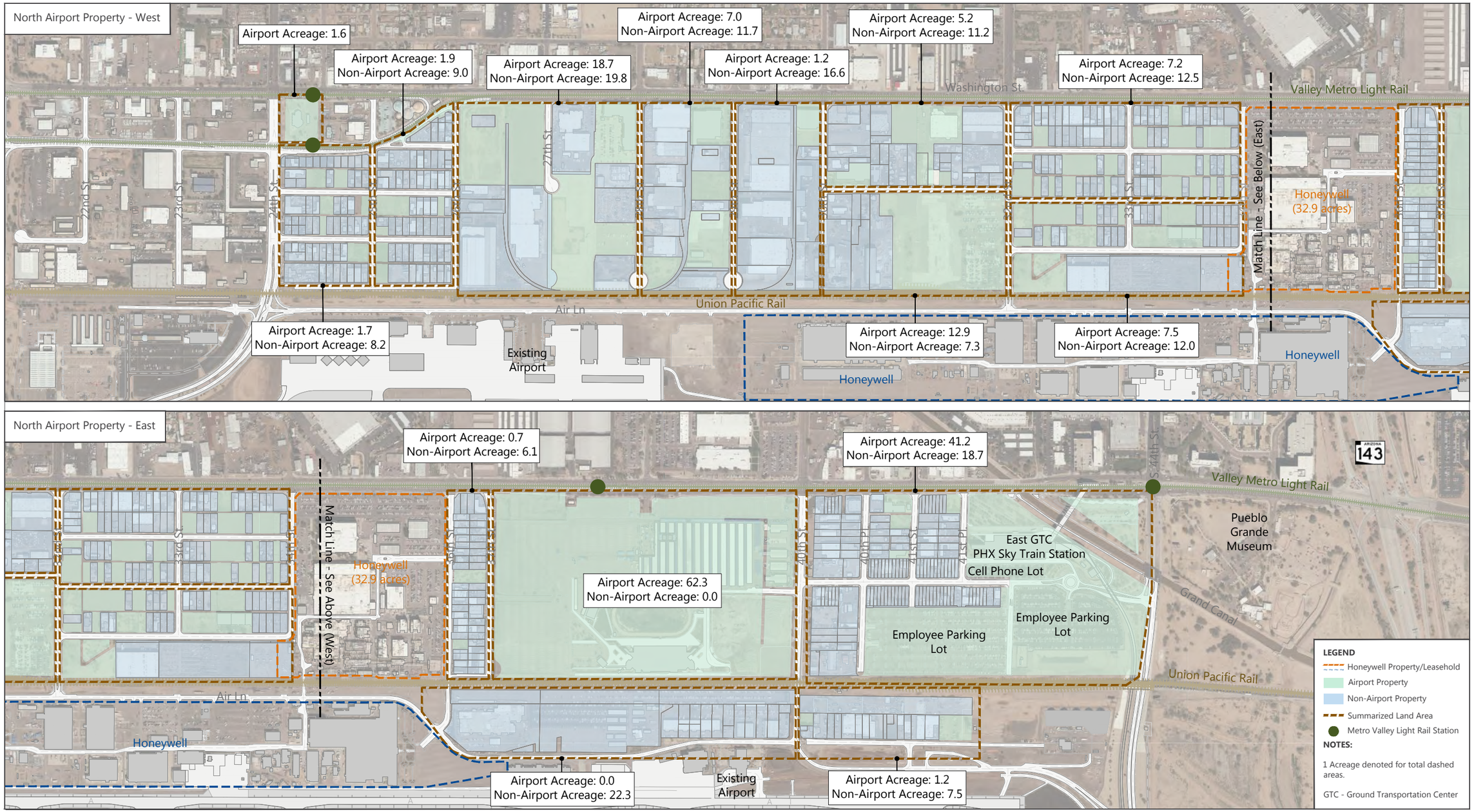
OWNER	TOTAL NORTHSIDE AREA ACERAGE[1]	PERCENTAGE OF TOTAL NORTHSIDE AREA
PHX AVN	170.1	38%
Private	163.1	37%
City of Phoenix (Streets/ROW)[2]	111.5	25%
Total	**444.7**	**100%**

NOTES:

1 Total acreage of the northside area does not include the 33-acre Honeywell property.

2 City of Phoenix (Streets/ROW) is estimated from the total gross northside area minus PHX AVN and privately-owned properties.

SOURCES: Ricondo & Associates, Inc., October 2018; C&S Engineers, Inc., October 2019; CoStar Group for Phoenix Market, October 2018; Maricopa County Assessor's Office Data, October 2018 (private property boundaries); Jacobs Engineering Group, Inc. Exhibit "A" Airport Property Inventory Maps, March 2015 (Airport property boundary).



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., May 2019 (concept); North Area Property Valuation Analysis; C&S Companies, Inc. October, 16, 2018.

EXHIBIT 5-20

Northside Airport Area

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-20-North Parcels.dwgLayout: Ex 5-20 Plotted: Sep 5, 2019, 11:13AM

The UPRR alignment creates a barrier between the northside area and the airfield. Two options were considered for the UPRR to allow access from the airfield to the northside area: (1) realigning the railroad and utilities closer to Washington Street around the northside area and (2) lowering the railroad into a trench along the existing alignment. The trench, which would be similar to the 10-mile Alameda Mid-Corridor Trench between the Port of Los Angeles and Long Beach, would be 30 feet below the existing grade to allow roadway and airfield taxilane bridges to be constructed at grade over the railroad . The depth of the trench would all for the required freight rail clearance of 25 feet. **Table 5-8** provides ROM cost estimates for the options that were considered.

TABLE 5-8 INITIAL RAIL REALIGNMENT AND TRENCH OPTIONS AND COST ESTIMATES

OPTION	DESCRIPTION	COST
1a	Realign 6,415 feet of track 500 feet north between 23rd Street and 32nd Street	$21,600,000
1b	Realign 7,138 feet of track 1,000 feet north between 33rd Street and South 41st Place	$27,900,000
1c	Realign 12,845 feet of track 1,000 feet north between 24th Street and South 41st Place	$54,100,000
2a	Construct 30-foot-deep by 65-foot-wide trench, 821 feet long, with 2,016-foot-long approach grades between 25th Street and 33rd Street	$63,700,000
2b	Construct 30-foot-deep by 65-foot-wide trench, 1,200 feet long, with 2,016-foot-long approach grades between Interstate 10 and 29th Street	$82,400,000
2c	Construct 30-foot-deep by 65-foot-wide trench, 821 feet long, with 2,016-foot long approach grades between 33rd Street and South 41st Street	$68,900,000
2d	Construct 30-foot-deep by 65-foot-wide trench, 9,450 feet long, with 2,016-foot-long approach grades between Interstate 10 and South 41st Place	$294,300,00

NOTE:

1 Costs are in 2019 dollars. No contingency has been applied to these rough order of magnitude cost estimates. Costs exclude property acquisition costs.

SOURCES: Ricondo & Associates, Inc., August 2018; C&S Engineers, Inc., August 2018 (rail options design); and Trace Consultants; 2018 (cost estimates).

Realignment of the railroad to the north would reduce freight train velocities, increase maintenance costs, increase risk of vehicle crossing accidents, and create challenges with staging and positioning trains. The trench option was identified as preferred. A trench width of 150 feet is preserved in the option to allow for additional train capacity, if necessary.

Based on input from staff with UPRR and PHX AVN, the options for a freight rail trench were further considered. Several utilities run parallel and perpendicular to the existing alignment that would require relocation around a rail trench. Pressurized water and gas lines can be rerouted above or below any rail trench option. The 30-foot rail trench depth would conflict with major transverse storm and sewer drains that rely on gravity and transverse the railroad crossings at 24th Street, 33rd Street, 37th Street, and 40th Street.[3] To mitigate some of these utility conflicts, options were developed for a 150-foot wide trench at

[3] Two 30-inch diameter gravity sewers and a 72-inch diameter storm drain crossing at 24th Street can maintain sufficient slope around or below the western portion of the railroad trench. A 72-inch diameter gravity storm drain at 33rd Street and an 84-inch diameter gravity storm drain at 40th Street have a crown height 21 feet below the existing grade, requiring relocation of the drain or pump-lift station below the railroad trench. Further utility analysis is required.

depths of 30 feet and 21 feet as well as a trench with variable depths to avoid conflicts with major storm drains. **Table 5-9** summarizes the refined freight rail trench options and their ROM cost.

TABLE 5-9 REFINED RAIL TRENCH OPTIONS AND COSTS

OPTION	DESCRIPTION	RAIL TRENCH COST[1]	COST PER ACRE[2]
2e	21-foot-deep by 150-foot-wide trench, 9,450 feet long, with 1,500-foot-long approach grades between Interstate 10 and South 41st Place	$302,000,000	$950,000
2f	30-foot-deep by 150-foot-wide trench, 9,450 feet long, with 2,016-foot-long approach grades between Interstate 10 and South 41st Place	$371,700,000	$1,100,000
2g	30-foot/21-foot-deep combination by 150-foot-wide trench, 12,225 feet long, with 1,430-foot-long west and 1280-foot-long east approach grades between Interstate 10 and 44th Street	$376,500,000	$1,110,000
2h	30-foot-deep by 150-foot-wide trench, 1,035 feet long, with 1,860-foot-long west and 2,580-foot-long east approach grades between 34th Street and 44th Street	$95,800,000	$480,000

NOTES:

1 Costs are in 2019 dollars. No contingency has been applied to these rough order of magnitude cost estimates and do not include property acquisition or relocation cost.

2 Cost per acre is the total area that may be available for support facility development without the 33-acre Honeywell property (445 acres) divided by the total land acquisition cost ($119,014,900) plus the rail trench option ROM cost.

SOURCES: Ricondo & Associates, Inc., C&S Engineers, Inc. (rail options design); and Trace Consultants; 2018 (cost estimates).

To compare the northside area options with the Salt River expansion options, an approximate cost per acre for the northside area was determined. This cost assumes land acquisition for all the northside area parcels that are not owned by PHX AVN, the City of Phoenix, or Honeywell. The total land acquisition estimate for all 163 available acres was $119,014,900 or approximately $729,260 per acre. If all available parcels were purchased (outside of the 33-acre Honeywell property), approximately 445 acres of land would be available for airport development.

Option 2e includes a constant 21-foot-deep trench and would require roadway and taxiway crossings to be raised 9 feet above grade to provide the 25-foot freight rail clearance. This 9-foot raise presented significant airfield challenges due to FAA standards for taxiway slopes that made it impractical for any airfield development north of the rail trench. Option 2f also included substantial utility conflicts (discussed above) and was only considered if airfield taxiway crossings were required both east and west of the existing Honeywell property. Option 2h did not meet a UPRR request for a trench long enough for practical storing and staging of train cars within the trench.

Exhibit 5-21 and **Exhibit 5-22** show Option 2g, which includes a 30-foot-deep trench along the western half of the Airport and 21-foot-deep trench along the east half. This option would avoid major utilities at 33rd Street and 40th Street. Roadway bridge structures are assumed to have a thickness of two feet and crossings on the eastern portion of the trench would rise to 7 feet above the existing grade to provide the 25-foot rail clearance. Because roadway slopes can be steeper than airfield taxiways, these roadway modifications were determined to be acceptable. The 30-foot-deep trench on the western portion of the northside area would allow taxiway crossings at grade.

West Rail Trench - Plan View

LEGEND
Airport Property Boundary/Honeywell Leasehold

E. Washington St.
E. Jefferson St.
E. Madison St.
E. Jackson St.
E. Harrison St.
S. 22nd St.
S. 23rd St.
S. 24th St.
S. 25th St.
S. 26th St.
S. 27th St.
S. 28th St.
S. 29th St.
S. 30th St.
S. 32nd St.
Rail at Grade
Rail Slope (30' Depth)
S. 24th St. (Bridge)
150' Trench Width
S. 32nd St. (Bridge)
Air Ln.
Honeywell
A
A1
A2
A3
A4
A5

West Rail Trench - Rail Profile

Rail At Grade
S. 24th St. (bridge)
S. 32nd St. (bridge)
Existing Rail Grade
Rail Slope (1.4%)
25'
30' Trench Depth
25'
East Rail Trench
Vertical direction scaled by 10

SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., November 2018 (concept).

NORTH
0
500 ft.

EXHIBIT 5-21

Rail Trench - West

East Rail Trench - Plan View

LEGEND
Airport Property Boundary/Honeywell Property/Honeywell Leasehold

E. Washington St.
E. Jefferson St.
E. Madison St.
E. Jackson St.
S. 33rd St.
S. 34th St.
S. 36th St.
S. 40th St.
S. 40th Pl.
S. 41st St.
S. 41st Pl.
Honeywell
Rail Slope (30' Depth)
Rail Slope (21' Depth)
Honeywell Crossing
Rail Slope (21' Depth)
Rail at Grade
Air Ln.
150' Trench Width
Honeywell
Air Ln.
Air Ln.
40th St.
A6
A7
A8
A9
A10
A11
A12
Runway 8-26 (11,489' x 150')

East Rail Trench - Rail Profile

West Rail Trench
21'
Rail Slope (1.4%)
Major Utility (21' Below Grade)
Honeywell (bridge)
Roadway Lift (7')
25'
S. 36th St. (bridge)
Roadway Lift (7')
25'
Existing Rail Grade
21' Trench Depth
S. 40th St. (bridge)
Roadway Lift (7')
24'
Major Utility (24' Below Grade)
Rail Slope (1.4%)
Vertical direction scaled by 10

SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., November 2018 (concept).

NORTH 0 500 ft.

EXHIBIT 5-22

Rail Trench - East

Although a rail trench was deemed the most favored solution to access the northside area, no trench option was selected as a preferred and most options were deemed feasible candidates to meet specific support facility development requirements. Compared to the Salt River expansion options, the most expensive rail trench option for northside area development would be $2,443,900 less per acre than the least expensive Salt River expansion option. The northside expansion option also provides 209 more acres than the largest Salt River expansion option.

5.6 ARIZONA AIR NATIONAL GUARD

The existing AZANG site located in the south airfield is bordered by the Salt River to the east and south, the airfield to the north, and the South Air Cargo complex to the west. Access to the site from public roads is only through a gate at the end of Old Tower Road. The site is effectively separated from the public, which is preferred by the 161st ARW for security purposes.

The AZANG requested more land to have the ability to accommodate eight KC-46A aircraft in taxi-in/taxi-out (pull-through) parking positions and an additional four KC-46A aircraft in tug-in or pushback parking positions. The AZANG also requested additional land to provide additional training facilities and support alert functions. AZANG personnel requested an additional 20 to 40 acres of developable land to accommodate the 12 potential KC-46A aircraft and additional support facilities.

Five expansion options were explored. Apron planning followed criteria in the Unified Facilities Criteria (UFC) Airfield and Heliport Planning and Design guidelines published by the Department of Defense.[4]

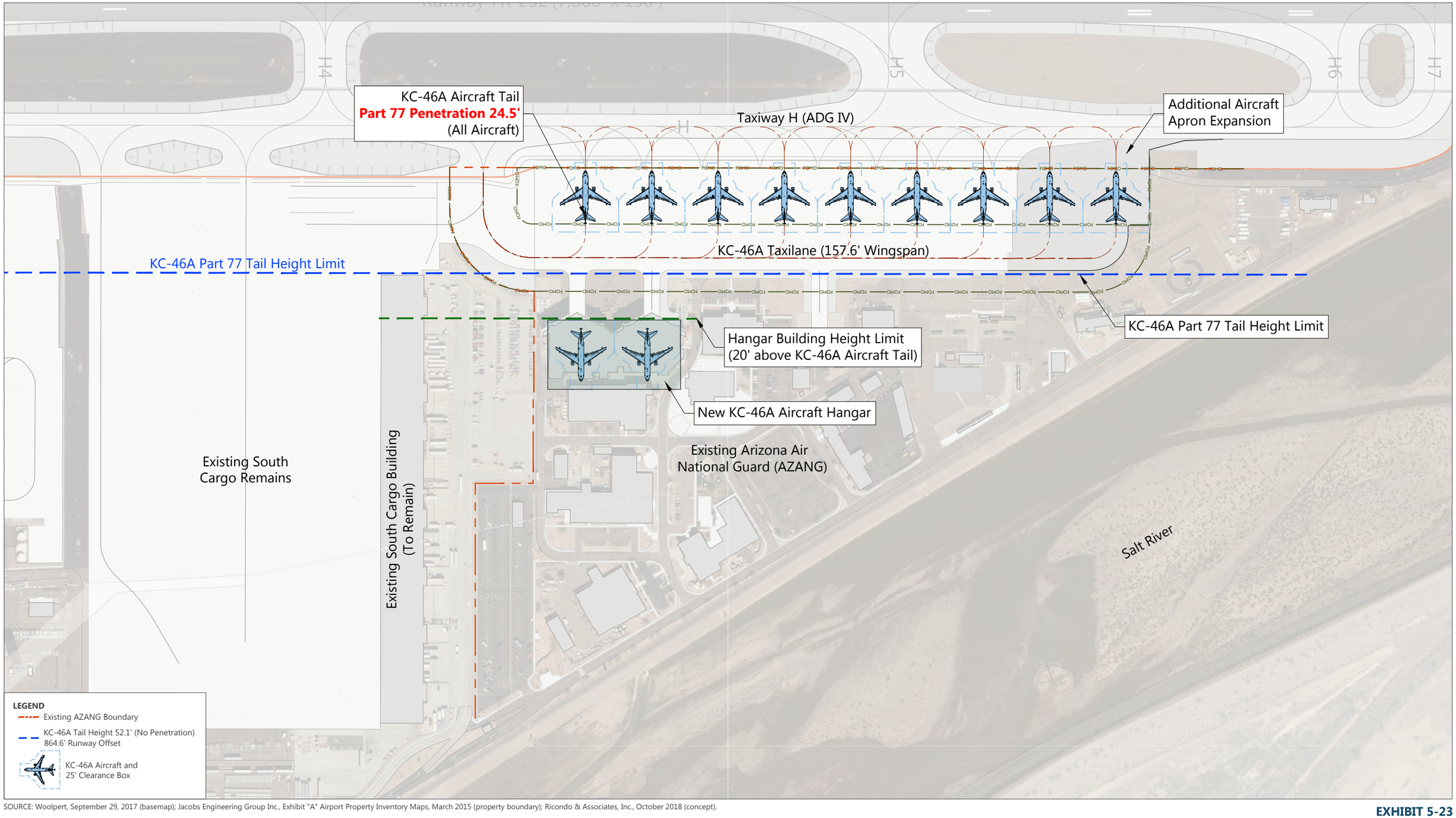
Option 1 – Redevelopment within the AZANG Boundary

Exhibit 5-23 shows the placement of 9 KC-46A aircraft in pull-through parking positions in the existing configuration on the AZANG apron and 2 KC-46A aircraft in a new hangar – less than the requested 12 parking positions. Existing Taxiway H would remain ADG IV capable and the taxilane behind the aircraft parking positions would be upgraded to accommodate KC-46A taxilane clearances, extending closer to the AZANG buildings. The existing hangers would be reconstructed wider to accommodate two KC-46A aircraft. The nine aircraft parking positions shown in this option would penetrate Runway 7R-25L Part 77 transitional surface by 24.5 feet. This option would not include any additional land to expand other facilities.

Option 2 – Remote Site Expansion

Exhibit 5-24 shows Option 2 which would have the same apron and hangar layout as Option 1 with three additional tug-in or pushback parking positions located south of the AZANG apron to accommodate the requested 12 KC-46A aircraft. These three additional parking positions would require the relocation of two AZANG facilities and modifications to the fuel staging area. An additional 5 acres is provided west of the cargo apron for the relocation of affected facilities and future facility needs. This area is only accessible by a secure VSR across the cargo apron and would not be intended for aircraft parking. GA facilities would need to be replaced on the airfield.

[4] U.S. Department of Defense, Unified Facilities Criteria (UFC) 3-260-01, *Airfield and Heliport Planning and Design*, November 17, 2008.

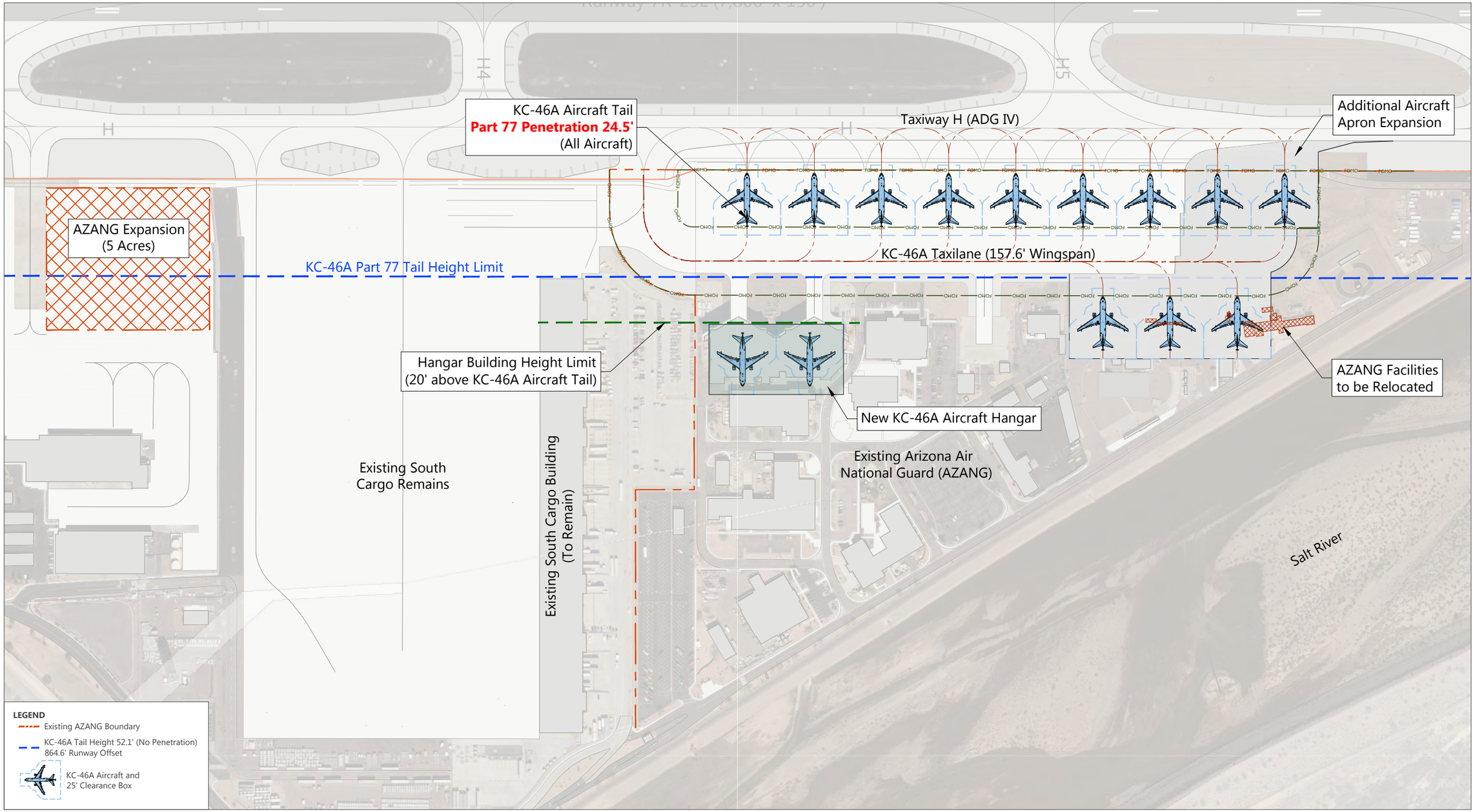


SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

NORTH 0 300 ft.

EXHIBIT 5-23

Arizona Air National Guard Option 1 - Redevelop within Existing Boundary



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

NORTH 0 300 ft.

EXHIBIT 5-24

Arizona Air National Guard Option 2 - Remote Site Expansion

Option 3 – Limited Contiguous Expansion

Option 3 on **Exhibit 5-25** shows a contiguous western apron expansion to accommodate 12 KC-46A aircraft in pull-through parking positions. This option would shift the nose clearance of the KC-46A aircraft 32 feet further from Taxiway H to provide ADG V clearances. The western expansion would use a portion of the cargo apron and would require demolition of a northern portion of the existing cargo building to accommodate ADG IV taxilane clearances. This demolition would allow for a continuous VSR to traverse south of the AZANG apron and north of the AZANG facilities. Similar to Options 1 and 2, a KC-46A capable hanger would be constructed over the existing hangar site. The tails of the KC-46A aircraft would penetrate the Runway 7R-25L Part 77 transitional surface by 21.5 feet. This option would not accommodate any additional AZANG facility growth within the existing site.

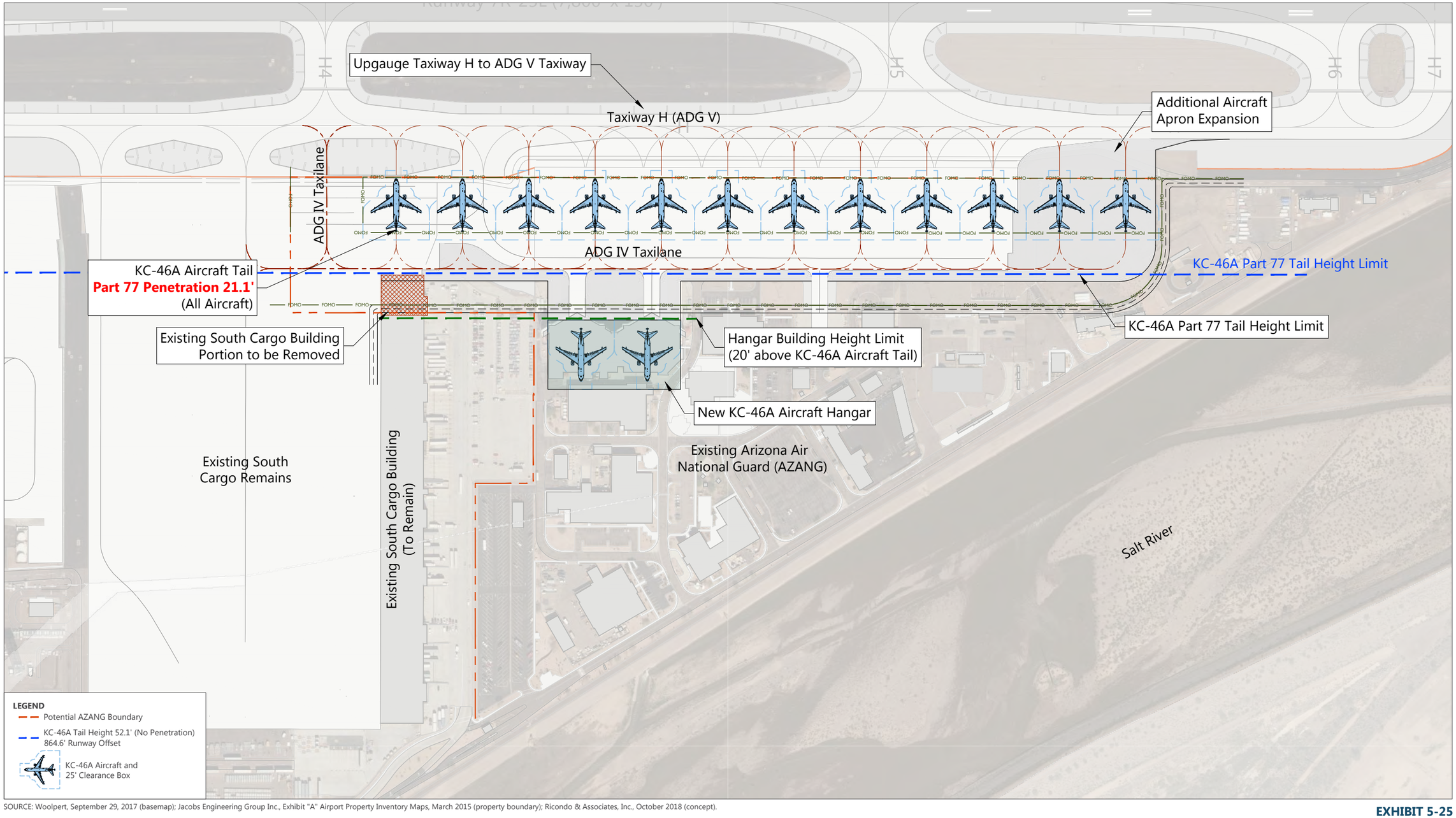
Option 4 – South Air Cargo Expansion

Exhibit 5-26 shows an expansion option with AZANG encompassing most of the existing South Air Cargo facility and apron, requiring cargo operations to be relocated. Eight KC-46A pull-through parking positions would be provided and served by ADG IV taxilanes. Four additional KC-46A aircraft would be parked in tug-in or push-back positions in the southwest portion of the apron. No parked KC-46A aircraft would penetrated penetrate any Part 77 surfaces in this option. This option would include a new KC-46A maintenance hangar, requiring demolition of a portion of the South Air Cargo building. The remainder of the building would be used by the AZANG. This option would provide an additional 24 acres of developable space outside of the apron. The guard shack and gate would be relocated west with Old Tower Road remaining as the only entrance/exit to the facility.

The existing AZANG apron could be used for remote aircraft parking during special events, including AZANG drills that require additional aircraft parking. An additional eight acres of apron space on the northwest portion of the existing cargo apron would be available for expansion of GA facilities or other tenants.

Option 5 – Relocate the AZANG to the North

Option 5 (**Exhibit 5-27**) shows relocation of the entire AZANG to the north airfield, adjacent to Taxiway A and Runway 8-26. The existing north GA area is underutilized and consists of several dilapidated small hangar and storage buildings. This option would reuse the entire north GA area for 12 KC-46A aircraft pull-through parking positions. The aircraft would be parked facing south to avoid penetrating Runway 8-26 Part 77 surfaces. A maintenance hangar would be constructed east of the apron for two KC-46A aircraft and may possibly penetrate the Runway 8-26 Part 77 surfaces along the southern edge of the building. All aircraft parking and servicing for the AZANG would occur south of the existing UPRR.

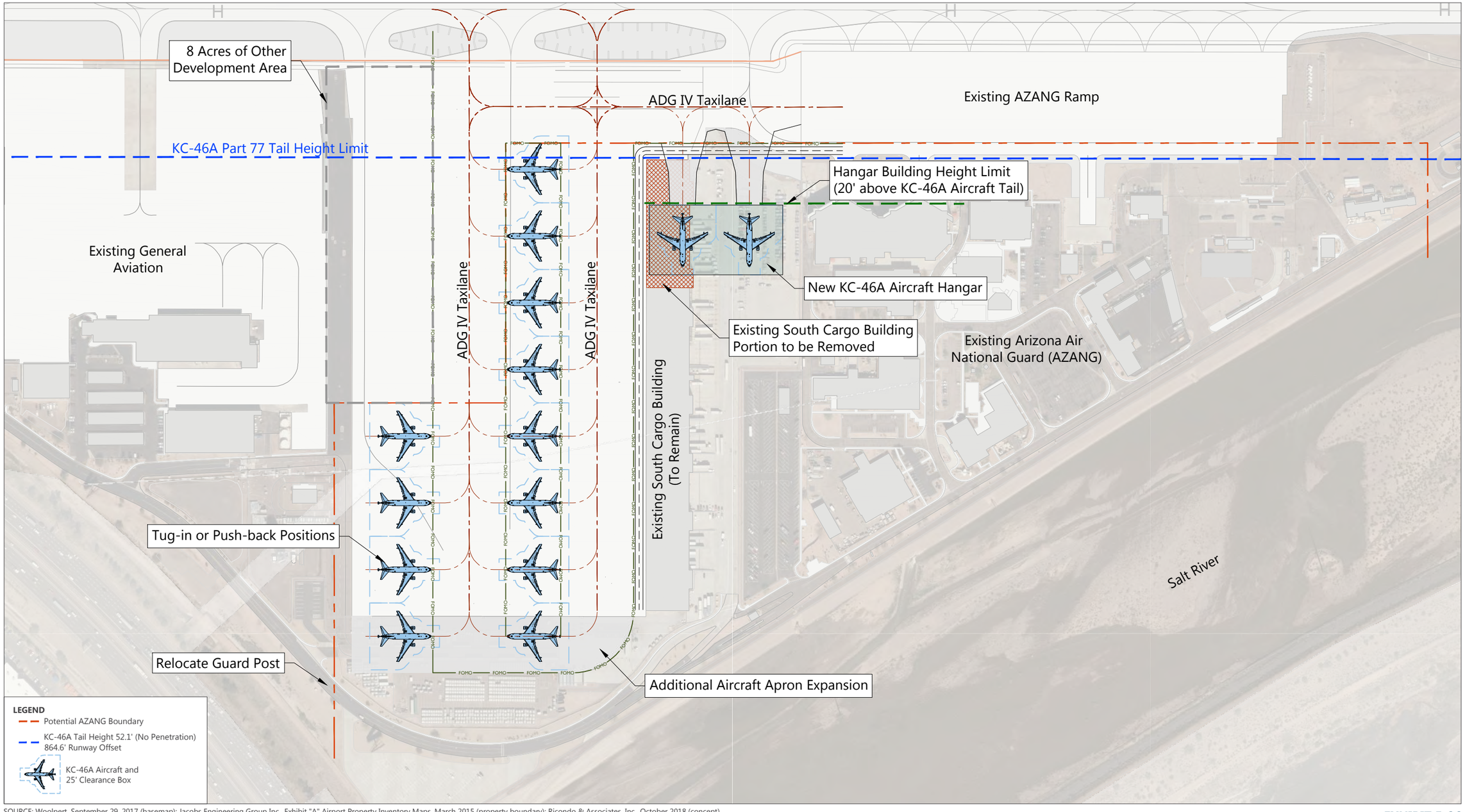


SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

NORTH 0 300 ft.

EXHIBIT 5-25

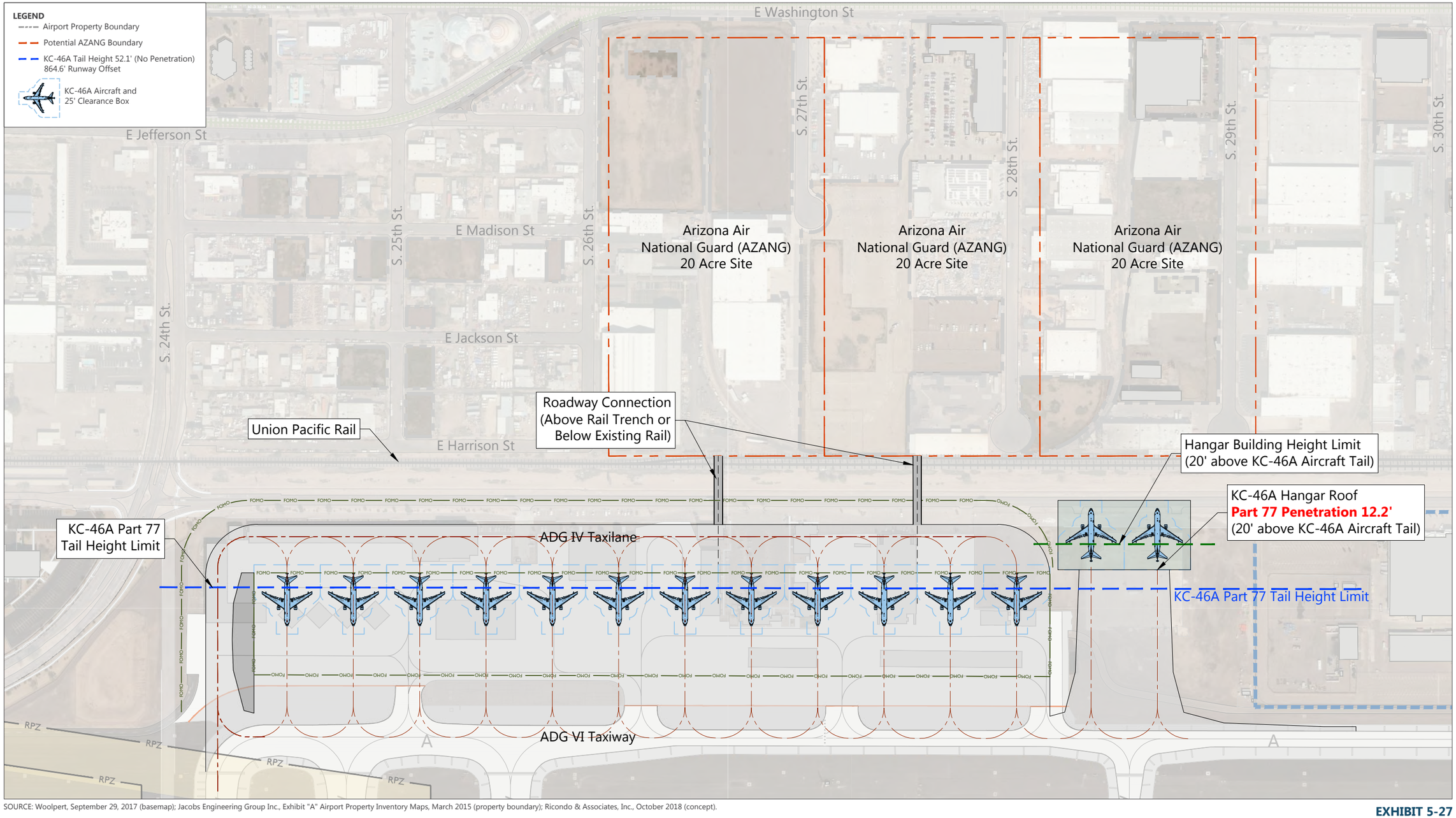
Arizona Air National Guard Option 3 - Limited Contiguous Expansion



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

EXHIBIT 5-26

Arizona Air National Guard Option 4 - South Cargo Expansion



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., October 2018 (concept).

EXHIBIT 5-27

NORTH 0 300 ft.

Arizona Air National Guard Option 5 - Relocate to the North

Other AZANG facilities would be relocated north of the UPRR, connected to the aircraft apron via VSRs over or under the railroad. Three 20-acre areas are shown on Exhibit 5-27 to accommodate the relocation of these facilities and provide land for future development needs. The relocation of the AZANG would allow the South Air Cargo facility to expand. The location of the AZANG surrounded by city streets and the railroad represents a less secure option.

5.6.1.2 AZANG EVALUATION

The five AZANG options were evaluated in collaboration with PHX AVN and the AZANG using the criteria outlined in Section 5.1 as presented in **Table 5-10**. During the development of options, it was identified by the AZANG that the U.S. Air Force would not allow delivery of KC-46A aircraft to bases with parking positions causing runway surface penetrations, dismissing Options 1 through 3. Option 5 was also dismissed due to the high cost of relocating the existing facilities, the potential Part 77 surface penetration by the aircraft hangar, and security concerns. Given the requirement for additional development, the potential reutilization of the existing cargo building, and secure location in the south airfield, Option 4 was the preferred option.

5.7 CARGO

The West Terminal and crossfield Taxiways U and V will require relocation of the West Air Cargo facilities used by all-cargo carriers and implementation of the AZANG preferred option would require relocation of the South Air Cargo facilities used by integrated carriers. Some of the options for new all-cargo and integrated cargo facilities were developed considering AZANG options.

Cargo facilities are ideally configured with standard depths for apron, cargo building, and a landside area for dock parking. All-cargo and integrated cargo facility layout planning guidelines for the dimensional depth of these areas are similar and are summarized in **Table 5-11**. The optimal layout for all-cargo or integrated facilities is configured with an ADG V or ADV VI taxilane serving an apron and a linear cargo building located in front of the apron. The landside area for dock parking would be located on the opposite side of the building from the apron to allow tractor-trailers to easily maneuver in and out of the facility. Customer parking can be located adjacent to the truck docking space or near the customer service portion of the cargo building.

As summarized in Section 4, facility requirements were developed for the baseline and high growth forecast. All options accommodate baseline PAL 3 requirements for both all-cargo and integrated cargo facilities. Where possible, high growth facility requirements for integrated cargo were accommodated followed by all-cargo requirements. All-cargo and integrated cargo facilities were collocated where possible.

TABLE 5-10 ARIZONA AIR NATIONAL GUARD EVALUATION MATRIX

CATEGORY	CRITERIA	OPTION 1 REDEVELOP WITHIN AZANG	OPTION 2 REMOTE SITE EXPANSION	OPTION 3 LIMITED CONTIGUOUS EXPANSION	OPTION 4 SOUTH AIR CARGO EXPANSION	OPTION 5 RELOCATE TO THE NORTH
Economic Viability	Development Costs	EXCEEDS	ADEQUATE	ADEQUATE	ADEQUATE	DEFICIENT
	Financial Feasibility	N/A	N/A	N/A	N/A	N/A
	Maintenance, Operation, and Deconstruction Costs	N/A	N/A	N/A	N/A	N/A
	Utilization of Existing Infrastructure	EXCEEDS	CHALLENGING	ADEQUATE	ADEQUATE	DEFICIENT
	Expansion Capability Beyond Planning Horizon	DEFICIENT	CHALLENGING	ADEQUATE	ACHIEVES	EXCEEDS
	Revenue Impacts	ACHIEVES	CHALLENGING	ADEQUATE	ADEQUATE	ADEQUATE
Operational Efficiency	Safety	ADEQUATE	ADEQUATE	ADEQUATE	EXCEEDS	ACHIEVES
	Compatibility	N/A	N/A	N/A	N/A	N/A
	Operational Impacts During Construction	ADEQUATE	CHALLENGING	ADEQUATE	ACHIEVES	EXCEEDS
	On-Airport Land Use	ACHIEVES	ACHIEVES	ACHIEVES	ACHIEVES	ACHIEVES
	Phasing Complexity/Scalability	ADEQUATE	ADEQUATE	ADEQUATE	ACHIEVES	ACHIEVES
	Flexibility	DEFICIENT	DEFICIENT	ADEQUATE	ACHIEVES	ACHIEVES
Natural Resource Conservation	Energy, Air Quality, and Greenhouse Gases	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
	Historic and Cultural Resources	N/A	N/A	N/A	N/A	N/A
	Environmental Consequence	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
Social Responsibility	Economic Impact to Business Partners and the Community	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	CHALLENGING
	Airport/Community Experience	ACHIEVES	ACHIEVES	ACHIEVES	ACHIEVES	DEFICIENT
	Level of Service	DEFICIENT	ADEQUATE	ADEQUATE	ACHIEVES	ACHIEVES
	Off-Airport Land Use Compatibility	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	DEFICIENT
					Top Option	

SOURCE: Ricondo & Associates, Inc., November 2018.

TABLE 5-11 INTEGRATED AND ALL-CARGO FACILITY LAYOUT ASSUMPTIONS

CARGO FACILITY COMPONENT	DEPTH (FT)	SPACE USE
Landside (Parking)	40[1]	Vehicle parking area for staff and customers
Landside (Dock)	200	Allow for tractor-trailer maneuvering and truck dock parking positions along the building length.
Building	132	Allow for cargo sortation and repacking for shipment or aircraft loading
Apron	300[2]	Accommodates straight-in parking of Boeing 747-800 aircraft (ADG VI) and provides sufficient space for GSE maneuvering around the aircraft

NOTES:

1 Parking areas require a minimum depth of 40 feet but can be elongated or square based on cargo facility layout.

2 Apron depth can be decreased to 275 feet and still accommodate a Boeing 747-800 aircraft. A Boeing 767-300F aircraft could be accommodated within a 275-foot deep apron.

SOURCES: Airport Cooperative Research Program, Report 143, *Guidebook for Air Cargo Facility Planning and Development*, 2015 (building and apron guidelines); Airports Council International-North America, *Airport Cargo Guide*, 2013 (landside access/docks, employee and customer parking guidelines); Ricondo & Associates, Inc., October 2018.

Option 1 – Expansion of South Air Cargo Area

Option 1, shown on **Exhibit 5-28**, includes relocation of the AZANG base and most FBO facilities to accommodate expansion of the South Air Cargo area. A rectangular layout is typically most efficient for cargo facilities given the large areas needed for apron, building, and dock parking. The wedge-shaped property on both sides of the South Air Cargo facility results in underutilized areas. Boeing 767-300F aircraft parked closest to the runway would penetrate Part 77 surfaces. This option would meet integrated cargo high growth requirements and baseline all-cargo requirements.

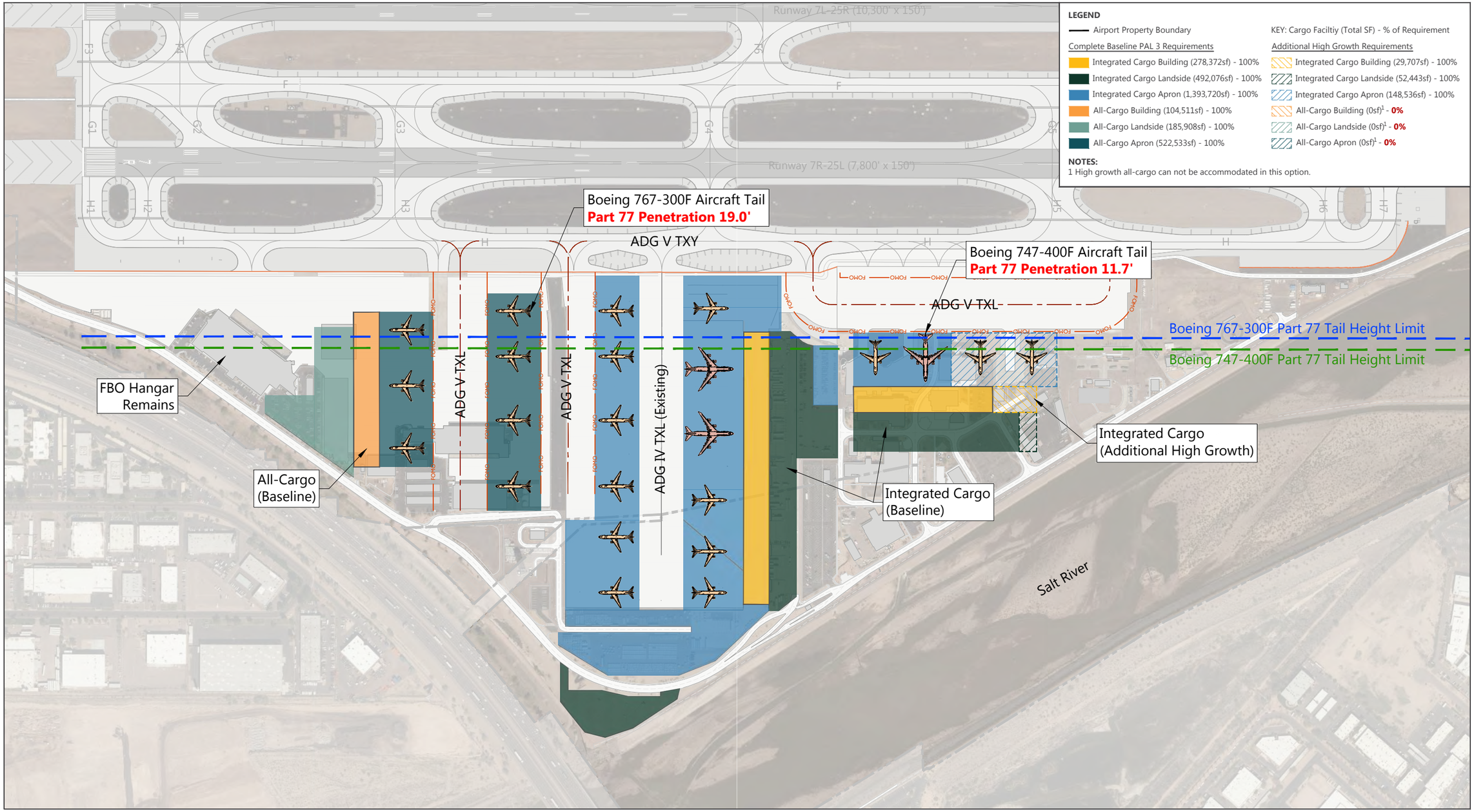
Option 2 – Expansion within North Airfield Property

Option 2, shown on **Exhibit 5-29**, includes the South Air Cargo facility remaining, with integrated cargo growth accommodated on the northwest portion of the airfield north of the Runway 8 end, displacing the existing north GA facilities. The narrow depth of the available land would result in an inefficient layout as the cargo building would be separated from the apron and would increase travel times between the facility and aircraft.

All-cargo would be accommodated in the northeast airfield near the Runway 26 end displacing the existing ARFF facility and Mesa Airlines Corporate Hangar. Property acquisition and the realignment of Air Lane would be required. To minimize the amount of property acquisition, the apron was positioned as close to the airfield as possible, requiring aircraft to push back directly onto Taxiway A. This layout would also be inefficient due to the cargo building located away from the apron instead of directly in front of the aircraft. The existing ARFF facility would be relocated to the west of the all-cargo building. This option would meet integrated cargo high growth requirements and baseline all-cargo requirements.

Option 3 – Relocation to Northwest Airfield and Former Dog Track Property

Option 3, shown on **Exhibit 5-30**, is configured with an integrated cargo facility on the former dog track property. This option would require placing the UPRR in a trench and constructing dual ADG V taxilane bridges over the railroad. Similar to Option 2, the ARFF facility would be relocated to the west.

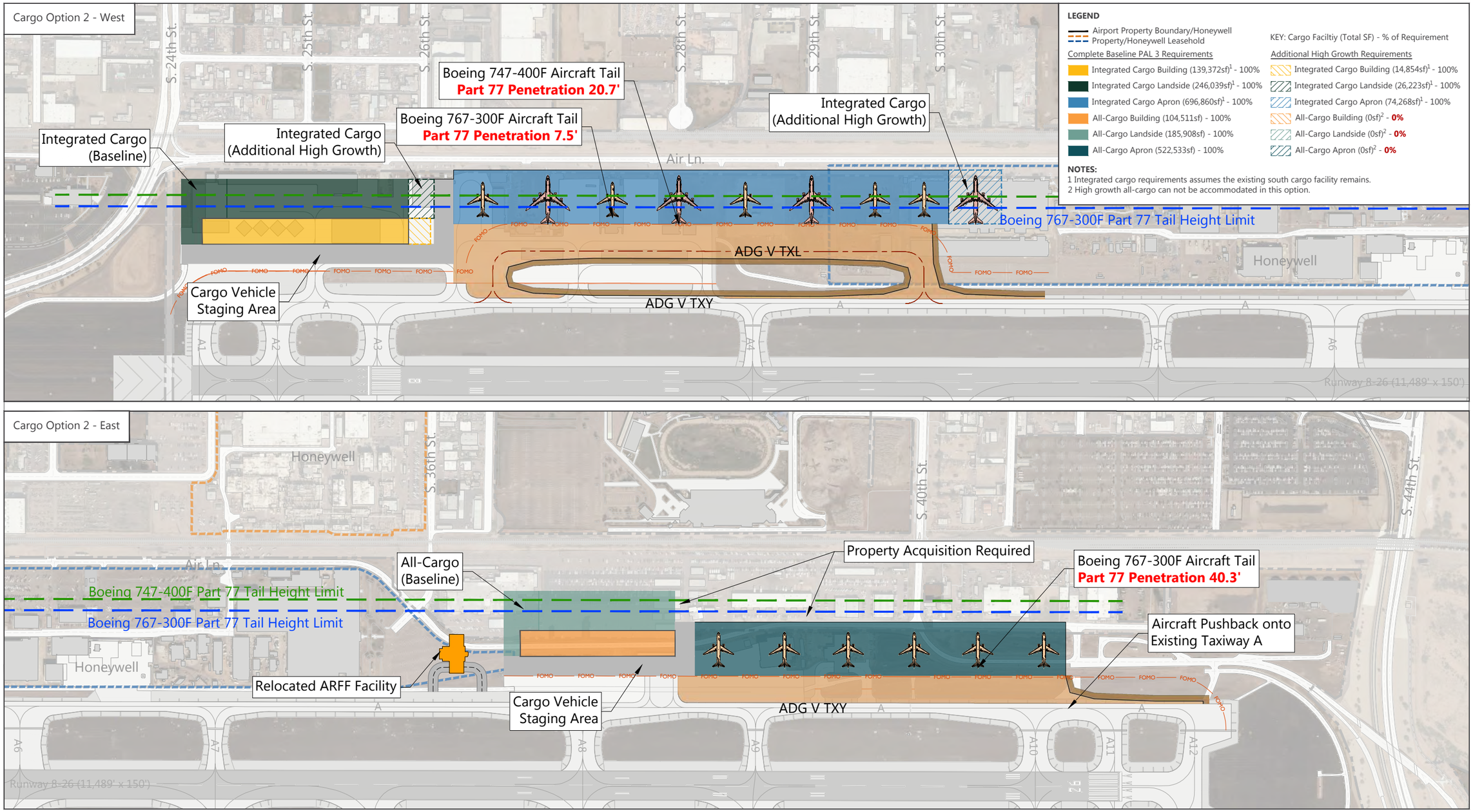


SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., November 2018 (concept).

EXHIBIT 5-28

Cargo Option 1
Expansion in the South Cargo Area

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-28-35-Cargo Options.dwgLayout: Ex 5-28 Plotted: Sep 5, 2019, 12:21PM



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., November 2018 (concept).

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-28-35-Cargo Options.dwgLayout: Ex 5-29 Plotted: Sep 5, 2019, 12:23PM

EXHIBIT 5-29

Cargo Option 2
Expansion within the North Airfield Property

Cargo Option 3 - Plan View

LEGEND

Airport Property Boundary/Honeywell Property/Honeywell Leasehold

KEY: Cargo Faciltiy (Total SF) - % of Requirement

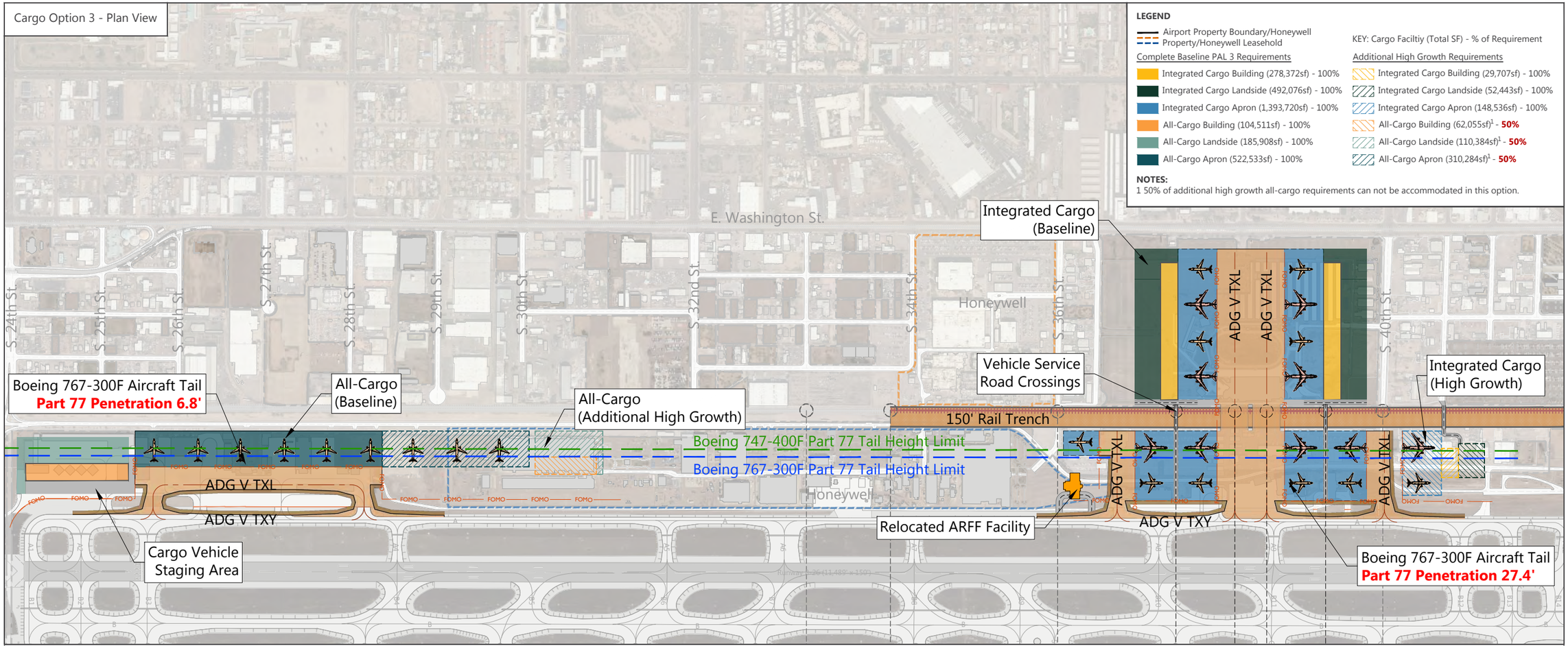
Complete Baseline PAL 3 Requirements

- Integrated Cargo Building (278,372sf) - 100%
- Integrated Cargo Landside (492,076sf) - 100%
- Integrated Cargo Apron (1,393,720sf) - 100%
- All-Cargo Building (104,511sf) - 100%
- All-Cargo Landside (185,908sf) - 100%
- All-Cargo Apron (522,533sf) - 100%

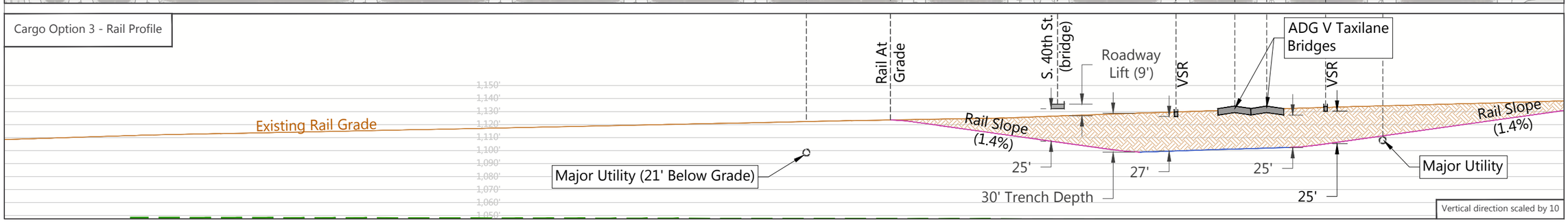
Additional High Growth Requirements

- Integrated Cargo Building (29,707sf) - 100%
- Integrated Cargo Landside (52,443sf) - 100%
- Integrated Cargo Apron (148,536sf) - 100%
- All-Cargo Building (62,055sf)[1] - **50%**
- All-Cargo Landside (110,384sf)[1] - **50%**
- All-Cargo Apron (310,284sf)[1] - **50%**

NOTES:
1 50% of additional high growth all-cargo requirements can not be accommodated in this option.



Cargo Option 3 - Rail Profile



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., November 2018 (concept).

NORTH 0 800 ft.

EXHIBIT 5-30

Cargo Option 3
Relocation to Northwest Airfield and Former Dog Track Property

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-28-35-Cargo Options.dwgLayout: Ex 5-30 Plotted: Sep 5, 2019, 12:27PM

All-cargo would be accommodated in the northwest airfield, mirroring the integrated cargo layout shown in Option 2. Aircraft parked in both cargo areas would penetrate Runway 8-26 Part 77 transitional surfaces. This option would meet integrated cargo high growth facility requirements and 50 percent of the additional PAL 3 high growth all-cargo requirement.

Option 4 – Relocation to Former Dog Track Property

Option 4, shown on **Exhibit 5-31**, would require the same UPRR trench as Option 3, but would incorporate the integrated and all-cargo facilities on the former dog track property. The aircraft apron would be placed on both sides of the UPRR trench, requiring cargo buildings to be placed in several locations within the area. The available depth between the UPRR trench and Washington Street would require the widths of some buildings and landside dock parking to be less than the preferred dimensions. This option would occupy the space west of the PHX Sky Train 44th Street Station. Aircraft parked on the apron south of the railroad trench would penetrate Part 77 surfaces. This option would meet high growth integrated and all-cargo facility requirements.

Option 5a – Relocation to Northside – West Development and Former Dog Track Property – Option A

Option 5a, shown on **Exhibit 5-32**, would include the relocation of integrated and all-cargo facilities north of the UPRR trench and on both sides of the Honeywell property, including a portion of the former dog track. The landside dock parking, vehicle parking, building, and GSE staging area would be located north of the UPRR trench, and the apron area would be located south of the UPRR trench. This layout would require the relocation of the ARFF (shown relocated to the west) and Mesa Airlines Corporate Hangar. Similar to Option 4, the aircraft parked on the apron south of the railroad trench would penetrate Part 77 surfaces. This area would meet the baseline all-cargo requirements.

The integrated cargo facility would be located directly west of the Honeywell property with dual ADG V taxilanes bridged over the UPRR trench. Like Option 4, the building and dock width for this facility would be less than the preferred width but would still meet the total area requirements. This option would meet the high growth integrated cargo requirements. Additional area would be available meet high growth all-cargo requirements combined with the area east of the Honeywell facility.

For the UPRR trench to avoid major utility crossing at 33rd Street and 40th Street, the trench depth would be 21 feet on the eastern section of the trench. For the required 25-foot rail clearance, the all-cargo VSR over the rail would require ramping up 7 feet from the existing grade to cross over the railroad.

Cargo Option 4 - Plan View

LEGEND

Airport Property Boundary/Honeywell Property/Honeywell Leasehold

KEY: Cargo Faciltiy (Total SF) - % of Requirement

Complete Baseline PAL 3 Requirements

- Integrated Cargo Building (278,372sf) - 100%
- Integrated Cargo Landside (492,076sf) - 100%
- Integrated Cargo Apron (1,393,720sf) - 100%
- All-Cargo Building (104,511sf) - 100%
- All-Cargo Landside (185,908sf) - 100%
- All-Cargo Apron (522,533sf) - 100%

Additional High Growth Requirements

- Integrated Cargo Building (29,707sf) - 100%
- Integrated Cargo Landside (52,443sf) - 100%
- Integrated Cargo Apron (148,536sf) - 100%
- All-Cargo Building (124,109sf) - 100%
- All-Cargo Landside (220,769sf) - 100%
- All-Cargo Apron (620,769sf) - 100%

Building Width - 125' (Preferred 132')
Dock Width - 165' (Preferred 200')

ADG VI TXL

PHX Sky Train 44th Street Station

Building Width - 237' (Preferred 132')
Dock Width - 423' (Preferred 200')

E. Washington St.

S. 40th St.

S. 40th Pl.

S. 34th St.

S. 36th St.

Honeywell

ADG V TXL

ADG V TXL

ADG V TXL

ADG V TXL

44th St.

Boeing 747-400F Part 77 Tail Height Limit

Boeing 767-300F Part 77 Tail Height Limit

Honeywell

Boeing 767-300F Aircraft Tail
Part 77 Penetration 25.2'

Boeing 747-400F Aircraft Tail
Part 77 Penetration 20.7'

Runway 7-25 (11,489' x 150')

Cargo Option 4 - Rail Profile

Major Utility
(21' Below Grade)

Rail At Grade

S. 36th St. (bridge)

25'

25'

25'

Rail Slope
(1.4%)

Rail At Grade

Existing Rail Grade

Major Utility
(24' Below Grade)

Vertical direction scaled by 10

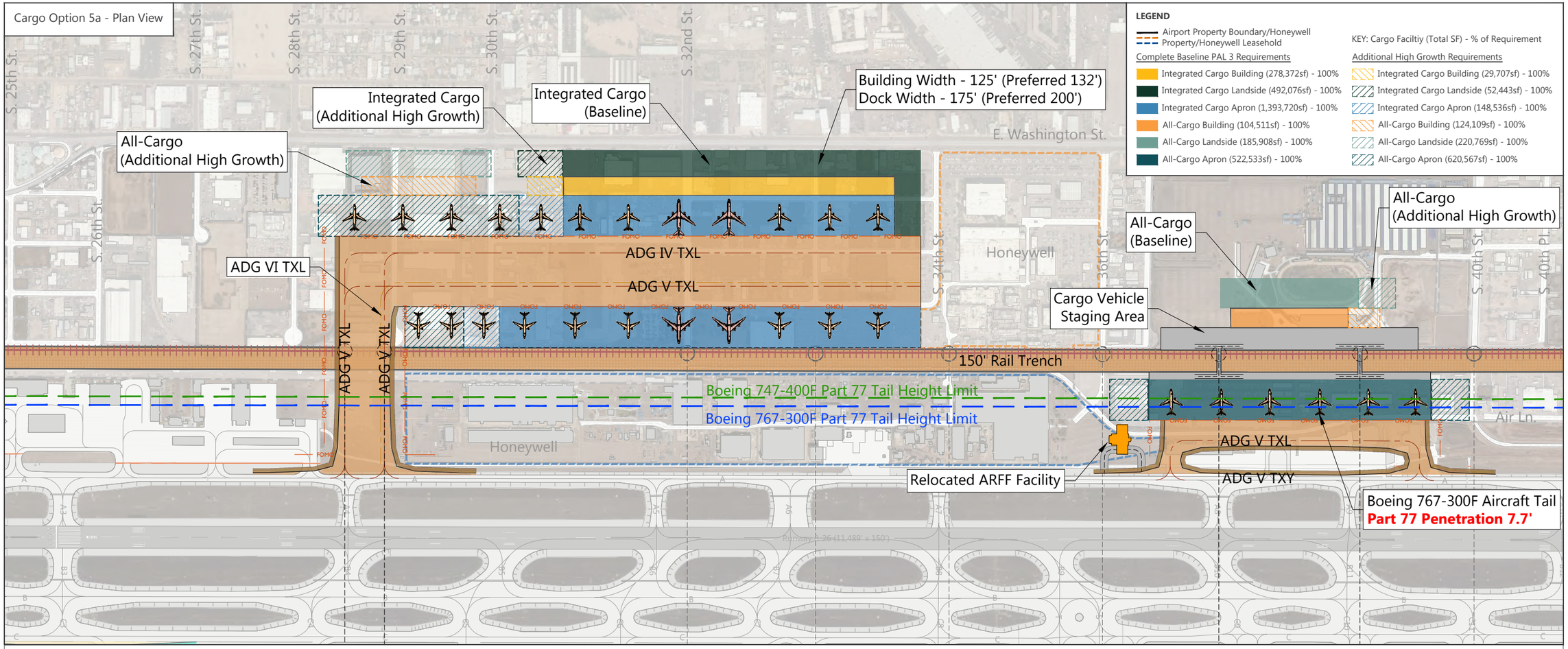
SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., November 2018 (concept).

NORTH 0 700 ft.

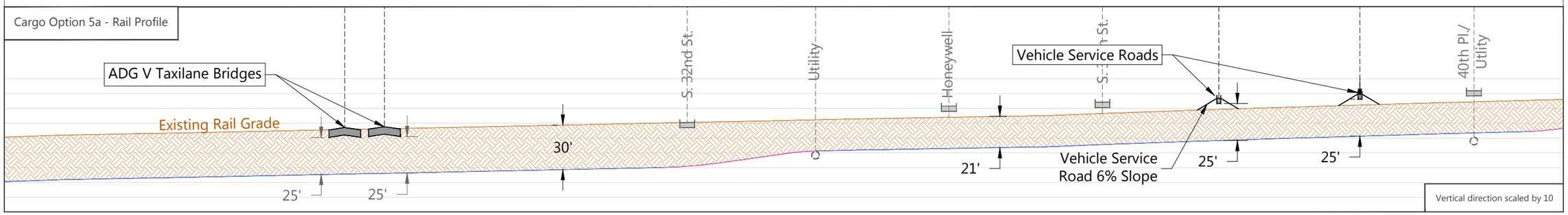
EXHIBIT 5-31

Cargo Option 4
Relocation to Former Dog Track Property

Cargo Option 5a - Plan View



Cargo Option 5a - Rail Profile



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., November 2018 (concept).

NORTH 0 700 ft.

EXHIBIT 5-32

Cargo Option 5a
Relocation to Northside - West Development and Former Dog Track Property - Option A

Option 5b – Relocation to Northside – West Development and Former Dog Track Property – Option B

Option 5b, shown on **Exhibit 5-33** includes the same all-cargo facility on the east side of the Honeywell property as Option 5a, with a different configuration for the facilities on the west side. The integrated and all-cargo facilities for high growth would extend eastward from 26th Street. The apron would be split on the north and south sides of the UPRR trench, providing an ADG V taxilane for an apron placed south of the UPRR trench. This layout would provide dual taxilanes north of the UPPR trench and allows for preferred dock and building widths while providing a 275-foot separation from Washington Street to allow other development along that street corridor. Approximately 16 acres of the existing airfield portion of the Honeywell leasehold would be affected by the eastern taxilane and southern apron area. This option uses the same rail trench profile illustrated in Option 5a. This option would meet high growth integrated and all-cargo requirements.

Option 6a – Relocation to Northside – West Development – Option A

Option 6a, shown on **Exhibit 5-34**, places the integrated and all-cargo facilities west of the Honeywell property and on both sides of a UPPR trench (similar layout to Option 5b). Due to the lack of available land between 26th Street and the Honeywell property, only about three-quarters of the all-cargo apron requirement can be accommodated, while all other facility requirements are met. Like Option 5b, cargo apron would be placed on the north and south sides of the UPRR trench, allowing for a 275-foot separation to Washington Street for other development along Washington Street. Approximately 20 acres of the existing airfield portion of the Honeywell leasehold would be affected by the western-most taxilane and southern apron areas. This option includes the same UPRR trench profile shown in Options 5a and 5b. This option would meet baseline and high growth requirements, except for high growth all-cargo apron requirements, which would require an additional 172,400 square feet of aircraft apron.

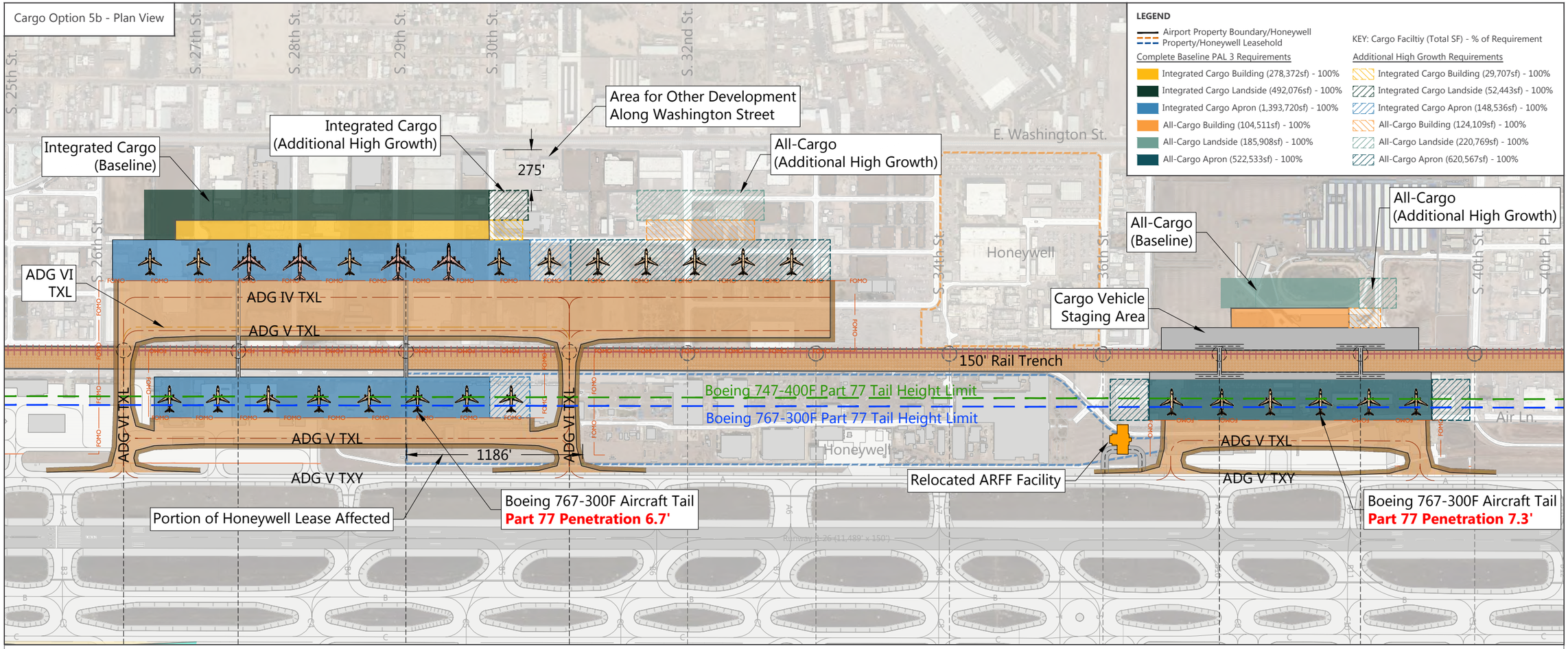
Option 6b – Relocation to Northside – West Development – Option B

Option 6b, shown on **Exhibit 5-35**, places integrated cargo and all-cargo facilities north of the Honeywell leasehold and extending eastward from 34th Street. The area would be served by dual ADG V taxilanes crossing over the UPRR trench through the Honeywell leasehold, and a single ADG V taxilane would cross the UPRR trench at the western end of the apron, through the existing north GA facility. Like Option 5a, the entire cargo facility would be located north of the UPRR trench and therefore would require a reduced building and dock width. A full UPRR trench profile is shown on the exhibit, but only the western portion of the trench would ultimately be required for cargo purposes. This option would meet high growth integrated and all-cargo requirements.

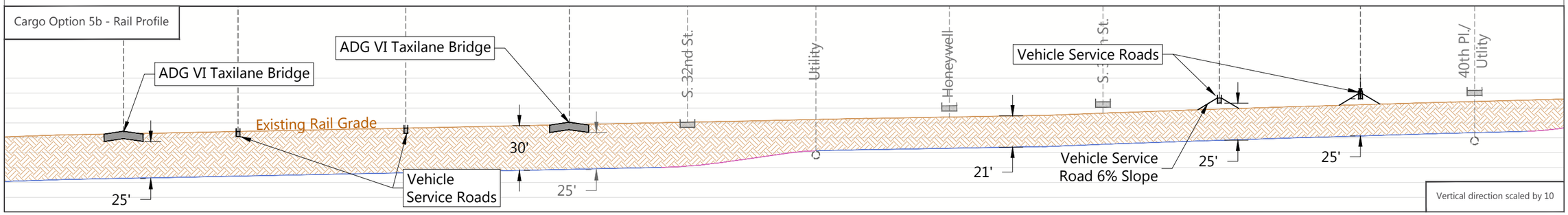
5.7.1.2 CARGO EVALUATION

The eight cargo options were evaluated using the criteria outlined in Section 5.1. **Table 5-12** summarizes the evaluations. Options that could not accommodate growth beyond the PAL 3 baseline requirements (Options 1, 2, 3, and 6a), and that were configured with separated cargo facilities (Options 5a and 5b) were generally evaluated as deficient or challenging. Option 4 would have more challenges than Option 6 due to the land use constraints of the former dog track property and separation between a portion of the apron and cargo buildings.

Cargo Option 5b - Plan View



Cargo Option 5b - Rail Profile



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., November 2018 (concept).

NORTH 0 700 ft.

EXHIBIT 5-33

Cargo Option 5b
Relocation to Northside - West Development and Former Dog Track Property - Option B

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-28-35-Cargo Options.dwgLayout: Ex 5-33 Plotted: Sep 5, 2019, 12:30PM

Cargo Option 6a - Plan View

LEGEND

Airport Property Boundary/Honeywell Property/Honeywell Leasehold

KEY: Cargo Faciltiy (Total SF) - % of Requirement

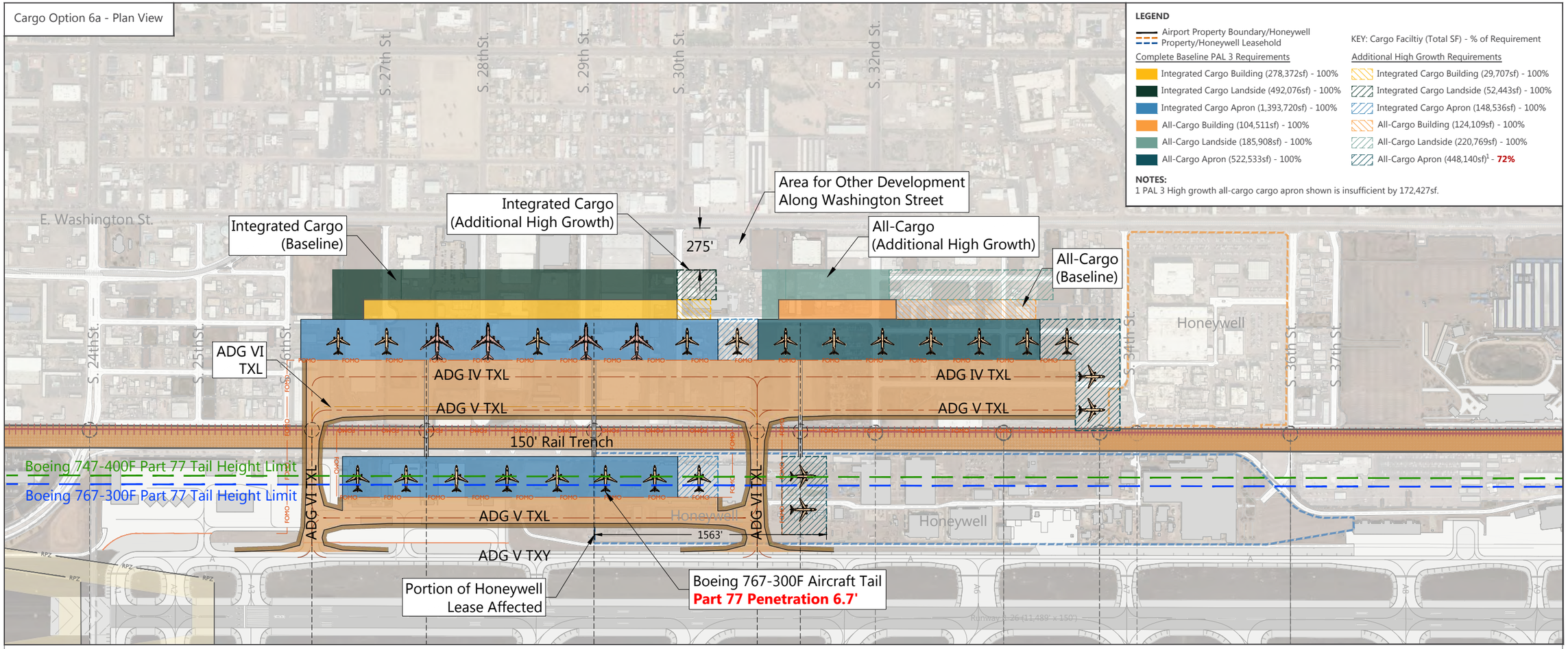
Complete Baseline PAL 3 Requirements

- Integrated Cargo Building (278,372sf) - 100%
- Integrated Cargo Landside (492,076sf) - 100%
- Integrated Cargo Apron (1,393,720sf) - 100%
- All-Cargo Building (104,511sf) - 100%
- All-Cargo Landside (185,908sf) - 100%
- All-Cargo Apron (522,533sf) - 100%

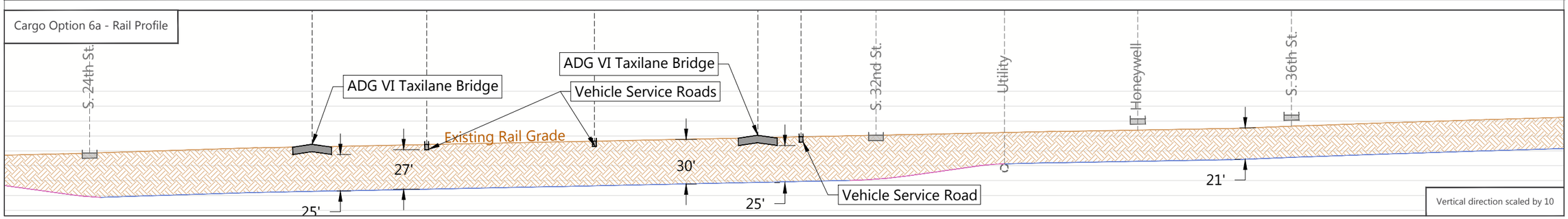
Additional High Growth Requirements

- Integrated Cargo Building (29,707sf) - 100%
- Integrated Cargo Landside (52,443sf) - 100%
- Integrated Cargo Apron (148,536sf) - 100%
- All-Cargo Building (124,109sf) - 100%
- All-Cargo Landside (220,769sf) - 100%
- All-Cargo Apron (448,140sf)[1] - **72%**

NOTES:
1 PAL 3 High growth all-cargo cargo apron shown is insufficient by 172,427sf.



Cargo Option 6a - Rail Profile



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., November 2018 (concept).

NORTH 0 700 ft.

EXHIBIT 5-34

Cargo Option 6a
Relocation to Northside - West Development - Option A

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-28-35-Cargo Options.dwgLayout: Ex 5-34 Plotted: Sep 5, 2019, 12:31PM

Cargo Option 6b - Plan View

LEGEND

Airport Property Boundary/Honeywell Property/Honeywell Leasehold

KEY: Cargo Faciltiy (Total SF) - % of Requirement

Complete Baseline PAL 3 Requirements

- Integrated Cargo Building (278,744sf) - 100%
- Integrated Cargo Landside (492,076sf) - 100%
- Integrated Cargo Apron (1,393,720sf) - 100%
- All-Cargo Building (104,511sf) - 100%
- All-Cargo Landside (185,908sf) - 100%
- All-Cargo Apron (522,533sf) - 100%

Additional High Growth Requirements

- Integrated Cargo Building (29,707sf) - 100%
- Integrated Cargo Landside (52,443sf) - 100%
- Integrated Cargo Apron (148,536sf) - 100%
- All-Cargo Building (124,109sf) - 100%
- All-Cargo Landside (220,769sf) - 100%
- All-Cargo Apron (620,567sf) - 100%

Integrated Cargo (Additional High Growth)

Building Width - 125' (Preferred 132')
Dock Width - 175' (Preferred 200')

All-Cargo (Additional High Growth)

Integrated Cargo (Baseline)

All-Cargo (Baseline)

E. Washington St.

S. 24thSt.

S. 25thSt.

S. 26thSt.

S. 27th St.

S. 28thSt.

S. 29th St.

S. 30th St.

S. 32nd St.

S. 34th St.

S. 36th St.

S. 37th St.

Honeywell

ADG IV TXL

ADG V TXL

ADG VI TXL

150' Rail Trench

Boeing 747-400F Part 77 Tail Height Limit

Boeing 767-300F Part 77 Tail Height Limit

Dual Taxiways through Existing Honeywell Lease

Runway 8-26 (11,489' x 150')

Cargo Opt 6b - Rail Profile

S. 24th St. (bridge)

ADG V Taxilane Bridges

S. 32nd St.

Utility

Honeywell

Roadway Lift (7')

S. 36th St.

Existing Rail Grade

25'

30'

25'

21'

Vertical direction scaled by 10

SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., November 2018 (concept).

NORTH 0 700 ft.

EXHIBIT 5-35

Cargo Option 6b
Relocation to Northside - West Development - Option B

TABLE 5-12 CARGO EVALUATION MATRIX

CATEGORY	CRITERIA	OPTION 1 CARGO EXPANSION WITHIN SOUTH CARGO	OPTION 2 LIMITED WITHIN AIRFIELD	OPTION 3 CARGO WITHIN EXISTING AIRPORT PROPERTY	OPTION 4 EAST DEVELOPMENT	OPTION 5A WEST & EAST DEVELOPMENT	OPTION 5B WEST & EAST DEVELOPMENT	OPTION 6A WEST DEVELOPMENT	OPTION 6B WEST DEVELOPMENT
Economic Viability	Development Costs	CHALLENGING	ADEQUATE	CHALLENGING	CHALLENGING	CHALLENGING	CHALLENGING	CHALLENGING	CHALLENGING
	Financial Feasibility	CHALLENGING	ADEQUATE	CHALLENGING	ADEQUATE	CHALLENGING	CHALLENGING	CHALLENGING	CHALLENGING
	Maintenance, Operation, and Deconstruction Costs	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	CHALLENGING	CHALLENGING	CHALLENGING	CHALLENGING
	Utilization of Existing Infrastructure	ACHIEVES	ACHIEVES	CHALLENGING	ADEQUATE	CHALLENGING	CHALLENGING	CHALLENGING	CHALLENGING
	Expansion Capability Beyond Planning Horizon	DEFICIENT	DEFICIENT	CHALLENGING	DEFICIENT	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS
	Revenue Impacts	DEFICIENT	DEFICIENT	CHALLENGING	DEFICIENT	ACHIEVES	ACHIEVES	ACHIEVES	ACHIEVES
Operational Efficiency	Safety	ADEQUATE	CHALLENGING	ADEQUATE	CHALLENGING	ADEQUATE	ADEQUATE	ADEQUATE	ACHIEVES
	Compatibility	ADEQUATE	CHALLENGING	ADEQUATE	CHALLENGING	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
	Operational Impacts During Construction	DEFICIENT	CHALLENGING	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
	On-Airport Land Use	DEFICIENT	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
	Phasing Complexity/Scalability	DEFICIENT	ACHIEVES	ACHIEVES	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
	Flexibility	DEFICIENT	DEFICIENT	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	CHALLENGING	ACHIEVES
Natural Resource Conservation	Energy, Air Quality, and Greenhouse Gases	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
	Historic and Cultural Resources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Environmental Consequence	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE	ADEQUATE
Social Responsibility	Economic Impact to Business Partners and the Community	DEFICIENT	CHALLENGING	ADEQUATE	ADEQUATE	ACHIEVES	ACHIEVES	ACHIEVES	ACHIEVES
	Airport/Community Experience	DEFICIENT	DEFICIENT	CHALLENGING	CHALLENGING	ACHIEVES	ACHIEVES	ACHIEVES	ACHIEVES
	Level of Service	DEFICIENT	DEFICIENT	CHALLENGING	DEFICIENT	ADEQUATE	ACHIEVES	CHALLENGING	ACHIEVES
	Off-Airport Land Use Compatibility	CHALLENGING	CHALLENGING	ADEQUATE	ADEQUATE	EXCEEDS	EXCEEDS	EXCEEDS	EXCEEDS
									Top Option

SOURCE: Ricondo & Associates, Inc., November 2018.

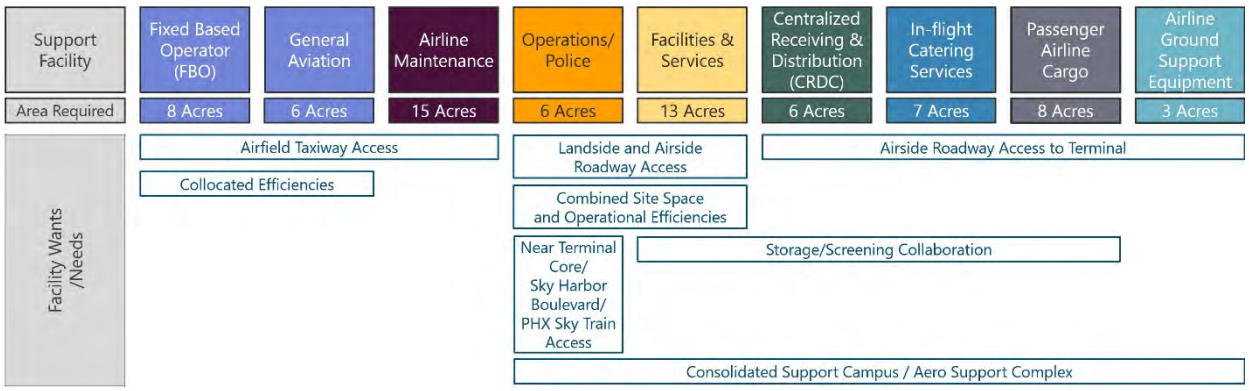
Cargo Option 6b was evaluated as the preferred option as it could meet PAL 3 high growth requirements with minimal impact to the existing airfield and would not result in any Part 77 penetrations by parked aircraft. The integrated and all-cargo facilities would be adjacent to each other in this option, providing greater flexibility for sharing of facilities and accommodating future growth. The dual ADG V taxilanes would incorporate an ADG VI taxilane (Boeing 747-800F aircraft) with a 108-foot wingspan limit on the adjacent taxilane. Also, Option 6b would not result in any Part 77 aircraft tail penetrations.

5.8 OTHER SUPPORT FACILITIES

Other support facilities include those associated with GA (both FBOs in the southwest airfield and facilities in the northwest airfield); the CRDC; flight kitchen; GSE maintenance; airline maintenance; and PHX AVN Operations, PHX AVN Facilities and Services Lot, and Police facilities.

The location of future support facilities is dependent on the future locations of the West Terminal and associated concourses, cargo facilities, and expansion of the AZANG base. These facility locations must also consider accessibility to necessary infrastructure (e.g., landside and airside roadways), operational functions (e.g., airfield taxiways and security screening capabilities), and available land. To optimize PHX's overall operational efficiency, support facilities that serve similar entities or share common functions are collocated where feasible. **Exhibit 5-36** depicts the location and area requirements for the major support facilities at PHX.

EXHIBIT 5-36 SUPPORT FACILITIES LOCATION AND AREA REQUIREMENTS



SOURCE: Ricondo & Associates, Inc., January 2019.

As shown on the exhibit, each of the different support facilities has different location requirements to support airport and airline operations. The GA and airline maintenance facilities require airfield taxiway access but do not need to be near other support facilities. All other support facilities are ideally placed near the terminal to serve airlines and passengers and could benefit from sharing certain storage and screening facilities. These facilities (Facilities and Services, CRDC, In-flight Catering, Passenger Airline Cargo, Airline GSE) require nearly 40 acres of land.

Cargo Option 6b was identified as the preferred option and would occupy much of the northside area west of the Honeywell property. The only remaining area that could support up to 40 acres of collocated facilities is in the northeast and northwest corners of the airfield. The northeast area was explored for the collocated facilities, but the area was determined to be better suited for GA. The travel time and distance between this northwest area and Terminal 3 and Terminal 4 would be longer than collocated facilities placed in the northeast corner of the airfield which could have VSR access around Runway 26. Furthermore, with the UPRR trench, the former dog track property could be used for these facilities and provide future expansion capability while allowing for other aeronautical development that could complement these facilities. The following describes the concept for other support facilities shown on **Exhibit 5-37**.

5.8.1 GENERAL AVIATION

With the relocation of South Air Cargo operations to the north and the AZANG's expansion into the former South Air Cargo area, a portion of the South Air Cargo apron would be available for GA FBO use. An area adjacent to FBO facilities would provide 8 acres for expansion of conventional hangars, apron, and associated taxilanes for transient GA aircraft, meeting PAL 3 requirements. The facility would share taxilanes with the AZANG and relocation of the existing VSR would be required, as shown on **Exhibit 5-38**.

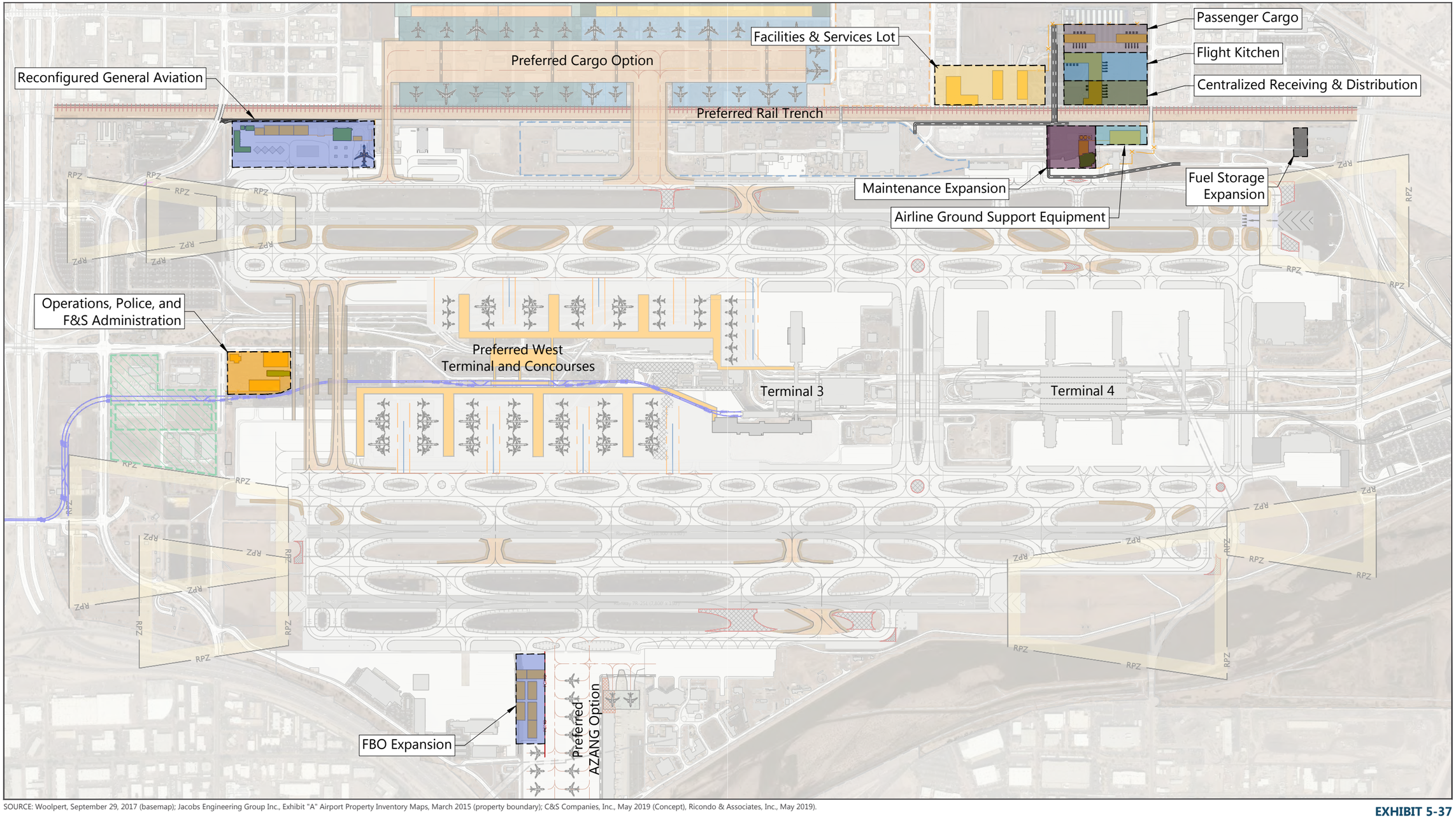
The GA facilities in the northwest corner of the airfield would be reconfigured in their existing location. The layout includes the removal of all T-hangars and one large executive shared-wall hangar. Several of the smaller corporate hangars would be replaced with larger corporate hangars capable of storing more aircraft. Additionally, the area directly east, bordered by the proposed future taxiway bridges, the UPRR, and existing Taxiway A, would be preserved for additional aeronautical and/or GA-related activities and businesses, such as accommodating sports teams, VIP flights, and an aircraft/passenger isolation area.

5.8.2 AIRLINE MAINTENANCE

American Airlines, Southwest Airlines, and Mesa Airlines operate airline maintenance facilities at the Airport. American Airlines and Southwest Airlines can expand within their existing leasehold and Mesa Airlines does not require any additional facilities within the planning horizon. Airline maintenance facility requirements identified the need for an additional 15 acres for any potential airline maintenance facilities. An area has been reserved adjacent to the Mesa Airlines Corporate Hangar facility for expansion, as illustrated on **Exhibit 5-39**. Areas identified for other aeronautical development could also be occupied by airline maintenance facilities.

5.8.3 NORTH AERO SUPPORT COMPLEX

The preferred concept collocates several support facilities, such as the CRDC, flight kitchen, passenger cargo operations, GSE maintenance and storage, the Facilities and Services Lot, and the Mesa Airlines Corporate Hangar and apron in the northeast airfield. The proposed development and accompanying facilities, referred to as the North Aero Support Complex, are shown on Exhibit 5-39. The collocation of the CRDC, flight kitchen, and passenger cargo facilities allows for more efficient use of the area by enabling joint use of landside access roads, vehicle parking lots, and loading/unloading docks. The Facilities and Services lot/service yard has access to landside and airside roadways and is compatible with the surrounding activities.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); C&S Companies, Inc., May 2019 (Concept), Ricondo & Associates, Inc., May 2019).

NORTH

0 1,100 ft.

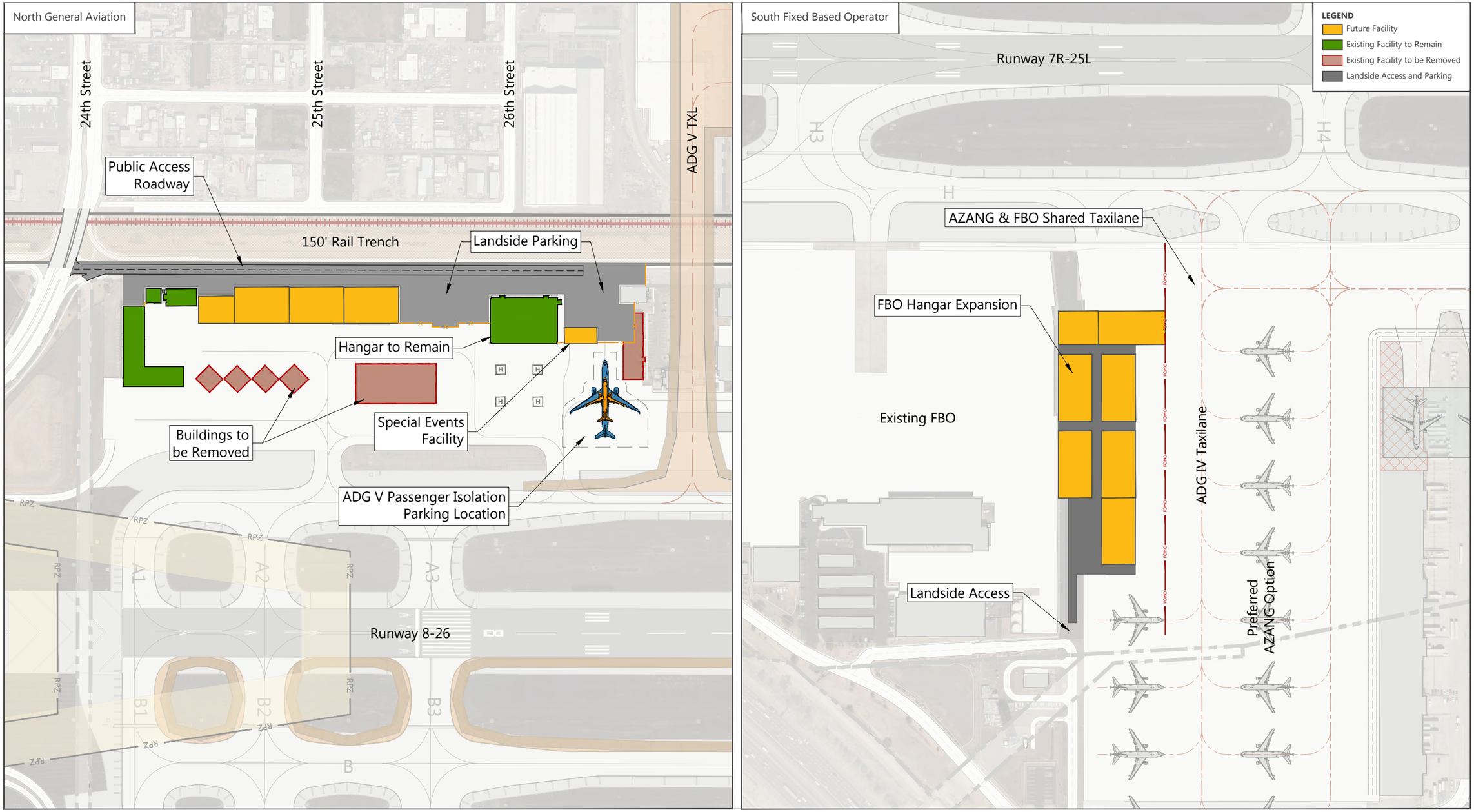
EXHIBIT 5-37

Other Support Facilities Preferred Option

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-37-39-Other Support Facilities.dwgLayout: Ex 5-37 Plotted: Sep 5, 2019, 05:11PM

North General Aviation

South Fixed Based Operator



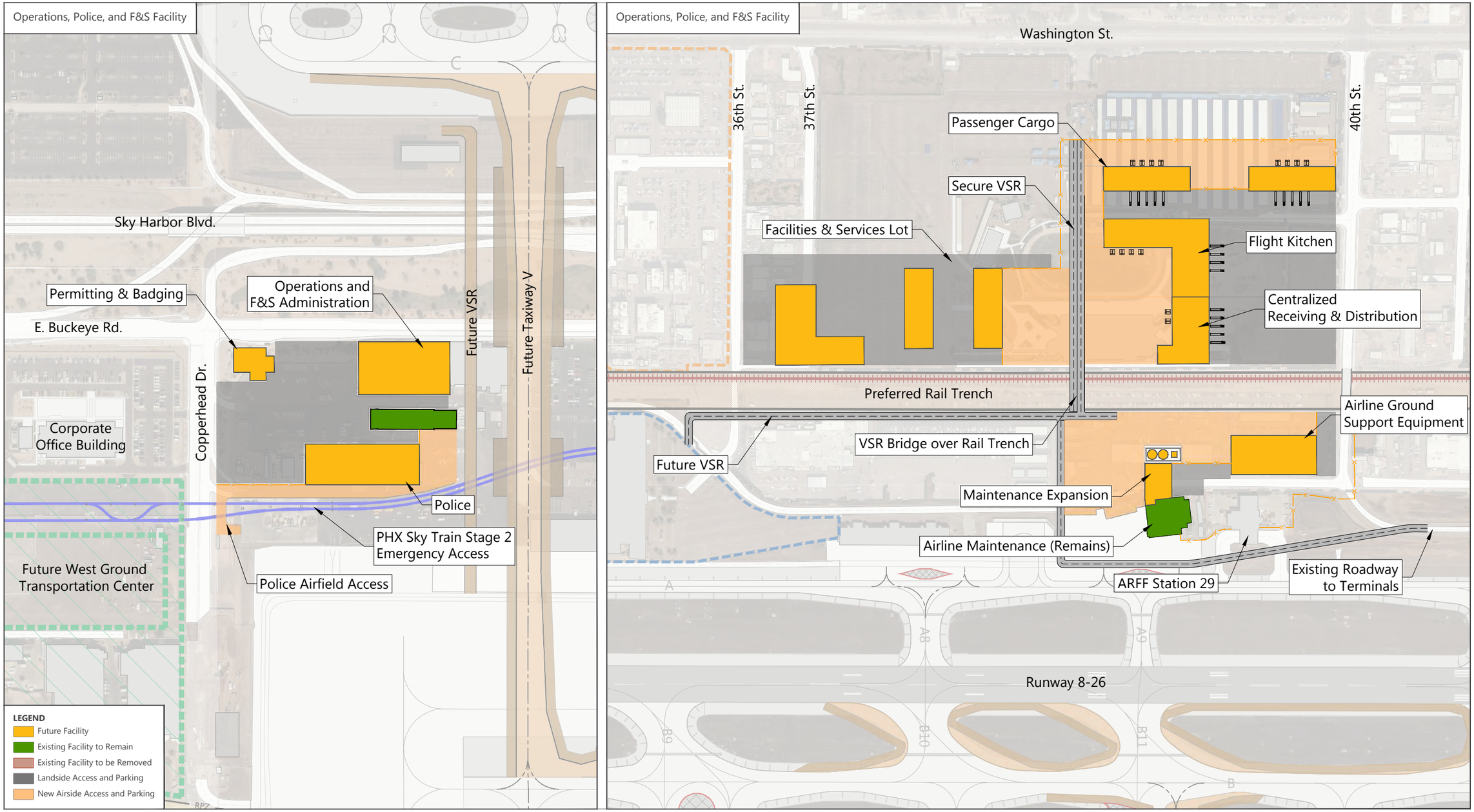
SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); C&S Companies, Inc., May 2019 (Concept), Ricondo & Associates, Inc., May 2019).

NORTH 0 300 ft.

EXHIBIT 5-38

General Aviation and Fixed Based Operator Preferred Option

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-37-39-Other Support Facilities.dwgLayout: Ex 5-38 Plotted: Sep 6, 2019, 10:26AM



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); C&S Companies, Inc., May 2019 (Concept), Ricondo & Associates, Inc., May 2019).

EXHIBIT 5-39

North Aero Support Complex and Operations Area Preferred Option

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-37-39-Other Support Facilities.dwg Layout: Ex 5-39 Plotted: Sep 5, 2019, 12:41PM

The area designated for GSE maintenance and storage would include a building equipped for use by multiple airlines, as well as ample apron space for storage of GSE equipment not in use.

5.8.4 PHX AVN COMPLEX (OPERATIONS, FACILITIES AND SERVICES, POLICE, AND BADGING/PERMITTING)

The preferred concept, shown on Exhibit 5-39 consolidates PHX AVN facilities associated with Operations, Facilities and Services Administration, Badging/Permitting, and the Airport Police Bureau in the west-central area of the airfield adjacent to the Corporate Office Building. The administrative and operations functions would have centralized access to the airfield to respond to emergencies and other urgent matters. A Badging/Permitting office would be located in this complex to be proximate the West GTC and associated PHX Sky Train station in order to provide transit and vehicle access for customers.

5.8.5 FUEL STORAGE

As discussed in Section 4, the fuel farm can accommodate storage for up to 4 days on site and accommodate storage for up to 21 days off site. Although no additional tanks are anticipated to be needed within the planning horizon, a 1.8-acre area west of the existing fuel farm facility (shown on Exhibit 5-37) has been reserved for potential expansion of fuel tanks or hydrant fueling pump facility.

5.9 LANDSIDE TRANSPORTATION FACILITIES

Development options for individual landside elements are presented in this subsection and culminate in a recommended preferred concept. The overall objectives for the development of the landside transportation options are as follows:

- Alleviate roadway congestion and remove non-Airport traffic from Airport roadways
- Provide ability to screen all vehicles on-Airport
- Improve access to and from Interstate 10
- Improve access to and from the Rental Car Center
- Promote greater use of public transportation and ground transportation centers
- Reduce complexity Issues

This section provides a summary of development options for landside transportation that have been established for the following elements:

- Terminal curbsides and vehicle parking
- West Airport access
- East Airport access

5.9.1 VEHICLE PARKING

As noted in Chapter 4, approximately 4,400 additional public and 600 employee vehicle parking spaces are needed by PAL 3. This parking demand accounts for increased TNC and autonomous vehicle activity. Due to the uncertainty of TNC and autonomous vehicle activity, as well as the proposed development of an on-

Airport hotel and 5,000 parking spaces in the West GTC, specific locations for vehicle parking development were not identified. Any additional parking would be accommodated by constructing additional parking facilities adjacent to the Future West Terminal.

It should be noted that the overall footprint to accommodate an additional 5,000 vehicle surface parking spaces and movement areas would encompass approximately 34 acres (assuming 300 square feet per space and drive aisles).

5.9.2 EVALUATION CRITERIA

Development options for future terminal curbside, East Airport Access, and West Airport/Rental Car Facility Access are presented in the following sections. Specific evaluation criteria were developed to compare the roadway options based on the following factors:

- **Compatibility** – Maximizes investment and minimizes potential negative impacts to surrounding facilities and transportation network.
- **Accommodates Demand** – Accommodates increased levels of passenger and vehicle activity.
- **Customer Experience** – Ability to conveniently and efficiently support movement of Airport users.
- **Feasibility** – Implementation is viable, realistic, and achievable in a manner that does not overburden the financial resources of the Airport, or other funding parties.
- **Cost** – Probable costs in 2019 dollars.

Each option was assigned a rating based on the criteria identified above. These designations are described as follows:

- **Exceeds** – The proposed option improves the overall LOS compared with baseline conditions.
- **Achieves** – The proposed option satisfies the overall LOS.
- **Adequate** – The proposed option satisfies the overall LOS with minor impacts.
- **Challenging** – The proposed option satisfies the overall LOS with significant impacts.
- **Deficient** – The proposed option does not satisfy the overall LOS.

5.9.3 TERMINAL CURBSIDES

Following the closure of Terminal 2, all Airport curbside activity will occur at Terminal 3 and Terminal 4. Terminal 3 provides inner and outer curbsides on both the north and south sides of the terminal, where the outer curbs serve commercial vehicle traffic and the inner curbs serve private vehicles. The Terminal 4 arrivals and departures curbs are grade-separated onto two separate levels. The lower level is designated for arrivals and consists of two north curbs and two south curbs. Private vehicles utilize the inner curbs, while commercial vehicles are positioned on the outer curbs. The upper level is designated for departures and consists of one curb on each of the north and south sides that are shared between commercial and private vehicles.

This subsection focuses on development of a curbside configuration for the preferred West Terminal concept. Multiple curbside options for the West Terminal were developed and evaluated assuming PAL 3

passenger demand. All curbside options include grade-separated arrivals and departures curbs on both the north and south sides of the West Terminal. The following subsections summarize the West Terminal curbside options and evaluation.

5.9.3.1 CURBSIDE OPTION 1

Curbside Option 1 would provide separate, inner and outer curbsides on both the north and south sides for arrivals activity on the lower level, as shown on **Exhibit 5-40**. A departures curb would be provided on both the north and south sides of the West Terminal on an upper level. The proposed inner curbs would be utilized by private vehicles while the outer curb would be reserved for commercial vehicles. Three crosswalks would connect pedestrians between the terminal and outer curb, which would create vehicle-pedestrian conflict points that may induce delays.

The anticipated length of curbside frontage on the arrivals inner curbsides (for private vehicles) would be approximately 630 feet (750 feet minus approximately 120 feet for three pedestrian crosswalks). The anticipated length of curbside frontage on the arrivals outer curbsides (for commercial vehicles) and on the departures curbsides (for private and commercial vehicles) would be approximately 750 feet.

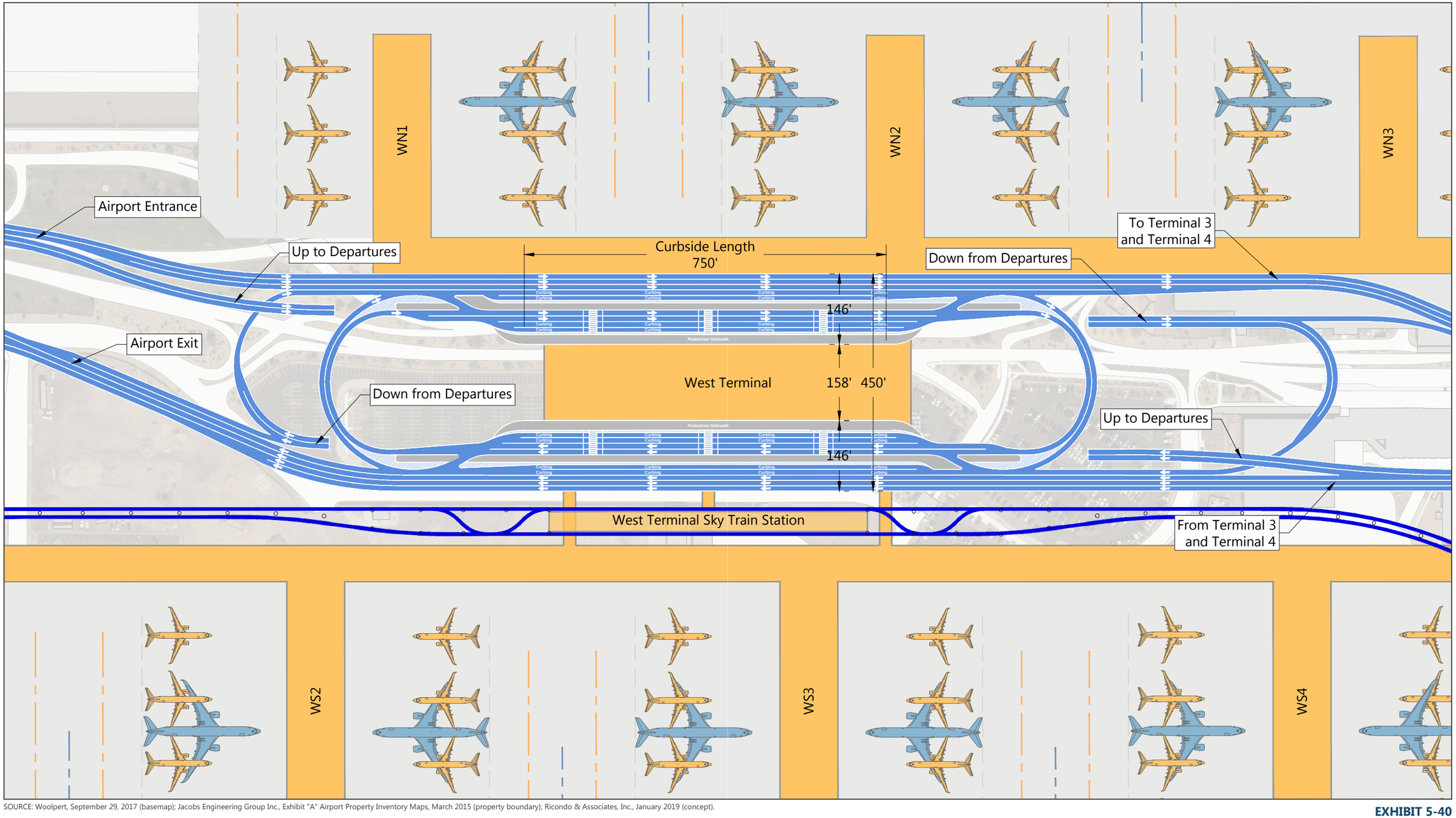
Curbside demand calculations were performed in accordance with methodologies contained in ACRP Report 40, *Airport Curbside and Terminal Area Roadway Operations*. Minimum curbside frontage lengths required to achieve curbside LOS C are summarized in **Table 5-13**.

TABLE 5-13 CURBSIDE OPTION 1 FRONTAGE SUMMARY

CURBSIDE	TRAVEL MODES	MINIMUM CURBSIDE FRONTAGE REQUIRED FOR LOS C[1,2] (FT)	OVERALL CURBSIDE LENGTH (FT)	LENGTH REDUCTION FOR CROSSWALKS (FT)	CURBSIDE FRONTAGE LENGTH PROVIDED[1] (FT)
Arrivals North Inner	Private	300	750	120	630
Arrivals North Outer	Commercial	255	750	-	750
Arrivals South Inner	Private	320	750	120	630
Arrivals South Outer	Commercial	210	750	-	750
Departures North	Mix	505	750	-	750
Departures South	Mix	565	750	-	750

NOTES:
1 Assumes two curbing lanes are provided.
2 Required curbside frontage length does not include space potentially needed for commercial vehicle staging on arrivals outer curbs.
SOURCE: Kimley-Horn and Associates, Inc., May 2019.

The provided curbside frontage lengths for each of the arrivals inner curbsides and each of the departures curbsides are projected to exceed the minimum required lengths for curbside LOS C under projected PAL 3 conditions. Arrivals outer curbsides are also projected to exceed the minimum required lengths and should have adequate space for vehicle staging for specific commercial modes that typically require it.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., January 2019 (concept).

NORTH

0 200 ft.

EXHIBIT 5-40

Curbside Option 1

5.9.3.2 CURBSIDE OPTION 2

Similar to Option 1, Curbside Option 2 would provide separate, inner and outer curbsides on both the north and south sides for arrivals on the lower level, as shown on **Exhibit 5-41**. Additionally, a single, departures curb is provided on both the north and south sides of the upper level. The proposed arrivals inner curbs would be utilized by private vehicles while the outer curb would be reserved for commercial vehicles. Three crosswalks connect pedestrians between the terminal and outer curb, which would create vehicle-pedestrian conflict points that may induce delays.

Option 2 would locate the southern curbsides south of the PHX Sky Train West Terminal station. This would allow the footprint of the West Terminal to be expanded south, increasing the available footprint for the building. Placing the curbsides south of the station would require the pier concourses to be shifted south, reducing the total number of south concourse narrowbody gates from 35 to 29.

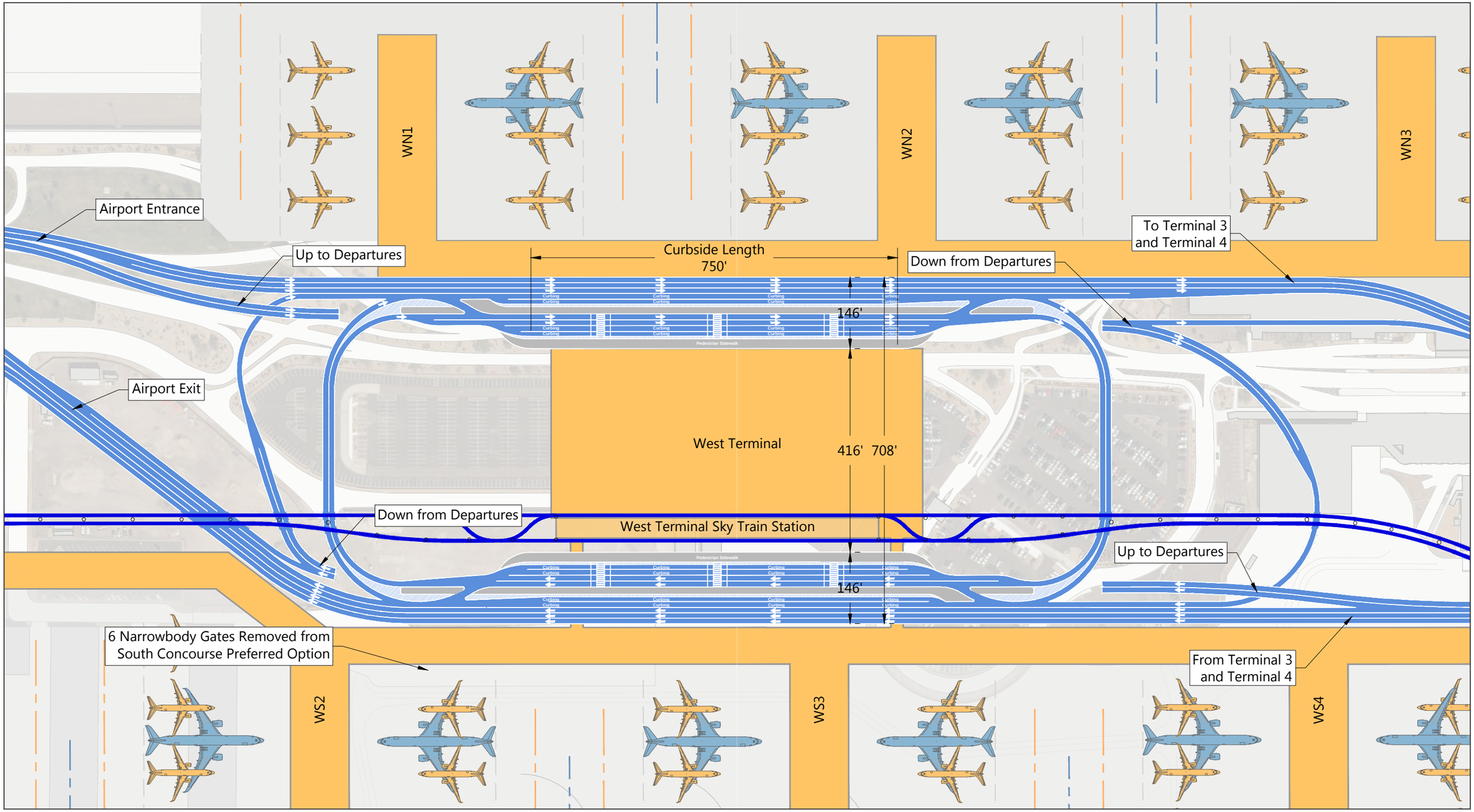
The anticipated length of curbside frontage on the arrivals inner curbsides (for private vehicles) would be approximately 630 feet (750 feet minus approximately 120 feet for three pedestrian crosswalks). The anticipated length of curbside frontage on the arrivals outer curbsides (for commercial vehicles) and on the departures curbsides (for private and commercial vehicles) would be approximately 750 feet. Minimum curbside frontage lengths required to achieve curbside LOS C are summarized in **Table 5-14**.

TABLE 5-14 CURBSIDE OPTION 2 FRONTAGE SUMMARY

CURBSIDE	TRAVEL MODES	MINIMUM CURBSIDE FRONTAGE REQUIRED FOR LOS C AT PAL 3[1,2] (FT)	OVERALL CURBSIDE LENGTH (FT)	LENGTH REDUCTION FOR CROSSWALKS (FT)	CURBSIDE FRONTAGE LENGTH PROVIDED[1] (FT)
Arrivals North Inner	Private	300	750	120	630
Arrivals North Outer	Commercial	255	750	-	750
Arrivals South Inner	Private	320	750	120	630
Arrivals South Outer	Commercial	210	750	-	750
Departures North	Mix	505	750	-	750
Departures South	Mix	565	750	-	750

NOTES:
1 Assumes two curbing lanes are provided.
2 Required curbside frontage length does not include space potentially needed for commercial vehicle staging on arrivals outer curbs.
SOURCE: Kimley-Horn and Associates, Inc., May 2019.

As shown, the provided curbside frontage lengths for each of the arrivals inner curbsides and each of the departures curbsides are projected to exceed the minimum required lengths to achieve curbside LOS C. Arrivals outer curbsides are also projected to exceed the minimum required lengths and should have adequate space for vehicle staging for specific commercial modes that typically require it.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., January 2019 (concept).

NORTH 0 200 ft.

EXHIBIT 5-41

Curbside Option 2

5.9.3.3 CURBSIDE OPTION 3

Curbside Option 3 would provide a single, arrivals curb on both the north and south sides on the lower level, as shown on **Exhibit 5-42**. Additionally, a single, departures curb is provided on both the north and south sides of the upper level. Both the arrivals curb and departures curb would be shared by private and commercial vehicles. In contrast to Options 1 and 2, Option 3 would not require pedestrian crosswalks. The anticipated length of curbside frontage on the arrivals curbsides and on the departures curbsides would be approximately 900 feet. Minimum curbside frontage lengths required to achieve curbside LOS C are summarized in **Table 5-15**.

TABLE 5-15 CURBSIDE OPTION 3 FRONTAGE SUMMARY

CURBSIDE	TRAVEL MODES	MINIMUM CURBSIDE FRONTAGE REQUIRED FOR LOS C AT PAL 3[1,2] (FT)	OVERALL CURBSIDE LENGTH (FT)	LENGTH REDUCTION FOR CROSSWALKS (FT)	CURBSIDE FRONTAGE LENGTH PROVIDED[1] (FT)
Arrivals North	Mix	555	900	-	900
Arrivals South	Mix	530	900	-	900
Departures North	Mix	505	900	-	900
Departures South	Mix	565	900	-	900

NOTES:
1 Assumes two curbing lanes are provided.
2 Required curbside frontage length does not include space potentially needed for commercial vehicle staging on arrivals curbs.
SOURCE: Kimley-Horn and Associates, Inc., May 2019.

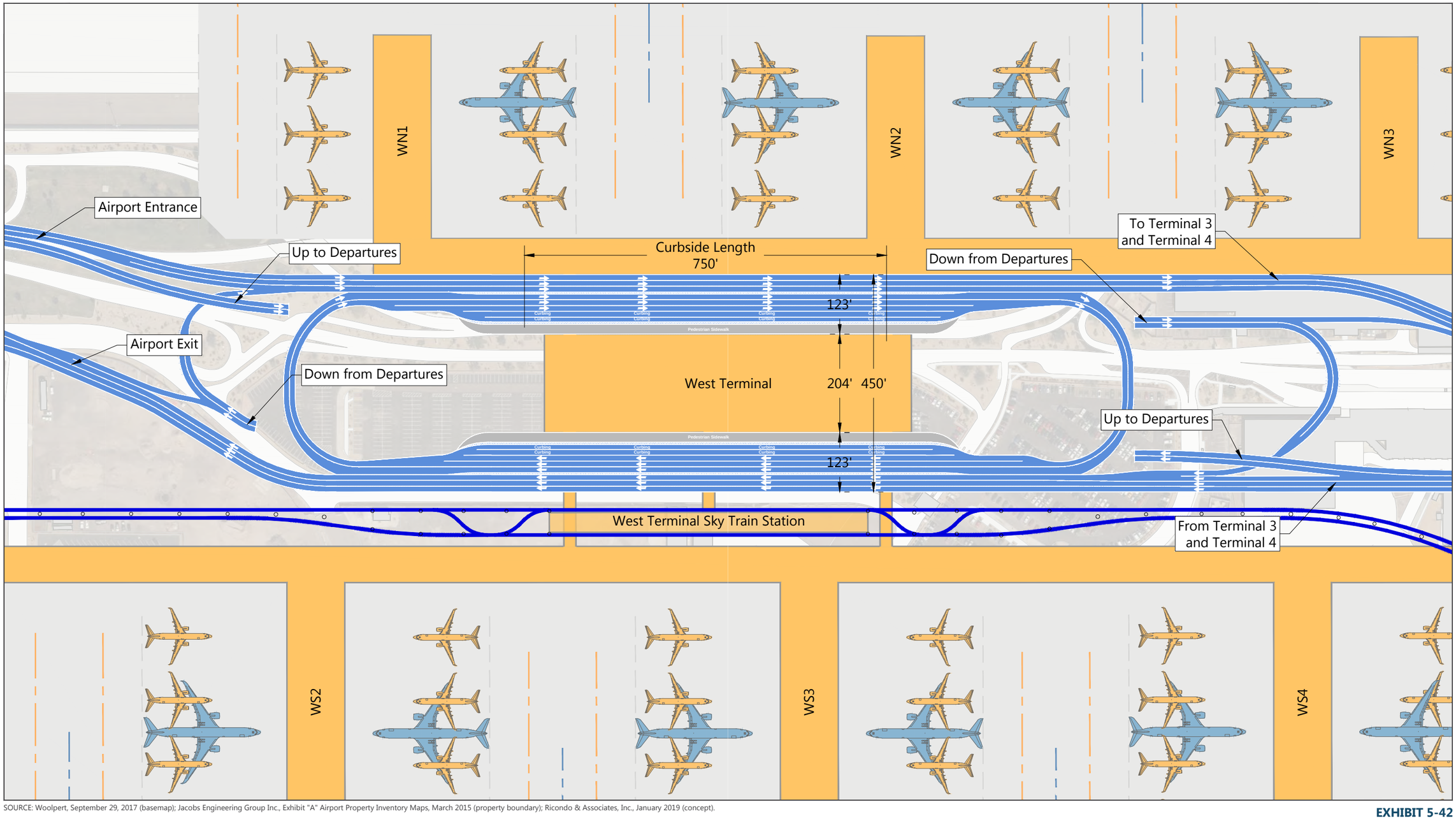
As shown, the provided curbside frontage lengths for each of the arrivals curbsides and each of the departures curbsides would be projected to exceed the minimum required lengths for curbside LOS C at PAL 3 and the arrivals curbsides should have adequate space for vehicle staging for specific commercial modes that typically require it.

5.9.3.4 PREFERRED CURBSIDE OPTION

Based on qualitative and quantitative evaluations of the three considered curbside options for the West Terminal, Option 3 has been identified as preferred since it can accommodate a wider terminal footprint while not impacting airside gates and/or airside operations. An evaluation of the three options described in this section is presented in **Table 5-16**.

5.9.3.5 CURBSIDE LEVEL OF SERVICE IMPROVEMENTS AT EXISTING TERMINALS

As summarized in Section 4.4.2.1, some of the curbsides at Terminal 3 and Terminal 4 are not projected to maintain an acceptable LOS through PAL 3. Upon opening of the proposed West Terminal, vehicular demand would be reduced on Terminal 3 and Terminal 4 curbsides depending on which airlines are relocated between terminals. This demand reduction and balancing at Terminal 3 and Terminal 4 is projected to mitigate curbside congestion and improve LOS to an acceptable level. There are also opportunities to reallocate vehicle modes between curbs and encourage greater utilization of GTC facilities and the PHX Sky Train to reduce demand on specific curbsides.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., January 2019 (concept).

NORTH

0 200 ft.

EXHIBIT 5-42

Curbside Option 3

TABLE 5-16 EVALUATION OF CURBSIDE OPTIONS

EVALUATION CRITERIA	DESCRIPTION	OPTION 1		OPTION 2		OPTION 3	
Compatibility	Maximizes investment and minimizes potential negative impacts to surrounding facilities and transportation network.	ADEQUATE	Curb roadway alignments integrate well with terminal area roadways. Significantly limits the terminal footprint which is not favorable for terminal operations.	CHALLENGING	Westbound terminal area roadway needs realignment to connect with southern curb. Impacts to airside require eliminating six narrowbody gates. Allows enhanced integration of Sky Train station within terminal building.	ACHIEVES	Curb roadway alignments integrate well with terminal area roadways. Allows for an acceptable terminal footprint width.
Accommodates Demand	Based on professional judgement. Accommodates increased levels of passenger and vehicle activity.	ACHIEVES	Both north and south arrivals and departures curbs provide an excess of length to accommodate LOS C. Limits West Terminal width to 158 feet (below the preferred 200 feet minimum)	EXCEEDS	Both north and south arrivals and departures curbs provide an excess of length to accommodate LOS C. Accommodates more than the 200-foot preferred terminal width.	EXCEEDS	Both north and south arrivals and departures curbs provide an excess of length to accommodate LOS C. Accommodates the 200-foot preferred terminal width
Customer Experience	Based on professional judgment. Able to conveniently and efficiently support movement of Airport users.	ACHIEVES	Ample crosswalk space and double parked curb length is provided. Pedestrians must cross vehicle traffic to move to outer curb. Limits traffic weaving between terminal area roadway and curb. Separate arrivals curb for private and commercial traffic. Similar curbside configuration to the existing Terminal 4, providing a familiar customer experience.	ACHIEVES	Ample crosswalk space and double parked curb length is provided. Pedestrians must cross vehicle traffic to move to outer curb. Limits traffic weaving between terminal area roadway and curb. Separate arrivals curb for private and commercial traffic. Similar curbside configuration to the existing Terminal 4, providing a familiar customer experience.	ACHIEVES	Ample double parked curb length is provided. No conflict between pedestrians and vehicles. Increased traffic between terminal area roadway and curb. Private and commercial traffic share the arrivals curb.
Feasibility	Implementation is viable, realistic, and achievable in a manner that does not overburden the financial resources of the Airport, or other funding parties.	ACHIEVES	Terminal footprint is small but does not require excessive construction efforts to surrounding airside and landside facilities.	ADEQUATE	Largest West Terminal footprint but requires excessive construction efforts to surrounding airside and landside facilities.	ACHIEVES	Terminal footprint is small (though larger than Option 1) but does not require excessive construction efforts to surrounding airside and landside facilities.
Cost	Probable construction costs in 2019 dollars.	ADEQUATE	Anticipated budget is +/- $137 million.	ADEQUATE	Anticipated budget is +/- $137 million. Potential additional cost for weaving below the PHX Sky Train Stage 2 alignment.	ADEQUATE	Anticipated budget is +/- $137 million.
			$137,000,000.00		**$137,000,000.00**		**$137,000,000.00**

NOTE: Costs are in 2019 dollars.
SOURCE: Kimley-Horn and Associates, Inc., May 2019.

5.9.4 AIRPORT ACCESS

5.9.4.1 CUT-THROUGH TRAFFIC MITIGATION

As summarized in Section 4.4.2.2, the ALPS model estimated 50 percent of peak hour westbound and 24 percent of peak hour eastbound weekday morning peak hour traffic is conducted by vehicles that cut-through the Airport. During the weekday evening peak hour, westbound cut-through traffic comprises approximately 52 percent of total traffic and eastbound cut-through traffic comprises approximately 57 percent of vehicle trips. To reduce the impacts of cut-through traffic at the Airport, several mitigation options were examined including entrance toll plazas, security plazas, license plate readers, and traffic calming improvements. Each option had various advantages and disadvantages in terms of revenue enhancement to pay for impacts to the roadway network, reduction of cut-through traffic, and impacts to Airport users.

Based on feedback from PHX AVN and its stakeholders, the primary objective to mitigate cut-through traffic was to reduce the overall number of vehicles utilizing the roadway network for non-Airport purposes while posing the least inconvenience to Airport users. The recommended mitigation option was implementation of entrance security plazas at the east and west entrances of the Airport. These plazas were included in various East Airport and West Airport Access options. Staffing the plazas during peak periods of activity or installing monitoring/tolling systems may further deter cut-through traffic if it is not satisfactorily reduced.

5.9.4.2 WEST AIRPORT/RENTAL CAR CENTER ACCESS

The projected increase in O&D passengers is expected to place significant demands on landside and transportation infrastructure, specifically the Airport's roadway network. To accommodate projected demand, options have been developed to improve roadway access from the west and east sides of the Airport. West Airport access options also depict connectivity improvements to the Rental Car Center. The primary objective to improve the transportation network in and around the Airport is to enhance connectivity in a cost-effective manner and reduce cut-through traffic. The following subsections present development options and summarizes the evaluation of the West Airport and Rental Car Center access options.

West Airport Access Option 1

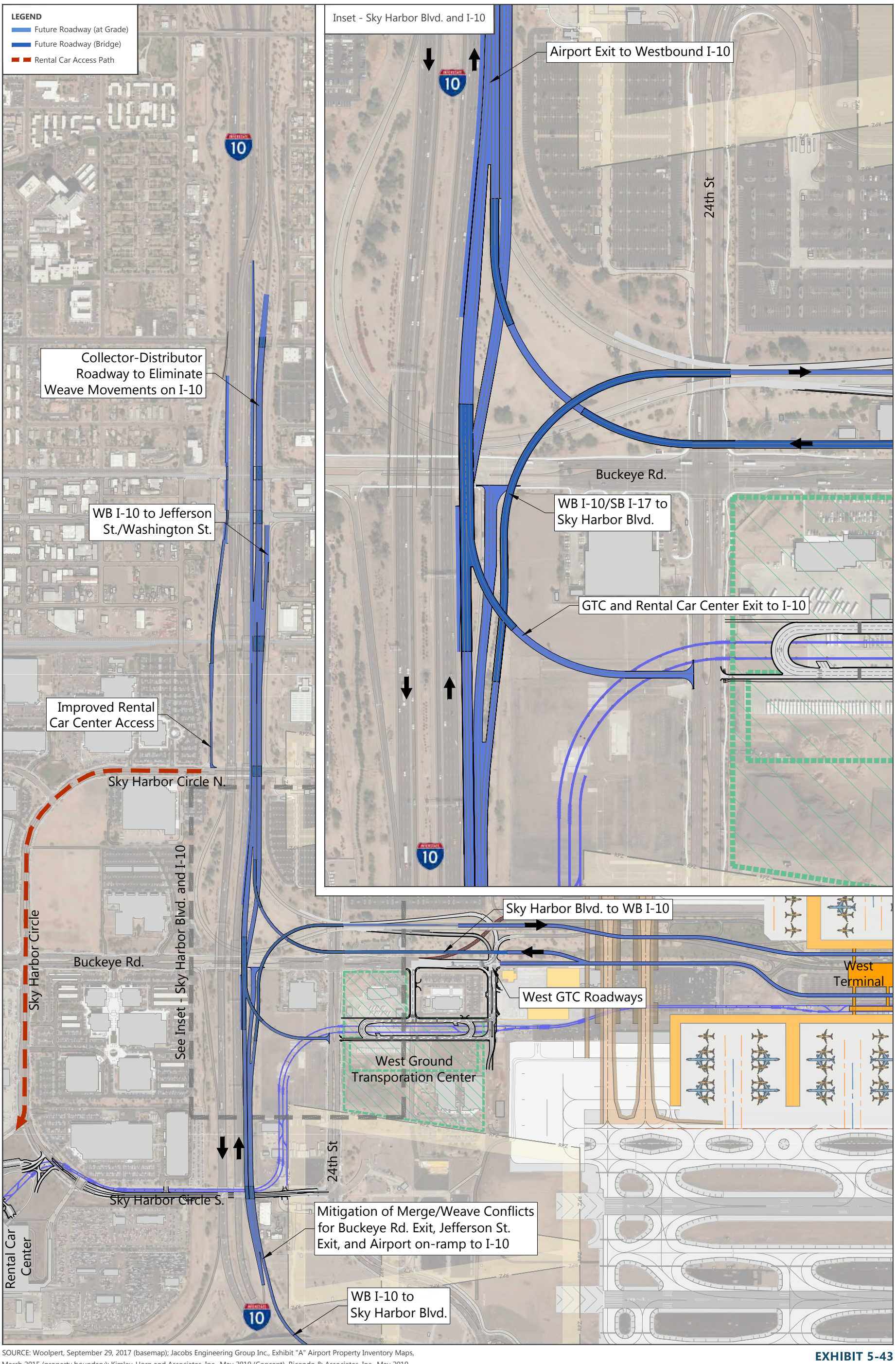
West Airport Access Option 1 would incorporate a comprehensive facility implementation strategy that enhances connectivity to and from Interstate 10, Interstate 17, the local roadway network, and surrounding facilities. The primary improvements associated with West Airport Access Option 1 are summarized in **Table 5-17** and shown on **Exhibit 5-43**.

Although each option was analyzed using the evaluation criteria described previously, there are benefits and challenges associated with each development option.

TABLE 5-17 WEST AIRPORT ACCESS IMPROVEMENTS – OPTION 1

RECOMMENDED IMPROVEMENT	PURPOSE
Construct southbound Interstate 10 exit ramp.	Bypasses intersections at Washington Street and Jefferson Street, provides additional queuing length for exiting Interstate 10. Enhances connectivity to the Rental Car Center.
Construct security plazas east of Interstate 10 and north of Buckeye Road.	Mitigates cut-through traffic without significantly impacting through-put capability. Captures all traffic entering Airport from the west.
Construct westbound Interstate 10 exit ramp and improve existing eastbound Interstate 17 exit ramp. Remove existing northbound Interstate 10 exit ramp.	Provides direct access from westbound Interstate 10 to Buckeye Road and the proposed Airport entrance. Provides direct access from eastbound Interstate 17 to Buckeye Road and the proposed Airport entrance. Eliminates the existing weave between the westbound Interstate 10 entrance ramp and the westbound Interstate 10 exit ramp. Prepares the area for full project implementation.
Construct airport entrance via flyover Ramp.	Provides direct access from westbound Interstate 10/northbound Interstate 17 to the Airport. Reduces congestion near Buckeye Road and local transportation network.
Construct entrance ramp from West GTC to northbound Interstate 10.	Provides direct access from West GTC and the Rental Car Center to westbound Interstate 10 and other major freeways north of the Airport. Reduces congestion near Buckeye Road and local transportation network.
Reconstruct entrance from Copperhead Drive to eastbound Sky Harbor Boulevard.	Accommodates vehicle traffic from eastbound Buckeye Road and West GTC.
Construct Interstate 17 collector-distributor road.	Eliminates existing weave on Interstate 10. Provides additional lanes of travel which increases capacity and reduce queueing. Improves access and connectivity of the surrounding infrastructure.
Construct new Airport exit. Remove existing exit.	Provides direct access from the Airport to westbound Interstate 10. Needed to align with Sky Harbor Boulevard. crossing under future Taxiways U/V. Reduces weave caused by the existing exit.

SOURCE: Kimley-Horn and Associates, Inc., May 2019.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Kimley-Horn and Associates, Inc., May 2019 (Concept), Ricondo & Associates, Inc., May 2019.

NORTH 0 800 ft.

EXHIBIT 5-43

West Airport Access
Option 1

West Airport Access Option 2

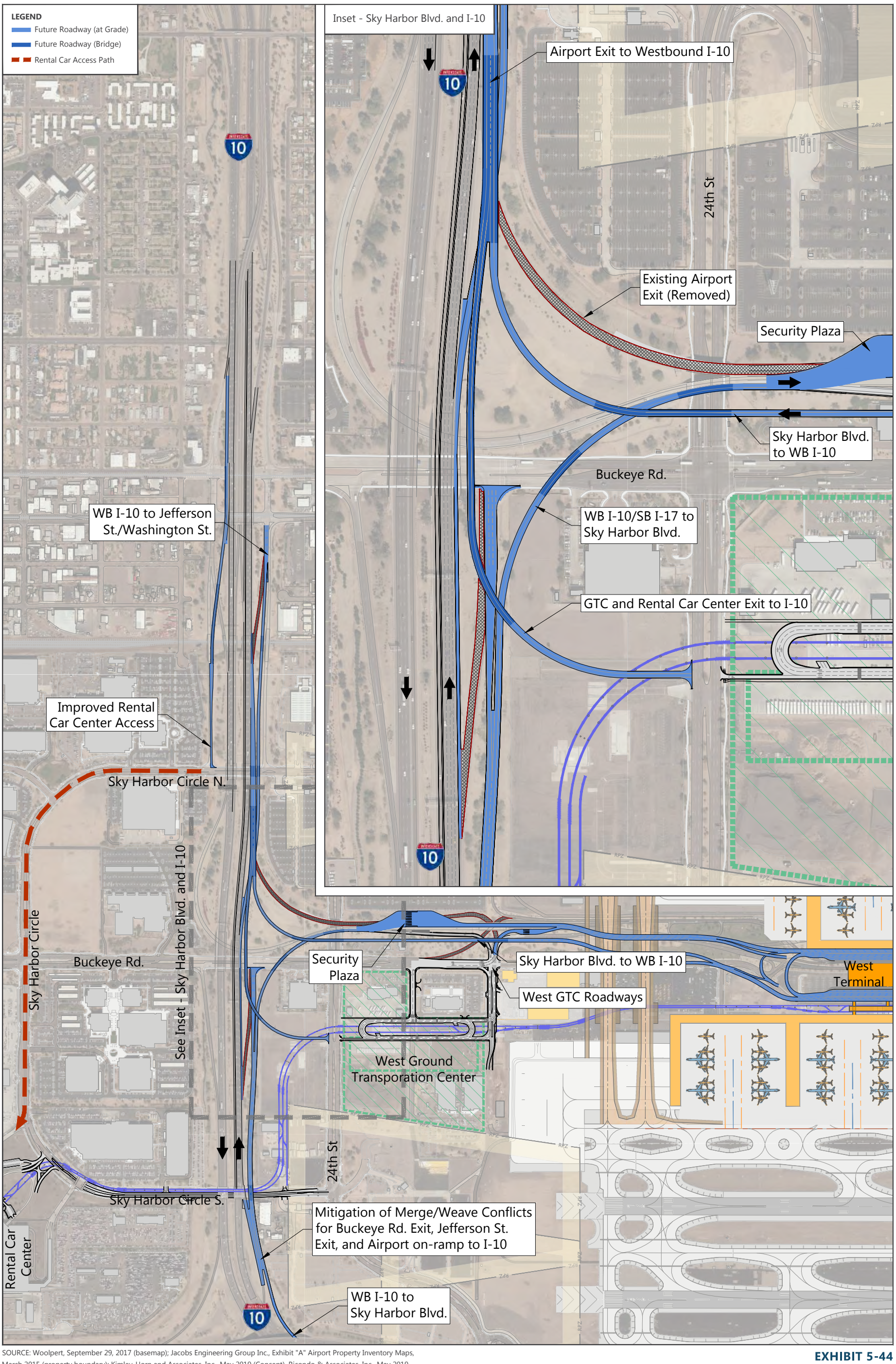
West Airport Access Option 2 provides several of the same facility improvements as Option 1 but with a lower overall project cost. The major difference between the two options is the inclusion of the collector-distributer (C-D) roads in Option 1, which significantly impacts project cost. The C-D roads would eliminate the weave on Interstate 10, provide direct access to the surrounding freeways, and reduce congestion/improve efficiency of Interstate 10 by moving the exiting traffic off the freeway. Option 2 does not propose a C-D road. Instead, it proposes a shift of the Jefferson Street exit to the south so traffic is off Interstate 10 before the Airport exit ties into Interstate 10. This would fix issues pertaining to weaving in a more cost-effective manner compared to Option 1. The primary drawbacks associated with Option 2 are that it would not relieve congestion on Interstate 10 to the same level as Option 1 and would only provide direct access to westbound Interstate 10 and not to SR 51.

The primary improvements associated with West Airport Access Option 2 are summarized in **Table 5-18** and shown on **Exhibit 5-44**.

TABLE 5-18 WEST AIRPORT ACCESS IMPROVEMENTS – OPTION 2

RECOMMENDED IMPROVEMENT	PURPOSE
Construct southbound Interstate 10 exit ramp.	Bypasses intersections at Washington Street and Jefferson Street, provides additional queuing length for exiting Interstate 10. Enhances connectivity to the rental car center.
Construct security plazas east of Interstate 10 and north of Buckeye Road.	Mitigates cut-through traffic without significantly impacting through-put capability. Captures all traffic entering Airport from the west.
Construct westbound Interstate 10 exit ramp and improve existing eastbound Interstate 17 exit ramp. Remove existing northbound Interstate 10 exit ramp.	Provides direct access from westbound Interstate 10 to Buckeye Road and the proposed Airport entrance. Provides direct access from southbound Interstate 17 to Buckeye Road and the proposed Airport entrance. Eliminates the existing weave between the westbound Interstate 10 entrance ramp and the westbound Interstate 10 exit ramp. Prepares the area for full project implementation.
Construct airport entrance via flyover ramp.	Provides direct access from westbound Interstate 10/southbound Interstate 17 to the Airport. Reduces congestion near Buckeye Road and local transportation network.
Reconstruct entrance from Copperhead Drive to eastbound Sky Harbor Boulevard.	Accommodates vehicle traffic from eastbound Buckeye Road and the West GTC.
Construct entrance ramp from West GTC to northbound Interstate 10.	Provides direct access from the Rental Car Center and West GTC to westbound Interstate 10 and other major freeways north of the Airport. Reduces congestion near Buckeye Road and local transportation network.
Construct Jefferson Street exit and remove the existing Jefferson Street exit.	Increases Jefferson Street exit capacity. Provides additional pavement for queueing. Moves exit to provide space for direct westbound Interstate 10 access from Airport exit.
Construct new Airport exit. Remove existing exit.	Provides direct access from the Airport to westbound Interstate 10 and surrounding freeway infrastructure. Needed to align with Sky Harbor Boulevard crossing under future Taxiways U and V. Eliminates weave caused by the existing exit.

SOURCE: Kimley-Horn and Associates, Inc., May 2019.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Kimley-Horn and Associates, Inc., May 2019 (Concept), Ricondo & Associates, Inc., May 2019.

NORTH 0 800 ft.

EXHIBIT 5-44

West Airport Access
Option 2

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5.9.4.3 PREFERRED WEST AIRPORT ACCESS OPTION

The two West Airport Access options were evaluated using the criteria described previously. An evaluation matrix comparing West Airport Access Option 1 and West Airport Access Option 2 is presented in **Table 5-19**.

Both West Airport Access Options 1 and 2 would enhance connectivity to passenger terminals, the West GTC, and the Rental Car Center. Both options incorporate security plazas to reduce cut-through traffic, reconfigure Buckeye Road to accommodate additional demand, and eliminate weaving south of Buckeye Road to increase capacity on Interstate 10. Both options would also widen the southbound Interstate 10 bridge over the Washington Street and Jefferson Street intersections to improve connectivity to Rental Car Center, relocate exits/entrances to increase merging capabilities, and reconfigure west Airport terminal roadways to enhance circulation and capacity.

As depicted in the evaluation matrix above, Option 1 and Option 2 project similar outcomes with respect to compatibility, accommodation of future demand, and overall customer experience. Option 2 would achieve these outcomes with a projected cost of $90 million compared with $143 million for Option 1; therefore, Option 2 is the recommended option for incorporation into the preferred concept.

5.9.4.4 EAST AIRPORT ACCESS

Several options were initially drafted to address challenges with roadways providing Airport access from the east. Based on feedback from PHX AVN and stakeholders and an analysis of feasibility, cost, and overall effectiveness, a single recommended improvement concept emerged. A second version of the recommended concept was developed that shifted the east entrance security plaza further to the east. This second version required closure of access from southbound 44th Street and did not improve any other evaluation criterial elements compared with the recommended concept. As such, this concept option was not included in the analysis provided below.

The East Airport Access Option would enhance connectivity to and from the Airport by modifying access points from SR 143 and the surrounding transportation network. It would also improve access between highly used transportation corridors and East Economy parking and other facilities located between 42nd Street and 44th Street while reducing cut-through traffic with the inclusion of a security plaza. The primary improvements associated with the east airport access option are summarized in **Table 5-20** and shown on **Exhibit 5-45**.

Utilizing the criteria described previously, an evaluation matrix that describes the East Airport Access concept is presented in **Table 5-21**. As shown, the recommended option is rated as "achieves" or "adequate" for all evaluation criteria and has a total project cost of $15 million. Although this option reduces transportation network capacity slightly by proposing the closure of the Airport entrance at 44th Street, the concept enhances connectivity to and from facilities on the east side of the Airport.

TABLE 5-19 EVALUATION OF WEST AIRPORT ACCESS OPTIONS

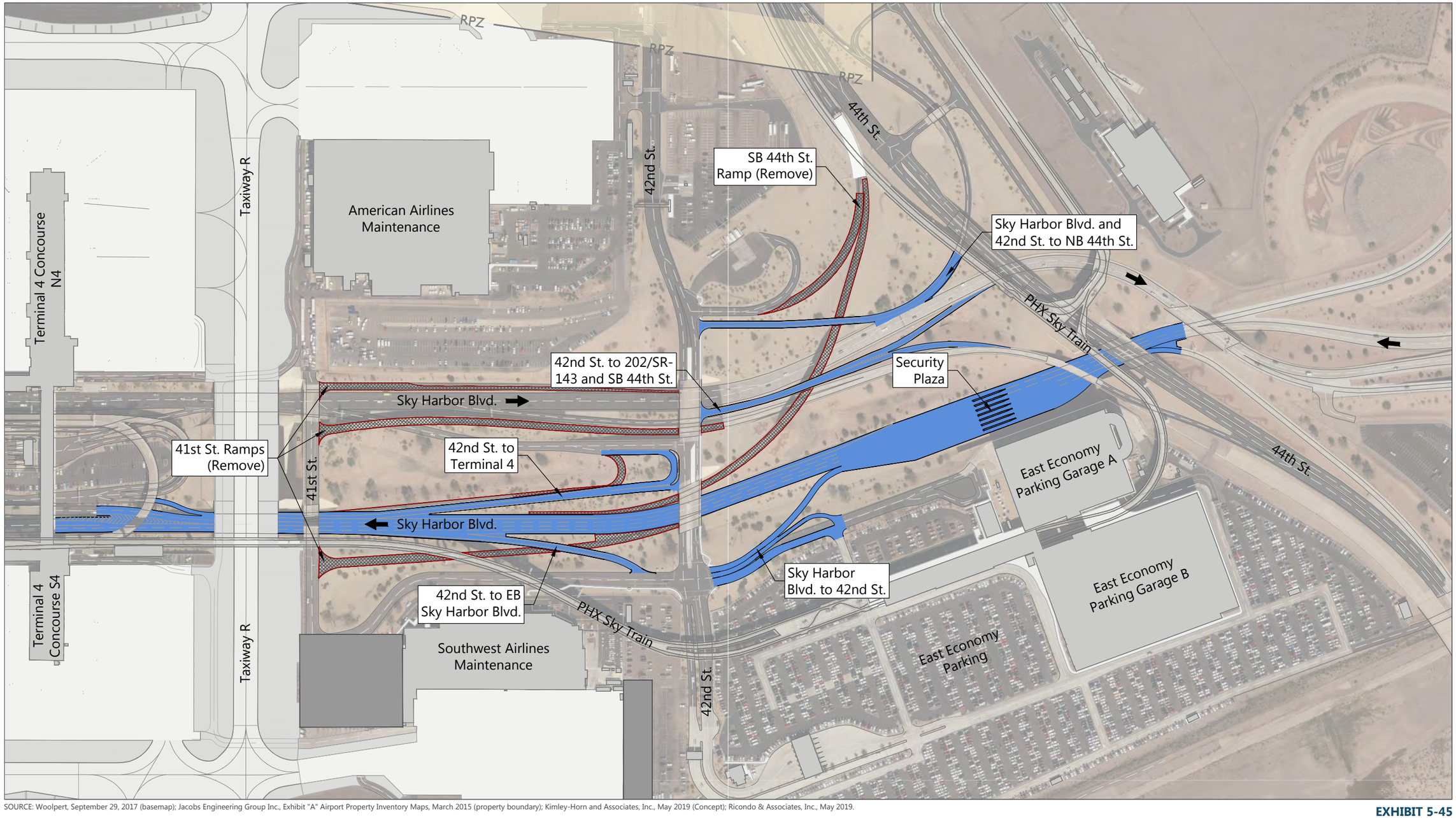
EVALUATION CRITERIA	DESCRIPTION	OPTION 1		OPTION 2	
Compatibility	Maximizes investment and minimizes potential negative impacts to surrounding facilities and transportation network.	ADEQUATE	Substantial traffic control and construction impacts to all Interstate 10 and SR 51 crossings in the project limits including the Railroad. RCC access could be constructed as a standalone project.	ADEQUATE	Substantial traffic control and construction impacts to all Interstate 10 crossings in the project limits including the Railroad. Substantial traffic control and construction impacts to Buckeye Road and the Buckeye Road entrance with the construction of the West GTC entrance. RCC access could be constructed as a standalone project.
Accommodates Demand	Based on professional judgement. Accommodates increased levels of passenger and vehicle activity.	EXCEEDS	The combination of all the improvements would add entrances, add exits, eliminate the existing weave on Interstate 10, and add additional freeway pavement which would increase Airport roadway efficiency (reducing traffic traveling through Washington Street and Jefferson Street intersections).	EXCEEDS	The combination of all the improvements would add entrances, add exits, eliminate the existing weave before the Buckeye Road exit, and add additional freeway pavement which would increase Airport roadway efficiency. Construction of the Jefferson Street exit would increase the exit ramp's capacity and capacity on Interstate 10 with additional pavement.
Customer Experience	Based on professional judgement. Able to conveniently and efficiently support movement of Airport users.	EXCEEDS	Provides the combined efficiencies and conveniences of RCC access, auxiliary Airport entrance and exit, auxiliary West GTC exit, improved additional entrances, improved exit access, and improved West GTC access.	EXCEEDS	Provides the combined efficiencies and conveniences of RCC access, auxiliary Airport entrance and exit, auxiliary West GTC exit, improved additional entrances, improved exit access, and improved West GTC access.
Cost	Probable construction costs in 2019 dollars.	DEFICIENT	**$143,000,000.00**	ACHIEVES	**$90,000,000.00**
Feasibility	Implementation is viable, realistic, and achievable in a manner that does not overburden the financial resources of the Airport or other funding parties.	DEFICIENT	Provides similar LOS as Option 2 at a greater cost.	ACHIEVES	Provides similar LOS as Option 1 at a reduced cost.

NOTE: Costs are in 2019 dollars.
SOURCE: Kimley-Horn and Associates, Inc., May 2019.

TABLE 5-20 EAST AIRPORT ACCESS IMPROVEMENTS

RECOMMENDED IMPROVEMENT	PURPOSE
Removal of southbound 44th Street ramps to 42nd Street and westbound Sky Harbor Boulevard.	Eliminates merge and weave congestion approaching Terminal 4.
Construct ramps from 42nd Street to 202/SR 143, and southbound 44th Street.	Provides a direct route from East Economy parking to transportation corridors. Ramps can be built independently if the Airport staff wanted to use a phased approach.
Construct ramp that connects 42nd Street to northbound 44th Street and Sky Harbor Boulevard.	Provides new connection from 42nd Street to Sky Harbor Boulevard and 44th Street which enhances connectivity from the Airport to local transportation network.
Remove ramps from 41st Street to Sky Harbor Boulevard.	Removes 41st Street from the local transportation network to make the roadway more secure for the Airport and more usable for the Airport maintenance/staff. Eliminates duplicitous, less direct Sky Harbor Boulevard access points.
Relocate re-circulation turnaround connecting eastbound Sky Harbor Boulevard to westbound Sky Harbor Boulevard.	Connection is to inner curb only, which reduces merging and enhances wayfinding.
Construct ramp from 42nd Street intersection to westbound Sky Harbor Boulevard.	Provides additional merging/queuing length with relocated circulation turnaround. Allows users to re-enter Sky Harbor Boulevard. if they mistakenly turn for parking. Provides more direct route from East Economy parking to Terminal areas and west Airport transportation system and connectors.
Construct ramp from westbound Sky Harbor Boulevard to 42nd Street Intersection	Connects security plaza to East Economy parking.
Construct security plaza at convergence of northbound 44th Street and 202/SR 143 entrance.	Mitigates cut-through traffic without significantly impacting through-put capability.

SOURCE: Kimley-Horn and Associates, Inc., May 2019.



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Kimley-Horn and Associates, Inc., May 2019 (Concept); Ricondo & Associates, Inc., May 2019.

NORTH

0 300 ft.

EXHIBIT 5-45

East Airport Access

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TABLE 5-21 EVALUATION OF EAST AIRPORT ACCESS CONCEPT

EVALUATION CRITERIA	DESCRIPTION	OPTION 1	
Compatibility	Maximizes investment and minimizes potential negative impacts to surrounding facilities and transportation network.	ACHIEVES	Reduces public confusion during inner-Airport transportation and reduces travel distance. Improves security. Provides better parking and Airport access. Requires minimal traffic control and disruption during construction phasing, except for 44th Street.
Accommodates Demand	Based on professional judgement, accommodates increased levels of passenger and vehicle activity.	ACHIEVES	By adding parking entrances and exits that connect directly with the major surrounding roadway infrastructure, the Airport will increase airport roadway efficiency. By simplifying movements, capacity is increased.
Customer Experience	Based on professional judgement, able to conveniently and efficiently support movement of Airport users.	ACHIEVES	Providing direct access to and from parking facilities improves convenience.
Feasibility	Implementation is viable, realistic, and achievable in a manner that does not overburden the financial resources of the Airport, or other funding parties.	ADEQUATE	Moderate impact on financial resources.
Cost	Probable construction costs in 2019 dollars.	ADEQUATE	Medium construction cost.
			$15,000,000.00

NOTE: Costs are in 2019 dollars.
SOURCE: Kimley-Horn and Associates, Inc., May 2019.

5.10 PREFERRED CONCEPT

The initial preferred concept for Airport development represented the assemblage of the selected options for various Airport facilities described in Sections 5.2 through 5.9. Once assembled, opportunities to refine the initial preferred concept to strengthen the overall concept were noted. Refinement of the preferred development concept yielded a final Preferred Airport Concept to be documented on the ALP. The Preferred Airport Concept was the basis for developing the environmental overview and implementation plan. Exhibit 5-37 illustrates the initial preferred concept as evaluated and described in Sections 5.2 through 5.8 (selected roadway options are not depicted on the exhibit.) The following subsections summarize refinements to the initial preferred concept.

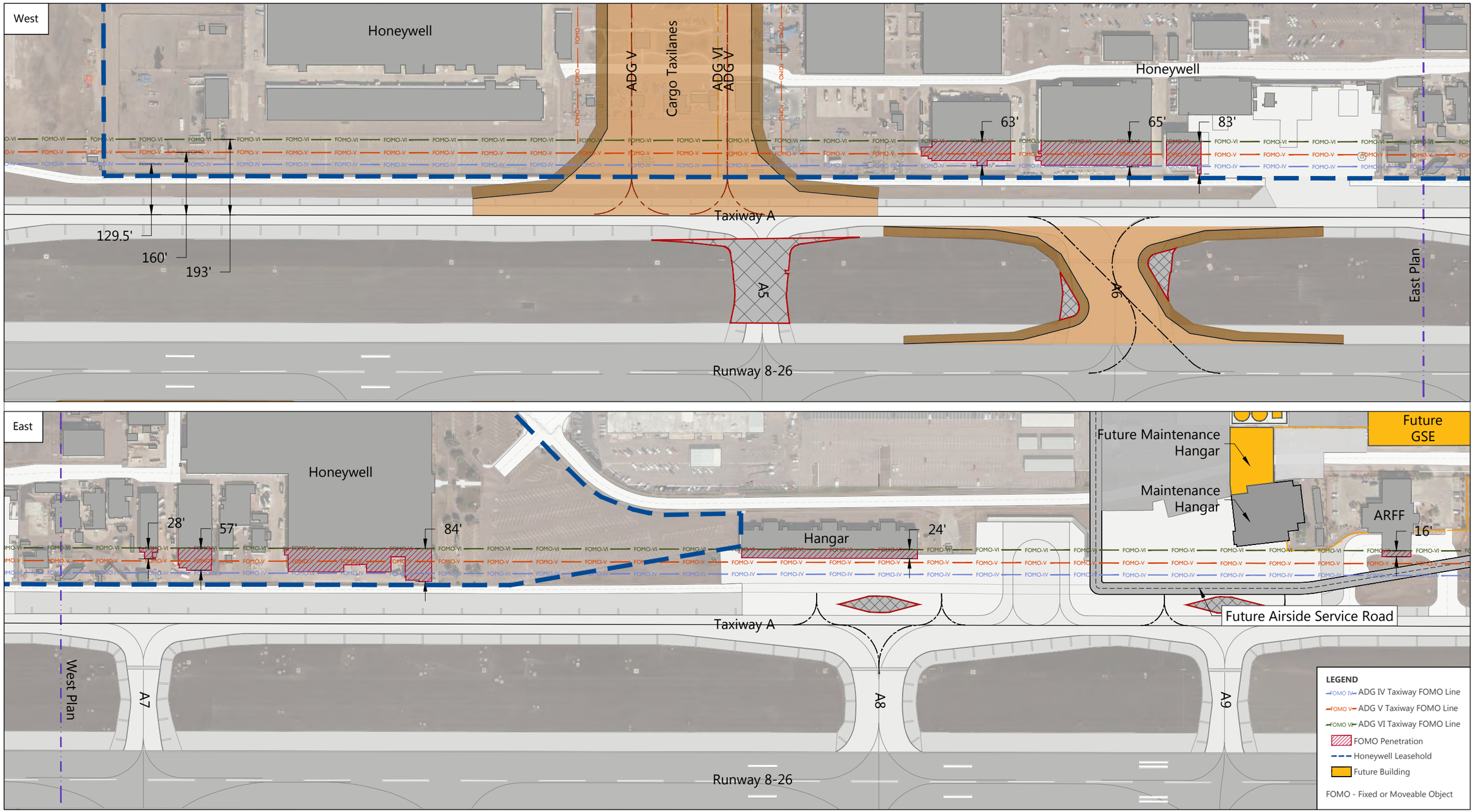
5.10.1 TAXIWAY A

Airfield access to the north cargo preferred option is provided by Taxiway A (parallel taxiway north of Runway 8-26). Taxiway A has a 400-foot centerline separation from Runway 8-26 which meets FAA runway to parallel taxiway separation standards for ADG V runways. The pavement width of Taxiway A is 75 feet (TDG 6) between Taxiways A1 and A3 and 50 feet (TDG 4) between Taxiways A3 and A12. The distance from the taxiway centerline to the fixed or moveable object line is used to determine the maximum aircraft wingspan allowed on a taxiway. Between Taxiways A1 and A3, that distance meets ADG V requirements. Between Taxiways A3 and A12, the distance meets ADG III requirements and accommodates aircraft up to Boeing 757-300W.

Many of the aircraft serving the north cargo area would be ADG IV or larger. Cargo aprons were planned to accommodate up to Boeing 747-800F aircraft (ADG VI) to reflect potential operations. At a minimum, Taxiway A would need to be upgraded between Taxiways A1 and A5 to ADG V or VI to accommodate the preferred cargo option. Upgrading Taxiway A between Taxiways A5 and A12 should be considered to reduce the number of runway crossings by cargo aircraft. Without upgrading the full length of Taxiway A, ADG IV or larger, cargo aircraft arriving on Runway 26 would need to exit south onto Taxiway B and cross Runway 8-26 at B3 or B4. ADG IV or larger aircraft arriving to Runway 8 would exit to the south onto Taxiway B and then taxi back the length of the runway to cross at Taxiways B3 or B4. If Taxiway A was ADG V capable, aircraft could exit Runway 8-26 to the north without the need for crossing the runway. **Exhibit 5-46** illustrates the impacts to facilities in the Honeywell leasehold for varying ADG fixed or moveable object lines.

5.10.2 PASSENGER HARDSTANDS

Prior to construction of the West Terminal and after the demolition of Terminal 2, apron loading hardstands could be placed on the former apron of Terminal 2 and West Air Cargo apron. These hardstands could be bus served from Gate F15 on the Terminal 3 South Concourse or from Terminal 4 gates. These hardstands, shown on **Exhibit 5-47**, could be configured to accommodate the future West Terminal concourses and implemented in stages to provide fuel ports and appropriate apron slope requirements. Bus staging locations could be within the footprint of the planned concourse piers and could include sunshades or temporary that include a holdroom and restrooms. The apron loading hardstands would provide an economical solution to accommodate interim gate needs, unexpected growth, irregular operations, or additional flights during special events in the Phoenix area. They are not intended to address long-term passenger gate requirements.

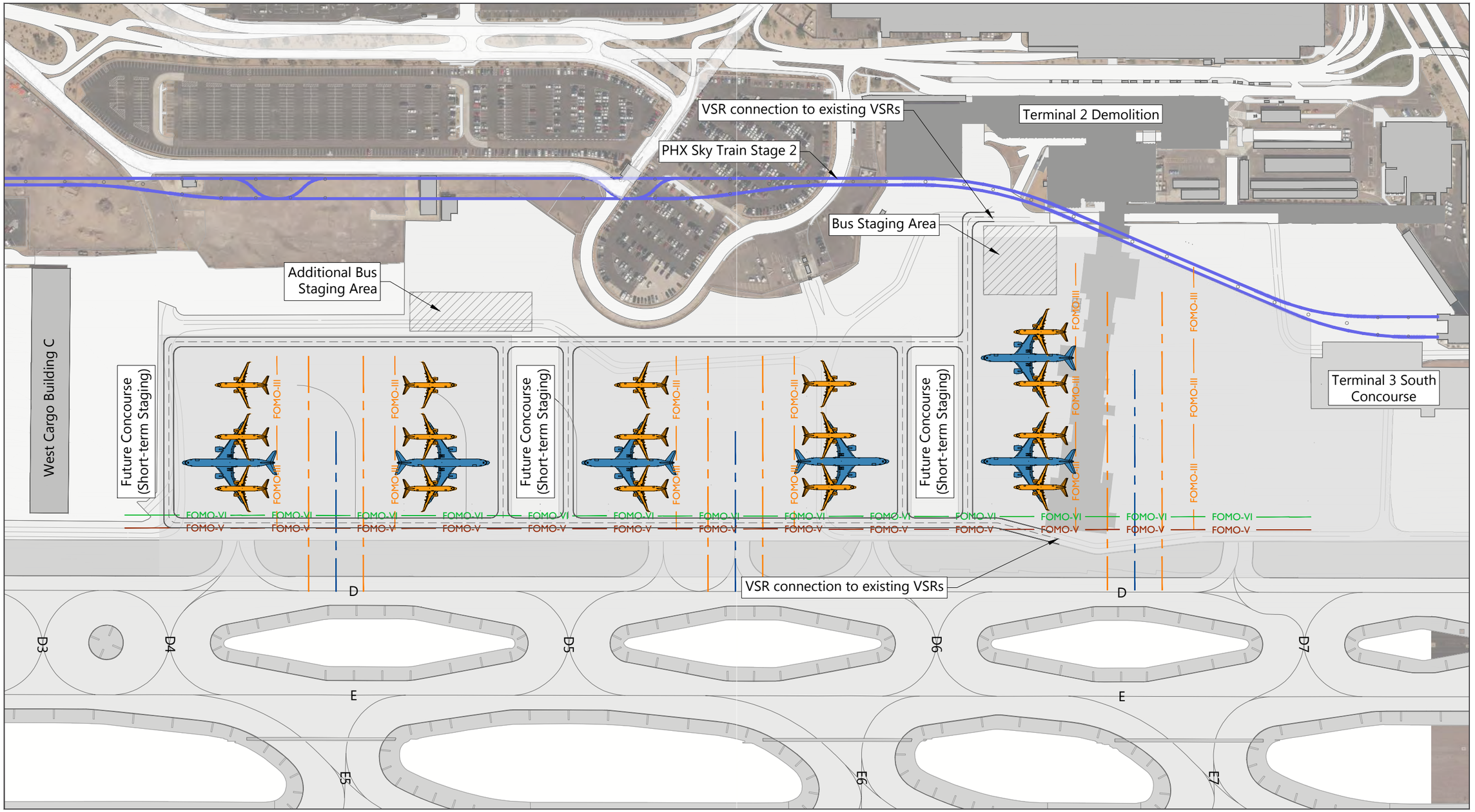


SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., April 2018 (concept).

NORTH 0 250 ft.

EXHIBIT 5-46

Taxiway A Object Free Area Penetrations



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., January 2019 (concept).

NORTH 0 140 ft.

EXHIBIT 5-47

West Passenger Hardstands

5.10.3 TERMINAL 4 – CONCOURSE S1

Terminal 4 Concourse S1 was defined in a Project Definition Report[5] and is shown on **Exhibit 5-48**. This concourse is intended to meet near-term gate demand in Terminal 4.

5.10.4 TERMINAL 3 NORTH CONCOURSE 2 AND CONNECTOR

To meet the near-term gate requirements for Terminal 4 airlines prior to the development of the West Terminal, an option for a single-loaded concourse east of the existing Terminal 3 North Concourse with a connector to both Terminal 3 and Terminal 4 was developed. As shown on **Exhibit 5-49**, this six narrowbody gate concourse (identified as Terminal 3 North Concourse 2) could be used for near-term gate expansion to accommodate PAL 1 and PAL 2 gate needs and supplement gate capacity during gate reconfiguration projects.

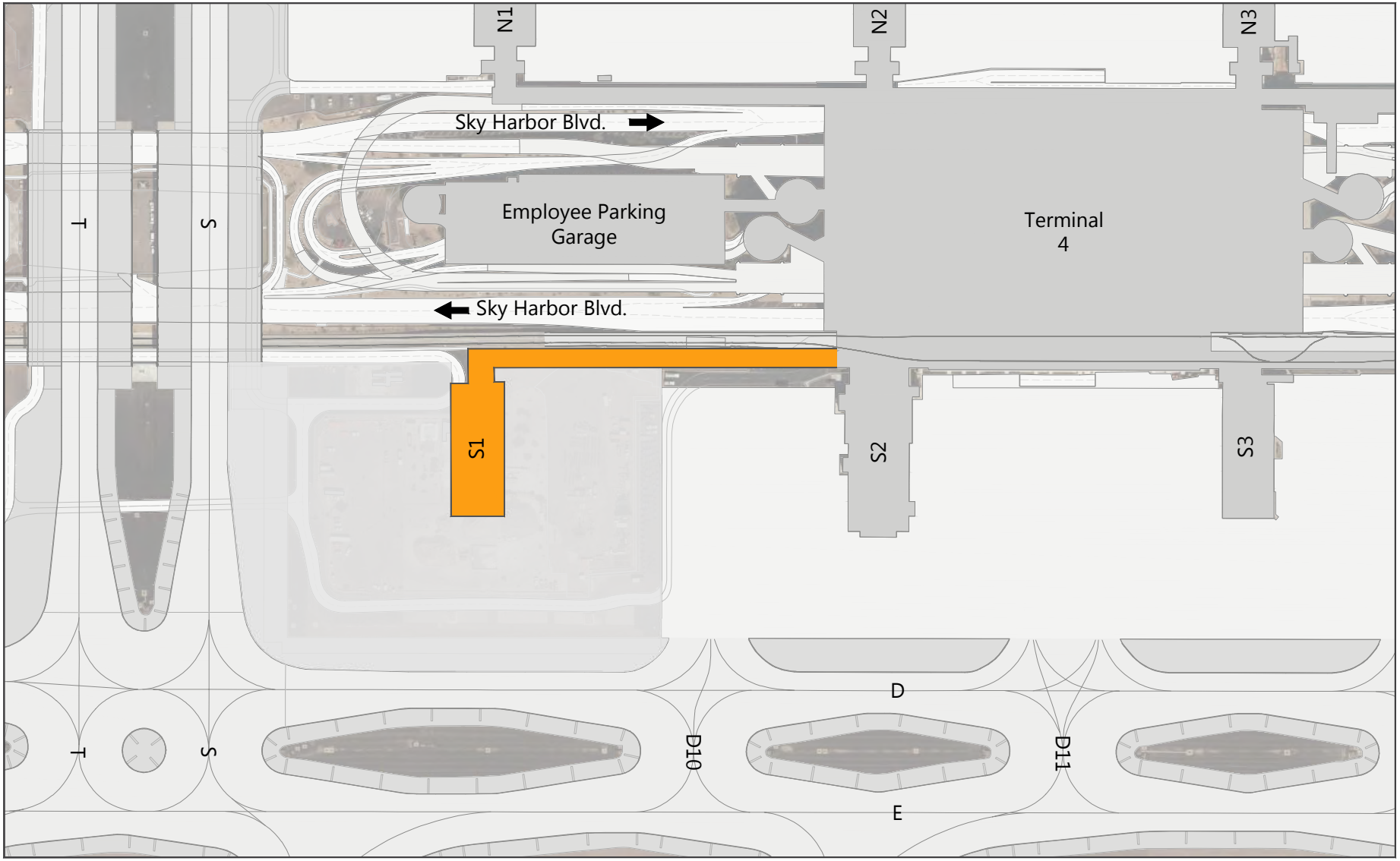
The concourse and connectors could be constructed in two phases. The first phase could include the concourse initially served by bus, with a VSR connection to the Terminal 3 North Concourse and Terminal 4 Concourse N1. When passenger demand and LOS require, a second phase could incorporate a passenger corridor at the concourse level to Terminal 3 and below Taxiways T and S to Terminal 4 Concourse N1. A below grade VSR could also be incorporated in this corridor below Taxiways T and S to alleviate baggage handling congestion to and from Terminal 4 and avoid vehicles crossing these taxiways. This passenger corridor would have a similar width to the corridors connecting the Terminal 4 north and south concourses.

The site for the concourse is occupied by the American Airlines mail sort facility, the Parking Operations and PHX Sky Train Design Team Annex facility, the north airfield electrical vault, and vehicle Gate 141. The north airfield electrical vault would be incorporated within the new concourse on the apron level. The Parking Operations and PHX Sky Train Design Team Annex facilities would be relocated within other PHX AVN facilities

The mail sort facility and vehicle checkpoint would be relocated south of the existing American Airlines Maintenance Hangar, as shown on **Exhibit 5-50**. This location would provide efficiencies for American Airlines for GSE storage and employee parking spaces near the existing facilities. The mail sort facility location shown would require the relocation of the existing American Airlines maintenance parking lot east of 42nd Street in an underutilized surface lot that contains the East Cell Phone Lot. The cell phone lot would be relocated south on the site of the former CNG facility.

The VSR directly west of the American Airlines Maintenance Hangar is within the Taxiway R fixed or moveable object line and is not marked through the American Airlines Maintenance Hangar apron. To provide better access between the North Aero Support Complex, the terminal core, and the relocated vehicle Gate 141, a secure VSR could traverse along the southern portion of the relocated mail sort facility and bridge over a nonsecure roadway providing access to the American Airlines Maintenance Hangar and be aligned parallel to 42nd Street until reaching the existing VSR east of the Runway 26 end.

[5] Airbiz Aviation Strategies Pty Ltd., *Phoenix Sky Harbor International Airport Project Definition Report FINAL*, November 14th, 2017.



SOURCE: Woolpert, September 29, 2017 (basemap); Airbiz, Phoenix Sky Harbor Terminal 4 / S1 Concourse PDR, November 14, 2017; Ricondo & Associates, Inc., May 2019 (concept).

EXHIBIT 5-48

NORTH 0 300'

Terminal 4
Concourse S1

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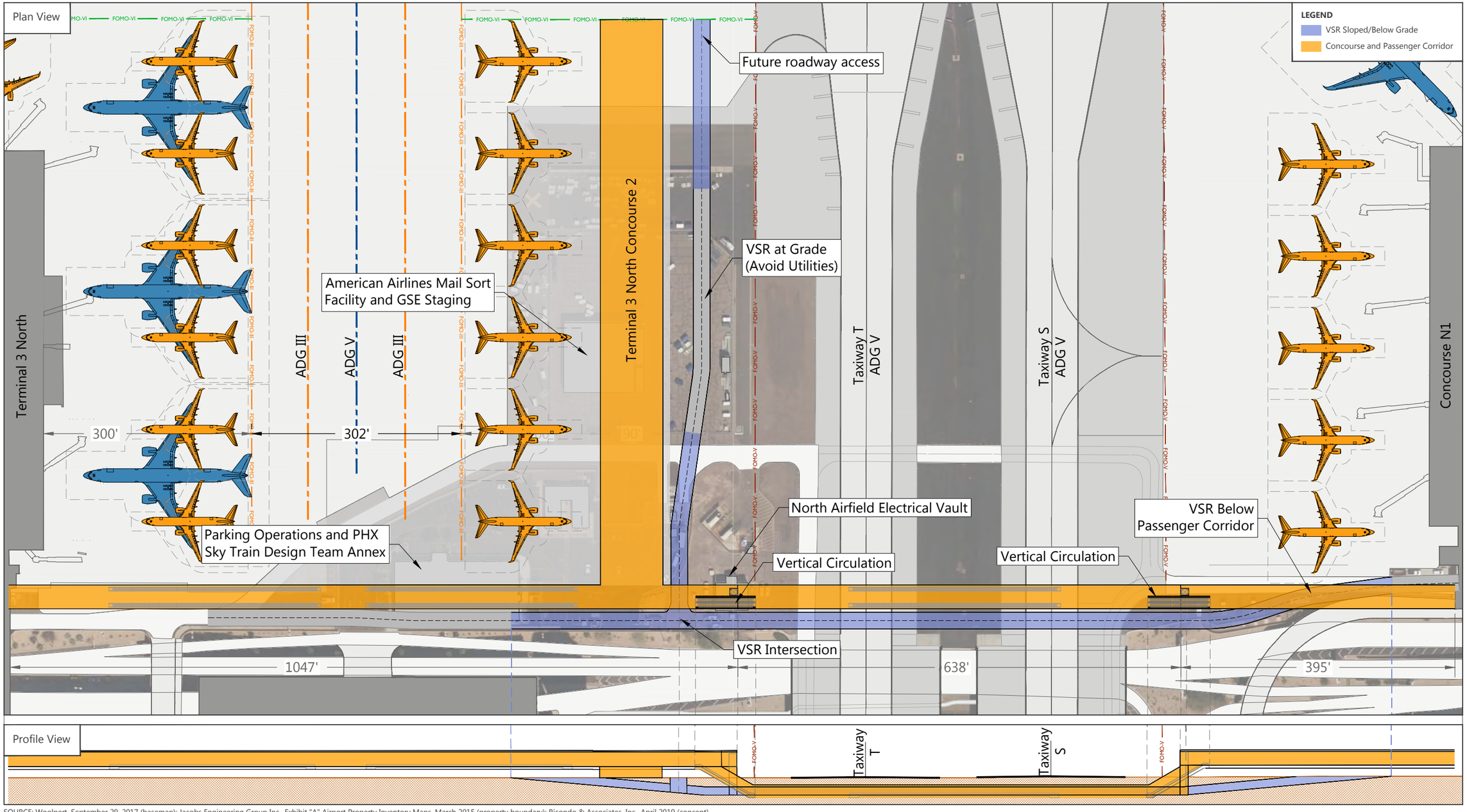


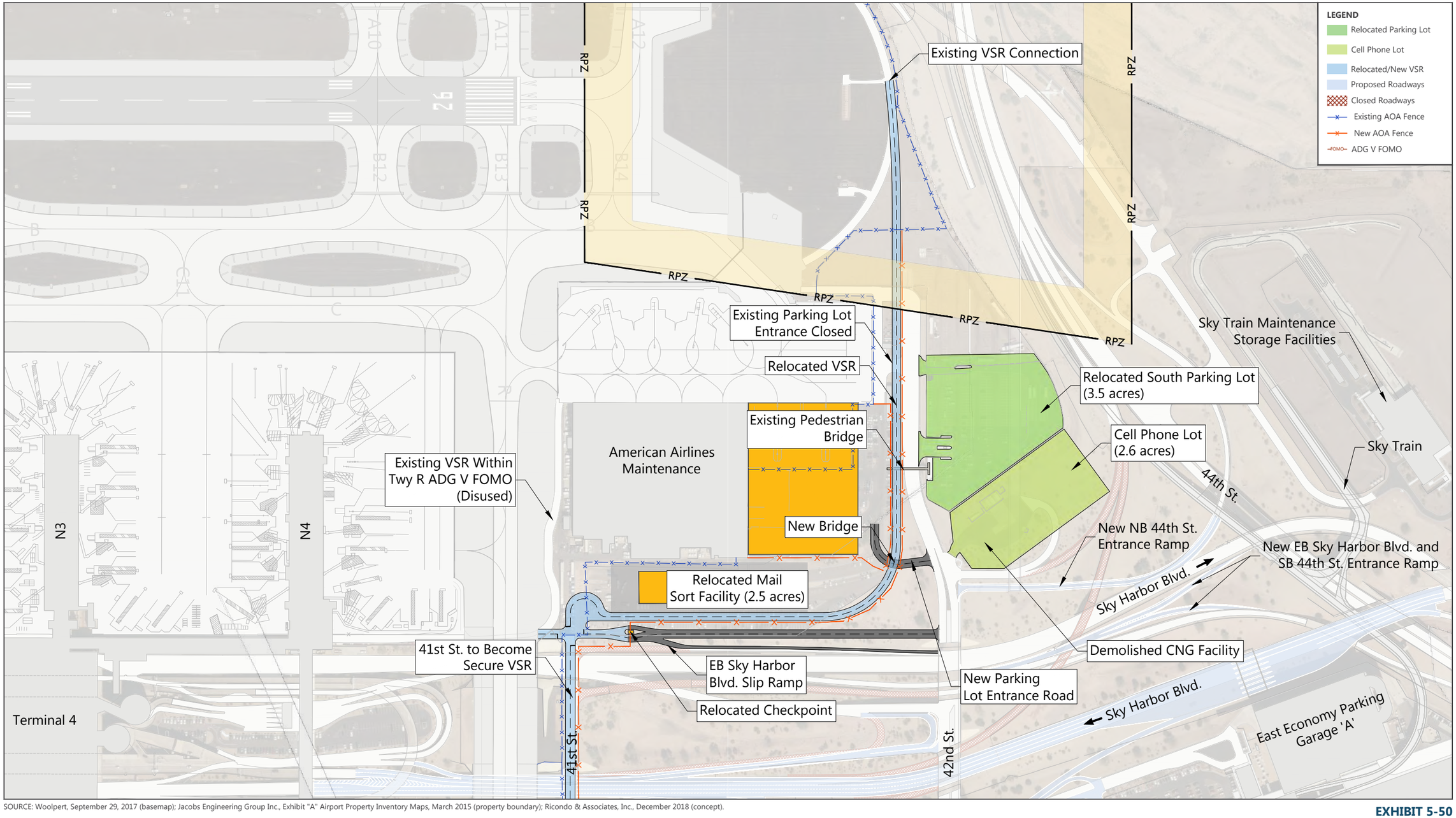
SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., April 2019 (concept).

NORTH 0 140 ft.

EXHIBIT 5-49

Terminal 3 North Concourse 2 and Connector

Drawing: P:\Project-Denver\PHX\CAMP\CAD\05-Development Alternatives\Ex-5-49-T3-T4 Connection.dwgLayout: Ex 5-49 Plotted: Sep 6, 2019, 09:58AM



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., December 2018 (concept).

NORTH 0 300 ft.

EXHIBIT 5-50

Relocated Mail Sort Facility and Vehicle Checkpoint

This alignment would require American Airlines maintenance employees parking in the surface lot to cross over the secure VSR. A pedestrian walkway over 42nd Street could be extended over the VSR. The relocated vehicle checkpoint would be accessed from 42nd Street and could include an onramp to eastbound Sky Harbor Boulevard for vehicles exiting the secure area. As defined in Section 5.9, 41st Street would no longer be required for public access and could become a VSR for secure vehicle access to the Terminal 4 south concourses or Southwest Airlines Maintenance Facility.

5.10.5 WEST TERMINAL AND CONCOURSE LAYOUT

For a comprehensive analysis of the West Terminal to meet the requirements defined in Section 4, and to develop accurate cost estimates, West Terminal floor plans were developed. The floorplans fit within the building footprint shown in pervious preferred concept exhibits. The terminal was split into two phases, a 500-foot long Phase 1 to support the 35 narrowbody gate south concourses and 260-foot long Phase 2 to support the 25 narrowbody gate north concourses.

5.10.5.1 LEVEL 0 – BAGGAGE HANDLING

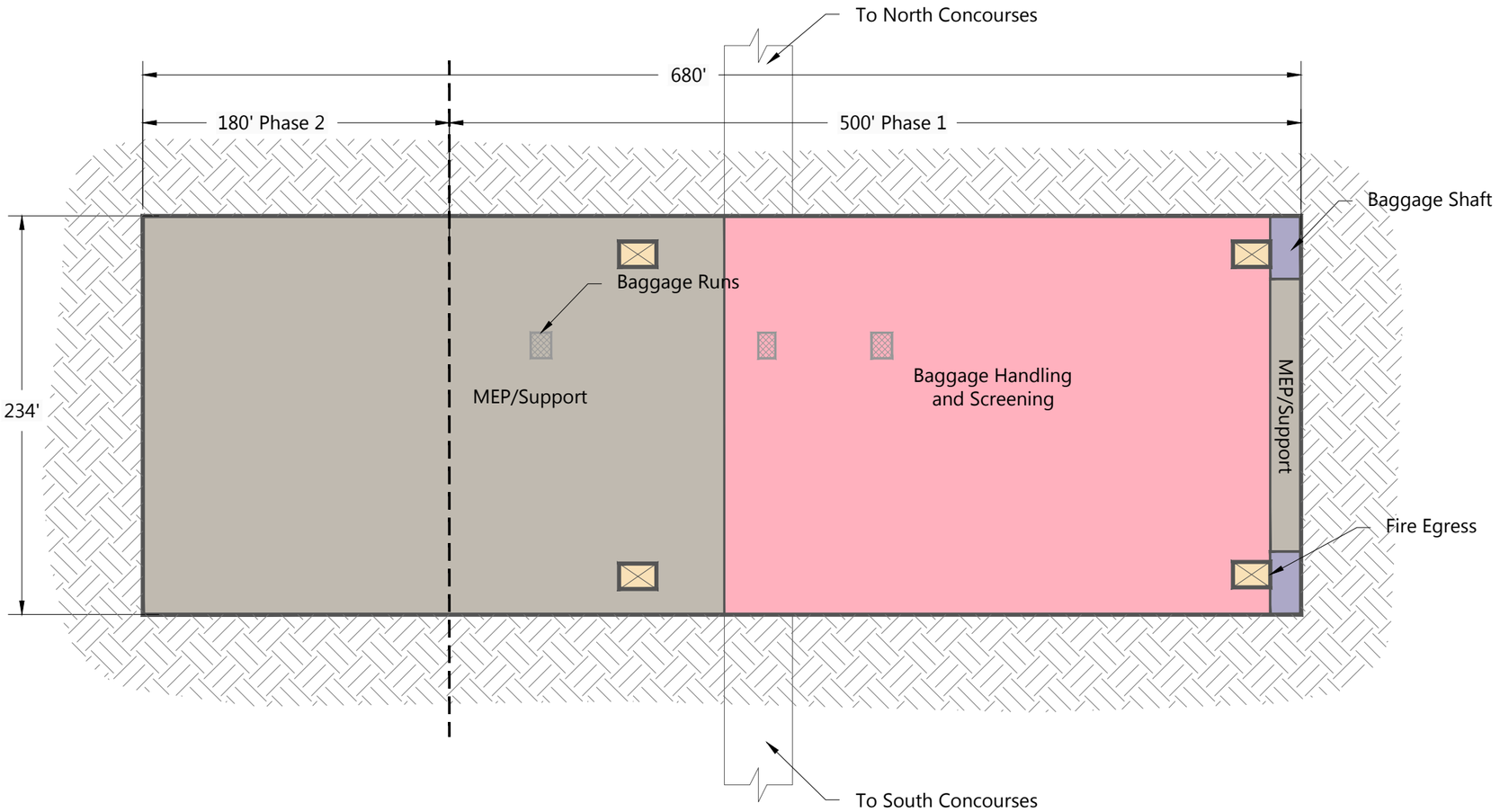
Similar to the existing Terminal 4, Level 0 (basement level) shown on **Exhibit 5-51** would house baggage handling and screening systems, as well as mechanical, electrical, and plumbing spaces. Anticipated long-term future terminal needs for baggage handling systems would likely decrease with anticipated technological improvements to automated baggage delivery systems and sortation facilities. Sortation functions would be assumed to occur below the concourse on the apron levels, allowing space within the basement of the facility to be used for other functions. Connections below the Level 1 departures roadways would allow for secure access to and from the apron level.

5.10.5.2 LEVEL 1 – ARRIVALS

Level 1 would be configured as the arrivals level, as shown on **Exhibit 5-52**. This level would include north and south arrivals curbs, with baggage claim devices and baggage offices. Vertical cores would be at the east and west ends of the terminal, with a main vertical core on the south center. This level would be similar to the existing Terminal 4 arrivals level but located at the same elevation as the concourse apron.

5.10.5.3 LEVEL 2 – SECURITY

Unlike Terminal 3 or Terminal 4, security would be situated above the arrivals level and below the departures level, as illustrated on **Exhibit 5-53**. This layout provides the minimum number of level changes for passengers arriving or departing the terminal by vehicle or PHX Sky Train. The security checkpoint layout would incorporate anticipated new measures for document control and decrease the need for queuing (passengers would be assigned a lane from document control). Access from the secure concourse level down to the arrivals level would be directed to east and west vertical cores. Passengers without bags and riding the PHX Sky Train could exit this level and connect directly to the station (level above).



LEGEND

- Baggage Handling and Screening
- Baggage Shaft
- MEP/Support
- Baggage Runs

NOTES:

MEP - Mechanical, Electrical and Plumbing

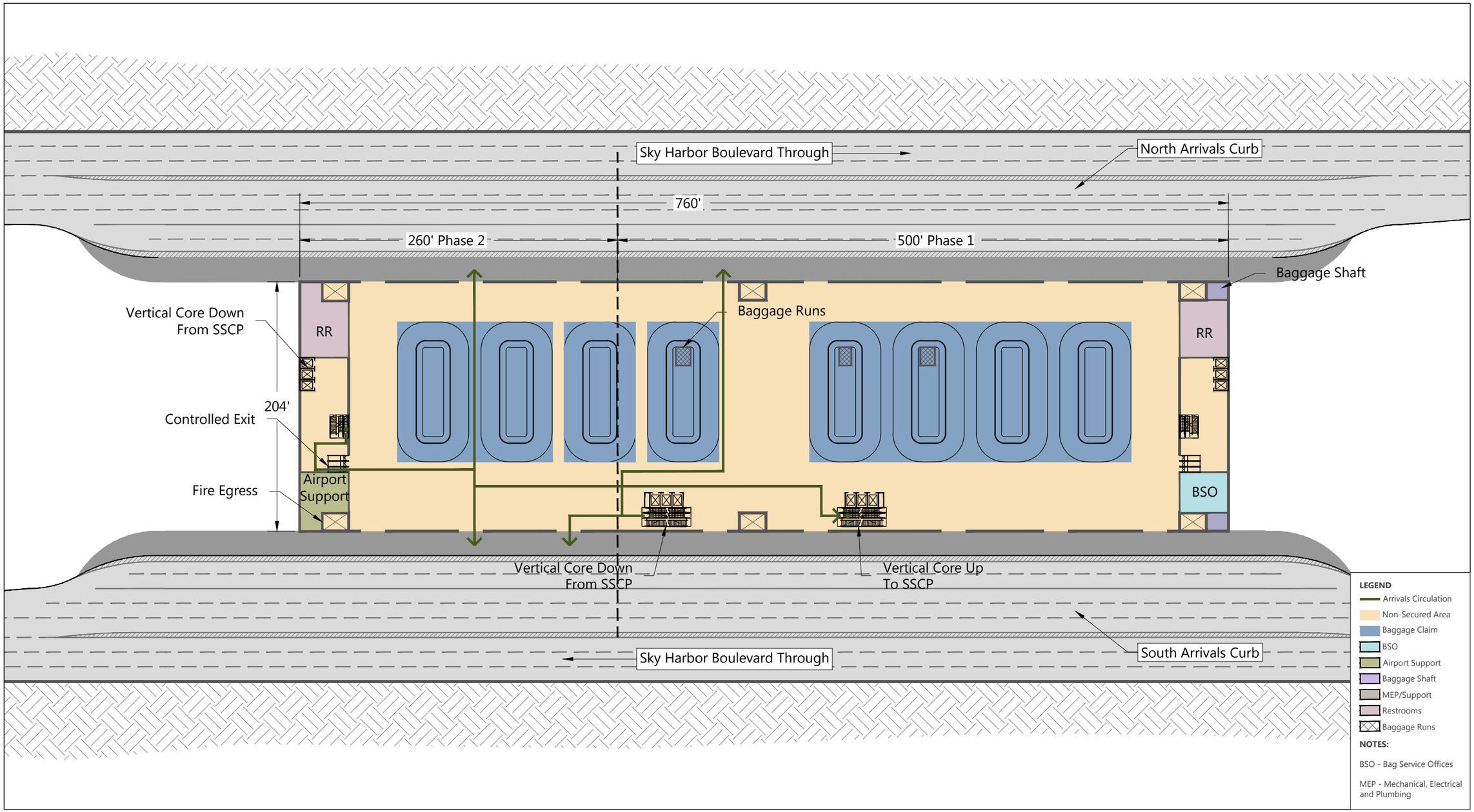
SOURCE: Ricondo & Associates, Inc., March 2019 (concept).

NORTH 0 80 ft.

EXHIBIT 5-51

West Terminal Layout
Level 0 - Baggage Handling

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-51-56-West Terminal Blocks.dwgLayout: Ex 5-51 Plotted: Sep 5, 2019, 02:47PM



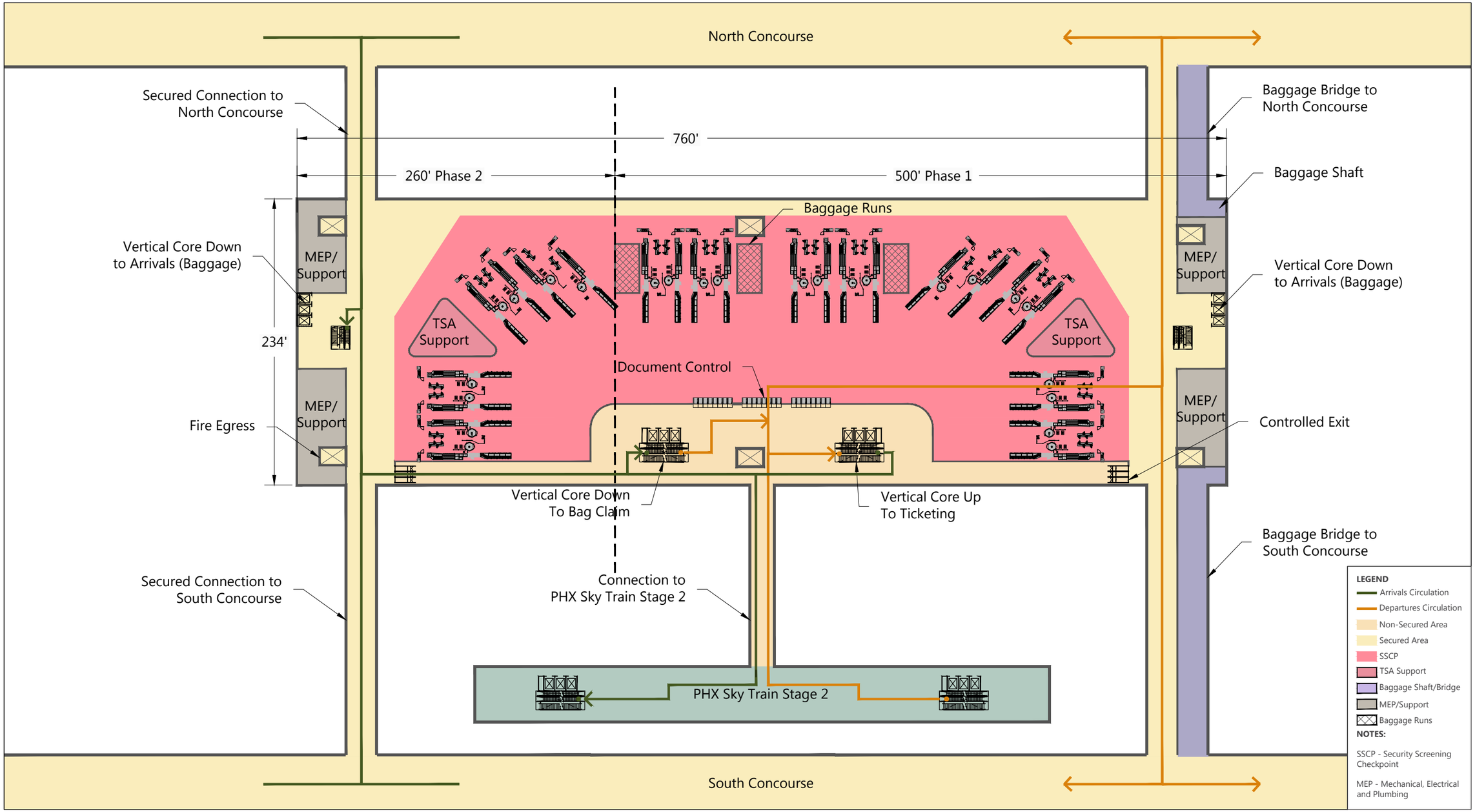
SOURCE: Kimley-Horn, December 2018 (Roadways); Ricondo & Associates, Inc., March 2019 (concept).

NORTH 0 80 ft.

EXHIBIT 5-52

West Terminal Layout
Level 1 - Arrivals

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-51-56-West Terminal Blocks.dwgLayout: Ex 5-52 Plotted: Sep 5, 2019, 02:48PM



SOURCE: Kimley-Horn, December 2018 (PHX Sky Train Stage 2); Ricondo & Associates, Inc., March 2019 (concept).

NORTH 0 80 ft.

EXHIBIT 5-53

West Terminal Layout
Level 2 - Security

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-51-56-West Terminal Blocks.dwgLayout: Ex 5-53 Plotted: Sep 5, 2019, 02:45PM

5.10.5.4 LEVEL 3 – DEPARTURES

Exhibit 5-54 illustrates the departures level above security. This level would include ticketing islands and airline ticket office space as well as north and south departures curbs. Baggage runs would connect from this level down to the basement for baggage handling and screening. The vertical core in the south center of the terminal would direct all passengers to the security level (with the west and east ends of the terminal used for support space).

5.10.5.5 WEST TERMINAL PROFILES

Profile views of the West Terminal are shown on **Exhibit 5-55**. All elevations were developed from the Sky Train Stage 2 West Terminal station under construction as of 2019 and anticipated apron elevations (similar to the existing apron elevation).

5.10.5.6 CONCOURSE LAYOUTS SECTIONS

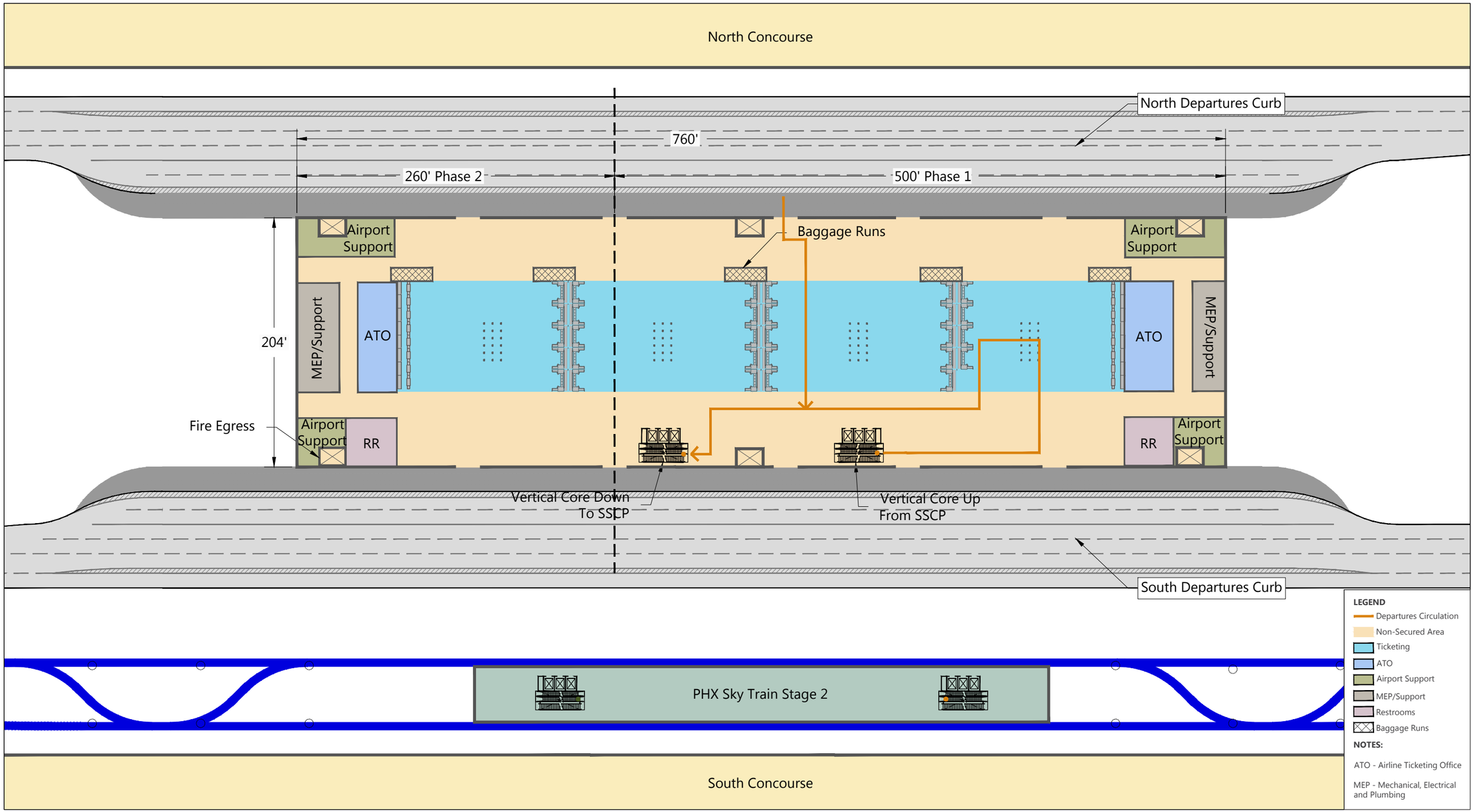
Exhibit 5-56 illustrates a holdroom layout for the north and south concourses that would meet the LOS requirements defined in Section 4. These holdrooms could accommodate the widebody and narrowbody aircraft configurations shown in preferred West Terminal concept. The beginning of each pier (the northern portion of the south concourse and southern portion of the north concourse) would be configured with a concessions area that would accommodate passengers for that concourse. The apron level would be used for baggage sortation and storage for concourse facilities.

5.10.6 INTERNATIONAL CONCOURSE N3.5

The international concourse at Terminal 4 has operational challenges, with widebody aircraft only able to use the eastern portion of Concourse N4 which requires push back onto and interferes with Taxiway R operations. When aircraft queue on Taxiway R for departure from Runway 25R, movement into and out of these gates is challenging. With the incorporated Terminal 3 North Concourse 2 and West Terminal development, there would be sufficient gate space at Terminal 4 to remove Concourses N3 and N4 and replaced them with a 150-foot wide International Concourse N3.5. As shown on **Exhibit 5-57**, an International Concourse N3.5 would provide adequate widebody aprons and taxilanes. This concourse would provide additional space for FIS processing and PAL 3 international widebody gate demand. By accommodating dual ADG V taxilanes between Concourse N2 and International Concourse N3.5, gates on the east side of Concourse N2 could be configured to accommodate additional widebody aircraft.

5.10.7 SUPPORT FACILITY VEHICLE SERVICE ROADWAY CONNECTION

The North Aero Support Complex located on the former dog track property would include several facilities that would require several vehicles to drive to and from the terminal core. The VSR alignment associated with the relocated mail sort facility and vehicle checkpoint (Exhibit 5-50) could accommodate near-term traffic demand, but would only connect to the eastern edge of Terminal 4 and require vehicles to cross Taxiway R at grade. With the future development of the West Terminal and the Terminal 3 North Concourse 2, a centralized VSR tunnel connecting the North Aero Support Complex and the terminal core would be warranted. This tunnel, shown on **Exhibit 5-58**, would initiate near the Honeywell leasehold and be routed under Taxiways A, B, and C, and Runway 8-26, and daylight east of the Terminal 3 North Concourse 2.



SOURCE: Kimley-Horn, December 2018 (PHX Sky Train Stage 2; Roadways); Ricondo & Associates, Inc., March 2019 (concept).

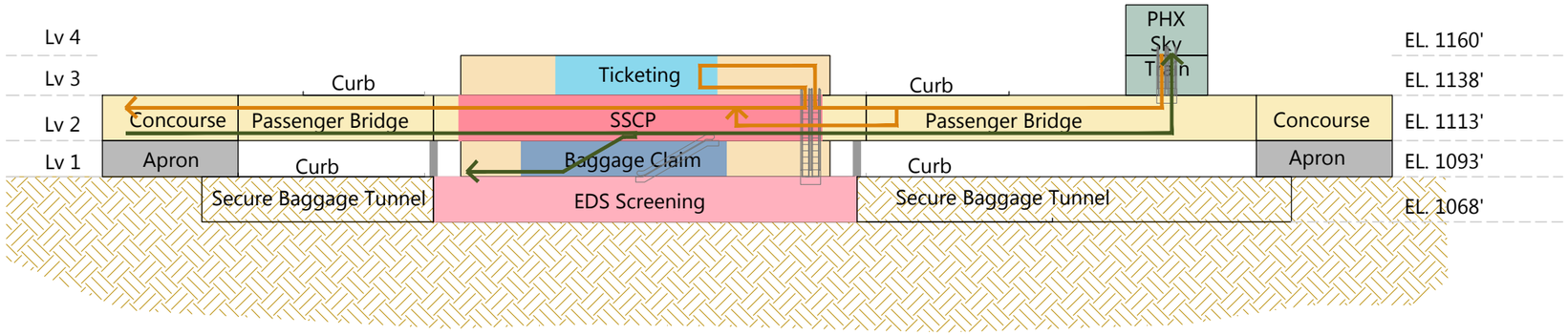
NORTH 0 80 ft.

EXHIBIT 5-54

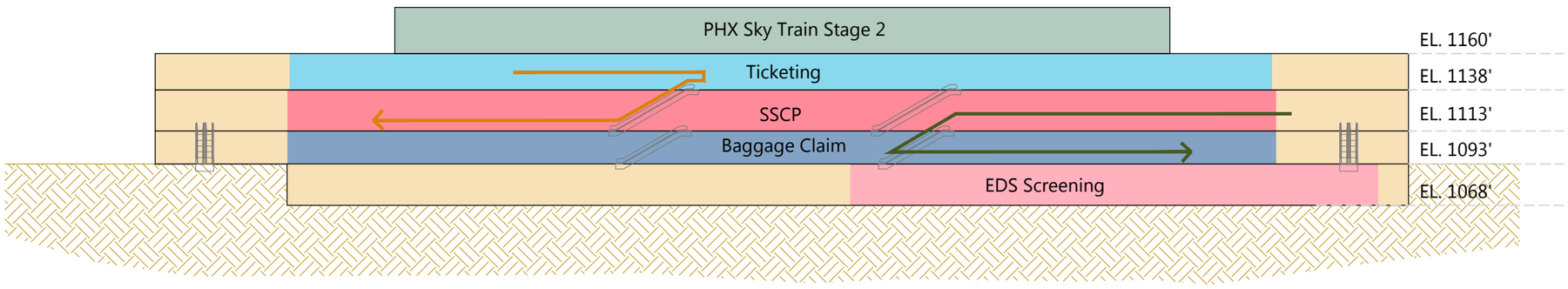
West Terminal Layout
Level 3 - Departures

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-51-56-West Terminal Blocks.dwgLayout: Ex 5-54 Plotted: Sep 5, 2019, 02:49PM

Profile- Facing East



Profile - Facing North



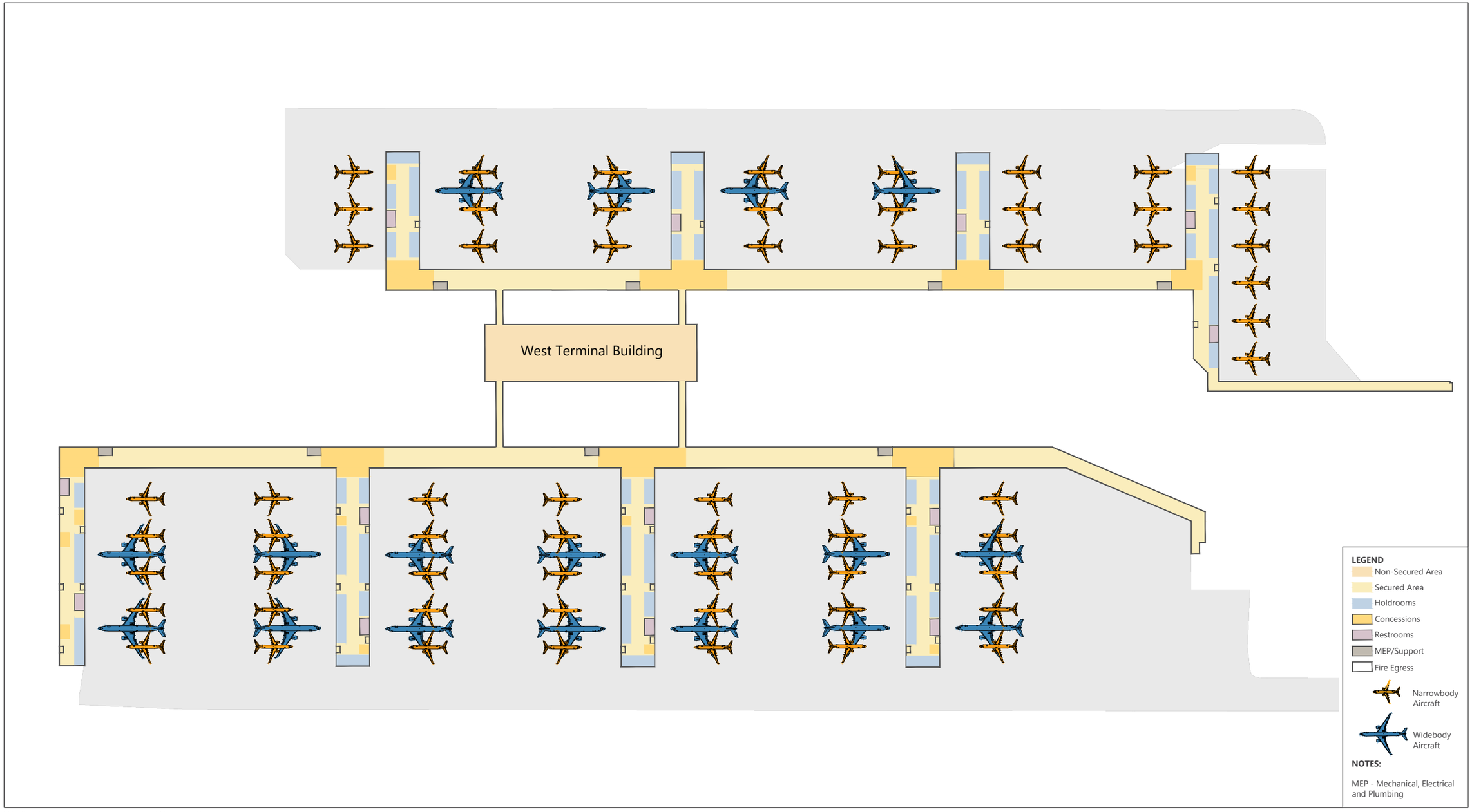
SOURCE: Ricondo & Associates, Inc., March 2019 (concept).

NORTH 0 80 ft.

EXHIBIT 5-55

West Terminal Profiles

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-51-56-West Terminal Blocks.dwgLayout: Ex 5-55 Plotted: Sep 5, 2019, 02:49PM

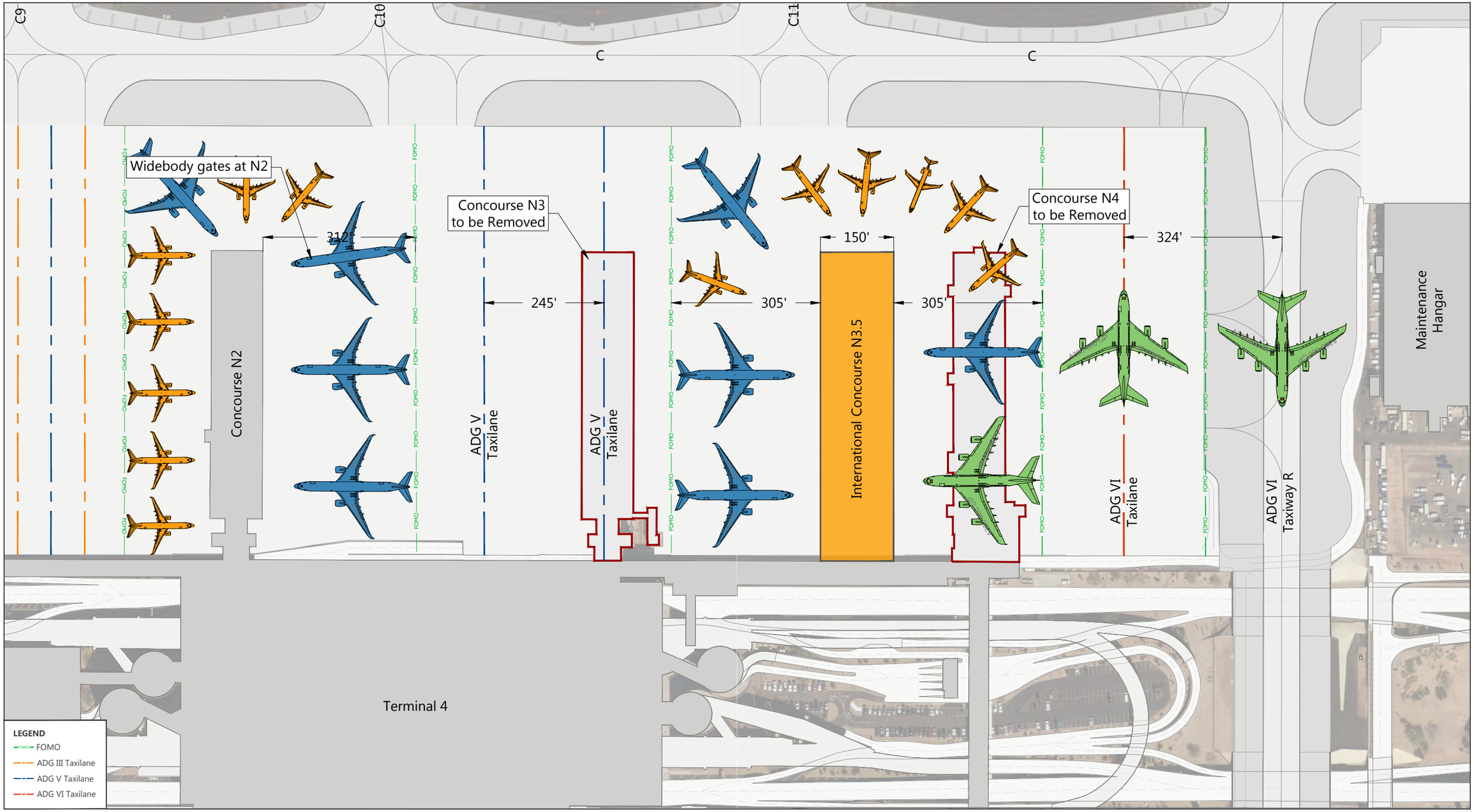


SOURCE: Ricondo & Associates, Inc., March 2019 (concept).

NORTH 0 350 ft.

EXHIBIT 5-56

West Terminal Concourse Layout

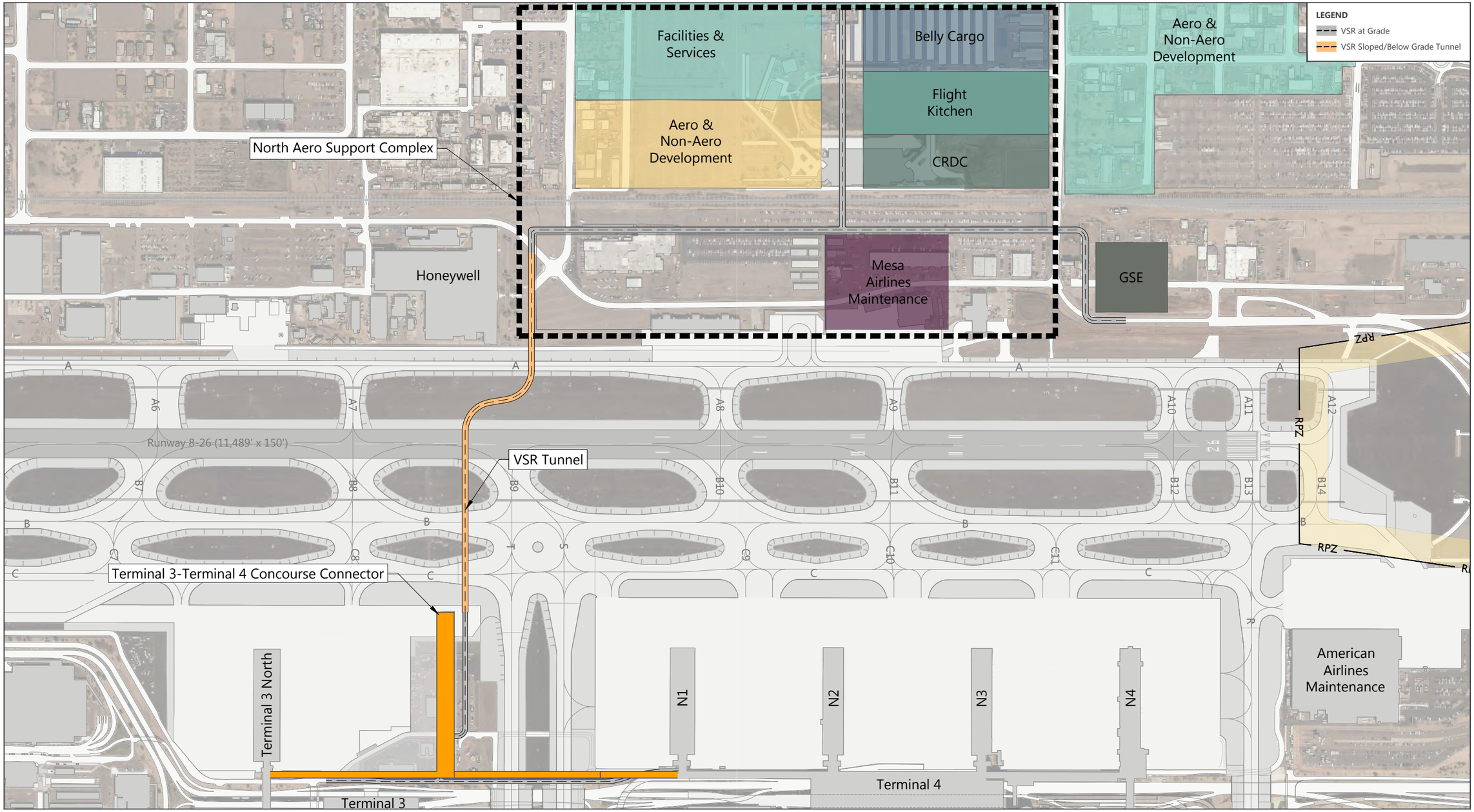


SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., January 2019 (concept).

NORTH 0 200 ft.

EXHIBIT 5-57

International Concourse N3.5



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., February 2019 (concept).

NORTH 0 500 ft.

EXHIBIT 5-58

North Aero Support Complex Vehicle Service Road Tunnel to Terminal Core

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-58-North Aero Support Complex VSR Tunnel to Terminal Core.dwgLayout: Ex 5-53 Plotted: Sep 5, 2019, 03:14PM

5.10.8 NON-AERONAUTICAL DEVELOPMENT OPPORTUNITIES

Property that is not needed for an aeronautical purpose over the next 20 years may provide interim opportunities to complement economic development efforts, while generating additional revenues to support sustainable Airport operations. This section provides an overview of the current community, market and industry context for non-aeronautical and aviation-related development on Airport property and identifies Airport supportive uses that may potentially be suitable in remaining land areas.

5.10.8.1 COMMUNITY AND RELATED AIRPORT PLANNING

Reinvent PHX – Gateway District

Reinvent PHX is a citywide planning initiative conducted in 2015 to promote transit-oriented development (TOD) and supportive land use patterns, with individual policy plans developed at the district level. Locations north of the Airport, including the Washington Street corridor and surrounding areas, are addressed in the Gateway District TOD Policy Plan.

Policy Plan recommendations generally promote a transit-oriented, mixed-use vision in areas surrounding light rail stations along the Washington Street corridor north of PHX. The plan's land use and master plan elements recommend mixed-use development with TOD "walkable urban center" orientation around the 24th and 44th Street stations, noting that the 44th Street area would potentially support a "major transportation hub" with multiple transportation modes converging in this location. Recommendations for the 38th Street station area emphasize uses that complement Gateway Community College.

Beyond the immediate vicinity of light rail features, industrial uses are generally proposed in the area south of Washington Street and north of the airfield – the plan's economic development element identifies advanced manufacturing and logistics as use opportunities in this area.

Walkable Urban Code

As part of Reinvent PHX, the Phoenix City Council adopted the Walkable Urban Code (WUC) as a zoning ordinance that will regulate development in proximity to light rail stations. As an interim measure, a transit-oriented development zoning overlay has been established in an area near the 24th Street Light Rail Station, including properties between Jefferson Street and Washington Street.

PHX Land Reuse Strategy

The PHX Land Reuse Strategy[6] provides a land use framework to guide the reuse and redevelopment of an approximately 1,400-acre study area west of PHX, including more than 750 Airport-owned properties that were acquired through the VARS program between 2005 and 2015 to address noise compatibility. Although there is no overlap between study areas, properties in the PHX Land Reuse Strategy area share some context with Airport-owned properties in areas directly north and west of PHX, which are considered for Airport-supportive land use under CAMP. Notably, properties in these areas are subject to similar market conditions and share some site characteristics as well as proximity to PHX and other nearby transportation features,

[6] C&S Engineers, Inc., *PHX Land Reuse Strategy Final Report*, March 2017.

including the Valley Metro light rail line and access to major transportation corridors like Interstate 10, Interstate 17, SF 202, and SR 143.

5.10.8.2 MARKET CONTEXT

Available Airport-owned properties present a range of opportunities for supportive use. This section provides a brief summary of the market context for uses consistent with established development patterns and community-based plans in the immediate submarket area, as well as aviation and aerospace uses that may benefit by locating in proximity to Airport facilities in conjunction with economic development pursuits.

Airport Submarket Activity

Land use in the direct vicinity of PHX is influenced by the Airport's presence, as well as the area's other transportation features including interstate and local highways, light rail lines, and the UPRR. These transportation features connect the area with established and expanding communities elsewhere in the growing region and beyond and provide a setting conducive to industrial use, which represents the primary type of development throughout much of the airport submarket.

In locations surrounding light rail stations along the Washington Street corridor and in areas to the north, land use patterns are more varied and include concentrations of commercial and residential properties.

The Airport-area real estate submarket includes approximately 1,500 non-residential properties and 35 million square feet of building space. As of 2019, new construction has been modest in the submarket, likely reflecting the limited supply of available land: 700,000 square feet of space has been built over the past five years, and one project is under construction. Overall vacancy in the Airport submarket has declined over the past several years and currently stands at 8 percent, representing strong occupancy and location desirability for inventory in this submarket.

Aviation and Aerospace Industries

Aviation and aerospace industries have a strong presence in Arizona, which is consistently ranked among the top states for these industries based on factors such as existing industry presence, workforce, economic conditions, and business climate. As of 2018, more than 1,200 aerospace companies operate in Arizona, many of which are located in the Phoenix region.

In addition to the aviation and aerospace operations located directly on site at PHX, several aerospace companies are located in the surrounding area. These include the Honeywell Aerospace Global Headquarters, UTC Aerospace, and GKN Aerospace, among others.

Aviation and aerospace industries provide high-quality jobs and substantial economic development benefits in the regions where they are located, and regions often compete to attract aviation and aerospace operators. The state of Arizona and regional economic development organizations have instituted programs and marketing efforts to target aviation, aerospace, and associated industries. Given the Phoenix area's existing industry presence and favorable business environment, the region will likely experience continued growth in these industries.

Operators from specialized segments of the aviation and aerospace industries, such as aircraft maintenance, repair and overhaul and some upper-tier supply chain manufacturers, require airfield access to support the

movement of aircraft or large equipment to and from nearby facilities. Such operators provide high-quality job opportunities and on-Airport land at PHX may provide an appealing setting to meet their specialized needs.

5.10.8.3 NORTHSIDE LAND USE OBJECTIVES

The CAMP preferred concept identifies the land and general layout needed to support efficient growth of cargo, airline support facilities, general aviation, and airport support facilities throughout the Airport's northside landholdings. The balance of the northside land (as shown in **Exhibit 5-59**) should support aviation-related business and aero-industrial opportunities wherever possible as these land use synergies contain the most economic development potential and help sustain Airport aeronautical activity. Additionally, CAMP recognizes the importance of integrating Airport northside growth with existing efforts to strengthen and revitalize businesses in the proximity of the 24th Street Light Rail Station; Airport land in this business revitalization area can be used to support non-aeronautical business growth and improve the overall gateway into the Airport area.

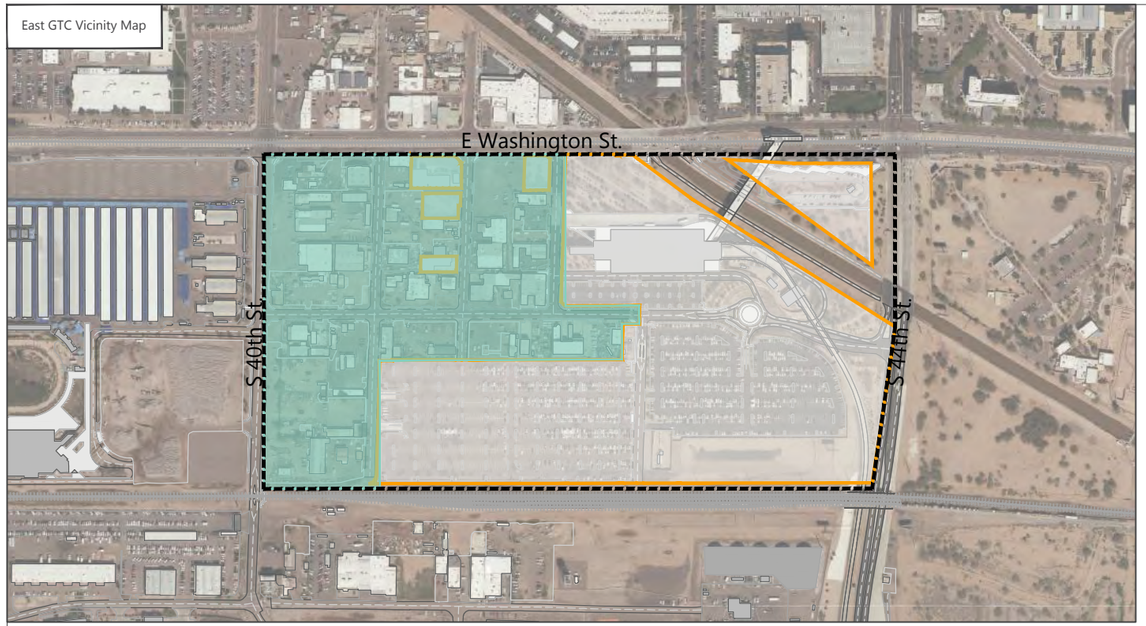
Throughout the northside new airport development will bring with it excellent opportunities to integrate and leverage transit-oriented design principles and create mixed-use (retail, office and destination uses with airport-related activity). This concept is particularly important to the 38th Street Light Rail Station area where the Gateway Community College and Honeywell Campus provide unique economic development catalysts for airport non-aeronautical development. This may include land development supporting the aerospace supply-chain or partnership opportunities to teach and train for future aero-business job growth.

Finally, lessons-learned from the Airport's Land Reuse Strategy should be considered in all northside development concepts. Historical, cultural, and environmental resources that characterize the northside corridor benefit from being actively identified and integrated into detailed planning processes early on with diverse stakeholder input and community participation.

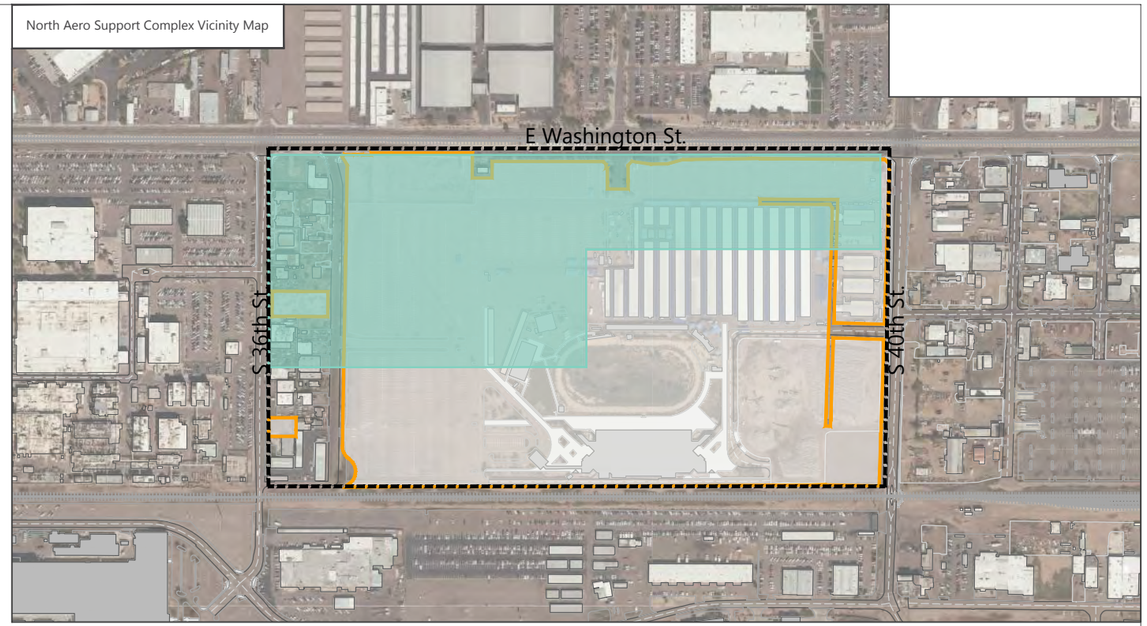
5.10.9 OVERALL PREFERRED CONCEPT

Exhibit 5-60 shows the overall land use plan for development of airfield, terminal, transportation, cargo, military, general aviation, support, aero-business and non-aero land uses.

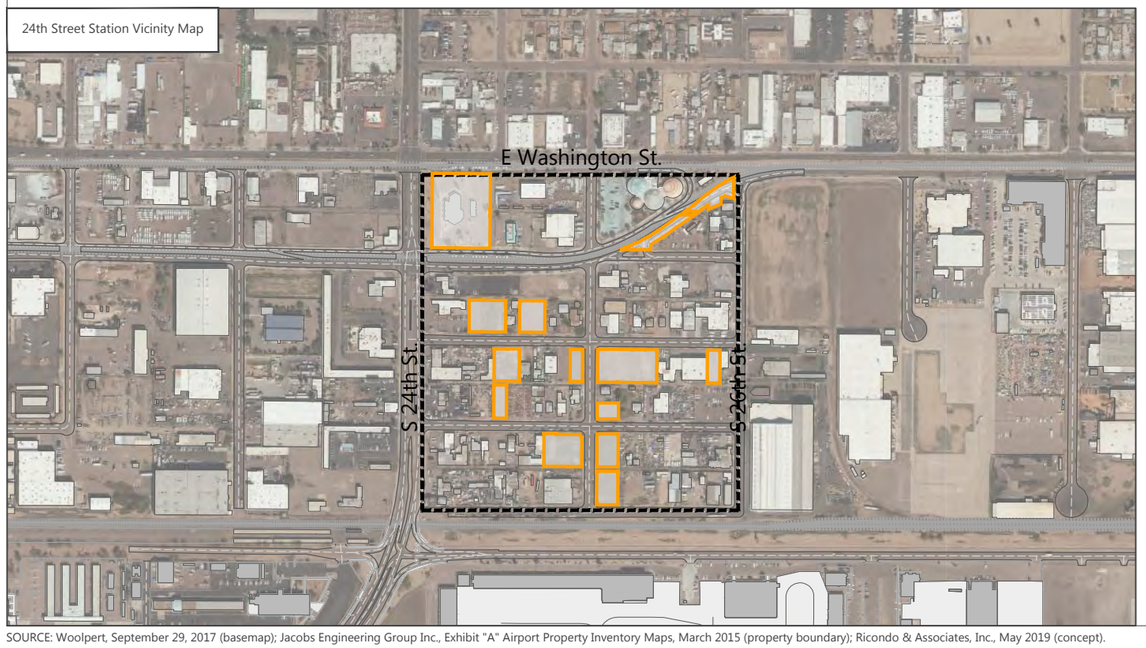
East GTC Vicinity Map



North Aero Support Complex Vicinity Map



24th Street Station Vicinity Map



Key Map



LEGEND

- Existing Airport Owned Property
- Aero-Industrial Area

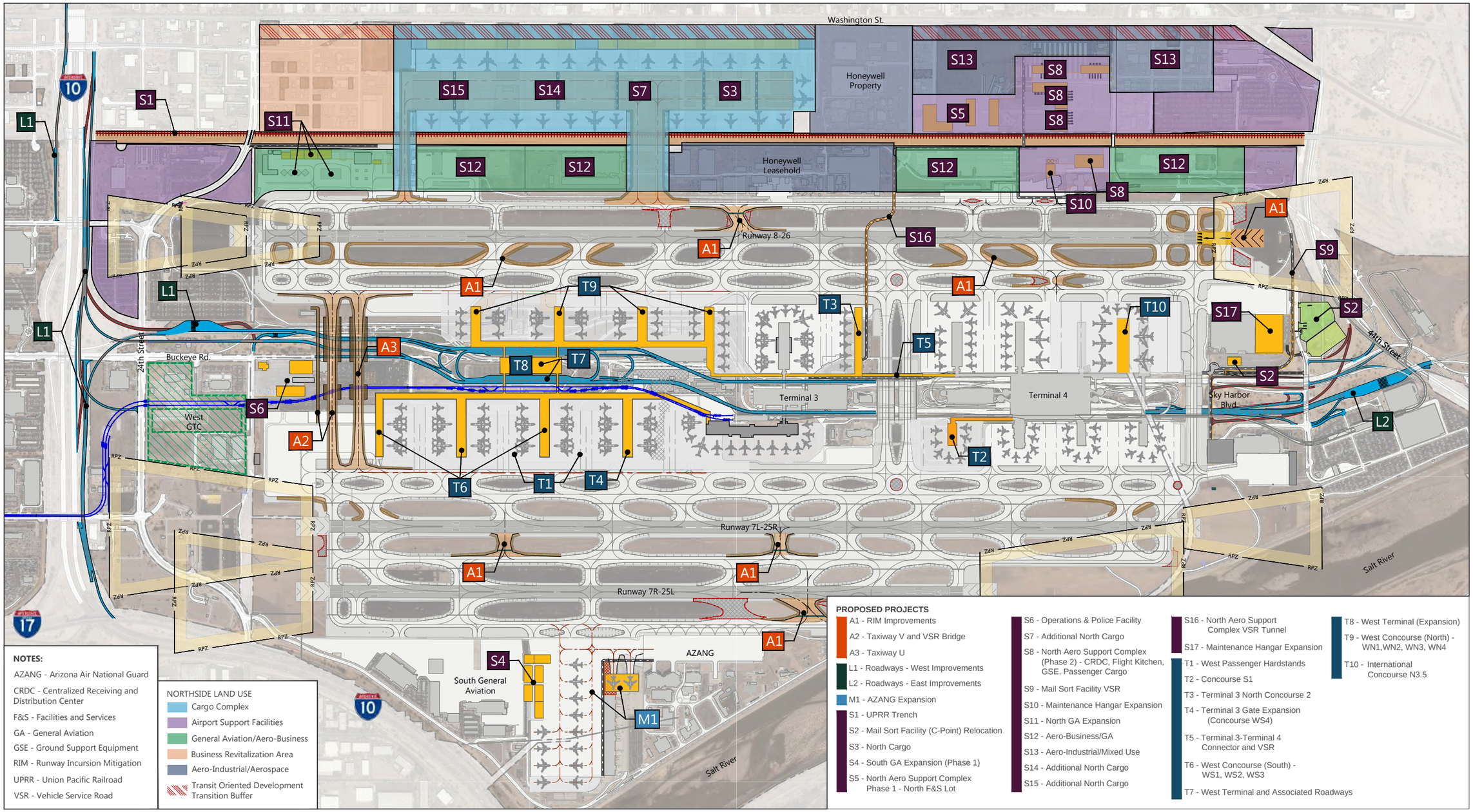
SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., May 2019 (concept).

NORTH 0 600 ft.

EXHIBIT 5-59

Northside Land Planning

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\05-Development Alternatives\Ex-5-59-Other Airport Landuse.dwgLayout: Ex 5-59 Plotted: Sep 5, 2019, 03:16PM



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); HNTB, October 2018 (Proposed Improvements); Ricondo & Associates, Inc., January 2019 (concept).

EXHIBIT 5-60

Overall Airport Concept

6. ENVIRONMENTAL OVERVIEW AND SUSTAINABILITY STRATEGY

This section provides a general overview of the potential environmental consequences and environmental review requirements associated with the preferred concept for CAMP. Prior to project implementation, the potential environmental effects of the projects comprising the preferred concept must be reviewed in accordance with the NEPA requirements and implementing guidance in FAA Orders 1050.1F, *Environmental Impacts: Policies and Procedures*, and 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*,[1] or the latest versions of those Orders at the time of environmental processing.

A project is considered ready for environmental review pursuant to NEPA when construction is expected to be initiated within a few years. As a general rule of thumb, construction should begin within three to five years of the FAA's issuance of a finding. The level of environmental documentation required for a project depends on the type of project(s), the potential environmental effects of the project(s), and the types of environmental resources that could be affected. The three levels of environmental documents prepared to comply with NEPA are:

- **Categorical Exclusion (CATEX):** FAA Order 1050.1F lists projects that typically do not result in significant adverse impacts. These projects are eligible for a categorical exclusion if no extraordinary circumstances are involved. A CATEX requires an assessment of potential areas of impact and associated documentation of no significant impacts.
- **Environmental Assessment (EA):** The airport sponsor is required to prepare an EA for projects that are not eligible for a categorical exclusion; the EA documents whether the project has the potential to result in a significant adverse impact. The EA presents a discussion and evaluation of the potential environmental effects. If no significant impacts would be expected to occur, or it is demonstrated that any potential impacts could be mitigated to a level below significance, then the FAA may issue a Finding of No Significant Impact (FONSI). If the adverse environmental impacts cannot be mitigated below a level of significance, then further analysis, in the form of an Environmental Impact Statement (EIS), may be required.
- **Environmental Impact Statement:** The FAA prepares an EIS, which presents detailed analyses of the environmental effects of a project. The EIS process provides for full public disclosure of significant environmental effects, practicable alternatives that would avoid or minimize adverse effects, and mitigation for those impacts that cannot be avoided.

[1] U.S. Department of Transportation, Federal Aviation Administration, Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, April 28, 2006.

6.1 PROJECTS POTENTIALLY ELIGIBLE FOR CATEGORICAL EXCLUSION

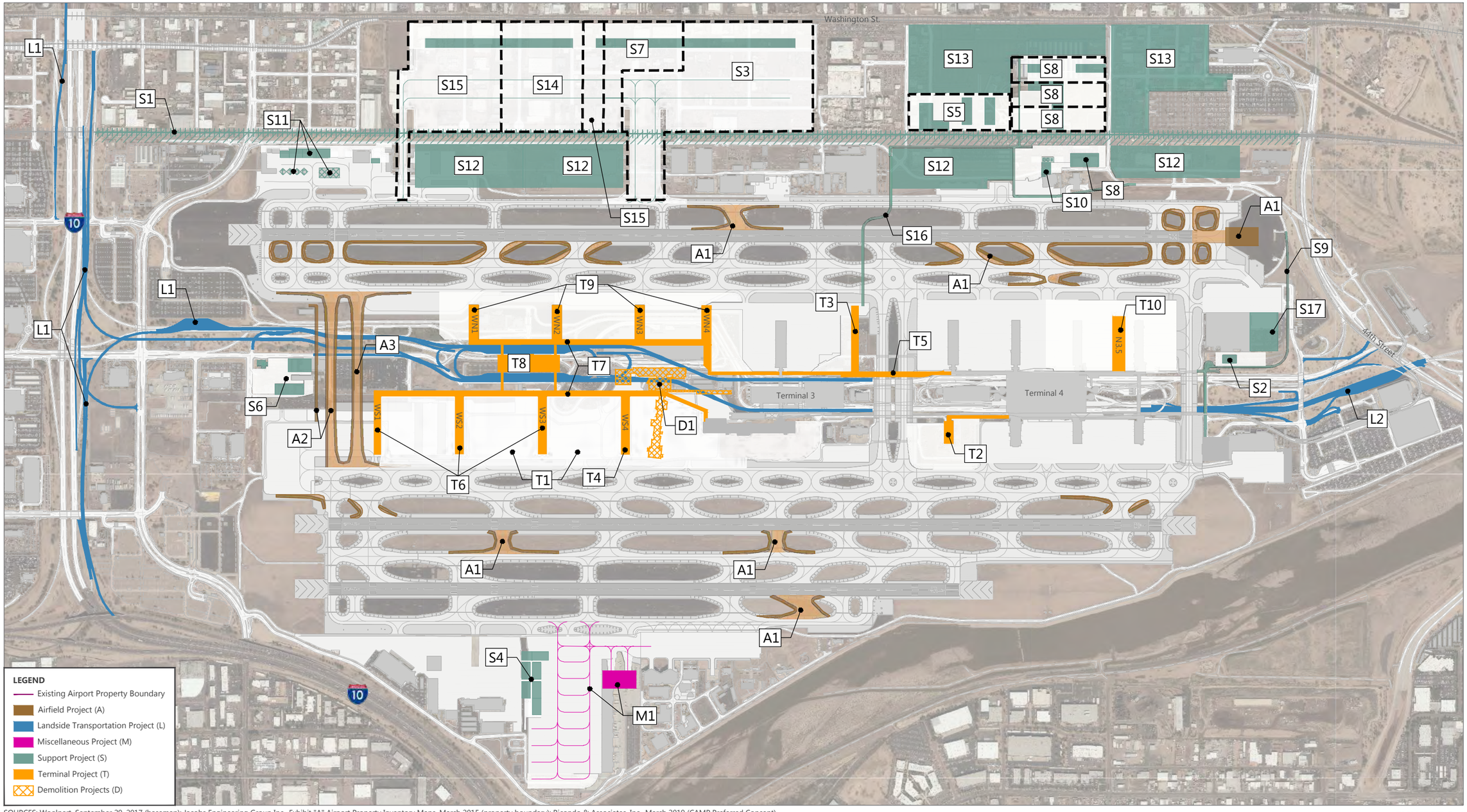
Exhibit 6-1 depicts the projects comprising the preferred concept. **Table 6-1** identifies the potential for each project to be categorically excluded from further NEPA review. As shown, almost half of the projects are potentially eligible for categorical exclusion. Table 6-1 also cites the potentially relevant paragraphs in FAA Order 1050.1F that may be considered to determine a project's eligibility for categorical exclusion. Although a potentially applicable categorical exclusion paragraph is identified for most projects, some projects would not likely be eligible for a CATEX based on the scale of the project or the presence of extraordinary circumstances (e.g., wetland effects). Furthermore, projects may be assessed together as a single "action" under NEPA if they are connected by implementation timing, proximity, or other common aspects of the projects, such as one project enabling implementation of another. Connected and enabling projects comprising a single action under NEPA may collectively not meet the definition of an action eligible for a CATEX. Therefore, Table 6-1 is intended to provide a reference to support future consideration of NEPA review needs.

6.2 ENVIRONMENTAL CONSIDERATIONS

Based on known environmental conditions presented in Section 2, Existing Conditions, and the preferred concept projects, the following NEPA environmental resource categories may be affected and would likely require assessment during environmental review of projects pursuant to NEPA:

- Air quality and climate
- Historical, archaeological, architectural, and cultural resources
- Department of Transportation Section 4(f) lands
- Hazardous materials
- Water resources (wetlands, floodplains, surface water, and groundwater)
- Noise and noise compatible land uses
- Socioeconomics, environmental justice, and children's health and safety risks

Other environmental resource categories identified in FAA Order 1050.1F are not addressed in this Environmental Overview for several reasons. Farmlands, coastal resources, and Wild and Scenic Rivers are not present on or within the vicinity of Airport property. Although much of the Airport is already developed, biological resources may be present. PHX AVN typically conducts an initial assessment of biological resources to evaluate the need for additional biological resource review, so the potential effects on biological resources would be considered for all development projects but are not expected to rise to the level of significance given past experience with Airport development projects. Finally, the categories of solid waste, pollution prevention, land use, visual resources, and natural resources and energy supply are not evaluated in this Environmental Overview because preferred concept projects are not expected to involve extraordinary circumstances associated with these categories or affect these resources given practices PHX AVN would take to comply with local, state, and federal regulations and guidance provided in City of Phoenix land use plans, as appropriate.



SOURCES: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., March 2019 (CAMP Preferred Concept).

NORTH

0 1,200 ft.

EXHIBIT 6-1

Preferred Concept

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\06-Environmental and Sustainability\Ex-06-01-Preferred Concept_20190614.dwgLayout: 6-1 Plotted: Sep 6, 2019, 10:19AM

TABLE 6-1 POTENTIAL CATEGORICAL EXCLUSION ELIGIBILITY (1 OF 2)

PROJECT NUMBER[1]	PROJECT NAME[2]	POTENTIALLY RELEVANT 1050.1F PARAGRAPH(S)[3]	PRELIMINARY EVALUATION OF CATEGORICAL EXCLUSION ELIGIBILITY[4]
Short-Range Development Projects – 0 to 3 Years			
A1	RIM Airfield Improvements (25%)[5]	5-6.4.e	Potentially eligible
A2	Taxiway V and VSR Bridge[5]	5-6.4.e	Project scale likely precludes eligibility
S1	UPRR Trench (50%)	--	Not eligible[5]
S2	Mail Sort Facility (C-Point) Relocation	5-6.4.f	Potentially eligible
T1	West Apron Hardstands	5-6.4.e	Potentially eligible
Short-Range Development Projects – 3 to 5 Years			
A1	RIM Airfield Improvements (25%)	5-6.4.e	Potentially eligible
D1	Terminal 2 Demolition and Apron Reconstruction (Hardstands)[6]	5-6.4.i	Project not likely eligible due to effects on Section 106 resources
S1	UPRR Trench (50%)	--	Not eligible[7]
T2	Concourse S1[5]	N/A	N/A
T3	Terminal 3 North Concourse 2	5-6.4.h	Project scale likely precludes eligibility
Short-Range Development Projects – 5 to 10 Years			
A1	RIM Airfield Improvements (50%)	5-6.4.e	Potentially eligible
L1	Roadways – West Improvements	5-6.4.a	Project scale likely precludes eligibility
L2	Roadways – East Improvements	5-6.4.a	Project scale likely precludes eligibility
M1	AZANG Expansion	--	Not Eligible[7]
S3	North Cargo (PAL 1)	5-6.4h	Project scale likely precludes eligibility
S4	South GA Expansion (60%)	5-6.4.h	Potentially eligible
S5	North Aero Support Complex (Phase 1) – North F&S Lot	5-6.4.f	Potentially eligible
S6	Operations and Police Facility	5-6.4.h	Potentially eligible
T4	Terminal 3 Gate Expansion (Concourse WS4)	5-6.4.h	Project scale likely precludes eligibility
T5	Terminal 3-Terminal 4 Connector and VSR	5-6.4.h	Potentially eligible
Long-Range Development Projects – 10 to 15 Years			
S7	Additional North Cargo (PAL 2)	5-6.4h	Project scale likely precludes eligibility
S8	North Aero Support Complex (Phase 2) CRDC, Flight Kitchen, GSE, and Passenger Cargo	5-6.4.f , 5-6.4.h	Potentially eligible
S9	Mail Sort Facility VSR	5-6.4.a	Potentially eligible
S10	Maintenance Hangar Expansion	5-6.4.f	Potentially eligible
S11	North GA Expansion	5-6.4.h, 5-6.4.i	Potentially eligible
S12	Aero-Business/General Aviation	5-6.4.h	Project scale likely precludes eligibility
S13	Aero-Industrial/Mixed Use	5-6.4.h	Project scale likely precludes eligibility

TABLE 6-1 POTENTIAL CATEGORICAL EXCLUSION ELIGIBILITY (2 OF 2)

PROJECT NUMBER[1]	PROJECT NAME[2]	POTENTIALLY RELEVANT 1050.1F PARAGRAPH(S)[3]	PRELIMINARY EVALUATION OF CATEGORICAL EXCLUSION ELIGIBILITY[4]
Long-Range Development Projects – 15 to 20 Years			
A3	Taxiway U[5]	5-6.4.e	Project scale likely precludes eligibility
T7	West Terminal and Associated Roadways	5-6.4.a	Project scale likely precludes eligibility
S4	South GA Expansion (40%)	5-6.4.h	Potentially eligible
S14	Additional North Cargo (PAL 3)	5-6.4h	Project scale likely precludes eligibility
T6	West Concourses (South) – WS1, WS2, and WS3	5-6.4.h	Project scale likely precludes eligibility
Post CAMP Development Plan – 20+ Years			
S15	Additional North Cargo (PAL 3 – High Growth)	5-6.4h	Project scale likely precludes eligibility
S16	North Aero Support Complex VSR Tunnel	5-6.4.a	Project scale likely precludes eligibility
S17	Maintenance Hangar Expansion	5-6.4.h	Potentially eligible
T8	West Terminal (Expansion)	5-6.4.h	Project scale likely precludes eligibility
T9	West Concourses (North) – WN1, WN2, WN3, and WN4	5-6.4.h	Project scale likely precludes eligibility
T10	International Concourse N3.5	5-6.4.h	Potentially eligible

NOTES:
-- No relevant categorial exclusion paragraph
N/A – Project has already received environmental clearance.

AZANG: Arizona Air National Guard
CRDC: Centralized Receiving and Distribution Center
F&S: Facilities and Services
GSE: Ground Support Equipment
GA: General Aviation
PAL: Passenger Activity Level
RIM: Runway Incursion Mitigation
UPRR: Union Pacific Railroad
VSR: Vehicle Service Road

1 The Project Number refers to the individual projects identified on Exhibit 6-1.

2 For environmental processing, certain projects listed individually in this table will be grouped with other projects (e.g., Construction of West Terminal and Construction of South or North Concourses), depending on timing, connected nature, and proximity of the projects.

3 The cited paragraphs in FAA Order 1050.1F are:
- 5-6.4.a Access road construction, and construction, relocation, or repair of entrance and service roadways that do not reduce the level of service on local traffic systems below acceptable levels.
- 5-6.4.e Federal financial assistance, licensing, or Airport Layout Plan (ALP) approval for the following actions, provided the action would not result in significant erosion or sedimentation, and will not result in a significant noise increase over noise sensitive areas or result in significant impacts on air quality: construction, repair, reconstruction, resurfacing, extending, strengthening, or widening of a taxiway, apron, loading ramp, or runway safety area (RSA), including an RSA using Engineered Material Arresting System (EMAS); or reconstruction, resurfacing, extending, strengthening, or widening of an existing runway. This CATEX includes marking, grooving, fillets, and jet blast facilities associated with any of the above facilities.
- 5-6.4.f Federal financial assistance, licensing, ALP approval, or FAA construction or limited expansion of accessory onsite structures, including storage buildings, garages, hangars, t-hangars, small parking areas, signs, fences, and other essentially similar minor development items.
- 5-6.4.h Federal financial assistance, licensing, or ALP approval for construction or expansion of facilities—such as terminal passenger handling and parking facilities or cargo buildings, or facilities for non-aeronautical uses at existing airports and commercial launch sites—that do not substantially expand those facilities.
- 5-6.4.i Demolition and removal of FAA buildings or structures, or financial assistance for or approval of an ALP for the demolition or removal of non-FAA owned, on-airport buildings and structures, provided no hazardous substances or contaminated equipment are present on the site of the existing facility. This CATEX does not apply to buildings and structures of historic, archaeological, or architectural significance as officially designated by Federal, state, tribal, or local governments.

4 Projects are eligible for a categorical exclusion as long as they are consistent with the descriptions of the cited paragraphs in FAA Order 1050.1F and no extraordinary circumstances exist, as listed in Section 5.2 of FAA Order 1050.1F. Categorical exclusion eligibility should be reassessed when individual projects or groups of projects are ready for environmental review and should include coordination with the FAA to confirm eligibility.

5 RIM airfield improvements, crossfield Taxiways U and V, and Concourse S1 were planned under separate planning studies but have been incorporated into the overall preferred concept.

6 Project would require a finding by the responsible federal agency if the project is federally funded.

7 On December 22, 2016, the Federal Aviation Administration issued a Finding of No Significant Impact for Terminal 2 concourse demolition and apron reconstruction, so categorical exclusion eligibility was only reviewed for the Terminal 2 headhouse demolition portion of this project.

SOURCES: Ricondo & Associates, Inc., April 2019 (based on U.S. Department of Transportation, Federal Aviation Administration, *Environmental Impacts: Policies and Procedures*, July 16, 2015).

Environmental resources located on and around Airport property are depicted on **Exhibit 6-2**. **Table 6-2** lists the projects comprising the preferred concept and identifies the environmental resource categories for which the potential exists for project implementation (e.g., construction and/or operation) to affect the resource and for which further analysis would likely be needed during future environmental review. A discussion of how each of the environmental resource categories identified in Table 6-2 was evaluated for each preferred concept project is provided following the table. The environmental resource effects identified herein are preliminary and intended to provide an early indication of the issues that would likely require detailed analyses during future NEPA review. The responses in Table 6-2 are not intended to indicate there would be an adverse effect; they are intended to identify areas that would need to be evaluated in the NEPA process. In addition, there may be other resources identified in the scoping process that may require the need for additional NEPA analysis. All preferred concept projects would be subject to some level of review under NEPA prior to implementation.

6.2.1 AIR QUALITY AND CLIMATE

Under NEPA, projects that would result in temporary emissions from construction activities, as well as long-term changes in operational emissions (e.g., operation of new buildings or other changes that affect aircraft and vehicle emissions), would be subject to a review for conformity with the NAAQS. It is anticipated that each of the preferred concept projects would result in temporary emissions from construction activities, and, as such, each project would likely require the evaluation of air quality effects under NEPA, as indicated by the "likely" responses in Table 6-2. Further, the implementation of preferred concept projects that include construction activities or change aircraft or vehicle activity patterns may require coordination with the Maricopa County Air Quality Department to determine air quality permitting requirements.

Although a significance threshold has not been established for the evaluation of climate change effects, greenhouse gas (GHG) emissions associated with construction and operational changes can be estimated with criteria pollutant emissions analyses and should be disclosed in the NEPA documentation.

6.2.2 HISTORICAL, ARCHAEOLOGICAL, ARCHITECTURAL, AND CULTURAL RESOURCES

If the development footprint of a preferred concept project coincides with a historical, archaeological, architectural, or cultural resource, of which two known resources are on Airport property (i.e., *The Phoenix* mural in Terminal 2 and the Pueblo Grande Ruin National Register District in the northeast area of the Airport), the potential for an effect on historical, archaeological, architectural, and cultural resources was identified in Table 6-2. Furthermore, it is assumed that every project that involves ground disturbance during construction would require evaluation of the potential for effects to archaeological resources; therefore, projects that would not directly affect known resources are indicated as "not determined" in the table because the absence of archaeological resources was not confirmed as part of this analysis. For all ground disturbing activities at the Airport, PHX AVN coordinates evaluation of potential archaeological effects with the City Archaeologist as part of the environmental review process.



SOURCES: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., March 2019 (CAMP Preferred Concept); US Environmental Protection Agency, March 2018 (hazardous material sites and groundwater contamination sites); US Department of the Interior, National Park Service, March 2018 (historical, archaeological, architectural and cultural resources sites); Federal Emergency Management Agency, March 2018 (floodplains); Maricopa County, March 2018 (historic, archaeological, architectural and cultural resources sites); AZGEO Clearinghouse, Arizona Land Resource Services (roads and schools).

EXHIBIT 6-2

Environmental Considerations for the Preferred Concept

TABLE 6-2 POTENTIAL ENVIRONMENTAL FACTORS ASSOCIATED WITH PREFERRED CONCEPT PROJECTS (1 OF 3)

PROJECT NUMBER	PROJECT NAME	ENVIRONMENTAL RESOURCE PRESENT [1]				CONSTRUCTION OR CHANGES IN ACTIVITY MAY REQUIRE ASSESSMENT OF CATEGORY [1]		
		CULTURAL RESOURCES [2]	SECTION 4(F) RESOURCES	HAZARDOUS MATERIALS	WATER RESOURCES	AIR QUALITY AND CLIMATE	NOISE [3]	SOCIO-ECONOMICS [4]
Short-Range Development Projects – 0 to 3 Years								
A1	RIM Airfield Improvements (25%)	Yes[5]	Yes[5]	Yes[5]	Yes	Likely	Not Likely	Not Likely
A2	Taxiway V and VSR Bridge[6]	Not Determined	No	Yes	Yes	Likely	Likely	Not Likely
S1	UPRR Trench (50%)	Yes[5]	Yes[5]	Yes[5]	Yes	Likely	Not Likely	Not Likely
S2	Mail Sort Facility (C-Point) Relocation	Yes	Yes	No	No	Likely	Not Likely	Likely
T1	West Apron Hardstands	Not Determined	No	Yes	Yes	Likely	Not Likely	Not Likely
Short-Range Development Projects – 3 to 5 Years								
A1	RIM Airfield Improvements (25%)	Yes[5]	Yes[5]	Yes[5]	Yes	Likely	Not Likely	Not Likely
D1	Terminal 2 Demolition and Apron Reconstruction (Hardstands)[7]	Yes	Yes	Yes	Yes	Likely	Not Likely	Not Likely
S1	UPRR Trench (50%)	Yes[5]	Yes[5]	Yes[5]	Yes	Likely	Not Likely	Not Likely
T2	Concourse S1[6]	Not Determined	No	Yes	No	Likely	Not Likely	Not Likely
T3	Terminal 3 North Concourse 2	Not Determined	No	Yes	Yes	Likely	Not Likely	Not Likely
Short-Range Development Projects – 5 to 10 Years								
A1	RIM Airfield Improvements (50%)	Yes[5]	Yes[5]	Yes[5]	Yes	Likely	Not Likely	Not Likely
L1	Roadways – West Improvements	Not Determined	No	Yes	Yes	Likely	Not Likely	Likely
L2	Roadways – East Improvements	Yes	Yes	No	Yes	Likely	Not Likely	Likely
M1	AZANG Expansion	Not Determined	No	Yes	Yes	Likely	Not Likely	Not Likely
S3	North Cargo (PAL 1)	Not Determined	No	Yes	Yes	Likely	Likely	Likely
S4	South GA Expansion (60%)	Not Determined	No	Yes[5]	Yes	Likely	Not Likely	Not Likely

TABLE 6-2 POTENTIAL ENVIRONMENTAL FACTORS ASSOCIATED WITH PREFERRED CONCEPT PROJECTS (2 OF 3)

PROJECT NUMBER	PROJECT NAME	ENVIRONMENTAL RESOURCE PRESENT [1]				CONSTRUCTION OR CHANGES IN ACTIVITY MAY REQUIRE ASSESSMENT OF CATEGORY [1]		
		CULTURAL RESOURCES [2]	SECTION 4(F) RESOURCES	HAZARDOUS MATERIALS	WATER RESOURCES	AIR QUALITY AND CLIMATE	NOISE [3]	SOCIO-ECONOMICS [4]
Short-Range Development Projects – 5 to 10 Years (continued)								
S5	North Aero Support Complex (Phase 1) – North F&S Lot	Not Determined	No	Yes	No	Likely	Not Likely	Likely
S6	Operations and Police Facility	Not Determined	No	Yes	Yes	Likely	Not Likely	Not Likely
T4	Terminal 3 Gate Expansion (Concourse WS4)	Not Determined	No	Yes	Yes	Likely	Not Likely	Not Likely
T5	Terminal 3-Terminal 4 Connector and VSR	Not Determined	No	Yes	Yes	Likely	Not Likely	Not Likely
Long-Range Development Projects – 10 to 15 Years								
S7	Additional North Cargo (PAL 2)	Not Determined	No	Yes	Yes	Likely	Likely	Likely
S8	North Aero Support Complex (Phase 2) CRDC, Flight Kitchen, GSE, and Passenger Cargo	Not Determined	No	No	No	Likely	Not Likely	Likely
S9	Mail Sort Facility VSR	Yes	Yes	Yes	Yes	Likely	Not Likely	Likely
S10	Maintenance Hangar Expansion	Not Determined	No	Yes	No	Likely	Not Likely	Not Likely
S11	North GA Expansion	Not Determined	No	Yes	No	Likely	Not Likely	Not Likely
S12	Aero-Business/General Aviation	Yes	Yes	Yes	Yes	Likely	Not Likely	Not Likely
S13	Aero-Industrial/Mixed Use	Yes	Yes	Yes	Yes	Likely	Not Likely	Likely
Long-Range Development Projects – 15 to 20 Years								
A3	Taxiway U[6]	Not Determined	No	No	No	Likely	Likely	Not Likely
T7	West Terminal and Associated Roadways	Not Determined	No	Yes	Yes	Likely	Not Likely	Likely
S4	South GA Expansion (40%)	Not Determined	No	Yes[5]	Yes	Likely	Not Likely	Not Likely
S14	Additional North Cargo (PAL 3)	Not Determined	No	Yes	Yes	Likely	Likely	Likely
T6	West Concourses (South) – WS1, WS2, and WS3	Not Determined	No	Yes	Yes	Likely	Not Likely	Not Likely

TABLE 6-2 POTENTIAL ENVIRONMENTAL FACTORS ASSOCIATED WITH PREFERRED CONCEPT PROJECTS (3 OF 3)

PROJECT NUMBER	PROJECT NAME	ENVIRONMENTAL RESOURCE PRESENT [1]				CONSTRUCTION OR CHANGES IN ACTIVITY MAY REQUIRE ASSESSMENT OF CATEGORY [1]		
		CULTURAL RESOURCES [2]	SECTION 4(F) RESOURCES	HAZARDOUS MATERIALS	WATER RESOURCES	AIR QUALITY AND CLIMATE	NOISE [3]	SOCIO-ECONOMICS [4]
Post CAMP Development Plan – 20+ Years								
S15	Additional North Cargo (PAL 3 – High Growth)	Not Determined	No	Yes	Yes	Likely	Likely	Likely
S16	North Aero Support Complex VSR Tunnel	Not Determined	No	Yes	Yes	Likely	Not Likely	Not Likely
S17	Maintenance Hangar Expansion	Yes	Yes	Yes	No	Likely	Not Likely	Not Likely
T8	West Terminal (Expansion)	Not Determined	No	Yes	Yes	Likely	Not Likely	Not Likely
T9	West Concourses (North) – WN1, WN2, WN3, and WN4	Not Determined	No	Yes	Yes	Likely	Not Likely	Not Likely
T10	International Concourse N3.5	Not Determined	No	Yes	No	Likely	Not Likely	Not Likely

NOTES:

Yes: Project may affect environmental resource based on project footprint and known existing environmental conditions.

No: Project is not anticipated to affect environmental resource based on project footprint and known existing environmental conditions.

Likely: An assessment of potential impacts may be needed based on project definition.

Not Likely: An assessment of potential impacts is not likely to be needed based on project definition.

AZANG: Arizona Air National Guard
CRDC: Centralized Receiving and Distribution Center
F&S: Facilities and Services
FAA: Federal Aviation Administration
GSE: Ground Support Equipment
GA: General Aviation
PAL: Passenger Activity Level
RIM: Runway Incursion Mitigation
UPRR: Union Pacific Railroad
VSR: Vehicle Service Road

1 Identification of potential environmental issues reflects a qualitative, planning-level review of available environmental conditions; additional review and analysis may be needed for NEPA processing.

2 Cultural resources is an abbreviation for the historical, archaeological, architectural, and cultural resources category. Effects associated with project implementation were identified if the project footprint is coincident with the location of known resources (see Section 6.2.2). The absence of archaeological resources within project footprints was not confirmed as part of this analysis; therefore, all other projects are indicated as "not determined" because the potential for archaeological resources effects during ground-disturbing construction activities is assumed to require further consideration.

3 The noise category includes consideration of potential changes in aircraft noise and effects on noise compatible land uses.

4 The socioeconomics category includes Environmental Justice and Children's Health and Safety Risks, and this analysis focuses specifically on potential surface traffic impacts, as discussed in Section 6.2.7.

5 The need for environmental review is dependent on the project footprint.

6 RIM airfield improvements, crossfield Taxiways U and V, and Concourse S1 were planned under separate planning studies but have been incorporated into the overall preferred concept.

7 Closure of the Terminal 2 processor building and the demolition of Terminal 2 concourse were approved in the *Finding of No Significant Impact and Record of Decision, Phoenix Sky Harbor International Airport, Terminal 3 South Concourse Reconstruction* (December 22, 2016). Demolition of the passenger processor building was not included in the Finding. In support of the 2006 EIS and Record of Decision, a Memorandum of Agreement among the FAA, City of Phoenix, Bureau of Reclamation, Salt River Project, and State Historic Preservation Officer was developed to address treatment of the mural (*The Phoenix*) with the demolition of Terminal 2 (a component of the Proposed Action in the 2006 Final EIS). Prior to demolition of the Terminal 2 processor building, additional NEPA processing, including final plans for treatment of the mural, would be required.

SOURCE: Ricondo & Associates, Inc., June 2019.

The closure of the Terminal 2 processor building and the demolition of the Terminal 2 concourse were approved in the *Finding of No Significant Impact and Record of Decision, Phoenix Sky Harbor International Airport, Terminal 3 South Concourse Reconstruction* (December 22, 2016). Demolition of the passenger processor building, a component of the Terminal 3 South Concourse Reconstruction project was not included in the Finding. In support of a 2006 EIS and Record of Decision, a Memorandum of Agreement, among the FAA, City of Phoenix, Bureau of Reclamation, Salt River Project, and State Historic Preservation Officer, was developed to address treatment of the mural with the demolition of Terminal 2 (a component of the Proposed Action in the 2006 Final EIS). Prior to demolition of the Terminal 2 processor building, additional NEPA processing, including final plans for treatment of the mural, would be required.

6.2.3 DEPARTMENT OF TRANSPORTATION SECTION 4(F) LANDS

Section 4(f) of the U.S. Department of Transportation Act of 1966 specifies that transportation projects cannot take land from public parks, historic sites, or wildlife refuges without first determining that no reasonable and prudent alternative exists. Takings can include direct impacts, such as physical acquisition of these lands, or indirect environmental impacts, such as high noise levels, which would make these lands unsuitable for their desired uses. Preferred concept projects with potential direct effects on Section 4(f) resources are identified in Table 6-2. Direct effects were identified if the development footprint was coincident with one of the two known historic resources on Airport property subject to Section 4(f)—*The Phoenix* or the Pueblo Grande Ruin National Register District.

Potential indirect effects on Section 4(f) resources in the vicinity of the Airport may include visual effects or changes in noise exposure at noise-sensitive resources. Although the preferred concept is not expected to induce growth in aircraft activity, change the runway layout, or change air traffic routes, the location of facilities on the airfield could affect runway use, as discussed in Section 6.2.6. Preferred concept projects that have the potential to affect noise exposure are indicated in the "noise" column in Table 6-2, and environmental review of these projects would include consideration of changes to noise exposure over noise-sensitive facilities, including Section 4(f) resources in the vicinity of the Airport.

6.2.4 HAZARDOUS MATERIALS

A potential hazardous materials effect was identified for a project in Table 6-2 if it met one or more of the following conditions.

- The footprint of the project overlaps with or is adjacent to the footprint of one of the known hazardous materials sites, which are depicted on Exhibit 6-2 and defined for purposes of this evaluation as:
  - An area associated with (1) a Superfund site, (2) a groundwater contamination plume, (3) an active groundwater monitoring well, or (4) an active fuel storage tank;
  - A site regulated by the U.S. Environmental Protection Agency; or
  - A site designated as a RCRA waste generator (a large quantity generator of regulated or hazardous waste).
- Operations at the site with project implementation may involve the use, transport, or storage of hazardous materials (such as fueling operations).

Most of the preferred concept projects would occur either adjacent to or coincident with a known hazardous materials site. Specifically, preferred concept projects in the northwest area of the Airport, the west side of the terminal core, and the south side of the Airport are within footprints of mapped ground contamination areas and active monitoring wells, so coordination with the applicable regulatory agencies would likely be required as part of NEPA review. Finally, preferred concept projects that would support fueling operations (e.g., concourses, general aviation, and cargo) are identified as presenting a potential hazardous materials issue given the need to meet regulatory requirements for construction and operation, such as obtaining permits and demonstrating commitment to implementing best practices to respond to potential fuel spills. In general, projects that involve the use, transport, or storage of hazardous materials would need to demonstrate compliance with local, state, and federal hazardous materials regulations.

NEPA documentation for preferred concept projects should include discussion of hazardous materials sites, including their location, owner/operator, and the type and extent of contamination, as applicable; the distance and direction of the site from the location of the project; and the regulatory status of the contaminated site, including cleanup activities. If a preferred concept project would be located at a site where contamination has occurred, then cleanup activities that have been done in the past or any cleanup that would be done prior to or during the commencement of the project should be described in the NEPA document.

6.2.5 WATER RESOURCES

Water resources in the vicinity of the Airport are shown on Exhibit 6-2. A potential water resources effect was identified in Table 6-2 if it met one or more of the following conditions.

- The footprint of a project would increase impervious surface area (requiring definition of stormwater management strategies).
- The footprint of a project would overlap with or be adjacent to an active groundwater monitoring well.

Preferred concept projects would not directly affect mapped surface water, floodplain, or wetland resources, which are shown on Exhibit 6-2. Although not directly captured in Table 6-2, projects that include ground-disturbing activities during construction may need to include consideration of effects on groundwater resources in addition to effects on active groundwater monitoring wells. The monitoring wells are located throughout the northwest area of the Airport, the western terminal core, and near the AZANG site, and projects that may affect these monitoring wells require either protection of the well from construction activities or abandoning of the well under an Arizona Department of Water Resources permit. As stated in Section 2.5.5, many of these wells are tenant owned, so coordination with the tenants and regulatory agencies would be required.

Preferred concept projects within the terminal core would not increase impervious surface area at the Airport because the terminal core is paved, with the exception of small landscaped areas, primarily along the roadways. The majority of area within sites accommodating the preferred concept projects outside the terminal core is developed and paved as well; although, development at most sites would likely result in an overall increase in impervious surface area that may require additional stormwater management considerations.

6.2.6 NOISE AND NOISE COMPATIBLE LAND USE

The preferred concept does not include projects intended to induce growth in aircraft activity, change the runway layout, or change aircraft traffic routes; therefore, no significant changes with respect to aircraft operations and noise exposure are anticipated. The potential need to address noise and noise compatible land use was identified in Table 6-2 for a project if it met one or more of the following conditions.

- Airfield projects that have the potential to affect runway use, such as the addition of crossfield taxiways that could improve the efficiency of access between the north and south airfields, would need to include consideration of noise effects on compatible land use. Evaluation may be qualitative if the efficiency benefits do not change runway use.
- Projects that would introduce new aircraft taxiing operations, such as the proposed cargo facilities north of the Union Pacific Railroad, may require consideration of potential noise effects.

6.2.7 SOCIOECONOMIC, ENVIRONMENTAL JUSTICE, AND CHILDREN'S HEALTH AND SAFETY RISKS

Under the category of socioeconomic, environmental justice, and children's health and safety risks, the potential for effects was identified for preferred concept projects in Table 6-2 if the project has the potential to change surface traffic patterns that could disrupt local traffic patterns or reduce levels of service on area roads.[2] In general, a project was identified in the Table 6-2 as "likely" to involve socioeconomic effects if it met one or more of the following conditions.

- The project is a new or relocated roadway that introduces new connections to or changes connections with the off-Airport surface roadway network.
- The project is a facility in a new on-Airport location that has the potential to change traffic patterns on area roadways, based on the location of the new facility and connection to the off-Airport surface roadway network. Implementation of projects north of the UPRR would likely change employee and cargo vehicle ground access patterns in the Airport vicinity.

An evaluation under NEPA may require surface traffic analyses to evaluate LOS along roadway segments and at roadway intersections to identify the changes associated with the preferred concept projects.

6.3 ENVIRONMENTAL PROCESSING STRATEGY

The ALP depicts the preferred concept projects that are reasonably foreseeable over the CAMP planning horizon. ALP approval can take one of two forms: (1) conditional approval, where one or more projects depicted on the ALP require further environmental review before being undertaken, and (2) unconditional approval, where NEPA compliance has been achieved for all projects depicted on the ALP. The ALP submitted to FAA with the preferred concept projects is therefore subject to conditional approval by FAA.

[2] Under NEPA, the socioeconomic category includes consideration of the effects of land acquisition. Land acquisition along the northern boundary of the Airport has been previously evaluated under NEPA and is underway. Proposed development in this area, therefore, does not constitute a new land acquisition action.

Individual or groups of preferred concept projects will then be subject to NEPA analysis to obtain unconditional approval of the portion(s) of the ALP depicting the project(s).

When considering the environmental review associated with the preferred concept projects, the dependencies among projects must be considered. The Council on Environmental Quality (CEQ) regulations require that connected projects be considered in the same environmental document. Projects may be connected either because one project enables another or because one project would not happen without a second. In addition, projects occurring in a similar location and/or timeframe should be considered in the same environmental document. When proceeding with environmental review and approval of projects that have the potential to be connected to other projects, independent utility must be demonstrated if those potentially connected projects are not considered.

Coordination with the FAA and other stakeholders (e.g., agencies with jurisdiction over affected resources) should occur well in advance of the need for environmental approval to determine how NEPA compliance can be achieved, including protocols and analyses required to support a compliance determination. Environmental processing of projects can take two or more years for an EIS and a year or more for an EA. Projects eligible for CATEX can be processed in a shorter time (i.e., three to six months). Projects requiring permits from other agencies often require additional time after the NEPA processing is complete to obtain permits; therefore, permit processing should be factored into the environmental processing timeline and the NEPA document must include the necessary information to support permit applications.

As the anticipated timing for undertaking the preferred concept projects is further evaluated and refined through subsequent advanced planning and decision-making, the environmental factors identified in this section as well as other emerging environmental issues should be reflected in the NEPA processing strategy. Ongoing collaboration with the FAA regarding updates and refinements to future project assumptions, such as timing and anticipated impacts, will be critical to refining a NEPA processing strategy and associated timeline.

6.4 SUSTAINABILITY STRATEGY

Sustainability is a core value of the PHX AVN and was integrated into the CAMP throughout the planning process. For example, the alternatives evaluation criteria reflect the four pillars of aviation sustainability as defined by Airports Council International – North America: Economic Viability, Operational Efficiency, Natural Resource Conservation, and Social Responsibility (often referred to as "EONS"), as illustrated on **Exhibit 6-3**.

In addition to incorporating sustainability considerations into the evaluation of alternatives, a number of recommended measures from past and ongoing sustainability planning efforts[3] can be integrated into the preferred concept, as described in the following subsections.

[3] New and ongoing efforts should be tracked and considered throughout implementation of the preferred concept.

EXHIBIT 6-3 ALTERNATIVES EVALUATION CRITERIA



SOURCE: Ricondo & Associates, Inc., October 2018.

6.4.1 PAST AND ONGOING PLANNING EFFORTS

6.4.1.1 SUSTAINABILITY MANAGEMENT PLAN AND UPDATE

In 2015, PHX AVN published a comprehensive sustainability management plan (SMP) for the airport system. The plan was a guiding document to create a pathway to enhanced sustainability and established seven focus areas: air quality, GHG emissions, energy, outreach, policies and contracts, waste and recycling, and water conservation. It provided action plans and associated initiatives to meet City and industry-coordinated goals for each focus area.

In June 2017, PHX AVN launched an update to the current SMP. The update is a multiphased effort, with phase two completed in early 2019. Thus far, the update has resulted in informed sustainability recommendations as well as a series of working groups tasked with evaluating and developing more complex programs. The following are several items that can be considered for the preferred concept:

- Consolidate waste management and recycling, potentially with the central receiving and distribution center for enhanced efficiency and reduced trucking.
- Improve wayfinding for Airport roadways.

- Implement solar or other renewable energy generation sources with preferred concept projects, where feasible.
- Install electric vehicle and equipment charging infrastructure with appropriate preferred concept projects.
- Install smart meters and implement monitoring/tracking systems for energy and water use with appropriate preferred concept projects.

6.4.1.2 STRATEGIC ENERGY MANAGEMENT PLAN

The SMP proposed the creation of a Strategic Energy Management Plan (SEMP) for PHX that provides a framework and strategy for decision-makers to reduce Airport energy use and meet the PHX AVN energy and GHG reduction goals. The SEMP's energy-reduction initiatives represent the most significant GHG reduction activities that can be addressed within PHX AVN's operational control. The CAMP's preferred concept can incorporate:

- High-efficiency equipment such as, but not limited to, LED lighting;
- Controls and monitors to reduce energy consumption and GHG emissions;
- Electrification to serve fuel and energy needs; and
- Retrocommissioning for any existing building renovations/expansions.

6.4.1.3 SOLID WASTE MANAGEMENT PLAN

The management and disposal of solid waste has considerable impacts on an airport's finances, operations, environmental well-being, and relationship with the community. The FAA recognized its significance when developing Section 133 of the FAA Modernization and Reform Act of 2012 (FMRA), which requires airports with a master plan to complete a recycling plan including/addressing:

- Solid waste audits
- Feasibility of solid waste recycling
- Minimization of solid waste generation
- Operation and maintenance requirements
- Review of waste management contracts
- Potential for cost savings or the generation of airport revenue

On September 30, 2014, the FAA issued *Guidance on Airport Recycling, Reuse, and Waste Reduction Plans*, which provides official guidance for preparing waste and recycling plans as part of an airport master plan, within a sustainability plan, or as a standalone document.[4]

[4] U.S. Department of Transportation, Federal Aviation Administration, *Guidance on Airport Recycling, Reuse, and Waste Reduction Plans*, September 30, 2014.

PHX AVN developed a Solid Waste Management Plan (SWMP) in accordance with FAA guidelines to address local factors, existing available information, and goals specific to the Airport. The report evaluated the existing waste management program and recommended additional strategies to increase landfill diversion in order to meet the Airport's goal of 40 percent landfill diversion by the year 2020. A waste audit and surveys of Airport tenants and employees helped create a baseline and identify areas for improvement. Using this baseline, as well as input from the Airport and stakeholders, a number of recommendations were identified to reduce waste and increase recycling. Implementation of the CAMP preferred concept should incorporate:

- Provision of adequate space and infrastructure for recycling
- Inclusion of liquid collection stations
- Inclusion of composting infrastructure, where feasible

6.4.2 PROJECT IMPLEMENTATION OPPORTUNITIES

The preferred concept is phased over a 20-year planning horizon. Each project presents opportunities to integrate sustainability by:

- Considering Total Cost of Ownership in the project prioritization, planning, design, and construction processes
- Implementing sustainable design and construction practices, leveraging available resources and certifications like the U.S. Green Building Council's Leadership in Energy & Environmental Design (LEED) rating system,[5] the Institute for Sustainable Infrastructure (ISI) Envision rating system, and the PHX AVN Design and Construction Green Guide
- Phasing projects strategically to maximize opportunities for material reuse
- Future-proofing facilities by considering climate change and implementing flexible design

6.4.3 ALTERNATIVE FUNDING OPPORTUNITIES

Several financial incentive programs are available to help airports implement energy efficiency and emission reduction programs. These alternative funding sources can support the economic feasibility of certain projects at PHX. The following is a sampling of FAA grant programs. PHX AVN should seek and consider additional opportunities as well, including local and state incentives and grants.

6.4.3.1 VOLUNTARY AIRPORT LOW EMISSIONS PROGRAM

The Voluntary Airport Low Emissions (VALE) program provides grant funding to airports in USEPA designated nonattainment or maintenance zones for criteria pollutants. As noted in Section 2.5.1, Maricopa County is a nonattainment area for O_3 and PM_{10} and in maintenance for CO. PHX AVN has already taken advantage of this program, securing a VALE grant for $1 million in 2015 to develop 28 charging stations for electric GSE at Terminal 4, with the support of Southwest Airlines and American Airlines replacing 68 diesel-powered airline GSE. These grants are funded through the Airport Improvement Program (AIP) and include

[5] The City of Phoenix requires LEED Silver for all of its new buildings.

an airport sponsor match requirement. The deadline for submitting project pre-applications is November 1 for grants issued the following year.

6.4.3.2 ENERGY EFFICIENCY OF AIRPORT POWER SOURCES PROGRAM

In 2012, Congress passed the *FAA Modernization and Reform Act of 2012*, which contained a provision (in Section 512) directing the agency to develop a grant program for airport projects that would "increase the efficiency of airport power sources." The Energy Efficiency of Airport Power Sources program (referred to as Section 512) encourages airports to conduct an energy audit to identify areas for improvement in energy efficiency. This can include no- to low-cost items, such as reprogramming building control systems, adjusting/adding lighting timers, and turning off computers, to higher-cost initiatives, such as lighting upgrades, HVAC replacements, or renewable energy installations. Airport sponsors that have conducted an energy audit may apply for funding for these types of projects. If an airport sponsor has not yet conducted an energy audit, they can apply for this grant to cover the cost of an audit. As part of the SEMP, PHX AVN conducted an energy audit that meets the Section 512 requirement, which helps fulfill the criteria for pursuit of funding.

Because Section 512 grants come out of AIP funding, regular AIP grant assurances and sponsor match requirements apply. The amount available for this program varies from year to year depending on the discretionary funds available. For example, in federal fiscal year (FY) 2017, the FAA had approximately $15 million set aside for this grant program, designated as "off the top" (i.e., programs applying for this grant would not compete against other regular AIP grant requests in their region). However, no funding was specifically set aside for this program in FY 2018 or FY 2019. Projects were still AIP-eligible but had to compete with other discretionary projects. Like the VALE program, the deadline for submitting project pre-applications is November 1 for grants issued the following year.

6.4.3.3 ZERO EMISSIONS VEHICLE AND INFRASTRUCTURE PROGRAM

The Zero Emissions Vehicle and Infrastructure program funds on-road, airport-owned zero emissions vehicles and supporting infrastructure with a 50 percent match requirement from airport sponsors. Cars, trucks, and buses are eligible, but must adhere to the Buy American requirements and FAA grant assurances. The Buy American requirement is a policy that designates a minimum percentage of the vehicle be manufactured in the United States. Until recently, most electric vehicles did not qualify. However, as technology has improved, more qualifying vehicles are coming to market, such as electric buses. Manufacturers may also apply for a waiver from this requirement. PHX AVN has explored opportunities to pursue Zero Emissions Vehicle and Infrastructure program funding in the past.

6.4.4 CONCLUSION

Integration of sustainability into implementation of the preferred concept would enhance the performance of future facilities, improve operational efficiency at the Airport, contribute to resource conservation and reduced environmental impacts, and benefit the community and other stakeholders.

7. IMPLEMENTATION PLAN

An implementation plan was developed to identify a phased approach for development of the preferred concept. This section describes factors affecting implementation, the phasing plan, and associated financial analysis.

7.1 FACTORS AFFECTING IMPLEMENTATION

In general, implementation of the preferred concept should be based on realized and trending demand, considering both magnitude and characteristics, and the need to provide additional capacity over the planning horizon. Ideally, projects would be implemented with adequate time to efficiently serve growing demand, but not so early that facilities would be significantly underutilized or not financially feasible. Similarly, management and operational policies can drive the facility optimization, influencing the scope and timing of future development by allocating available capacity in a manner that optimizes and balances the use of existing facilities.

The ability to correctly time implementation decisions requires an understanding of the factors that trigger facility development, ongoing data monitoring and analysis to identify when actions should be taken, recognition of regulatory changes or policy implications, and an organizational structure and process to implement project planning and construction when demand dictates. Focused planning and programming as intermediate steps are critical, as projects must be refined and adjusted as warranted prior to the start of design and construction. Likewise, the timing of necessary environmental processing must be considered to ensure the project implementation schedule is not adversely impacted. The financial implications of development decisions, both individually and in the context of other development actions and investment needs, must also be considered in timing decisions.

7.1.1 VOLUME AND CHARACTER OF GROWTH

The volume and characteristics of activity must be considered in determining when development should occur. Activity characteristics, such as the number of domestic passengers and international passengers, may require different improvements regardless of total passenger numbers. The number of operations by various sizes and types of aircraft also influence facility requirements. All aspects of activity must be accounted for and understood, especially those that are specific project drivers.

Many metrics are used to determine the volume and characteristics of growth in any particular activity at the Airport. Various statistics, appropriate to the type and characteristics of activity under review, need to be analyzed to determine the timing and scope of facilities development. The need to minimize disruptions to Airport operations and tenant activities can influence project phasing. Therefore, detailed planning, design, and phasing analyses are necessary to ensure the operational impacts of any facility relocations or replacements are defined, communicated, and minimized.

7.1.2 REGULATORY REQUIREMENTS AND TECHNOLOGICAL CHANGES

Changes in technology, passenger and baggage processing, airline operating policies and procedures, transportation mode shifts, and security requirements need to be considered in evaluating implementation

decisions and timing. Those include the proliferation of transportation network companies and autonomous vehicles, security inspection process improvements, automated international arrivals passenger processing steps, and related technologies for passengers and baggage. Technological changes can influence the specific facility requirements under consideration, with the potential to alter the size, capacity, or configuration of the specific improvement. Similarly, regulatory changes can alter the scope or configuration of recommended improvements or, alternatively, introduce the need for previously unidentified or undefined improvements.

7.1.3 GENERAL CRITERIA FOR PLANNING IMPLEMENTATION

Several factors should be considered when phasing development projects, with the following goals in mind:

- **Allow sufficient time** – This requires identifying the time necessary to complete planning, obtain required regulatory reviews and approvals, coordinate with appropriate stakeholders, analyze financial requirements, and undertake final design and construction to ensure the development project is in place and operational in time to meet demand. On many major projects, the time for this overall process, through project delivery, can span several years or considerably longer if full federal environmental review under NEPA is required.
- **Minimize operational impacts** – This requires identifying means to avoid or minimize the loss of interim capacity (e.g., interim loss of gates or taxiways) and/or generate unnecessary or avoidable congestion and delay, maintain roadway and parking facility accessibility, maintain an acceptable LOS for Airport tenants and users, and minimize passenger inconvenience and confusion.
- **Maintain a logical sequence of development** – This requires considering long-term development identified in the preferred concept when planning for near-term projects to protect the flexibility of future options and minimize the potential for future facility relocations or impacts.

7.2 PHASING PLAN

A phasing plan for the preferred concept was developed based on the baseline forecast and in some cases on related enabling projects. The projects were categorized into time frames corresponding with short-term (0–3 years, 3–5 years), medium-term (5–10 years, 10–15 years), and long-term (15–20 years, 20+ years) periods. The division between short-term, medium-term, and long-term is made for purposes of characterizing development that has a higher likelihood of justification and implementation (in the short- and medium-term); however, it is important to recognize these phases are approximate and subject to change based on actual activity growth and characteristics.

The timing of facility construction is heavily dependent on decisions by PHX AVN, as well as factors such as technology changes, evolving regulatory requirements, demand magnitude and characteristics, and airline decisions. Consequently, it is not appropriate to assume that all facilities will be constructed when identified in the phasing plan since PHX AVN engages a strategy of implementing projects as needed and justified, and when financially feasible.

The following tables and exhibits present the phasing plan for the preferred concept. Individual project identifiers consist of letters identifying a project category, as listed in **Table 7-1**, followed by sequential numbers. The projects contained in each time frame are described in **Tables 7-2** through **7-7** and shown

on **Exhibits 7-1** through **7-6**. For each project, the tables include a project identifier, name, description, development trigger, preceding projects, subsequent projects, and estimated costs.

TABLE 7-1 PROJECT CATEGORIES

PROJECT IDENTIFIER	CATEGORY
A	Airfield
T	Terminal/concourse
ET	Existing terminal/concourse improvement or upgrades
S	Support facility
L	Landside improvement
D	Demolition of existing facility
P	Site preparation or land acquisition
M	Miscellaneous

SOURCE: Ricondo & Associates, Inc., June 2019.

Enabling projects (preceding projects) and project dependencies (subsequent projects) are identified in the table. Preliminary rough order of magnitude construction cost estimates are listed for each project. Construction cost estimates are in 2019 dollars and include associated soft costs (contingency, general conditions, design, construction and program management, testing/commissioning, and related and miscellaneous project costs) but no cost escalation.

An estimated cost is not provided for projects, such as tenant-driven projects, for which PHX AVN would not incur a cost. Other projects, such as the modification of existing gates, require additional study to fully understand whether PHX AVN would incur a cost.

7.3 FINANCIAL ANALYSIS

This section presents a potential funding plan for the PHX AVN to implement projects in the preferred concept as presented in the phasing plan. The projects are divided into three periods: short-term (FY[1] 2020 through FY 2025), medium-term (FY 2026 through FY 2035), and long-term (FY 2036 and beyond).

The actual implementation schedule for the various construction projects recommended in the CAMP will be influenced, in part, by demand, funding availability, City priorities, and other relevant factors, and may not correspond precisely to the schedule described in this section. For purposes of the illustrative financial analysis, a specific implementation schedule was assumed. However, it should be noted that this schedule of implementation and the actual funding strategies for each project will be determined nearer to the time of project implementation. There is greater uncertainty the further out in the planning period.

[1] Fiscal year begins July 1.

TABLE 7-2 PHASING PLAN 0–3 YEARS

PROJECT ID	PROJECT	PROJECT DESCRIPTION	PRECEDING PROJECT(S)	SUBSEQUENT PROJECT(S)	ESTIMATED ROM COST[1]
A1	RIM Airfield Improvements (25%)[2]	Various taxiway and runway improvements for the airfield to increase airfield efficiency and enhance safety for aircraft operations. The taxiway improvements defined in the RIM Study are recommended to be completed within a 10-year period. Since completion of the projects could be influenced by other Airport needs and funding, the costs of the RIM program were divided evenly over 10 years. It is assumed that 25 percent of RIM project costs would occur in this time frame.			$13,697,975
A2	Taxiway V and Vehicle Service Road (VSR) Bridge[2]	Crossfield taxiway to provide air traffic control with greater flexibility and reduce overall average taxi distances. Includes a bridge that provides a crossfield vehicular connection in the west airfield. Taxiway includes two taxiway bridges over the PHX Sky Train and Sky Harbor Boulevard. This project includes construction of a VSR bridge that will improve airside roadway access between the western north and south airfields. Implementing Taxiway V provides immediate delay benefit and greater operational flexibility while reducing taxiway congestion around the existing terminals.			$73,454,340
P1	Site Prep – Terminal 3 North Concourse 2	Prior to construction of Terminal 3 North Concourse 2 and Terminal 3–Terminal 4 Connector, the area must be cleared and prepared for development. Site preparation includes relocation of any utilities affected by the facility and removal of equipment, pavement, and existing facilities.	S2	T3, T5	$17,993,958
P2	North Land Acquisition (50%)	Prior to commencing the northside development, land acquisition is required south of Washington Street, west of 30th Street, and east of 44th Street. Assumes approximately 50 acres of land acquisition.		S3, S5, S8, S13	$32,542,000
P3	Site Prep – North Properties	As parcels are purchased in Project P2, the sites should be cleared and prepared for development, including the removal of existing structures and pavements. These sites will be readied for the North Cargo and North Aero Support Complex.	P2	S3, S5, S8, S13	$14,775,936
S1	UPRR Trench (50%)	Placement of the Union Pacific Railroad in a 30-foot-deep trench to allow a secure airfield connection to the planned North Cargo and North Aero Support Complex and provide an overpass for roadway crossings, most notably at 24th Street. The project is anticipated to be completed over a 5-year period, requiring 50 percent of project costs included in this time frame.		S3, S5, S7, S8, S13, S14, S15	$220,554,373
S2	Mail Sort Facility (C-Point) Relocation	Prior to construction of Terminal 3 North Concourse 2 (Project T3) and site prep of the area (Project P1), the existing Mail Sort Facility and vehicle Gate 141 will be relocated south of the existing American Airlines Maintenance Hangar. Vehicle parking in this area would be relocated onto an underutilized parking lot east of 42nd Street, and the East Cell Phone Lot would be relocated slightly south onto the site of the former CNG refueling station.		T3, T5	$10,760,798
T1	West Apron Hardstands	Reconfiguration of the West Cargo Apron (east of the west cargo facility and west of Terminal 2) to accommodate apron-loaded bus gates served from Terminal 3 or Terminal 4 to provide near-term additional gate capacity. Improvements to apron slope and drainage to accommodate this aircraft layout.			$4,111,086
				Total (0–3 Years) Cost:	**$387,890,466**

NOTES:
1 Rough order of magnitude (ROM) construction cost estimates are in 2019 dollars and include associated soft costs (contingency, general conditions, design, construction and program management, testing/commissioning, and related and miscellaneous project costs) but no cost escalation.
2 RIM airfield improvements and crossfield Taxiway V were planned under separate planning studies but have been incorporated into the overall preferred concept.
SOURCES: TRACE Consulting, June 2019 (cost estimates); Ricondo & Associates, Inc., June 2019 (projects).

TABLE 7-3 PHASING PLAN 3–5 YEARS

PROJECT ID	PROJECT	PROJECT DESCRIPTION	PRECEDING PROJECT(S)	SUBSEQUENT PROJECT(S)	ESTIMATED ROM COST[1]
A1	RIM Airfield Improvements (25%)[2]	The continuation of the RIM airfield improvements initiated in the 0-3-year time frame for various taxiway and runway facilities.			$13,697,975
D1	Terminal 2 Demolition and Apron Reconstruction (Hardstands)	Terminal 2 has reached the end of its useful life. Upon completion of the Terminal 3 Modernization Program, the remaining Terminal 2 airlines will be relocated to Terminal 3. This will allow Terminal 2 to be demolished, and this project includes apron rehabilitation to accommodate additional apron hardstands, expanding the hardstands included in the 0-3-year time frame.		T4	$32,961,678
ET1	Existing Gate Modification	Modifications to 17 existing Terminal 4 North Concourse gates to accommodate aircraft fleet changes. This project may require apron striping changes, relocation of passenger boarding bridges, and fuel pit relocations.			
P2	North Land Acquisition (50%)	Continued purchase of land initiated during the 0-3-year time frame between Washington Street and the Union Pacific Railroad trench for future Airport expansion. Assumes approximately 50 acres of land acquisition.		S3, S5, S8, S13	$32,542,000
P3	Site Prep – North Properties	Continuation of the north properties site preparation initiated during the 0-3-year time frame for North Cargo and North Aero Support Complex.	P2	S3, S5, S8, S13	$14,628,828
S1	UPRR Trench (50%)	Continuation of the UPRR trench initiated during the 0-3-year time frame to allow a secure airfield connection to propose North Cargo and North Aero Support Complex and provide an overpass for roadway crossings, most notably 24th Street.		S3, S5, S7, S8, S13, S14, S15	$220,554,373
T2	Concourse S1[2]	Construction of an eight-gate concourse (or five narrowbody and two widebody aircraft) serving Terminal 4 airlines. The concourse includes approximately 60,000 square feet of passenger area and would ease passenger holdroom congestion at Concourses S2, S3, and S4 and provide additional Terminal 4 gate capacity.			$310,000,000
T3	Terminal 3 North Concourse 2	Construction of a second north concourse at Terminal 3, with six narrowbody gates accessible to both Terminal 4 and Terminal 3 airlines. Passenger connectors to each terminal could be constructed separately (Project T5), allowing the terminal to function as a bus-gate facility in the interim. The concourse includes approximately 75,000 square feet of passenger area (i.e., holdrooms, commercial area, amenities, passenger circulation). This project would also provide additional gate capacity to support gate modifications of Concourses N1 through N4 (Project ET1).	S2	T5	$177,672,000
				Total (3-5 Years) Cost:	**$802,056,854**

NOTES:
1 Rough order of magnitude (ROM) construction cost estimates are in 2019 dollars and include associated soft costs (contingency, general conditions, design, construction and program management, testing/commissioning, and related and miscellaneous project costs) but no cost escalation.
2 RIM airfield improvements and Concourse S1 were planned under separate planning studies but have been incorporated into the overall preferred concept.
SOURCES: TRACE Consulting, June 2019 (cost estimates); Ricondo & Associates, Inc., June 2019 (projects).

TABLE 7-4 PHASING PLAN 5–10 YEARS

PROJECT ID	PROJECT	PROJECT DESCRIPTION	PRECEDING PROJECT(S)	SUBSEQUENT PROJECT(S)	ESTIMATED ROM COST[1]
A1	RIM Airfield Improvements (50%)[2]	The continuation of the RIM airfield improvements initiated in the 0-3-year and 3-5-year time frames for various taxiway and runway facilities.			$27,395,950
ET2	Existing Gate Modification	Modifications to existing Terminal 4–North Concourse gates to accommodate aircraft fleet changes. Six existing Terminal 3 South Concourse gates may require modification for the Terminal 3 Gate Expansion (Project T4) corridor. This project may require apron striping changes, relocation of passenger boarding bridges, or fuel pit relocations.			
L1	Roadways – West Improvements	Roadway connection improvements to Interstate 10 and Interstate 17, including a west security plaza. The improvements include the removal and addition of on- and off-ramps and roadways to provide direct access to the Rental Car Center, West Ground Transportation Center, and Sky Harbor Boulevard and could be implemented incrementally within the next 10 years depending on funding sources and surrounding projects (e.g., improvements for West GTC access to Interstate 10 should be completed after the West GTC). The west security plaza should be incorporated after review and discussion with the Department of Homeland Security and the TSA.	West GTC		$90,000,000
L2	Roadways – East Improvements	Roadway connection improvements to address traffic weaving near Terminal 4 and an east security plaza. Improvements include removal of access from 44th Street and reconfiguration of on- and off-ramps and roadways to reduce congestion and enhance safety. These improvements could be implemented within the next 10 years and made incrementally depending on funding. The east security plaza should be incorporated after review and discussion with the Department of Homeland Security and the TSA.			$14,880,829
M1	AZANG Expansion	Displacement of the South Cargo facility to allow expansion of the AZANG to accommodate larger KC-46A aircraft. The existing South Cargo building would be reutilized by the AZANG. Prior to the AZANG, the existing South Cargo operators must be relocated (Project S3).	S3	S4	Tenant Improvement
P5	Site Prep – Existing F&S Lot	Site preparation of existing F&S Lot to accommodate construction of the Operations and Police facility (Project S6).		S6	$3,772,920
P6	Additional North Land Acquisition	Continued purchase of land between Washington Street and the Union Pacific Railroad trench for future north cargo expansion. Assumes approximately 20 acres of land acquisition.		S7	$15,474,944
P7	Site Prep – Additional North Properties	As parcels are purchased in Project P6, the sites should be cleared and readied for development, including the removal of existing structures and pavements.	P6	S7	$30,742,260
S3	North Cargo	Development of the initial phase of a consolidated North Cargo facility to accommodate relocation of the South Air Cargo facility (displaced by the AZANG expansion). The first phase of the North Cargo facility would be constructed to support the existing integrated cargo operation demands and additional growth, including a 180,000-square-foot cargo building.	P2, P3	S7, S14, S15	$263,180,331
S4	South GA Expansion (Phase 1)	The 8-acre area remaining on the existing South Cargo apron and outside the AZANG expansion would be redeveloped to accommodate additional executive hangars and aircraft parking for the FBOs. This project was divided into two phases; Phase 1 would constitute 60 percent of the 8-acre development.	S3, M1		$30,263,441
S5	North Aero Support Complex (Phase 1) – North F&S Lot	Relocation of F&S Lot to the North Aero Support Complex to allow for the relocation of the Operations and Police Facility (Project S6) and additional administration facilities. This project requires the VSR bridge over the UPRR trench (Project S1) to be implemented for secure access to the Airport.	P5	S8, S13	$45,213,630
S6	Operations and Police Facility	Relocation of the Operations and Police Facility displaced by the West Terminal and concourses. The new facility would have access to Sky Harbor Boulevard and the airfield and be located near the PHX Sky Train West GTC Station. This site would also accommodate additional PHX AVN functions that are distributed throughout the Airport (e.g., Airport locksmiths and badging offices). This project can be implemented after relocation of the F&S Lot (Project S5)	S5		$10,696,380
T4	Terminal 3 Gate Expansion (Concourse WS4)	The first pier of the West Terminal (WS4) can be constructed prior to the West Terminal facility and would extend from the Terminal 3 South Concourse via secure walkway. This pier accommodates 10 narrowbody gates (or 4 widebody and 2 narrowbody gates) and includes approximately 160,000 square feet of passenger area. The concourse also facilitates gate requirements for Terminal 3 and Terminal 4 airlines through use of the Terminal 3–Terminal 4 Connector (Project T5). Three apron-load regional jet gates at Terminal 3 (F13, F14, and F15) must be relocated to allow for the secure passenger walkway.	D1	T6, T8	$360,749,048
T5	Terminal 3–Terminal 4 Connector and VSR	A passenger tunnel and corridor connecting Terminal 3 North Concourse 2 to Terminal 3 and Terminal 4. The connector allows for utilization of gates from either terminal while providing a secure connection between terminals. This project would be required within this time frame to improve passenger level of service and allow for Terminal 4 airlines to continue growing outside of the available Terminal 4 gates. The project includes a tunnel for airside vehicles to replace vehicle crossings on Taxiways S and T.	T3		$194,291,063
				Total (5–10 Years) Cost:	**$1,086,660,797**

NOTES:
1 Rough order of magnitude (ROM) construction cost estimates are in 2019 dollars and include associated soft costs (contingency, general conditions, design, construction and program management, testing/commissioning, and related and miscellaneous project costs) but no cost escalation.
2 RIM airfield improvements were planned under separate planning studies but have been incorporated into the overall preferred concept.
SOURCES: TRACE Consulting, June 2019 (cost estimates); Ricondo & Associates, Inc., June 2019 (projects).

TABLE 7-5 PHASING PLAN 10–15 YEARS

PROJECT ID	PROJECT	PROJECT DESCRIPTION	PRECEDING PROJECT(S)	SUBSEQUENT PROJECT(S)	ESTIMATED ROM COST[1]
ET3	Existing Gate Modification	To accommodate gate requirements, additional modifications to six aircraft gates at Terminal 4 Concourse N4 may be required. This project may require apron striping changes, relocation of passenger boarding bridges, or fuel pit relocations.			
P8	Site Prep – West Air Cargo Complex	Prior to construction of the West Terminal and south concourses, the existing West Cargo facility must be cleared and prepared for development.	S14	T6	$5,141,880
P9	Additional North Land Acquisition	Continued purchase of land between Washington Street and the Union Pacific Railroad trench for future North Cargo expansion. Assumes approximately 15 acres of land acquisition.		S14	$11,552,000
P10	Site Prep – Additional North Properties	As parcels are purchased in Project P9, the sites should be cleared and readied for development, including the removal of existing structures and pavements.	P9	S14	$18,437,076
S7	Additional North Cargo	Expansion of the North Cargo complex to allow for cargo growth and relocation of all-cargo operations from the West Air Cargo Complex (Project P8) due to construction of the West Terminal and associated concourses. Includes construction of an additional 105,000 square feet of cargo building.	P6, P7, S3	S14, S15	$76,313,558
S8	North Aero Support Complex (Phase 2) – CRDC, Flight Kitchen, GSE, Passenger Cargo	A new facility for screening and storage of Airport deliveries with secure airfield access. Relocation of flight kitchen facilities from off-Airport to on-Airport. Relocation and growth of ground support equipment maintenance and storage facilities and passenger cargo from the West Air Cargo Complex to the North Aero Support Complex.	S5, S9	T6, T7	$70,905,861
S9	Mail Sort Facility VSR	The secure VSR outside the American Airlines Maintenance Hangar apron area is needed to accommodate support facilities in the North Aero Support Complex. The new VSR will connect to Taxiway R and cross Sky Harbor Boulevard using the 41st Street bridge, which becomes secured with implementation of the east roadway improvements (Project L2).	S2	S8, S10	$2,228,700
S10	Maintenance Hangar Expansion	After the North Aero Support Complex is implemented, the remaining area can be used to accommodate any small aircraft maintenance hangars (expansion of the existing Mesa Airlines Maintenance Hangar). This project would be tenant driven and no costs are identified.	S9		Tenant Improvement
S11	North GA Expansion	The implementation of the West Terminal and concourses requires the relocation of the VIP and sports teams aircraft parking area. Because the existing northwest GA facilities will be beyond their useful lifespan, the potential to accommodate these functions within this redeveloped area would be warranted. This project would be tenant driven and no costs are identified.			Tenant Improvement
S12	Aero-Business/General Aviation	Aero business development areas to support future facilities requiring airfield access to Taxiway A. This project would be tenant driven and no costs are identified.			Tenant Improvement
S13	Aero-Industrial/Mixed Use	Aero industrial development areas to support future facilities. Pending the development of the North Aero Support Complex, an opportunity to develop the surrounding aero-industrial/mixed use areas with access to the secure VSR would be available. This project would be tenant driven and no costs are identified.			Tenant Improvement
				Total (10–15 Years) Cost:	**$184,579,076**

NOTE:
1 Rough order of magnitude (ROM) construction cost estimates are in 2019 dollars and include associated soft costs (contingency, general conditions, design, construction and program management, testing/commissioning, and related and miscellaneous project costs) but no cost escalation.
SOURCES: TRACE Consulting, June 2019 (cost estimates); Ricondo & Associates, Inc., June 2019 (projects).

TABLE 7-6 PHASING PLAN 15–20 YEARS

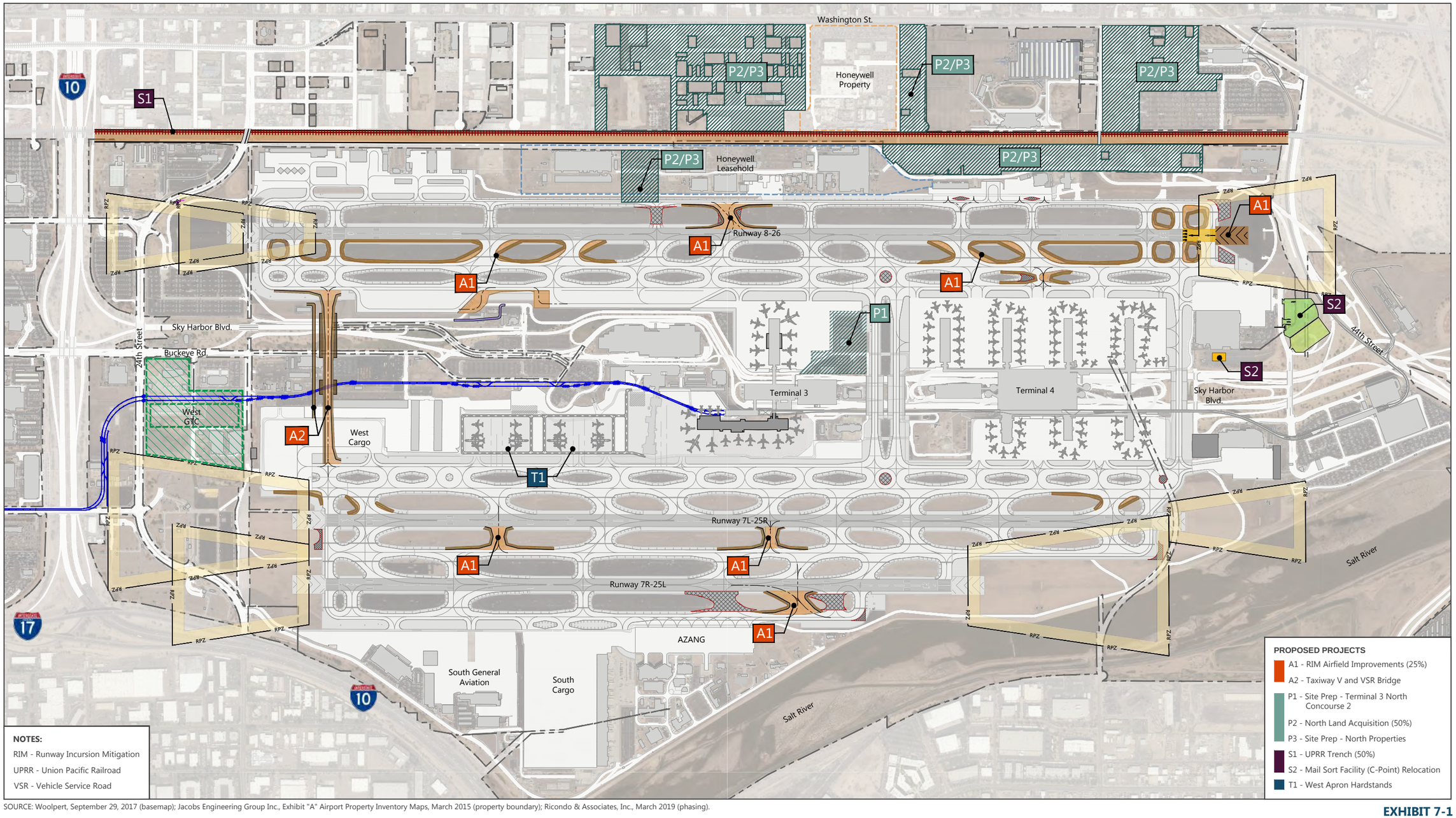
PROJECT ID	PROJECT	PROJECT DESCRIPTION	PRECEDING PROJECT(S)	SUBSEQUENT PROJECT(S)	ESTIMATED ROM COST[1]
A3	Taxiway U[2]	The development of the West Terminal and subsequent concourses would increase airfield congestion on the surrounding taxiways. To alleviate this, the second crossfield taxiway (Taxiway U) should be constructed prior to the West Terminal complex.	A2	T6	$48,969,560
ET4	Existing Gate Modification	To accommodate gate requirements, modifications to three gates at Terminal 4 Concourse N1 and realignment of all Terminal 3 north and south concourses may be required. This includes prioritizing MARS stands at both concourses for future flexibility. This project may require apron striping changes, relocation of passenger boarding bridges, or fuel pit relocations.			
P11	Additional North Land Acquisition	Continued purchase of land between Washington Street and the Union Pacific Railroad trench for North Cargo expansion. Assumes approximately 20 acres of land acquisition.		S15	$14,659,000
P12	Site Prep – Additional North Properties	As parcels are purchased in Project P11, the sites should be cleared and readied for development, including the removal of existing structures and pavements.	P12	S15	$12,849,610
S4	South GA Expansion (Phase 2)	This project would develop the remaining 40 percent of the 8-acre area outside the AZANG expansion for FBO use.	S3, M1		$20,175,628
S14	Additional North Cargo	Expansion of the North Cargo complex to allow for cargo growth and relocation of all-cargo operations from the West Air Cargo Complex due to construction of the West Terminal and associated concourses. Includes construction of an additional 135,000 square feet of cargo building.	P9, P10, S7	S15	$122,361,398
T6	West Concourses (South) – WS1, WS2, WS3	Three additional south concourses (in addition to Concourse WS4) providing 25 additional narrowbody gates (or 10 widebody and 5 narrowbody gates). The concourses would displace all existing West Cargo facilities, which would be relocated to the north (Project S7). The West Terminal south concourses will accommodate the relocation of a Terminal 4 airline and allow Terminal 4 airlines to expand into the vacated concourses. Terminal 3 connected gates utilized by Terminal 4 airlines would be vacated and available for Terminal 3 airline growth. This project Includes approximately 465,000 square feet of passenger area.	T1, T7	T8	$956,125,963
T7	West Terminal and Associated Roadways	A terminal with dual-level curbs on the north and south sides (similar to existing Terminal 4) allowing for processing of passengers for up to 35 narrowbody gates. It would include a PHX Sky Train station as well as adjacent terminal parking. Terminal building consists of approximately 475,000 square feet of passenger area (i.e., check-in, baggage claim, security, commercial, circulation, and amenities). The project allows the existing Terminal 4 facility to be redeveloped to meet remaining Terminal 4 airline needs.		T7, T8	$564,225,591
				Total (15–20 Years) Cost:	**$1,739,366,749**

NOTES:
1 Rough order of magnitude (ROM) construction cost estimates are in 2019 dollars and include associated soft costs (contingency, general conditions, design, construction and program management, testing/commissioning, and related and miscellaneous project costs) but no cost escalation.
2 Crossfield Taxiway U was planned under separate planning studies but has been incorporated into the overall preferred concept.
SOURCES: TRACE Consulting, June 2019 (cost estimates); Ricondo & Associates, Inc., June 2019 (projects).

TABLE 7-7 PHASING PLAN 20+ YEARS

PROJECT ID	PROJECT	PROJECT DESCRIPTION	PRECEDING PROJECT(S)	SUBSEQUENT PROJECT(S)	ESTIMATED ROM COST[1]
ET5	Existing Gate Modification	Development of Project T10 would provide dual widebody taxilanes between existing Concourse N2 and new International Concourse N3.5. Eight Terminal 4 Concourse N2 gates could be modified to allow for ADG V parking positions. This project may require apron striping changes, relocation of passenger boarding bridges, or fuel pit relocations.			
S15	Additional North Cargo	Expansion of the North Cargo complex to the west to accommodate integrated and all-cargo high-growth requirements. Assumes an expansion of approximately 155,000 square feet of cargo building.	P11, P12, S14		$174,985,566
S16	North Aero Support Complex VSR Tunnel	Vehicle traffic from the North Aero Support Complex may warrant the need for a secure VSR below the north portion of the airfield for a faster and more efficient connection to the central portion of the terminal core (near Terminal 3) depending on the facilities constructed and their utilization. The VSR alignment shown in Project S9 could still be utilized for Terminal 4 access.	S5, S8, S10, S12		$225,000,000
S17	Maintenance Hangar Expansion	Expansion of the existing American Airlines Maintenance Hangar has been envisioned east of the existing facility. This project would accommodate potential needs. This project is tenant driven and no costs are identified.			Tenant Improvement
T8	West Terminal (Expansion)	Expansion of the West Terminal allowing for processing of passengers for up to 25 additional narrowbody gates (Project T9). Terminal building expansion consists of approximately 220,000 square feet of passenger area.	T7	T9	$234,965,469
T9	West Concourse (North) – WN1, WN2, WN3, WN4	Four north concourse piers (WN1, WN2, WN3, WN4) providing 42 additional narrowbody gates (or 4 widebody and 34 narrowbody gates) with a Terminal 3 connection. Includes approximately 480,000 square feet of passenger area. These additional 25 narrowbody gates would provide more gate capacity than currently accommodated at Terminal 4.	T8		$799,524,000
T10	International Concourse N3.5	With the additional gate capacity served at the West Terminal, airlines remaining at Terminal 4 (including the international carriers) could justify consolidating the N3 and N4 concourses into a single International Concourse N3.5. The location of this concourse would be better suited for widebody operations and larger holdroom capacity. Due to the discretionary nature of this project, no cost has been estimated.			Discretionary Project
				Total (20+ Years) Cost:	**$1,434,475,035**
				Total (All Projects) Cost:	**$5,635,028,976**

NOTE:
1 Rough order of magnitude (ROM) construction cost estimates are in 2019 dollars and include associated soft costs (contingency, general conditions, design, construction and program management, testing/commissioning, and related and miscellaneous project costs) but no cost escalation.
SOURCES: TRACE Consulting, June 2019 (cost estimates); Ricondo & Associates, Inc., June 2019 (projects).

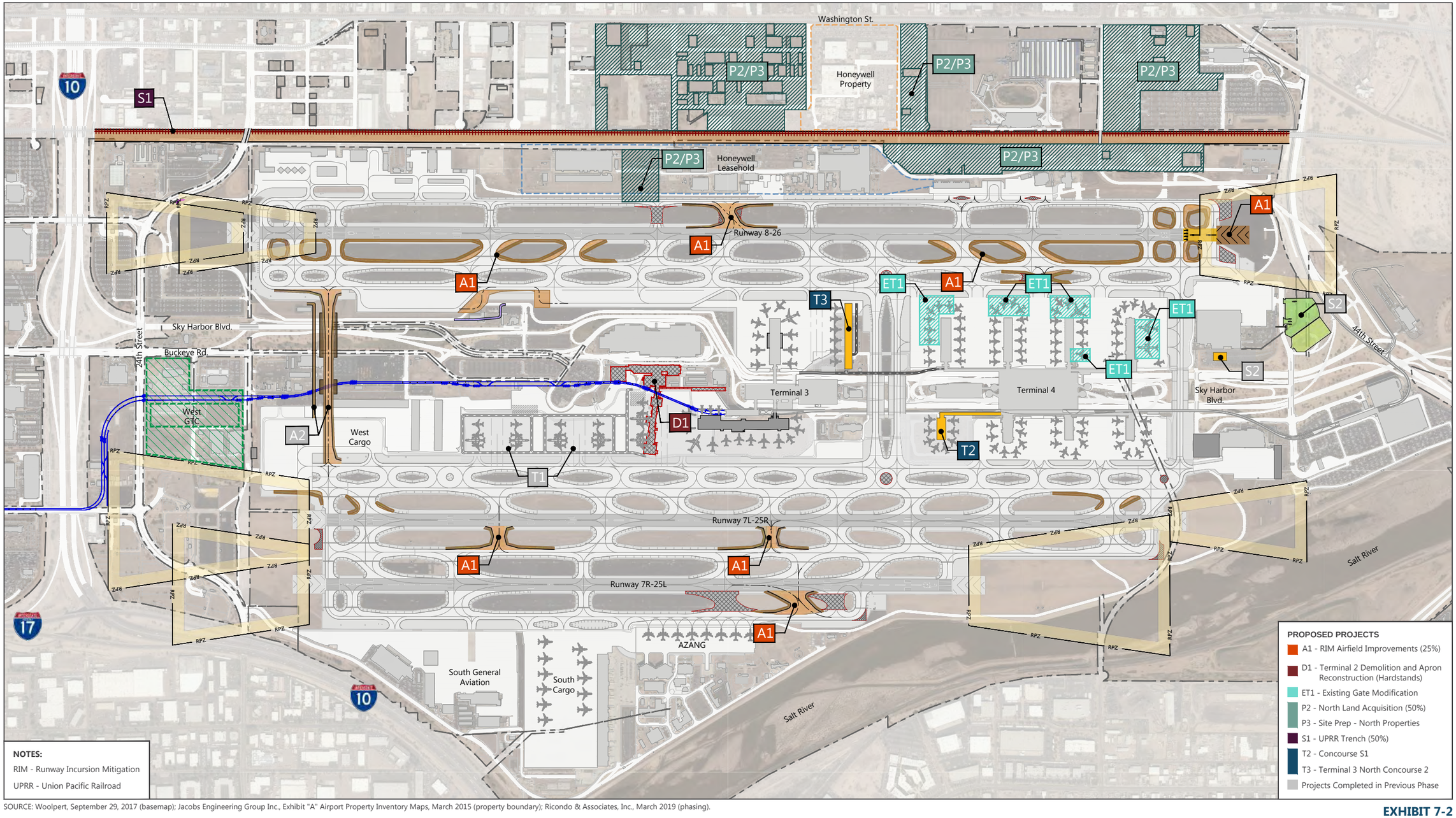


SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., March 2019 (phasing).

EXHIBIT 7-1

Phasing Plan
0-3 Years

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\07-Implementation Plan\Ex-7-01-06-CAMP Phasing.dwgLayout: 0-3 Yrs Plotted: Sep 6, 2019, 11:39AM

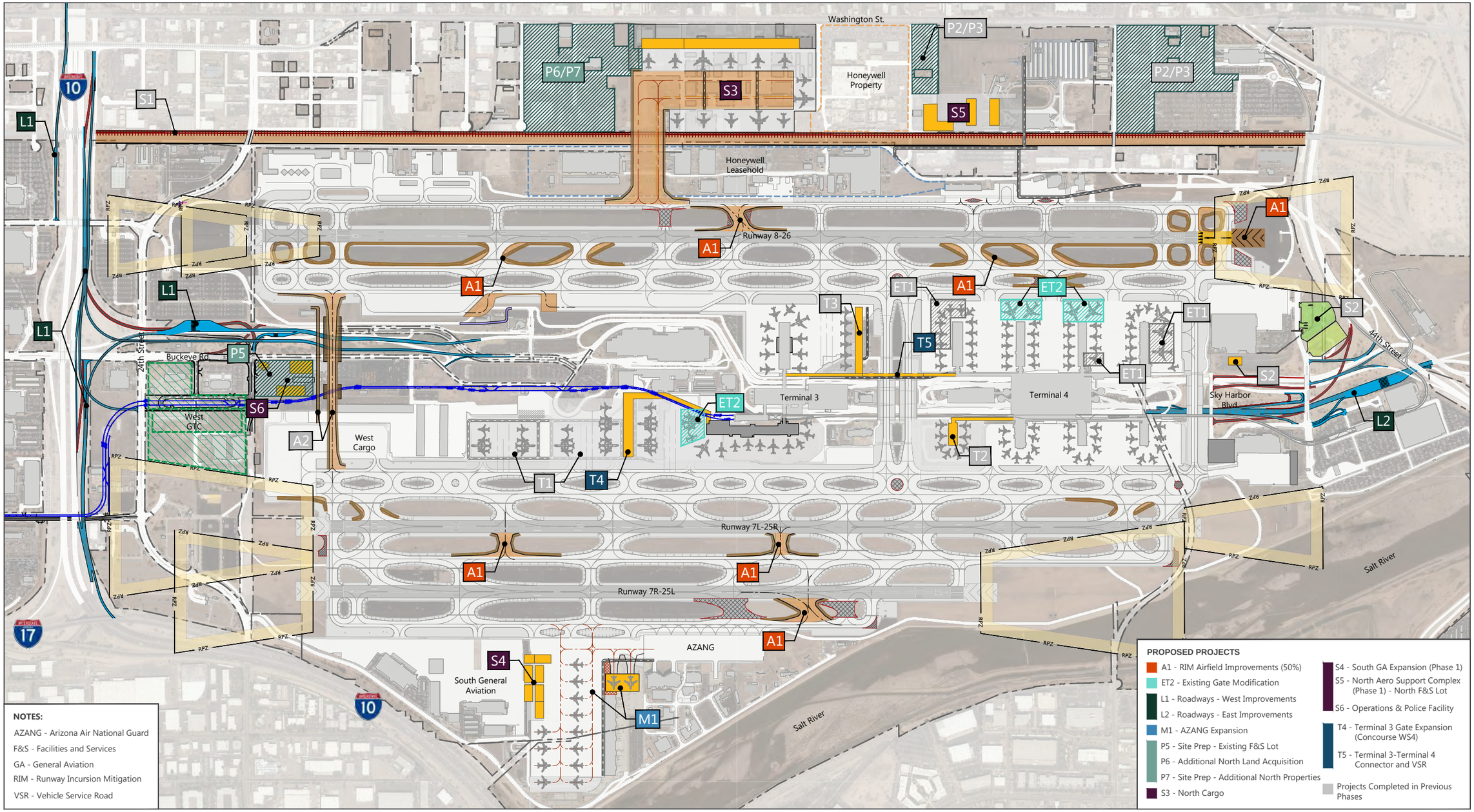


SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., March 2019 (phasing).

EXHIBIT 7-2

Phasing Plan
3-5 Years

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\07-Implementation Plan\Ex-7-01-06-CAMP Phasing.dwgLayout: 3-5 Yrs Plotted: Sep 6, 2019, 11:40AM



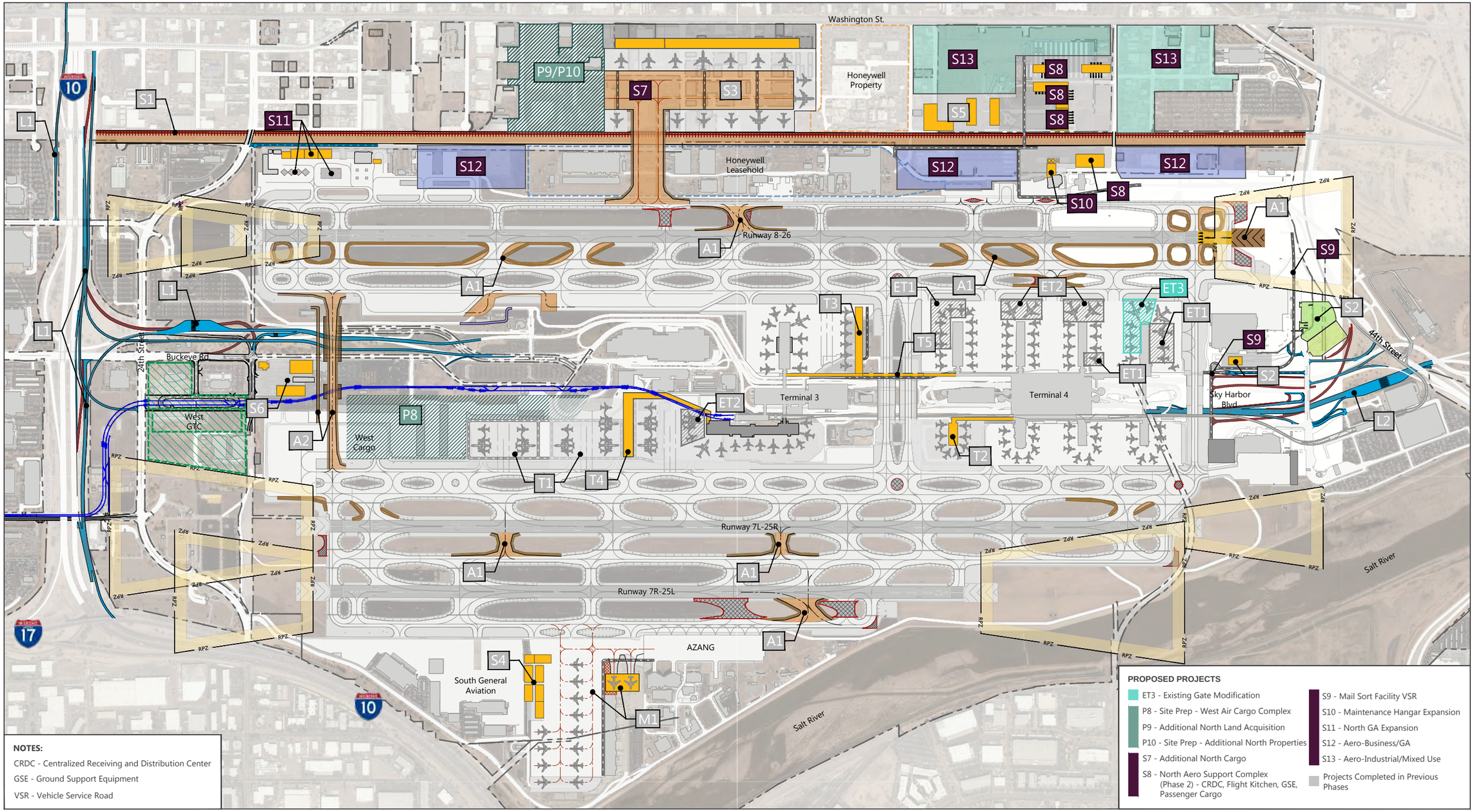
SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., March 2019 (phasing).

NORTH 0 1,200 ft.

EXHIBIT 7-3

Phasing Plan
5-10 Years

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\07-Implementation Plan\Ex-7-01-06-CAMP Phasing.dwgLayout: 5-10 Yrs Plotted: Sep 6, 2019, 11:42AM

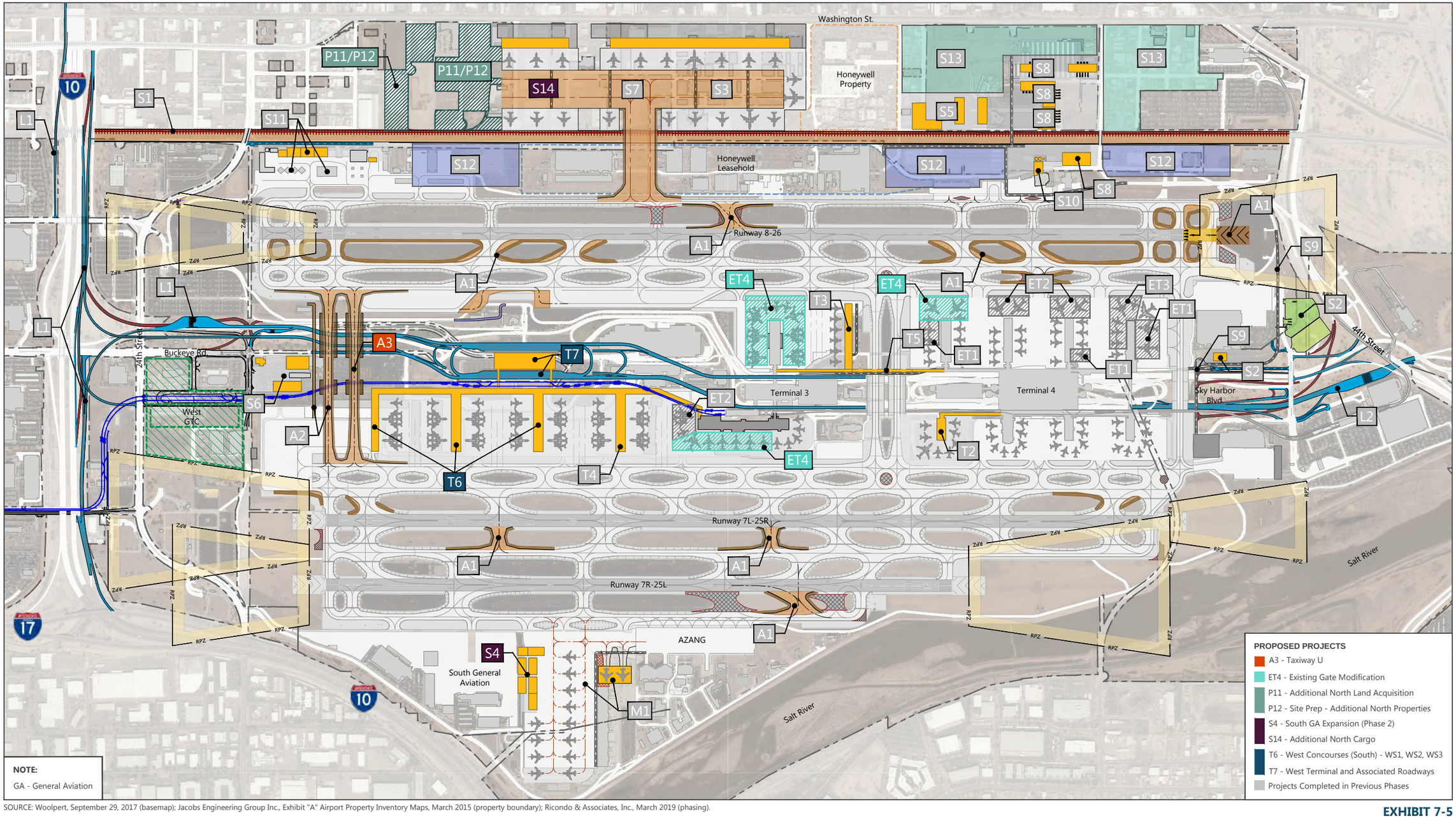


SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., March 2019 (phasing).

EXHIBIT 7-4

Phasing Plan
10-15 Years

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\07-Implementation Plan\Ex-7-01-06-CAMP Phasing.dwg Layout: 10-15 Yrs Plotted: Sep 6, 2019, 11:43AM



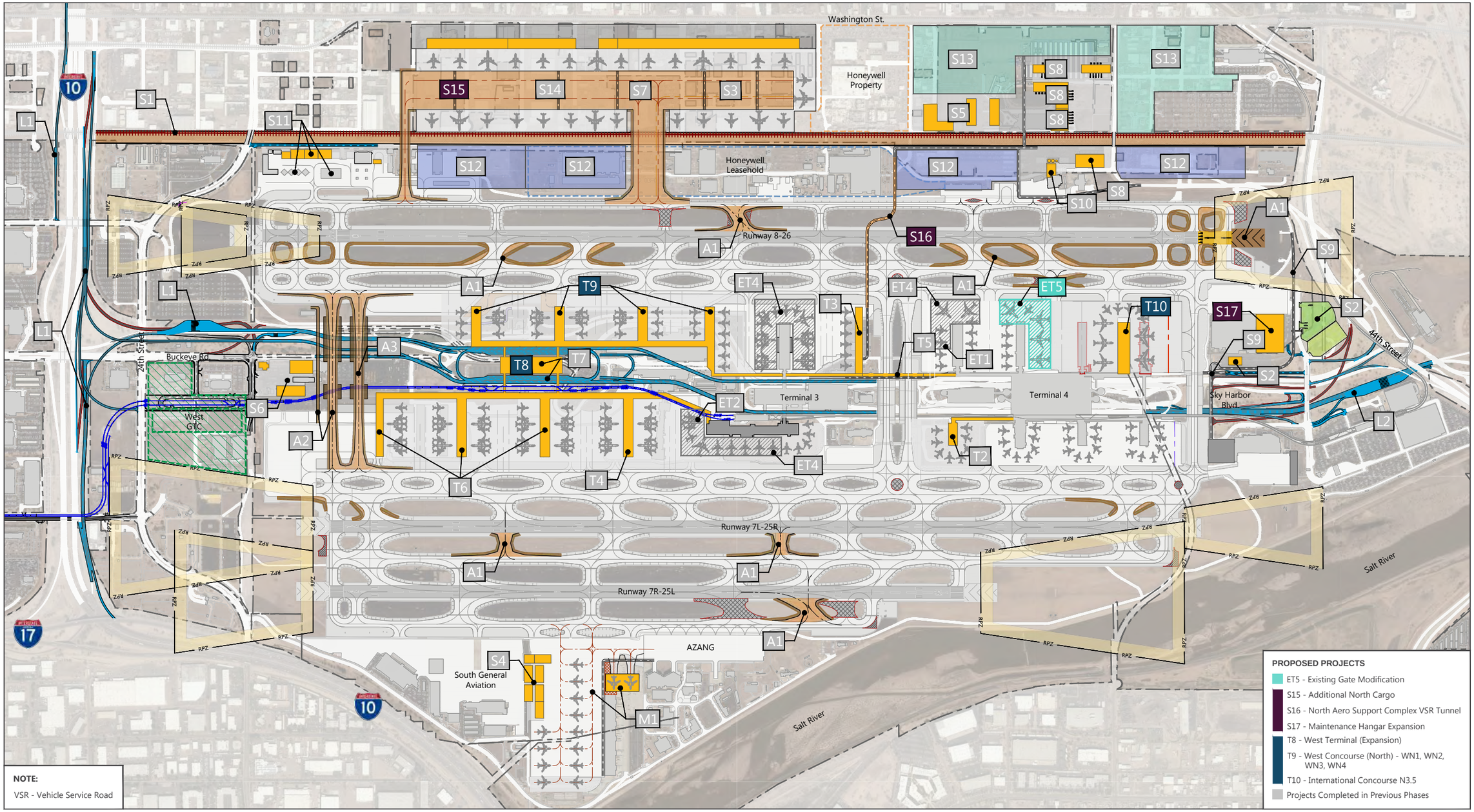
SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., March 2019 (phasing).

NORTH 0 1,200 ft.

EXHIBIT 7-5

Phasing Plan
15-20 Years

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\07-Implementation Plan\Ex-7-01-06-CAMP Phasing.dwgLayout: 15-20 Yrs Plotted: Sep 6, 2019, 11:46AM



SOURCE: Woolpert, September 29, 2017 (basemap); Jacobs Engineering Group Inc., Exhibit "A" Airport Property Inventory Maps, March 2015 (property boundary); Ricondo & Associates, Inc., March 2019 (Phasing).

NORTH 0 1,200 ft.

EXHIBIT 7-6

Phasing Plan
20+ Years

Drawing: P:\Project-Denver\PHX\CAMP\ACAD\07-Implementation Plan\Ex-7-01-06-CAMP Phasing.dwg Layout: 20+ Yrs Plotted: Sep 6, 2019, 11:49AM

In summary, the financial analysis for the CAMP was conducted as follows:

- The Airport's existing financial structure and applicable financial information was reviewed.
- A list of recommended capital development projects was prepared.
- Rough order of magnitude (ROM) cost estimates for the preferred concept were prepared.
- PHX AVN's financial consultant (LeighFisher) developed a financial plan to fund the recommended projects, based on anticipated availability of various sources of funds.

7.3.1 BACKGROUND INFORMATION

The City owns and operates, through PHX AVN, the Airport and two general aviation airports, Phoenix Goodyear and Phoenix Deer Valley Airports. PHX AVN provides the Phoenix metropolitan area with a self-supporting system of airports and aviation facilities that accommodate commercial and general aviation in a safe, efficient, and convenient manner. PHX AVN is also responsible for the development of Airport property for aviation and commercial related services, obtaining and administering FAA grants, and ensuring the compatibility of proposed developments with and around the Airport in accordance with federal, state, and local standards.

PHX AVN is headed by the Director of Aviation Services who is responsible for executing the aviation policies established by the Phoenix Aviation Advisory Board (PAAB) and Phoenix City Council (City Council) and administering the operations of the Airport. The PAAB provides nonbinding advisory recommendations to the City Council regarding all three airports, including concession agreements, leases, master plans, studies, and development plans. The City Council establishes the major policies associated with the development and operation of the airports. Additionally, the City Council adopts ordinances establishing fee structures for airport facilities use, including airline rates and charges. Certain accounting, bond financing, treasury, and related financial functions are performed by the City's Finance Department. This section presents a discussion of the financial practices at the Airport and provides an overview of the Operating Agreements between the City, air carriers, and tenants; Airport rates and charges and operating requirements; and the Airport revenue bond ordinance.

7.3.1.1 AVIATION ENTERPRISE FUND

The City accounts for Airport system financial operations as a separate Aviation Enterprise Fund according to generally accepted accounting principles (GAAP) for government entities. The Aviation Enterprise Fund is used to account for services provided to the general public using the City-owned airports. The cost of providing these services is recovered primarily through user rentals, fees, and charges (e.g., landing fees, terminal and ground rentals, parking fees, and concession fees). PHX AVN works with its financial consultant on an annual basis to review the most recent actual financial results, and the updated projected financial results, for various purposes including annual budgeting and capital project funding analyses. Based on analyses performed by the City's financial consultant, PHX AVN believes it is reasonable to expect the availability of the capital project funding sources summarized in this section.

7.3.1.2 OPERATING AGREEMENTS

The City Code defines the terms and conditions by which air carriers at the Airport use the airfield in common with other users and may occupy and use exclusive, joint, and common space in the terminal buildings. The City Code provides that airline rents, fees, and charges be calculated pursuant to a compensatory rate-setting methodology. PHX AVN can adjust fees and determine its capital expenditures without airline approval. PHX AVN also can adjust terminal rates and landing fees at any time to reflect changes in cost. PHX AVN uses short-term (month-to-month) Letters of Authorization for airline space within its terminal facilities, providing the City with the flexibility to maximize the use of its terminal facilities.

PHX AVN also maintains operating agreements with various nonairline companies, such as retail, food and beverage tenants, rental car operators, and advertisers.

7.3.1.3 AIRPORT REVENUE BOND ORDINANCE

Airport Revenue Bonds have been a source of financing for certain improvements and expansion projects at the Airport. The Airport Revenue Bond Ordinance (Bond Ordinance)[2] authorizes the issuance of bonds by the City. The Aviation Enterprise Fund, through the City, has agreements with the City of Phoenix Civic Improvement Corporation (the CIC), an affiliated nonprofit corporation, to issue airport bonds on its behalf. The Bond Ordinance requires all revenues be deposited in the Revenue Fund and applied to the following funds in the order listed: Operation and Maintenance Fund; Senior Bond Fund; Senior Bond Reserve Fund; Junior Lien Bond Fund; Junior Lien Bond Reserve Fund; Junior Subordinate Lien Obligations; and the Airport Improvement Fund. Any funds held in the Airport Improvement Fund may be used for any lawful Airport purpose.

Additionally, pursuant to Section 4.3 Rate Covenant of the Bond Ordinance, the City covenants that it will in each fiscal year establish, maintain, and enforce schedules of rates, fees, and charges for the use of the Airport (i) sufficient to produce net Airport revenues at least equal to 125 percent of the amount required to be paid into the bond fund from the revenue fund, after subtracting other available funds deposited in the bond fund, in such fiscal year and subtracting any passenger facility charge (PFC) credit applicable to such fiscal year; and (ii) sufficient to produce amounts required to be deposited in the Bond Reserve Fund and any separate bond reserve fund for such fiscal year.

7.3.2 ESTIMATED COSTS

CAMP is a plan for the development of Airport terminals, facilities, airfield, and roadways. Projects have been identified that are intended to allow the PHX AVN to modify, expand, construct, or replace facilities and infrastructure over the planning horizon to meet forecast demand at a desirable level of service. The projects that are expected to be implemented through the planning horizon, and associated estimated project costs, are identified in Tables 7-2 through 7-7.

The total ROM cost estimate for all projects is $5.6 billion. Recognizing the conceptual nature of the CAMP, implementation of these capital development projects would occur only after further refinement through

[2] Ordinance No. S-21974 adopted by the Mayor and Council of the City of Phoenix, April 20, 1994.

advanced planning and programming and engineering and architectural analyses. Therefore, the estimated CAMP costs developed for purposes of this financial analysis must be viewed as preliminary, reflecting a master plan level of detail subject to refinement in subsequent implementation phases.

The ROM cost estimates include cost contingency allowances and were prepared acknowledging that the costs could vary significantly (up or down) after more detailed planning and design. There was no specific assumption regarding cost escalation; although, some element of escalation or variance could be considered to be included in the contingency allowances and general uncertainty of the ROM cost estimates. It is expected that this will be addressed in the ongoing financial and capital planning undertaken by the City to review financial resources, updated capital needs, and the strategy for phasing and implementation.

7.3.3 FUNDING SOURCES

This section summarizes the various funding sources that the City expects to be available to fund the CAMP capital projects. The next section presents the assumed amounts of these funding sources to be applied to the CAMP.

7.3.3.1 FEDERAL AIRPORT IMPROVEMENT PROGRAM GRANTS

The Airport and Airway Improvement Act of 1982 authorizes funding of the federal AIP from the Airport and Airway Trust Fund for nationwide airport development, airport planning, and noise compatibility planning and programs. The Airport and Airway Trust Fund is funded through user taxes on airfares, air freight, and aviation fuel.

The FAA distributes grants under the AIP to airport operators in two ways: entitlement grants and discretionary grants. Entitlement grants are distributed based on the number of enplaned passengers served at airports on an annual basis. Discretionary grants are distributed for individual projects based on funding availability and the priority of projects at airports nationwide. AIP grants may be used to fund eligible land acquisition, noise mitigation, airfield improvements, airport roadways, and safety and security systems and equipment. Generally, only those projects that do not generate revenues are eligible for AIP grant funding.

AIP grant eligibility is generally assumed to be 75 percent for eligible projects at large-hub airports, such as PHX. All the airfield pavement projects in the CAMP are likely eligible for AIP funding. However, entitlement grants available to the Airport in any given year are established by a formula set forth in the FAA AIP Handbook.[3]

Discretionary grants (annual and multiyear commitments through FAA Letters of Intent [LOIs]) are distributed by each FAA region based on availability and project priorities. Discretionary funds are awarded at the discretion of the FAA region for projects based on a national priority system. The highest weights are assigned to safety, reconstruction, and capacity enhancement projects.

[3] Federal Aviation Administration, Order 5100.38D-Change 1, *Airport Improvement Program Handbook*, February 26, 2019.

7.3.3.2 FEDERAL RAILROAD GRANTS

The U.S. Department of Transportation has many grant programs for rail projects facilitated through the Federal Highway Administration (FHWA) and Federal Rail Administration (FRA). These grants are disbursed based on a competitive, merit-based process for the improvement of the safety, efficiency, and reliability of intercity passenger and freight rail systems. There are four programs that the City will explore for federal funding for the Union Pacific Railroad trench project: Railway/Highway Crossing Section 130 Program; Better Utilizing Investments to Leverage Development (BUILD) Transportation Discretionary Grant Program; Consolidated Rail Infrastructure and Safety Improvements (CRISI) Program; and Infrastructure for Rebuilding America (INFRA) Grant Program.

7.3.3.3 ARIZONA DEPARTMENT OF TRANSPORTATION GRANTS

ADOT has an airport capital improvement program (ACIP) similar to the FAA's AIP that distributes grants to Arizona airports. State funds come from flight property tax, aircraft lieu tax, and aviation fuel tax. The ADOT ACIP allocates funding from the State Aviation Fund and distributes these funds for design/construction, planning, and land acquisition projects. As airport sponsors receive AIP grants, they apply to the state for the matching local funds. The maximum grant funds any one sponsor can receive cannot exceed 10 percent of the average revenue for the fiscal year.

7.3.3.4 PASSENGER FACILITY CHARGE REVENUES

Since 1991, the collection of a PFC at the nation's airports has been authorized under Title 14 of the Code of Federal Regulations, Part 158, and the PFC Program has been administered by the FAA. PFCs are collected from qualified passengers to fund eligible airport projects. Since April 1, 2001, a PFC of up to $4.50 per qualified enplaned passenger can be imposed by an airport operator in the United States. Since July 1, 2002, the City has collected a $4.50 PFC (less $0.11 airline collection fee) from qualified enplaned passengers at PHX.

PFC revenues may be used on a "pay-as-you-go" basis or leveraged to pay debt service on bonds or other debt used to pay for PFC-eligible projects. Although the FAA is required to approve the collection of a PFC and the use of PFC revenues, the PFC Program permits local collection of PFC revenues through the airlines operating at airports and provides more flexibility to airport sponsors than the AIP funding. PFCs may be used for any AIP-eligible project, although PFC eligibility is generally broader than AIP eligibility.

As of May 2019, the FAA has approved 10 PFC applications totaling $3.0 billion of impose and use authority for $3.8 billion of capital improvement projects. There are currently four active PFC applications totaling $2.1 billion with an expiration date of January 1, 2037.[4] This amount includes $583.8 million of "pay-as-you-go," $772.5 million of bond capital, and $790.5 million of finance interest. As of May 2019, the City has collected approximately $1.7 billion of the PFC collection authority.

[4] According to the City of Phoenix Aviation Department, the four active applications are: PFC #6 (09-09-C-02-PHX, PFC #7 (15-10-C-00-PHX), PFC#8 (18-11-C-00-PHX), and PFC #9 (19-12-C-00-PHX).

7.3.3.5 RAILROAD REHABILITATION AND IMPROVEMENT FINANCING

The Railroad Rehabilitation and Improvement Financing (RRIF) program was established by the Transportation Equity Act for the 21st Century (TEA-21) and amended by the Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), the Rail Safety Improvement Act of 2008, and the Fixing America's Surface Transportation (FAST) Act. Under this program the Department of Transportation, Build America Bureau, is authorized to provide direct loans and loan guarantees to finance development of railroad infrastructure. These direct loans can fund up to 100 percent of a railroad project and include repayment periods up to 35 years past substantial completion. The City anticipates that RRIF loans can be applied to the Union Pacific Railroad trench project.

7.3.3.6 AIRPORT REVENUE BONDS

The City, through the CIC on behalf of the Airport, has previously issued bonds to pay for capital projects. As of January 1, 2019, there is $780.1 million of Senior Lien Airport Revenues and $669.9 million of Junior Lien Airport Revenues in principal outstanding. **Table 7-9** and **Table 7-10** summarize these bonds.

TABLE 7-9 OUTSTANDING JUNIOR LIEN AIRPORT REVENUE BONDS

ISSUE DATE	SERIES	PURPOSE	ORIGINAL ISSUANCE	MATURITY DATES	BONDS OUTSTANDING
September 1, 2010	2010A	Airport Improvements	$642,680,000	July 1, 2013–2040	$31,310,000
September 1, 2010	2010B	Airport Improvements	$21,345,000	July 1, 2040	$21,345,000
September 1, 2010	2010C	Airport Refunding	$32,080,000	July 1, 2023–2025	$32,080,000
December 15, 2015	2015A	Airport Improvements	$95,785,000	July 1, 2016–2045	$91,820,000
December 15, 2015	2015B	Airport Refunding	$18,655,000	July 1, 2034	$18,655,000
December 21, 2017	2017D	Airport Refunding	$474,725,000	July 1, 2021–2040	$474,725,000
		Total Junior Lien Airport Revenue Bonds Outstanding			**$669,935,000**

SOURCE: Senior Lien Airport Revenue Bond, Series 2018 (AMT), Official Statement, October 25, 2018.

TABLE 7-10 OUTSTANDING SENIOR LIEN AIRPORT REVENUE BONDS

ISSUE DATE	SERIES	PURPOSE	ORIGINAL ISSUANCE	MATURITY DATES	BONDS OUTSTANDING
March 5, 2013	2013	Airport Refunding	$196,600,000	July 1, 2014–2032	$160,825,000
November 21, 2017	2017A	Airport Improvements	$190,930,000	July 1, 2018–2047	$189,130,000
November 21, 2017	2017B	Airport Refunding	$173,440,000	July 1, 2021–2038	$173,440,000
November 21, 2017	2017C	Airport Refunding	$35,745,000	July 1, 2018–2021	$30,610,000
November 28, 2018	2018	Airport Improvements	$226,180,000	July 1, 2019–2048	$226,180,000
		Total Senior Lien Airport Revenue Bonds Outstanding			**$780,185,000**

SOURCE: Senior Lien Airport Revenue Bond, Series 2018 (AMT), Official Statement, October 25, 2018.

7.3.3.7 PRIVATE OR THIRD-PARTY FUNDING

The City expects to use private or third-party funding for several of the CAMP projects, including, for example, cargo development. If it is later determined that private or third-party funding is not available, the City can use Airport Funds or defer or cancel the project.

7.3.3.8 AIRPORT IMPROVEMENT FUND

Under the terms of the City's Bond Ordinance, Section 2.6 Airport Improvement Fund, Amounts held in the Airport Improvement Fund may be used for any lawful airport purpose including but not limited to the payment of obligations of the City relating to the Airport including general obligation bonds issued for airport purposes and any obligations owed by the City pursuant to leases or installment purchase agreements or other obligations relating to the Airport.

7.3.3.9 CAMP FUNDING SOURCES

The estimated use of funding sources was provided by the City's financial consultant, based on the proposed development plan, and associated project cost estimates for CAMP are identified in the following: **Table 7-11** short-term (FY 2020 through FY 2025), **Table 7-12** medium-term (FY 2026 through FY 2035), and **Table 7-13** long-term (FY 2036 and beyond).

7.3.4 SUMMARY

The financial analysis presents the CAMP capital projects and estimated project costs and a funding plan for these projects. PHX AVN's financial consultant has identified sources of funding for approximately $5.6 billion in future capital projects.

There is considerable uncertainty in project cost estimates, particularly for a time horizon out 20 years and beyond. There is also uncertainty in other factors related to implementing individual projects, such as growth in airline traffic.

PHX AVN will monitor the need for projects and the availability of funding sources and may adjust phasing and/or scope of individual projects in future years, depending on the circumstances. However, based on current analysis and conditions, the City anticipates the ability to fund a program of improvements as presented in the CAMP.

TABLE 7-11 SHORT-TERM PROGRAM FUNDING SOURCES

(Dollars in Thousands)

PROJECT DESCRIPTION	PHASING PLAN	ESTIMATED ROM COST[1]	AIP/FEDERAL/ STATE GRANTS	PFC PAY-GO	RRIF LOAN	JUNIOR PFC BONDS	SENIOR BONDS	PRIVATE OR 3RD PARTY	AIF PHX
A1. RIM Airfield Improvements (25%)	0–3 Years	$13,698	$10,273	$0	$0	$0	$0	$0	$3,424
A2. Taxiway V and Vehicle Service Road (VSR) Bridge	0–3 Years	$73,454	$55,091	$0	$0	$0	$0	$0	$18,364
P1. Site Prep – Terminal 3 North Concourse 2	0–3 Years	$17,994	$0	$0	$0	$0	$0	$0	$17,994
P2. North Land Acquisition (50%)	0–3 Years	$32,542	$0	$0	$0	$0	$0	$0	$32,542
P3. Site Prep – North Property	0–3 Years	$14,776	$0	$0	$0	$0	$0	$0	$14,776
S1. UPRR Trench (50%)	0–3 Years	$220,554	$55,139	$55,139	$110,277	$0	$0	$0	$0
S2. Mail Sort Facility (C-Point) Relocation	0–3 Years	$10,761	$0	$0	$0	$0	$0	$10,761	$0
T1. West Apron Hardstands	0–3 Years	$4,111	$0	$0	$0	$0	$0	$0	$4,111
A1. RIM Airfield Improvements (25%)	3–5 Years	$13,698	$10,273	$0	$0	$0	$0	$0	$3,424
D1. Terminal 2 Demolition and Apron Reconstruction (Hardstands)	3–5 Years	$32,962	$0	$0	$0	$0	$0	$0	$32,962
P2. North Land Acquisition (50%) (3–5 Years)	3–5 Years	$32,542	$0	$0	$0	$0	$0	$0	$32,542
P3. Site Prep – North Property	3–5 Years	$14,629	$0	$0	$0	$0	$0	$0	$14,629
S1. UPRR Trench (50%)	3–5 Years	$220,554	$55,139	$0	$110,277	$0	$0	$0	$55,139
T2. Concourse S1	3–5 Years	$310,000	$0	$0	$0	$0	$0	$0	$310,000
T3. Terminal 3 North Concourse 2	3–5 Years	$177,672	$0	$62,185	$0	$0	$115,487	$0	$0
Short-term (0–5 Years) Subtotal		**$1,189,947**	**$185,915**	**$117,324**	**$220,554**	**$0**	**$115,487**	**$10,761**	**$539,907**

NOTES:

AIF: Airport Improvement Fund; AIP: Airport Improvement Program; PFC: Passenger Facility Charge; RRIF: Railroad Rehabilitation and Improvement Financing

1 Rough order of magnitude (ROM) construction cost estimates are rounded to the nearest thousand 2019 dollars and include associated soft costs (contingency, general conditions, design, construction and program management, testing/commissioning, and related and miscellaneous project costs) but no cost escalation.

SOURCES: TRACE Consulting, June 2019 (cost estimates); Ricondo & Associates, Inc., June 2019 (projects); City of Phoenix Aviation Department, May 2019; LeighFisher, May 2019.

TABLE 7-12 MEDIUM-TERM PROGRAM FUNDING SOURCES

(Dollars in Thousands)

PROJECT DESCRIPTION	PHASING PLAN	ESTIMATED ROM COST[1]	AIP/FEDERAL/ STATE GRANTS	PFC PAY-GO	RRIF LOAN	JUNIOR PFC BONDS	SENIOR BONDS	PRIVATE OR 3RD PARTY	AIF PHX
A1. Airfield Improvements (50%)	5–10 Years	$27,396	$20,547	$0	$0	$0	$0	$0	$6,849
L1. Roadways – West Improvements	5–10 Years	$90,000	$18,000	$0	$0	$45,000	$0	$0	$27,000
L2. Roadways – East Improvements	5–10 Years	$14,881	$0	$0	$0	$0	$0	$0	$14,881
P5. Site Prep – Existing F&S Lot	5–10 Years	$3,773	$0	$0	$0	$0	$0	$0	$3,773
P6. Additional North Property Acquisition	5–10 Years	$15,475	$0	$0	$0	$0	$0	$0	$15,475
P7. Site Prep – Additional North Properties	5–10 Years	$30,742	$0	$0	$0	$0	$0	$0	$30,742
S3. North Cargo	5–10 Years	$263,180	$22,149	$0	$0	$0	$0	$233,648	$7,383
S4. South GA Expansion (Phase 1)	5–10 Years	$30,263	$0	$0	$0	$0	$0	$30,263	$0
S5. North Aero Support Complex (Phase 1) – North F&S Lot	5–10 Years	$45,214	$0	$0	$0	$0	$0	$0	$45,214
S6. Operations and Police Facility	5–10 Years	$10,696	$0	$0	$0	$0	$0	$0	$10,696
T4. Terminal 3 Gate Expansion (Concourse WS4)	5–10 Years	$360,749	$0	$0	$0	$90,187	$180,375	$0	$90,187
T5. Terminal 3–Terminal 4 Connector and VSR	5–10 Years	$194,291	$0	$0	$0	$48,573	$97,146	$0	$48,573
P8. Site Prep – West Air Cargo	10–15 Years	$5,142	$0	$0	$0	$0	$0	$0	$5,142
P9. Additional North Land Acquisition	10–15 Years	$11,552	$8,664	$2,888	$0	$57	$0	$0	$0
P10. Site Prep – Additional North Properties	10–15 Years	$18,437	$0	$0	$0	$0	$0	$0	$18,437
S7. Additional North Cargo	10–15 Years	$76,314	$57,235	$19,078	$0	$0	$0	$0	$0
S8. North Aero Support Complex (Phase 2) – CRDC, Flight Kitchen, GSE	10–15 Years	$70,906	$53,179	$17,726	$0	$0	$0	$0	$0
S9. Mail Sort Facility VSR	10–15 Years	$2,229	$1,672	$557	$0	$0	$0	$0	$0
Medium-Term (5–15 Years) Subtotal		**$1,271,240**	**$181,446**	**$40,250**	**$0**	**$183,817**	**$277,520**	**$263,912**	**$324,352**

NOTES:
AIF: Airport Improvement Fund; AIP: Airport Improvement Program; PFC: Passenger Facility Charge; RRIF: Railroad Rehabilitation and Improvement Financing
1 Rough order of magnitude (ROM) construction cost estimates are rounded to the nearest thousand 2019 dollars and include associated soft costs (contingency, general conditions, design, construction and program management, testing/commissioning, and related and miscellaneous project costs) but no cost escalation.
SOURCES: TRACE Consulting, June 2019 (cost estimates); Ricondo & Associates, Inc., June 2019 (projects); City of Phoenix Aviation Department, May 2019; LeighFisher, May 2019.

TABLE 7-13 LONG-TERM PROGRAM FUNDING SOURCES

(Dollars in Thousands)

PROJECT DESCRIPTION	PHASING PLAN	ESTIMATED ROM COST[1]	AIP/FEDERAL/ STATE GRANTS	PFC PAY-GO	RRIF LOAN	JUNIOR PFC BONDS	SENIOR BONDS	PRIVATE OR 3RD PARTY	AIF PHX
A3. Taxiway U	15–20 Years	$48,970	$36,727	$12,242	$0	$0	$0	$0	$0
P11. Additional North Land Acquisition	15–20 Years	$14,659	$0	$0	$0	$0	$0	$0	$14,659
P12. Site Prep – Additional North Properties	15–20 Years	$12,850	$0	$0	$0	$0	$0	$0	$12,850
S14. Additional North Cargo	15–20 Years	$122,361	$0	$0	$0	$0	$0	$0	$122,361
S4. South GA Expansion (Phase 2)	15–20 Years	$20,176	$0	$15,132	$0	$0	$0	$0	$5,044
T6. West Concourses (South) – WS1, WS2, WS3	15–20 Years	$956,126	$0	$0	$0	$0	$717,094	$0	$239,031
T7. West Terminal and Associated Roadways	15–20 Years	$564,226	$0	$0	$0	$0	$423,169	$0	$141,056
S15. Additional North Cargo	20+ Years	$174,986	$0	$0	$0	$0	$0	$0	$174,986
S16. North Aero Support Complex VSR Tunnel	20+ Years	$225,000	$0	$0	$0	$0	$0	$0	$225,000
T8. West Terminal (Expansion)	20+ Years	$234,965	$0	$0	$0	$0	$176,224	$0	$58,741
T9. West Concourse (North) – WN1, WN2, WN3, WN4	20+ Years	$799,524	$0	$0	$0	$0	$599,643	$0	$199,881
Long-Term (15+ Years) Subtotal		**$3,173,842**	**$36,727**	**$27,374**	**$0**	**$0**	**$1,916,131**	**$0**	**$1,193,610**
Total		**$5,635,029**	**$404,088**	**$184,948**	**$220,554**	**$183,817**	**$2,309,138**	**$274,673**	**$2,057,868**

NOTES:
AIF: Airport Improvement Fund; AIP: Airport Improvement Program; PFC: Passenger Facility Charge; RRIF: Railroad Rehabilitation and Improvement Financing
1 Rough order of magnitude (ROM) construction cost estimates are rounded to the nearest thousand 2019 dollars and include associated soft costs (contingency, general conditions, design, construction and program management, testing/commissioning, and related and miscellaneous project costs) but no cost escalation.
SOURCES: TRACE Consulting, June 2019 (cost estimates); Ricondo & Associates, Inc., June 2019 (projects); City of Phoenix Aviation Department, May 2019; LeighFisher, May 2019.

APPENDIX A

Phoenix City Council CAMP Approval

City of Phoenix

Minutes

City Council Policy Session

Meeting Location:
City Council Chambers
200 W. Jefferson St.
Phoenix, Arizona 85003

Tuesday, June 11, 2019 **2:30 PM** **phoenix.gov**

CALL TO ORDER

Mayor Gallego called the Policy session to order on Tuesday, June 11, 2019, at 2:50 p.m. in the City Council Chambers.

Present: 9 - Councilman Sal DiCiccio, Councilmember Carlos Garcia, Councilwoman Betty Guardado, Councilman Michael Nowakowski, Councilwoman Laura Pastor, Councilwoman Debra Stark, Councilwoman Thelda Williams, Vice Mayor Jim Waring and Mayor Kate Gallego

Vice Mayor Waring was present telephonically.

COUNCIL INFORMATION AND FOLLOW-UP REQUESTS

This item is scheduled to give City Council members an opportunity to publicly request information or follow up on issues of interest to the community.

Councilwoman Williams welcomed Councilman Garcia and Councilwoman Guardado to the Phoenix City Council. She thanked everyone who attended the 10th Anniversary Celebration of the Agave Library. Councilwoman Williams announced the Itty Bitty Beach Party at Deer Valley Pool (19400 N. 19th Ave.), taking place Friday, June 14, at 9:30 a.m. She also announced the Deer Valley Park (19602 N. 19th Ave.) fireworks spectacular, taking place Saturday, June 22, at 6 p.m. Councilwoman Williams also announced her upcoming Community Breakfast with guest speaker City Auditor Ross Tate, taking place Friday, June 28, at 8 a.m., at the Metro Center Doubletree (10220 N. Metro Pkwy. E.). She also announced an upcoming “shred-a-thon,” taking place Saturday, June 29, at 7:30 a.m. at the Deer Valley Community Center (2001 W. Wahalla Lane).

Councilwoman Stark announced an upcoming community coffee chat, taking place Wednesday, June 26, at 8 a.m., at the North Mountain Visitor Center

(12950 N. 7th St.), with guest speaker Mayor Kate Gallego.

Councilwoman Pastor announced the Grand Canalscape Kickoff, taking place Tuesday, June 11, at 6 p.m., at the Phoenix Coding Academy (4445 N. Central Ave.). She also announced Family Movie Night, taking place Saturday, June 15, at 6:30 p.m., at Solano Park (5625 N.17th Ave.) Councilwoman Pastor thanked her friends and colleagues for their support.

Mayor Gallego shared her support for Councilwoman Pastor in response to comments made at a recent City Council meeting.

Councilman Nowakowski announced an upcoming community meeting, taking place Wednesday, June 12, at 6 p.m., at University Park (1002 W. Van Buren St.), discussing an expansion of the Human Services campus. He also announced an upcoming downtown transportation plan meeting, taking place Saturday, June 15, at 9 a.m., at the Arizona State University A.E. England Building (424 N. Central Ave.). Councilman Nowakowski thanked everyone who participated in the Cesar Chavez Leadership Institute's young people program, and congratulated all participants. He announced the summer reading program at Phoenix public libraries throughout the City, where summer programming is available through Aug. 1.

Councilmember Garcia thanked City staff for their work on the Districts 5 and 8 Inauguration, and thanked community members for attending. He announced his staff was busy transitioning into their new roles, and that they are looking forward to continuing to work with their constituents. Councilmember Garcia stated his office was committed to an open-door policy.

Councilwoman Guardado thanked City staff for their work on the Districts 5 and 8 Inauguration. She announced her staff was busy transitioning into their new roles and that they are looking forward to continuing to work with their constituents. Councilwoman Guardado stated her office was committed to being accessible to neighborhood leaders. She announced an upcoming district tour, taking place Saturday, June 22, with guest speakers Mayor Kate Gallego and LD30 Representative Raquel Teran. Councilwoman Guardado stated the June 22 district tour will start in the Royal Palms neighborhood and end in Maryvale, and is designed to travel her district learning about important issues. She also announced a pool safety event, taking place Saturday, June

22, at 4 p.m., at Maryvale pool (4444 N. 51st Ave.).

Vice Mayor Waring announced an upcoming community meeting, taking place Thursday, June 13, at 6 p.m., at the Paradise Valley Community Center (17402 N. 40th St.), with special guest City Manager Ed Zuercher answering community questions.

CONSENT ACTION

There was no Consent Agenda for this meeting.

CALL FOR AN EXECUTIVE SESSION

No vote was held to call an Executive Session.

REPORTS AND BUDGET UPDATES BY THE CITY MANAGER

City Manager Ed Zuercher announced the next City Council Formal meeting on Wednesday, June 19, 2019, will be the final budget vote.

DISCUSSION AND POSSIBLE ACTION (ITEM 1)

1 Update and Action on Phoenix Sky Harbor International Airport (PHX) Comprehensive Asset Management Plan (CAMP)

This report provides an overview of the recently completed CAMP planning process, the issues analyzed in that process, and the resulting recommendations to the Aviation Department to efficiently manage airport facilities and land-use investment for the next 20 years.

THIS ITEM IS FOR DISCUSSION AND POSSIBLE ACTION.

Discussion

Assistant City Manager Deanna Jonovich introduced the item and fellow presenters Aviation Director Jim Bennett and Deputy Director Jordan Feld.

Mr. Bennett detailed the economic impact of Phoenix Sky Harbor, which annually generates $38.7 billion in total impact to the Arizona economy, and supports more than 58,000 jobs. He stated Phoenix Sky Harbor generates $2.2 billion in state and local taxes per year. Mr. Bennett

introduced the 20-year roadmap designed to meet future demands of Phoenix Sky Harbor.

Mr. Feld explained the planning process and stakeholder involvement programs, which included 14 project committee meetings, 12 community and industry group presentations, seven Phoenix Aviation Advisory Board meetings, three City Council meetings and two open-house workshops. He stressed meeting materials were available in both English and Spanish, as well as online.

Mr. Feld stated stakeholders identified three priorities, including terminal facilities, support facilities and roadway security. He presented a 20-year forecast of demand for passengers, cargo and support services, which combined is projected to create a 390-acre facility deficiency by 2039. Mr. Feld stated facility performance grades would continue to decline, largely due to a lack of available space, over the next 20 years.

Mr. Feld outlined existing land use at Phoenix Sky Harbor, where terminal space cannot expand, largely due to the current placement of support services and cargo facilities. He presented staff recommendations for future land use, which would create a central, expanded terminal corridor separate from support services, and allow cargo and Air National Guard facilities to grow and expand. Mr. Feld identified a small-business zone and a transit-oriented design transition zone.

Mr. Bennett stated the proposed investment in Phoenix Sky Harbor's future land use would total $5.7 billion, which would be funded by state and federal grants, passenger facility charges and bonds.

David Anderson spoke in favor of the item and commended staff's stakeholder outreach and feedback processes.

Kristina Floor spoke in favor of the item and future expansion of the Air National Guard facility.

Nicolas Cortez submitted a card neither in favor or in opposition of the item.

Gonzalo de la Melena spoke in favor of the item and commended staff's efforts to include minority-owned, female-owned and small-business stakeholders in the aviation corridor.

Speaker comment cards were submitted for the record in favor of Item 1 by the following individuals: Gary Schooler, Fred Gardea, Gregory Torrez, Steve Grauer, Bryan Amarel, Susan Ehrlich, Mike Huckins, and David Gieselski.

Councilman DiCiccio thanked the Air National Guard for their service to the community and expressed his desire to attract future installments of state-of-the-art refueling jets and facilities. He requested expanded facilities for the Air National Guard and federal consideration of Phoenix Sky Harbor for increased Air National Guard presence. Councilman DiCiccio asked whether current tenants Cutter and Swift plan to relocate from present locations, and whether cargo aircraft are currently using the longest runway due to their large size.

Mr. Bennett clarified Cutter and Swift are not planned to be relocated. Mr. Feld confirmed large cargo operations use the longest runway due to the large size of the cargo aircraft.

Councilman DiCiccio stressed the importance of celebrating businesses operating out of Phoenix Sky Harbor. He commended Aviation staff for exemplary maintenance and cleanliness at Phoenix Sky Harbor.

Councilwoman Stark asked whether Gateway Community College had been part of the stakeholder process.

Mr. Feld confirmed Gateway Community College was included in stakeholder processes, and had been involved in planning of the proposed mixed-use corridor of the small-business zone and transit-oriented design transition zone.

Councilwoman Stark requested Gateway Community College be included in land-use studies south of the light rail, and commended Aviation staff.

Mayor Gallego stressed the importance of working with Union Pacific

Railroad, and the importance of mixed-use, transit-oriented development surrounding light rail. Mayor Gallego asked whether staff proposed short-term land uses.

Mr. Feld stated construction and prep would take two years, and confirmed staff would be working with community stakeholders during that time to determine short-term land-uses.

Mayor Gallego asked about potential long-term land-use partnerships developed in partnership with Community and Economic Development.

Ms. Jonovich confirmed Community and Economic Development staff would assist in the development of long-term land-use strategies.

Councilman Nowakowski asked whether the City currently owns the property needed for expansion north of the Union Pacific Railroad.

Mr. Fled stated about 100 acres would need to be acquired.

Councilman Nowakowski asked whether land owners and renters near the Swap Meet, nearby churches and community centers would be notified of potential upcoming changes.

Mr. Feld confirmed staff would be reaching out to both land-owners and renters in surrounding areas, businesses, churches and community centers.

Councilmember Garcia asked whether neighborhoods would be included in planning processes.

Mr. Feld confirmed neighborhood associations and groups would be invited to participate in the planning process.

Councilwoman Williams commended Aviation staff and stressed the importance of Phoenix Sky Harbor and the Air National Guard for the State of Arizona.

Councilwoman Guardado stressed the importance of quality jobs around

Phoenix Sky Harbor.

Councilwoman Pastor asked whether Gateway Community College is being consulted on the creation and retention of quality jobs.

Mr. Feld confirmed Gateway Community College is being engaged in aviation-related certificate programs, as well as involved in the small-business and transit-oriented development corridors.

Councilwoman Pastor stated many airport workers from working families live in other districts and should be included in stakeholder outreach. She commended Aviation staff and community partners for their work on the comprehensive asset management plan.

Councilman Nowakowski stressed the importance of local, minority-owned, women-owned, small businesses and restaurants at Phoenix Sky Harbor. He requested future growth of the airport continue to prioritize these businesses.

A motion was made by Councilwoman Williams, seconded by Councilman Nowakowski, that this item be approved. The motion carried by the following vote:

Yes:	9 -	Councilman DiCiccio, Councilmember Garcia, Councilwoman Guardado, Councilman Nowakowski, Councilwoman Pastor, Councilwoman Stark, Councilwoman Williams, Vice Mayor Waring and Mayor Gallego
No:	0	

ADJOURN

There being no further business to come before the Council, Mayor Gallego adjourned the meeting at 4:05 p.m.

For further information, please call the Management Intern, City Manager's Office, at 602-262-4449.

APPENDIX B

Abbreviations and Acronyms

APPENDIX B ABBREVIATIONS AND ACRONYMS

ACRONYM/ ABBREVIATION	DEFINITION	ACRONYM/ ABBREVIATION	DEFINITION
AAC	Aircraft Approach Category	FIS	Federal Inspection Service
AC	Advisory Circular	FY	Fiscal Year
ACI	Airports Council International	GA	General Aviation
ADEQ	Arizona Department of Environmental Quality	GHG	Greenhouse Gas
ADG	Airplane Design Group	GSE	Ground Support Equipment
ADOT	Arizona Department of Transportation	GT	Ground Transportation
ACIP	Airport Capital Improvement Program	HS	Hot Spot
ALP	Airport Layout Plan	IATA	International Air Transport Association
ALPS	Advanced Land Transportation Performance Simulation	LOS	Level of Service
AOA	Airport Operations Area	MARS	Multiple Aircraft Ramp System
APS	Arizona Public Service	MSF	Maintenance Storage Facilities
ARFF	Aircraft Rescue and Firefighting	NAAQS	National Ambient Air Quality Standards
ARTCC	Air Route Traffic Control Center	NAVAID	Navigational Aid
ARW	Air Refueling Wing	NEPA	National Environmental Policy Act
AST	Aboveground Storage Tank	NPL	National Priority List
ATCT	Airport Traffic Control Tower	NRHP	National Register Historic Places
ATI	American Transport International	PAAB	Phoenix Aviation Advisory Board
AvGas	Aviation Gasoline	PFC	Passenger Facility Charge
AZANG	Arizona Air National Guard	RCC	Rental Car Center
CAA	Clean Air Act	RCRA	Resource Conservation and Recovery Act
CATEX	Categorical Exclusion	RIM	Runway Incursion Mitigation
CDRC	Consolidated Distribution and Receiving Center	ROM	Rough Order of Magnitude
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	SEMP	Strategic Energy Management Plan
CIC	Civic Improvement Corporation	SIP	State Implementation Plan
CFR	Code of Federal Regulations	SMP	Sustainability Management Plan
CNG	Clean Energy Compressed Natural Gas	TAF	Terminal Area Forecast
COB	Corporate Office Building	TDG	Taxiway Design Group
CSA	Combined Statistical Area	TI	Traffic Interchanges
DOT Act	U.S. Department of Transportation Act of 1966	TNC	Transportation Network Companies
EA	Environmental Assessment	TRACON	Terminal Radar Approach Control
EDS	Explosive Detection System	ULCC	Ultra Low-Cost Carriers
EIS	Environmental Impact Statement	UPRR	Union Pacific Railroad
F&S	Facility and Services	USC	United States Code
FAA	Federal Aviation Administration	USEPA	U.S. Environmental Protection Agency
FBO	Fixed-base Operators	VALE	Voluntary Airport Low Emissions
FEMA	Federal Emergency Management Association	VSR	Vehicle Service Roads

APPENDIX C

Ramp Charts

APPENDIX C RAMP CHARTS

This appendix contains ramp charts for the gate requirements analysis described in Section 4.3.1. **Exhibit C-1** contains the ramp charts for PAL 1. **Exhibit C-2** contains the ramp charts for PAL 2. **Exhibit C-3** contains the ramp charts for PAL 3.

C.1 PAL 1 RAMP CHARTS

EXHIBIT C-1 PAL 1 RAMP CHARTS (1 OF 11)

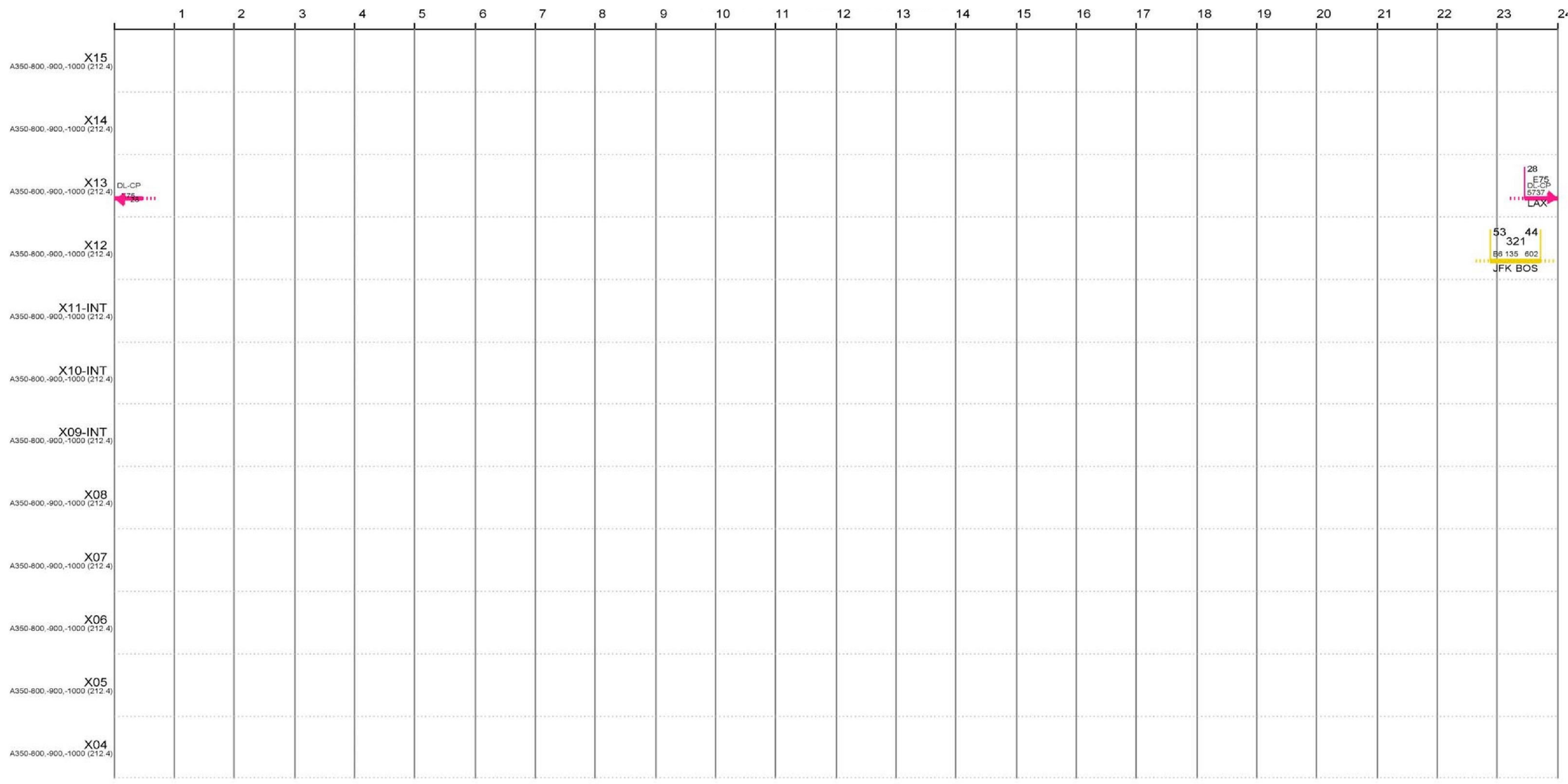
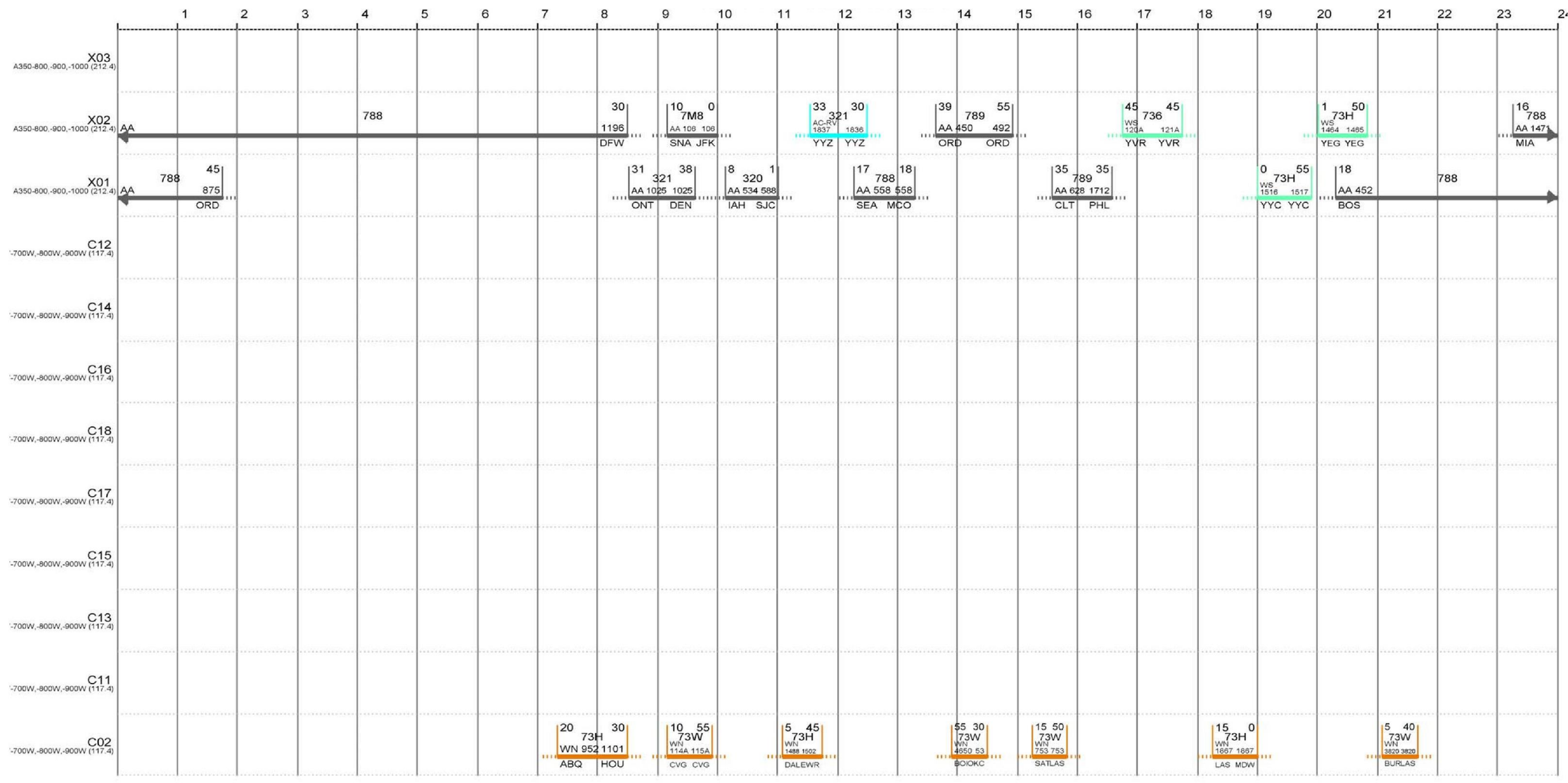


EXHIBIT C-1 PAL 1 RAMP CHARTS (2 OF 11)



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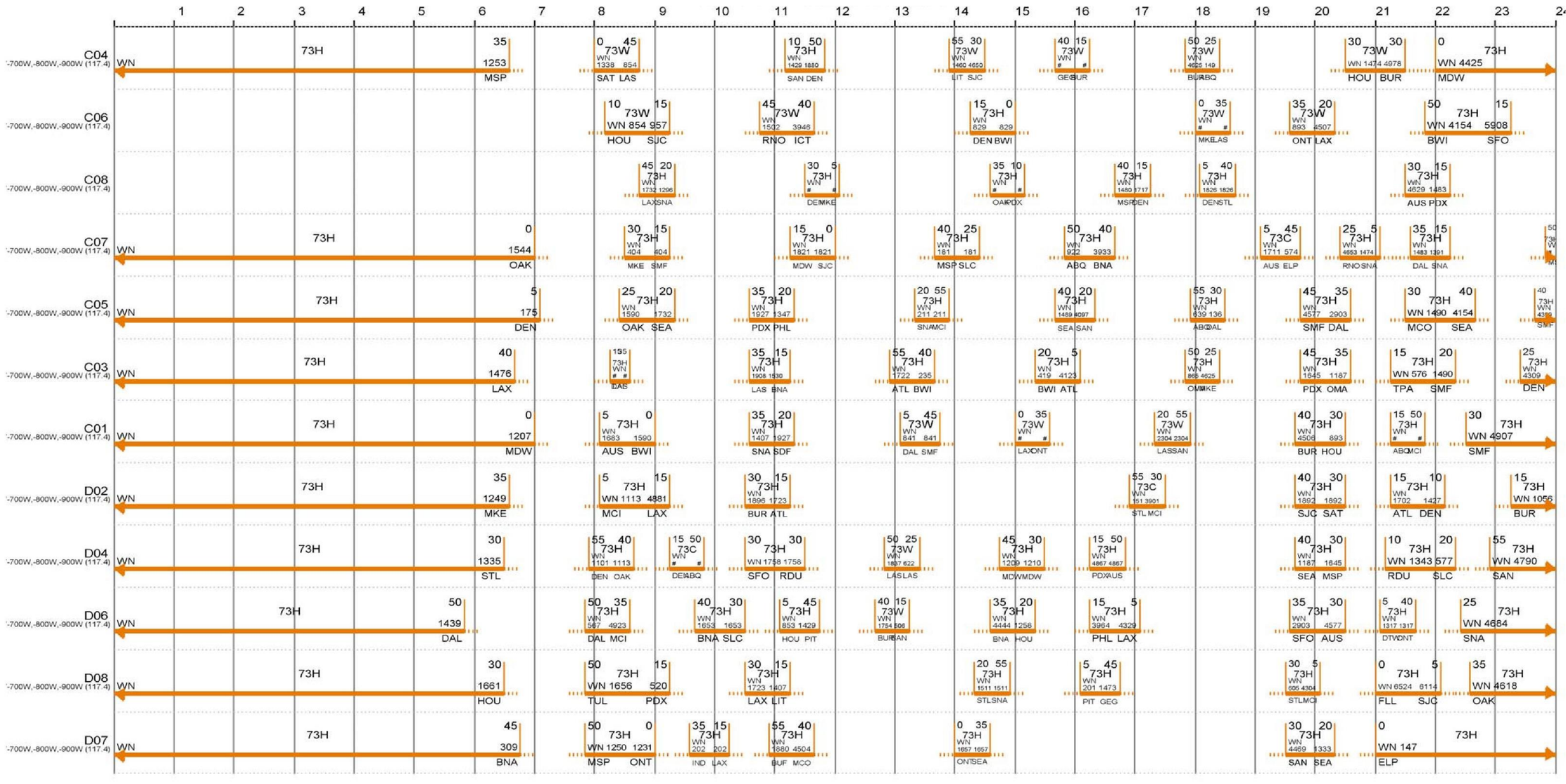

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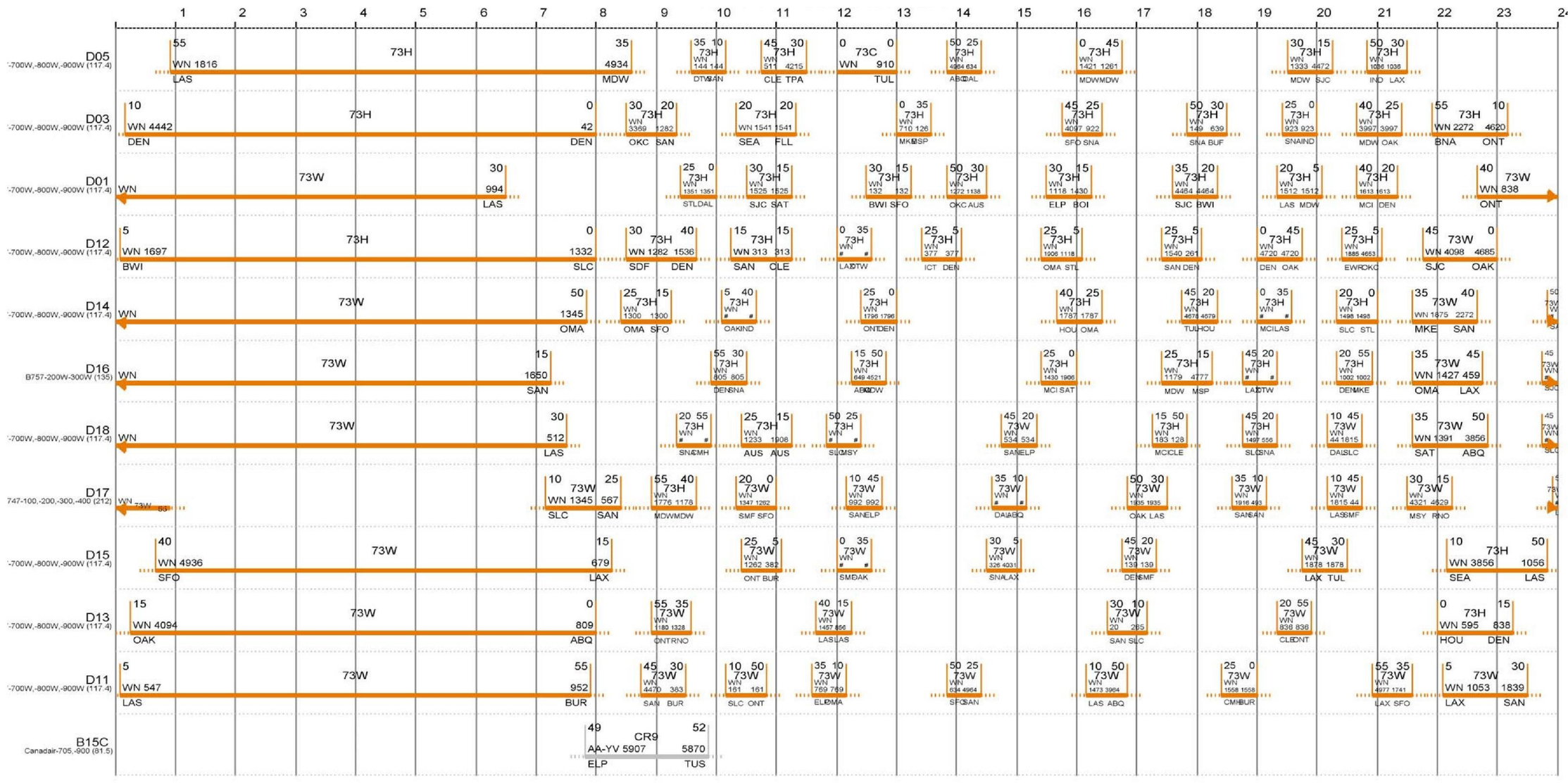

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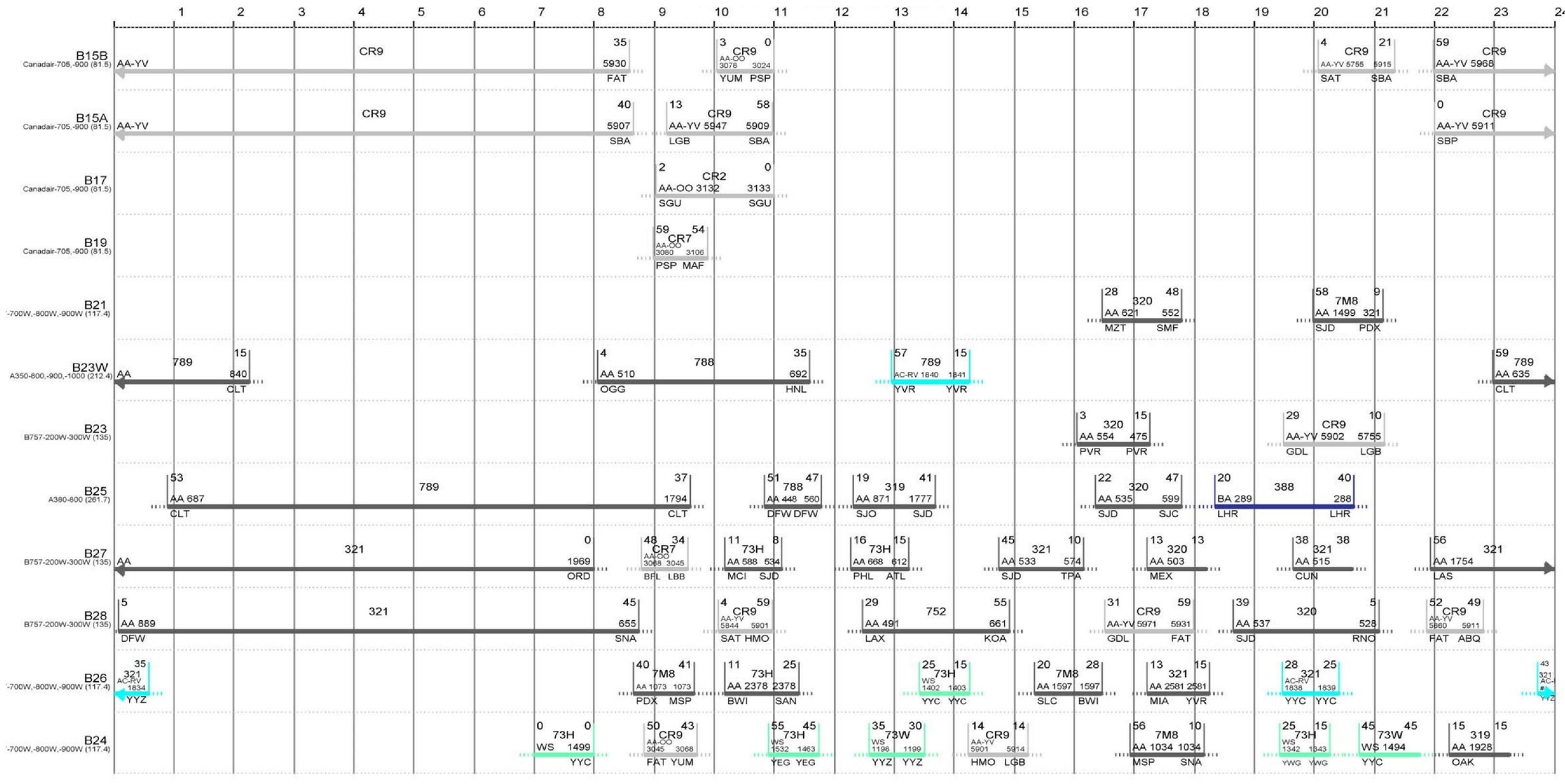

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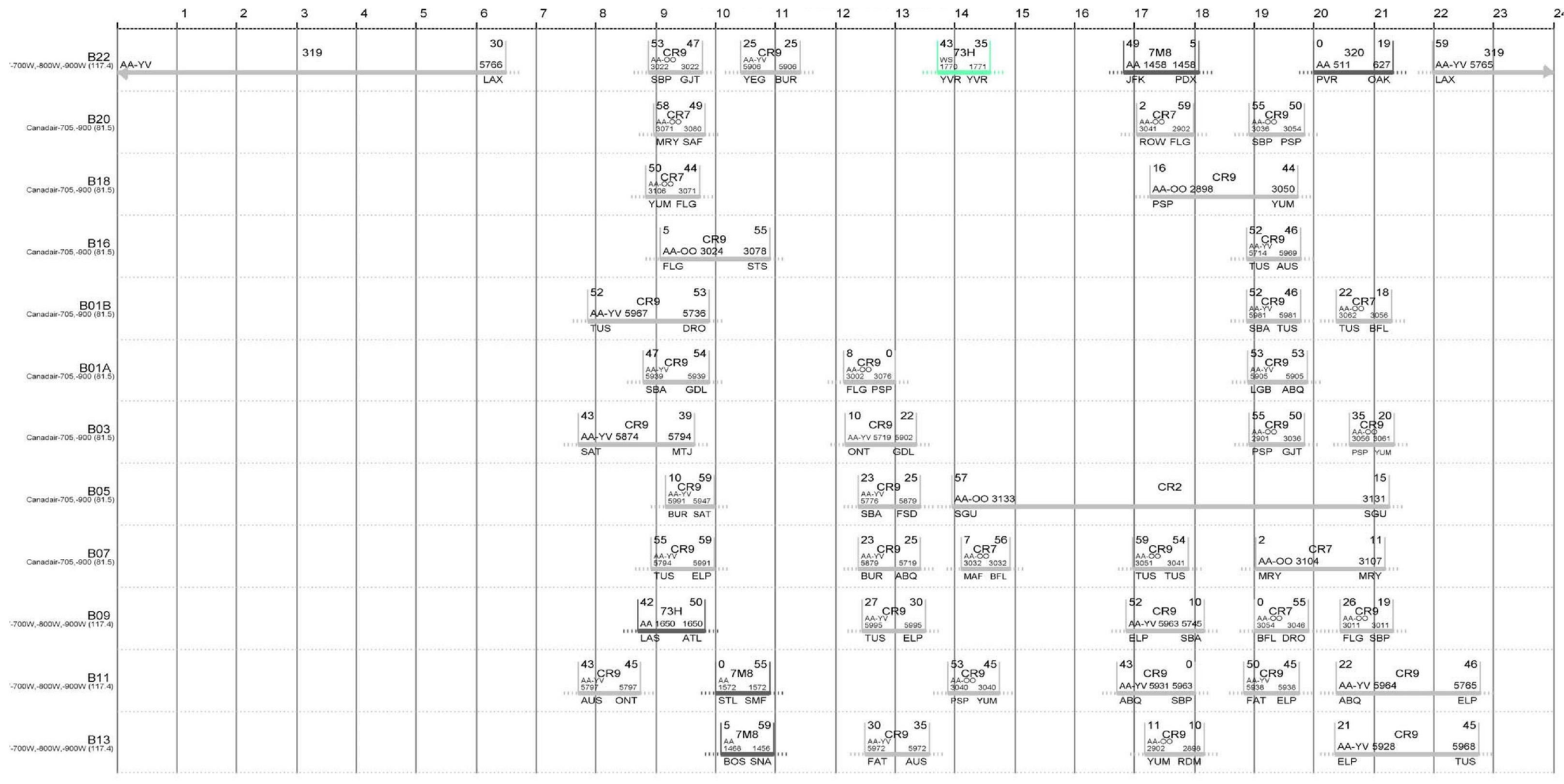

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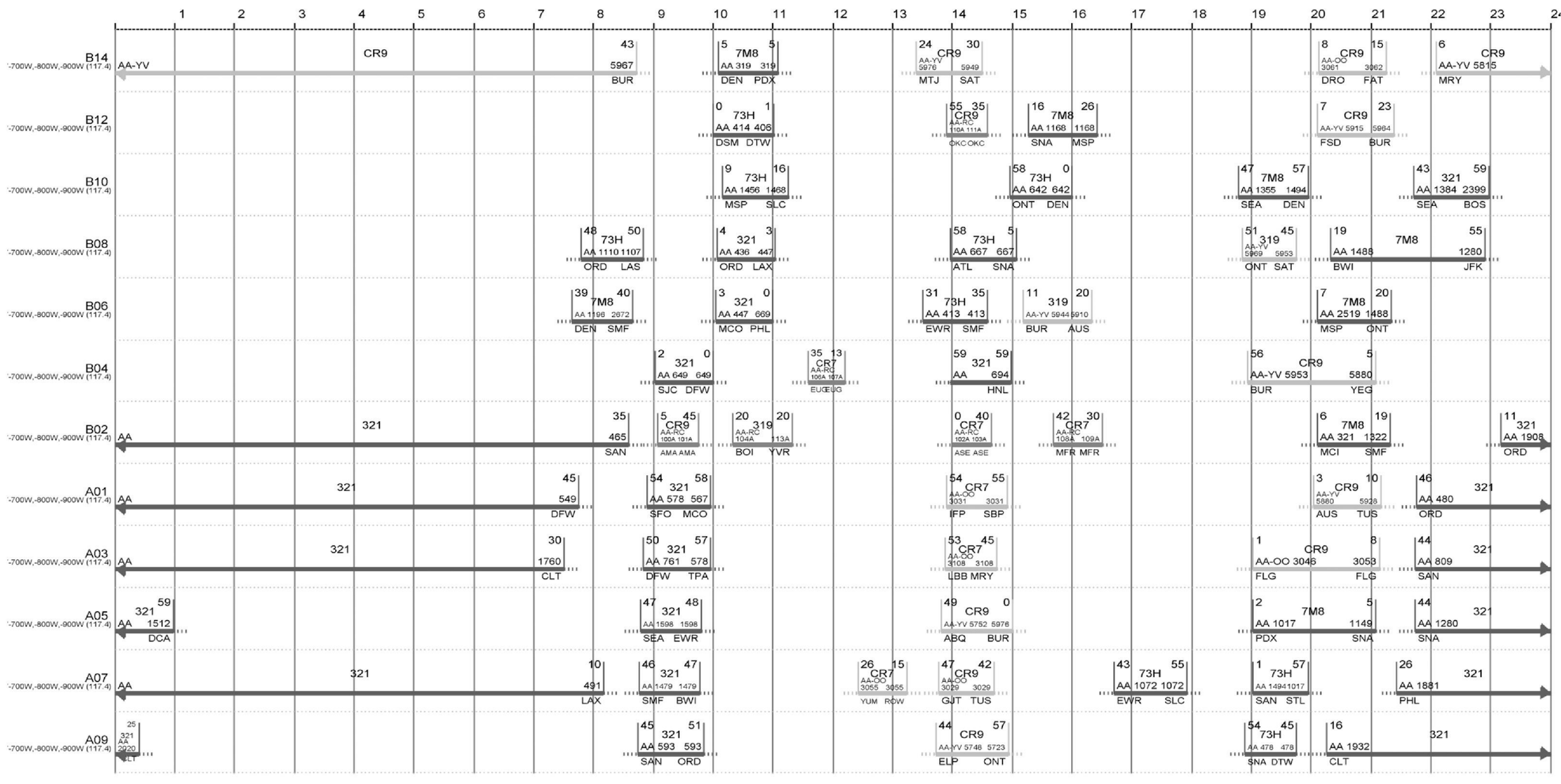

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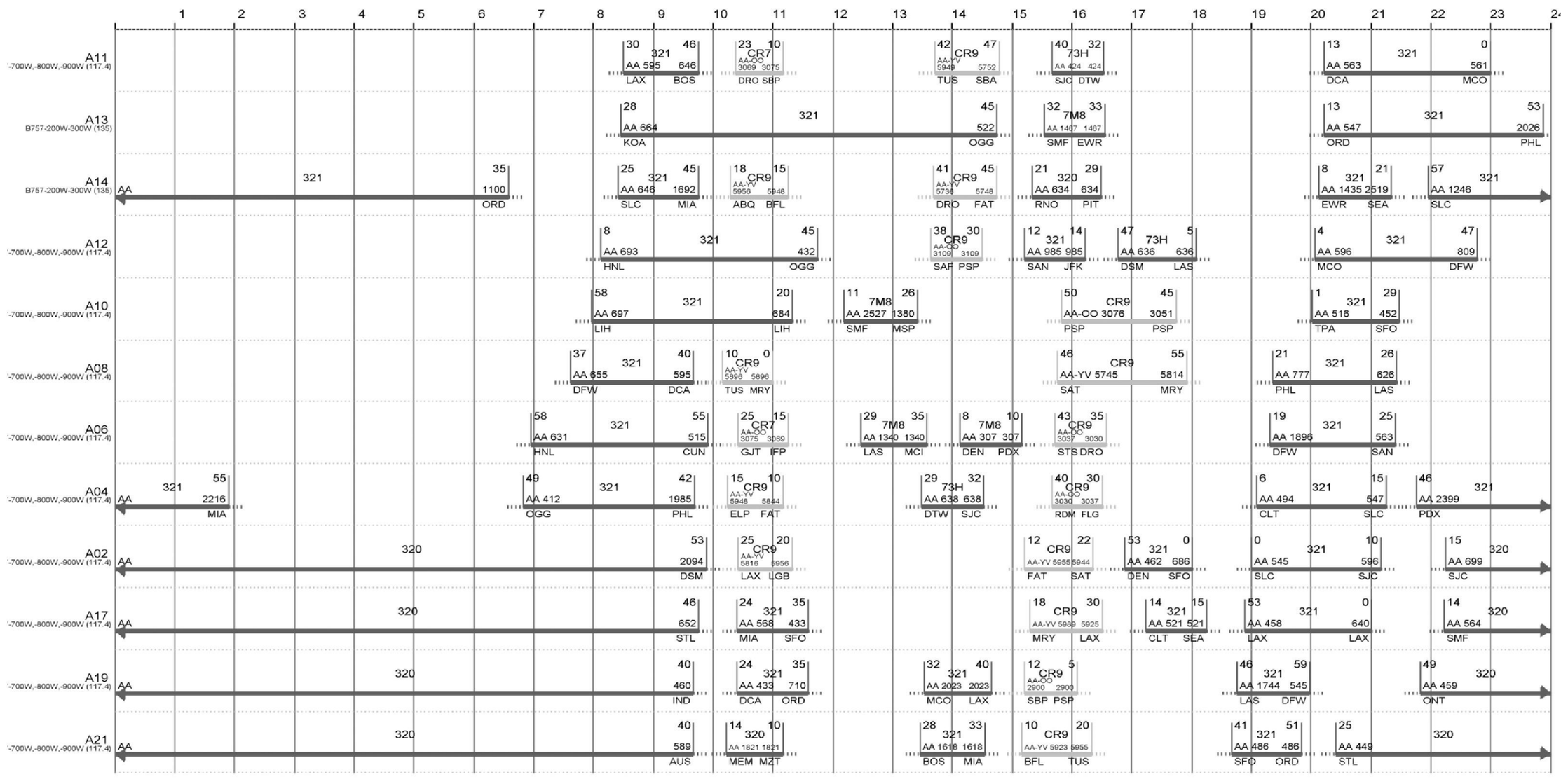

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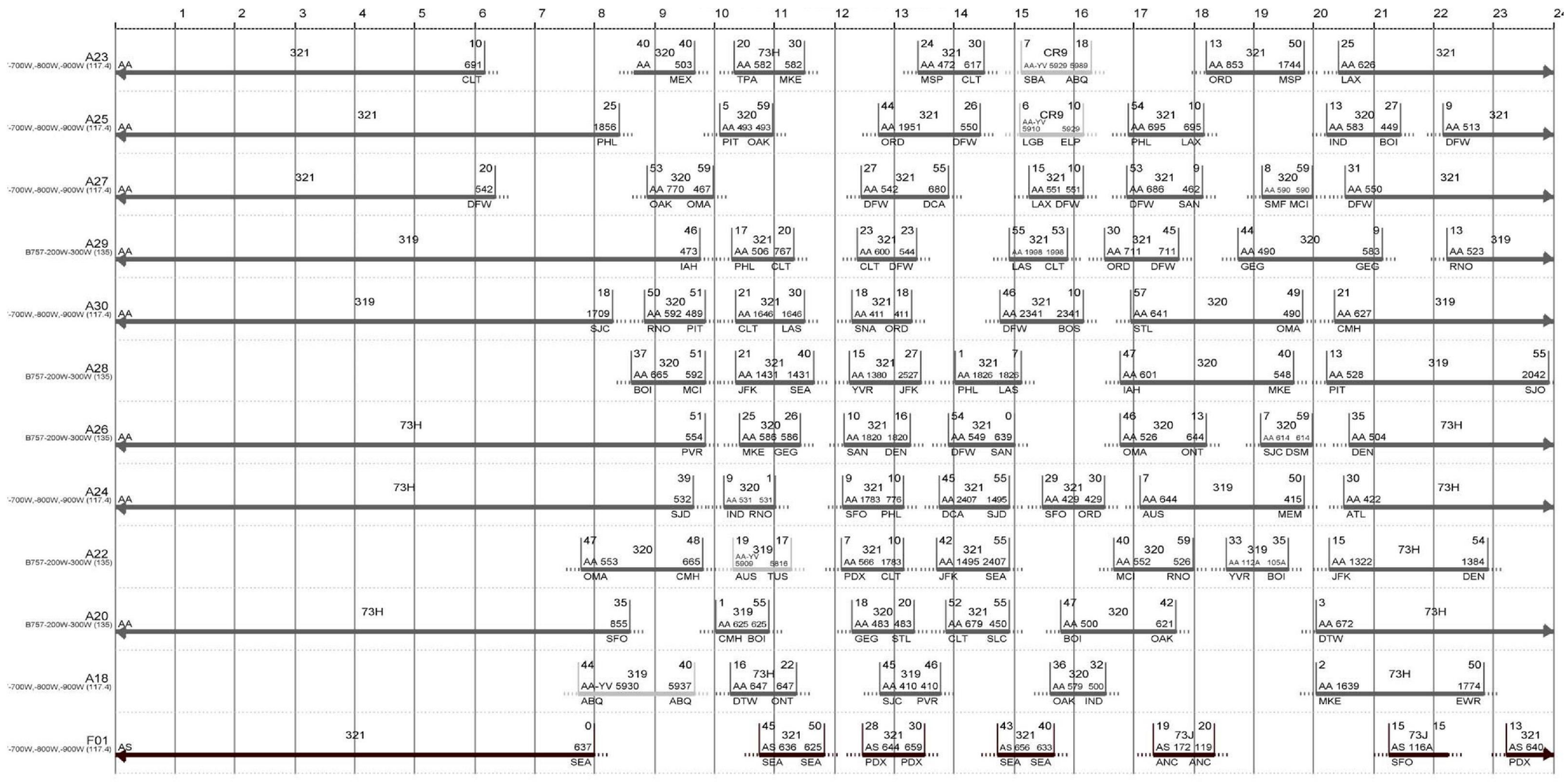

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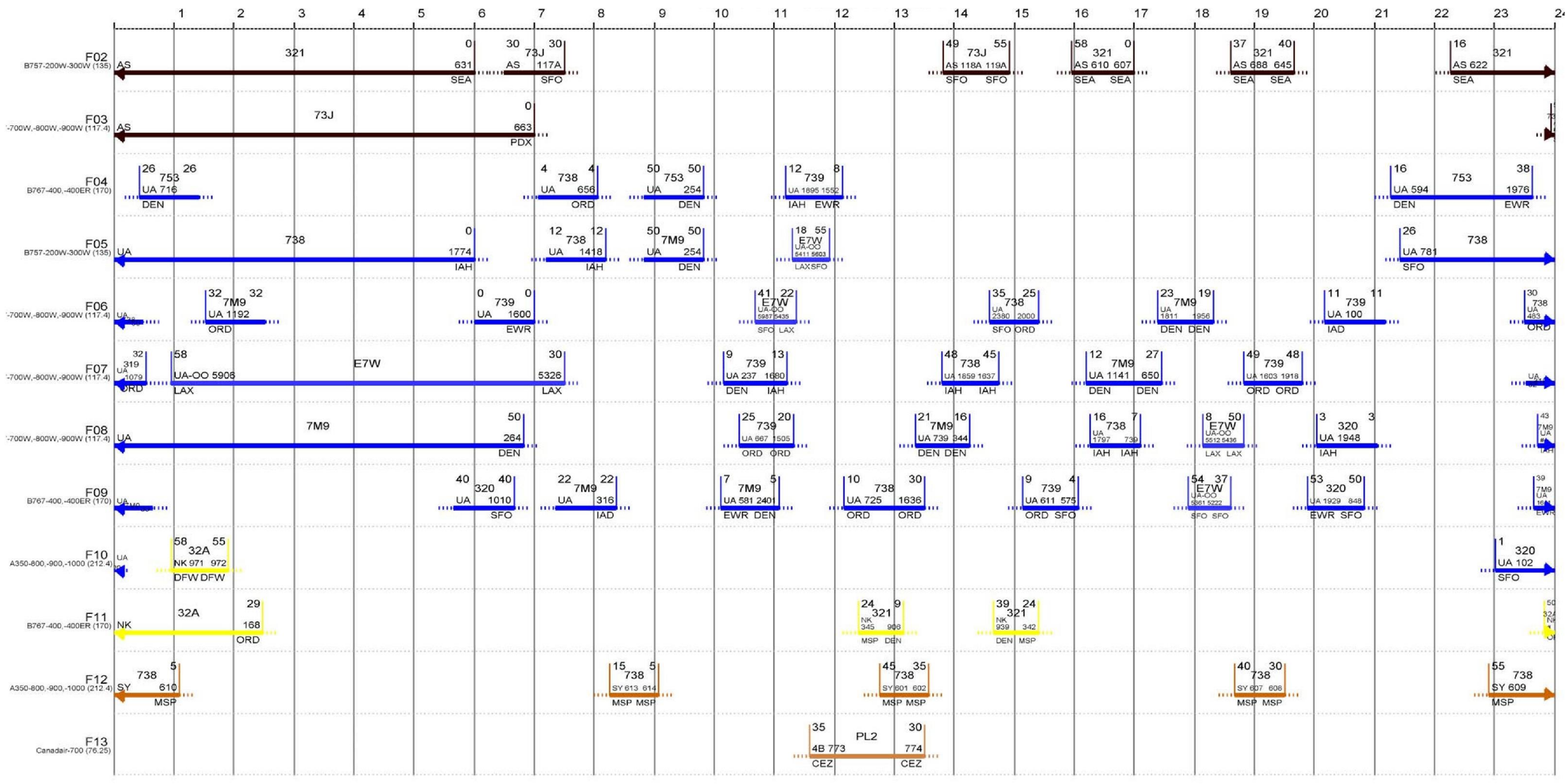

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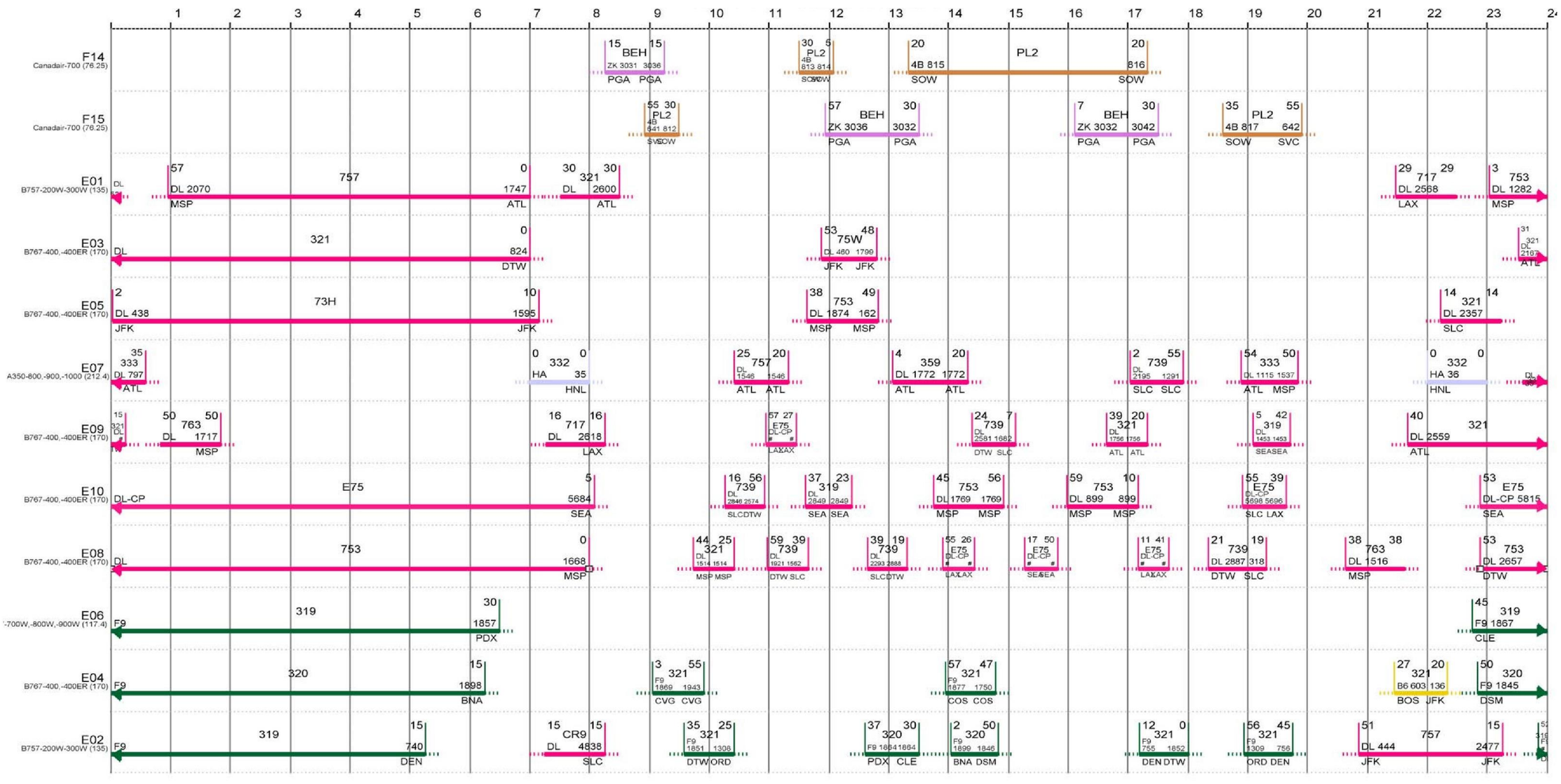
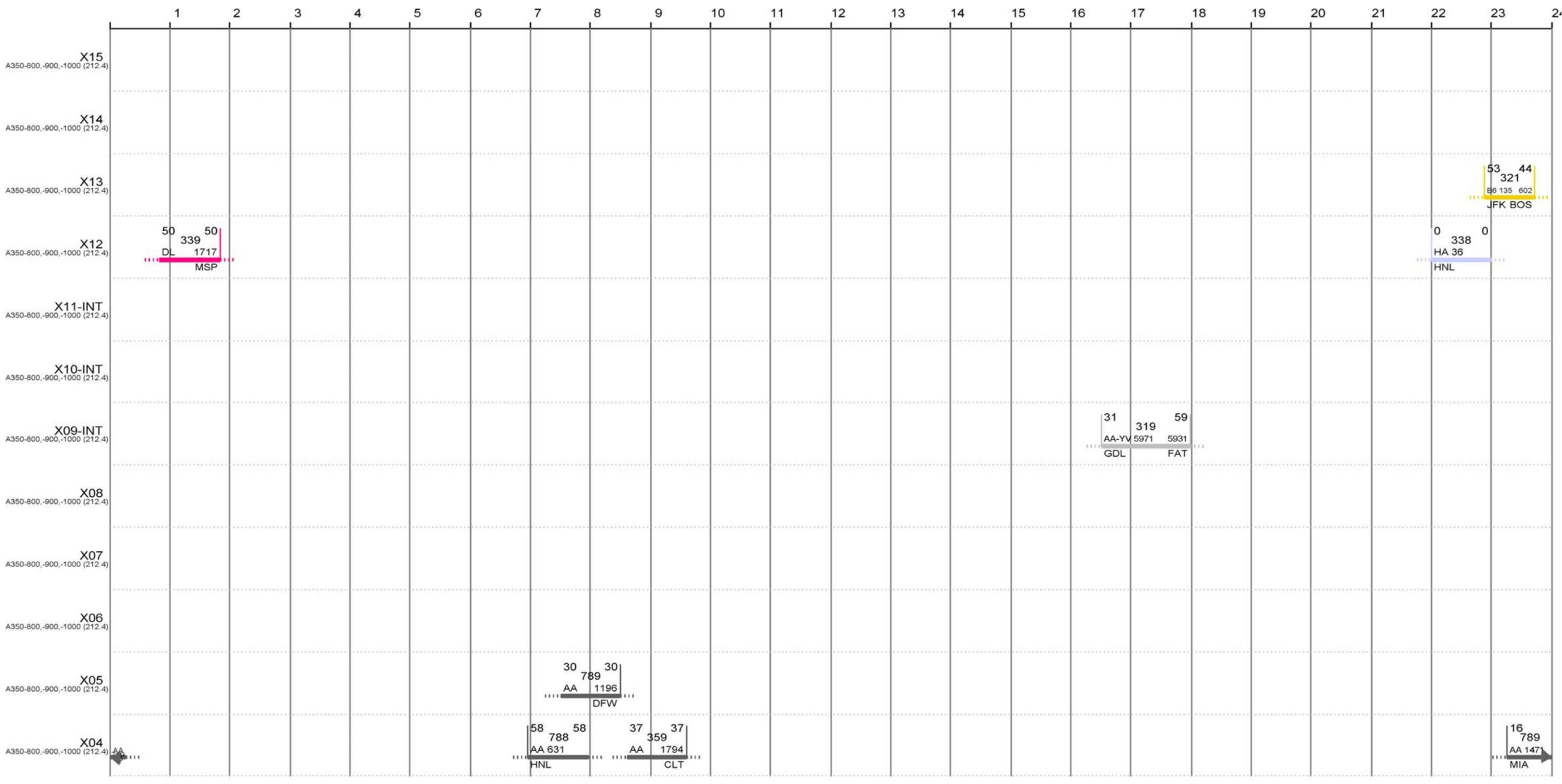


C.2 PAL 2 RAMP CHARTS

EXHIBIT C-2 PAL 2 RAMP CHARTS (1 OF 11)



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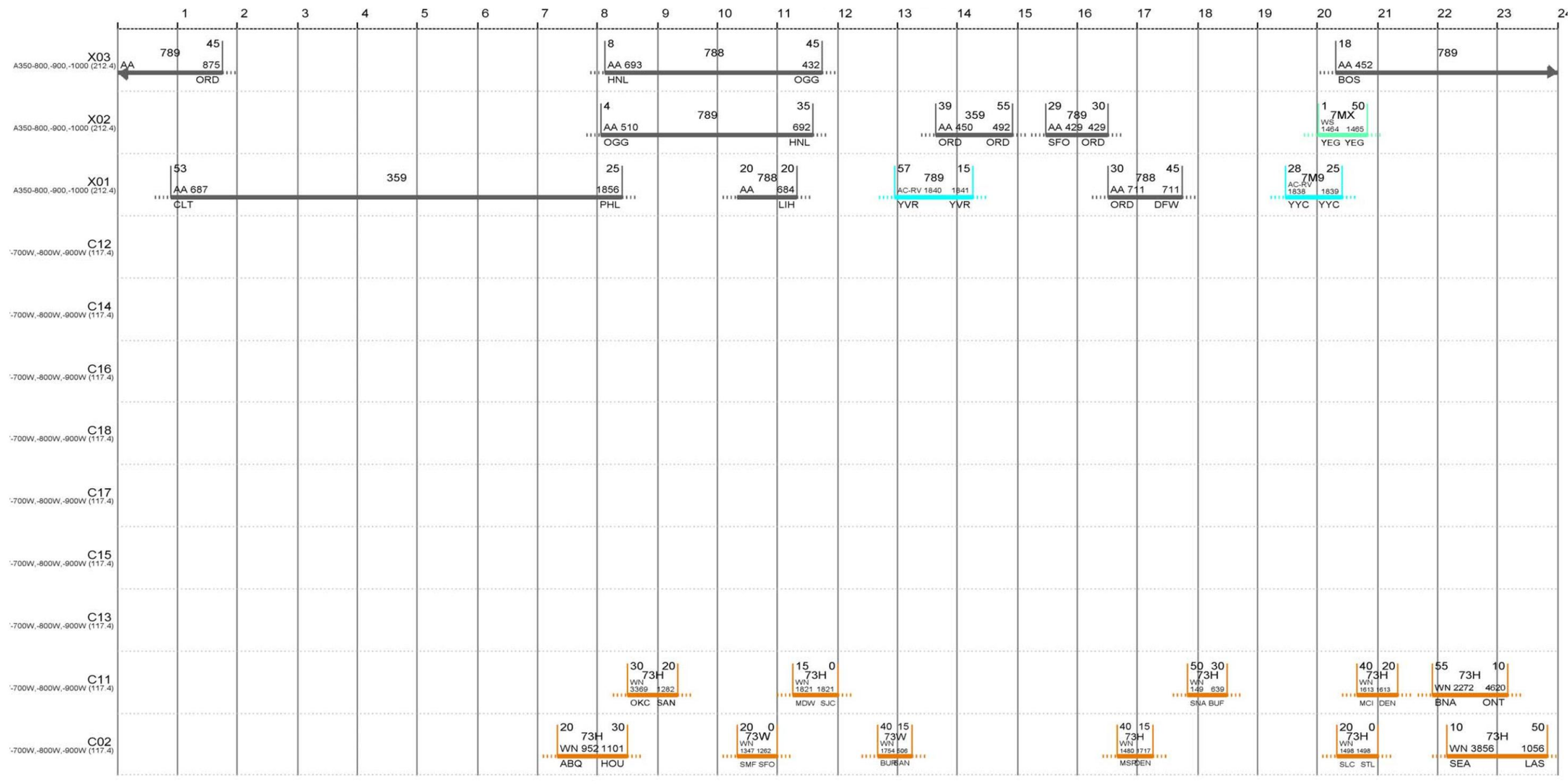

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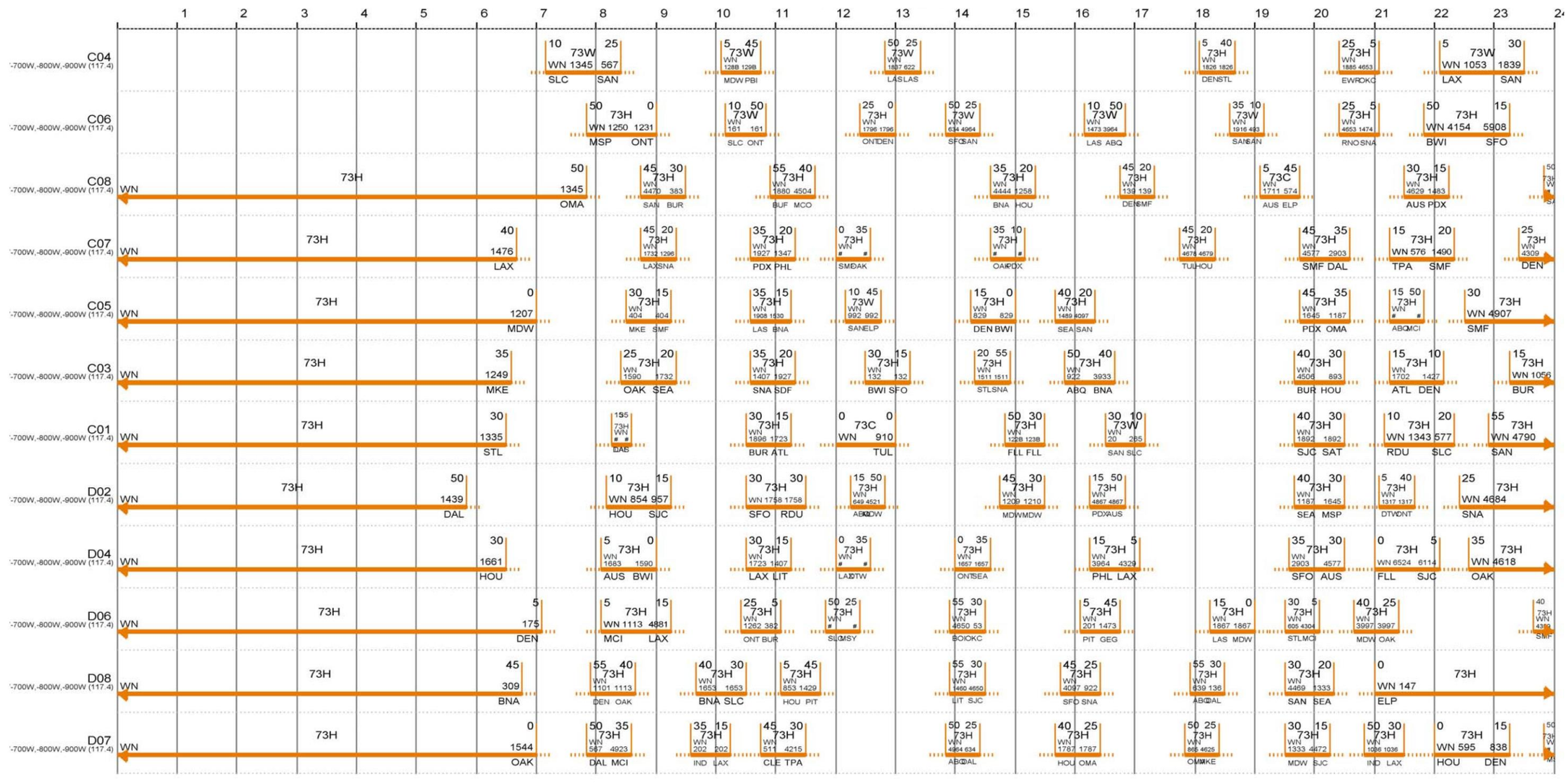

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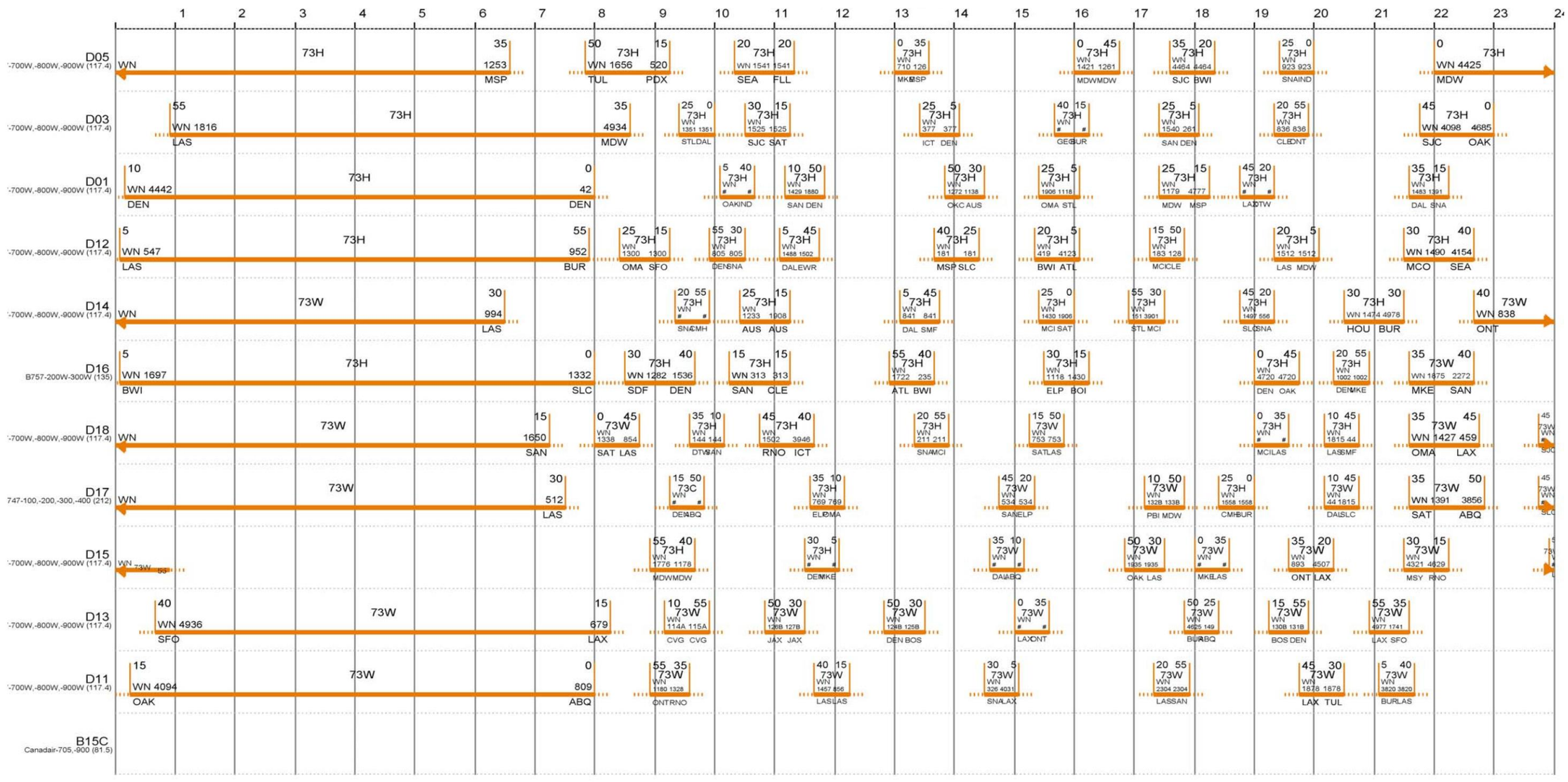

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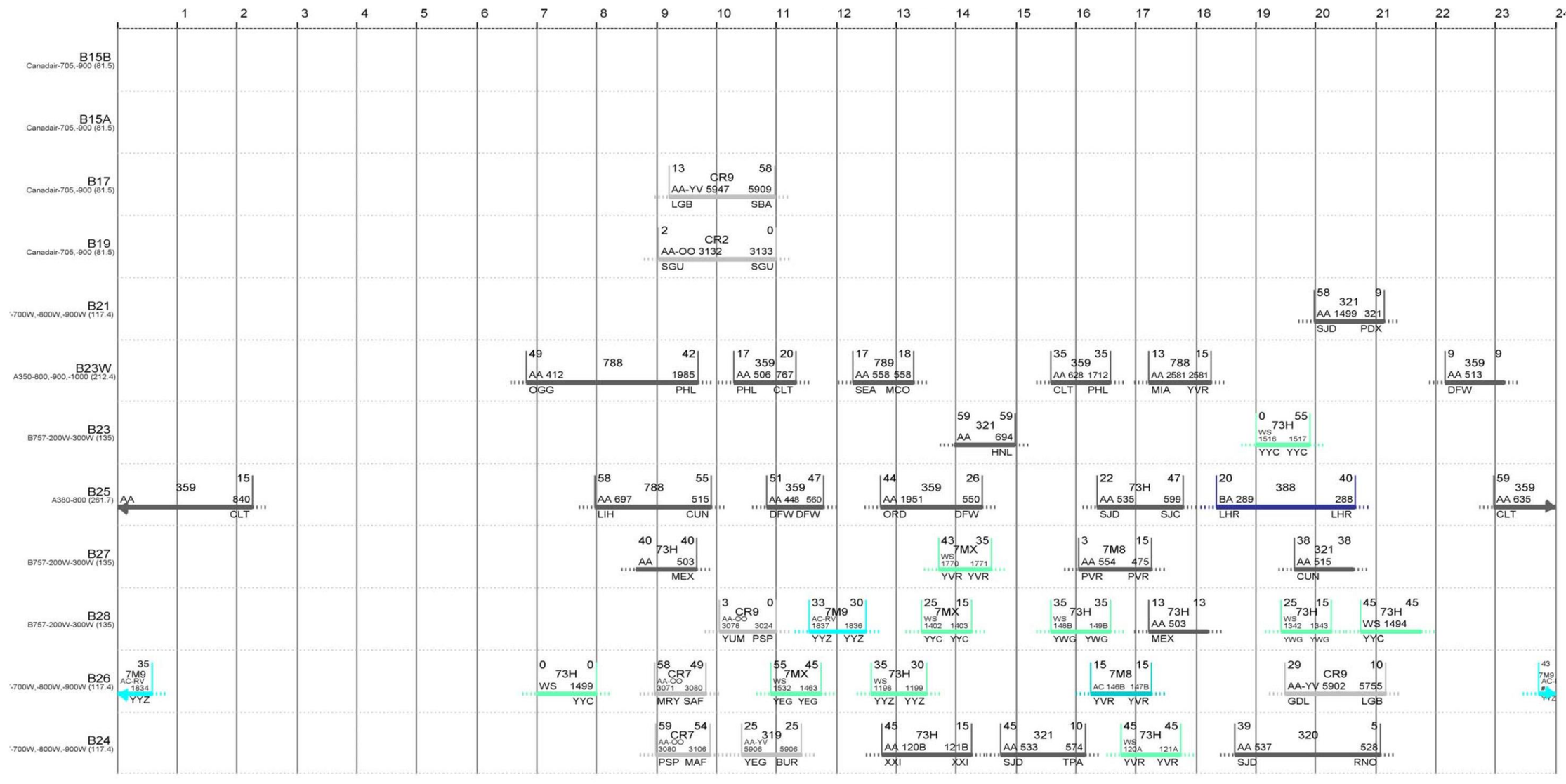


EXHIBIT C-2 PAL 2 RAMP CHARTS (6 OF 11)

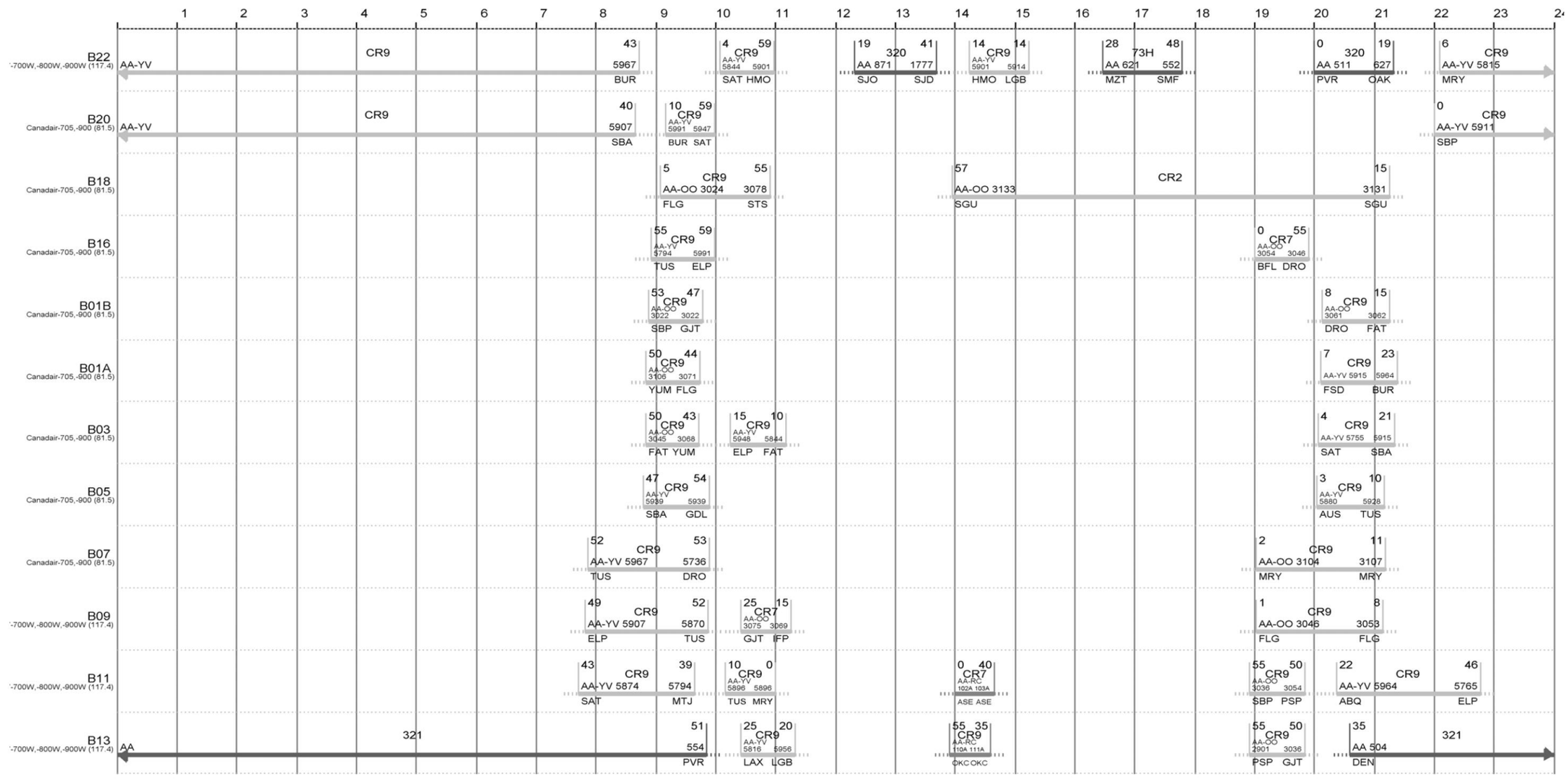


EXHIBIT C-2 PAL 2 RAMP CHARTS (7 OF 11)

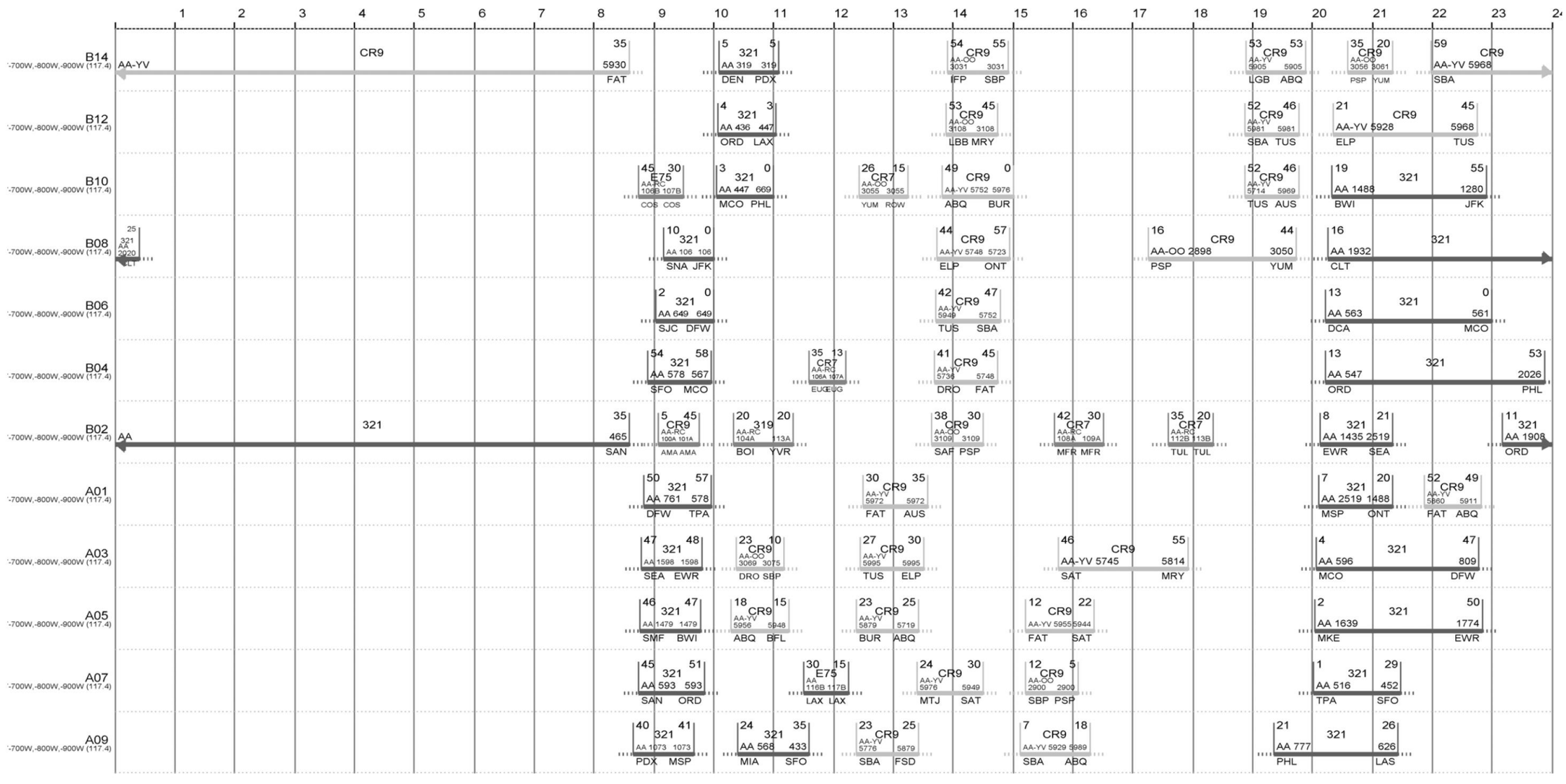


EXHIBIT C-2 PAL 2 RAMP CHARTS (8 OF 11)

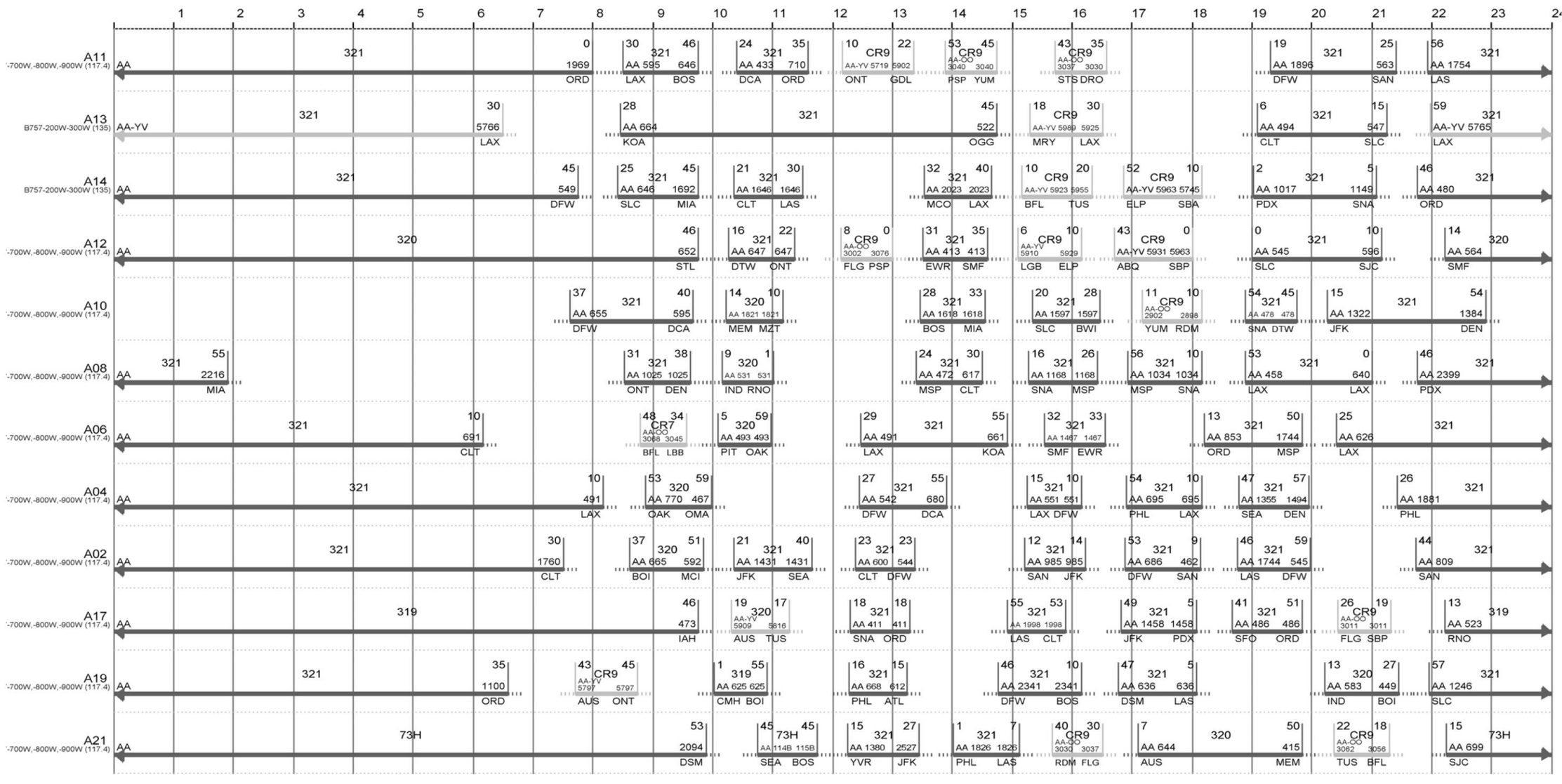


EXHIBIT C-2 PAL 2 RAMP CHARTS (9 OF 11)

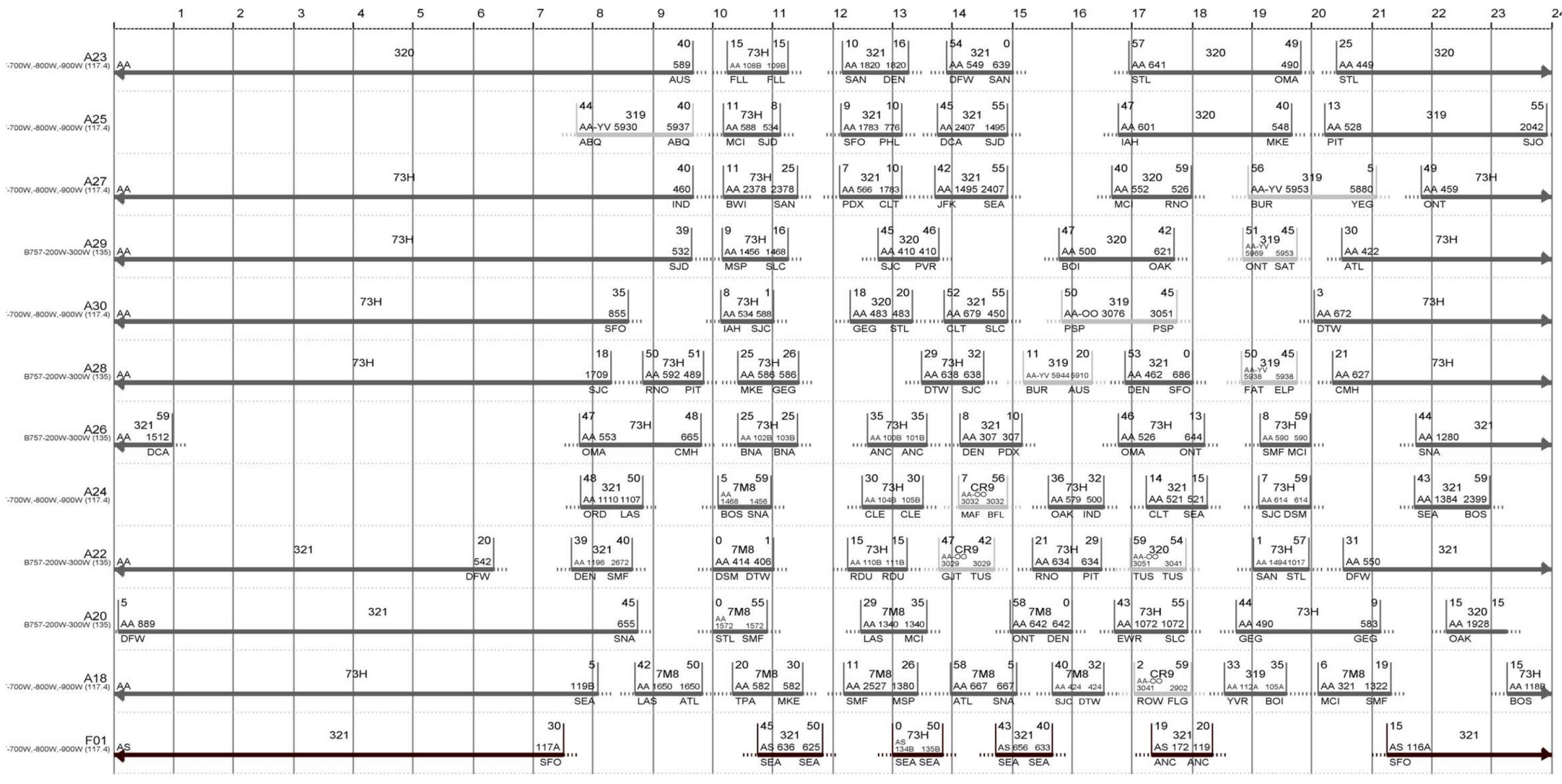


EXHIBIT C-2 PAL 2 RAMP CHARTS (10 OF 11)

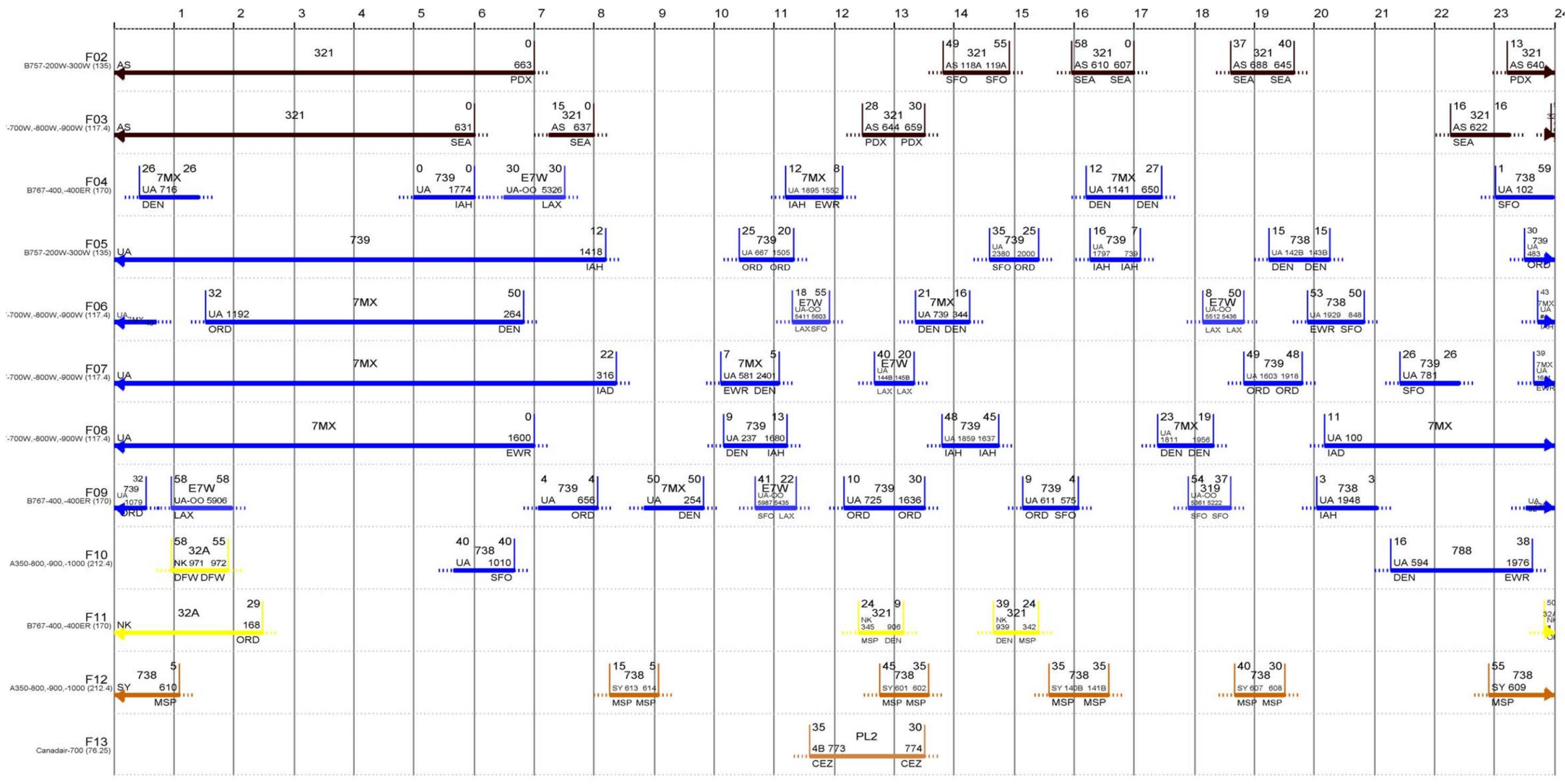
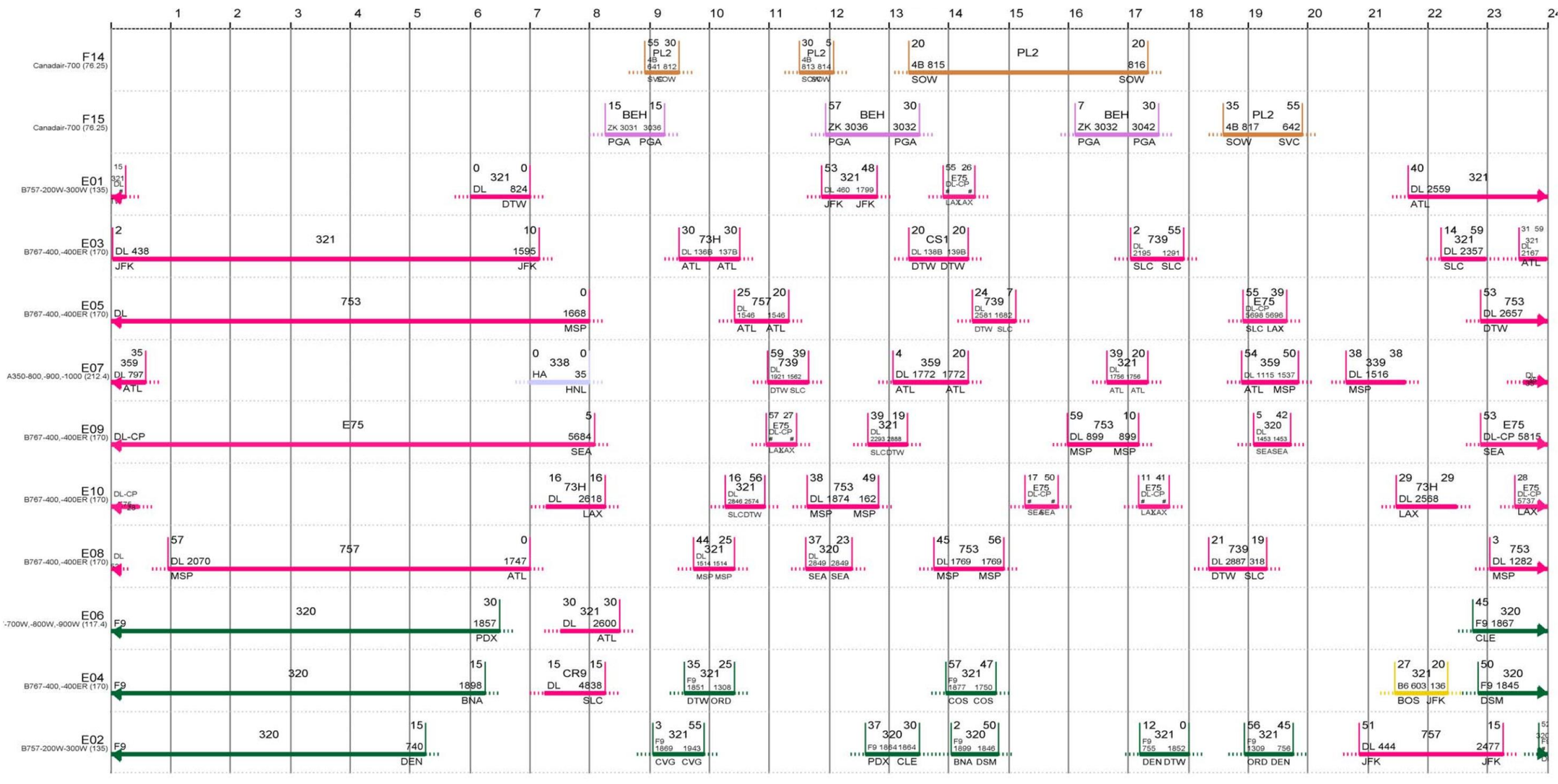


EXHIBIT C-2 PAL 2 RAMP CHARTS (11 OF 11)



C.3 PAL 3 RAMP CHARTS

EXHIBIT C-3 PAL 3 RAMP CHARTS (1 OF 11)

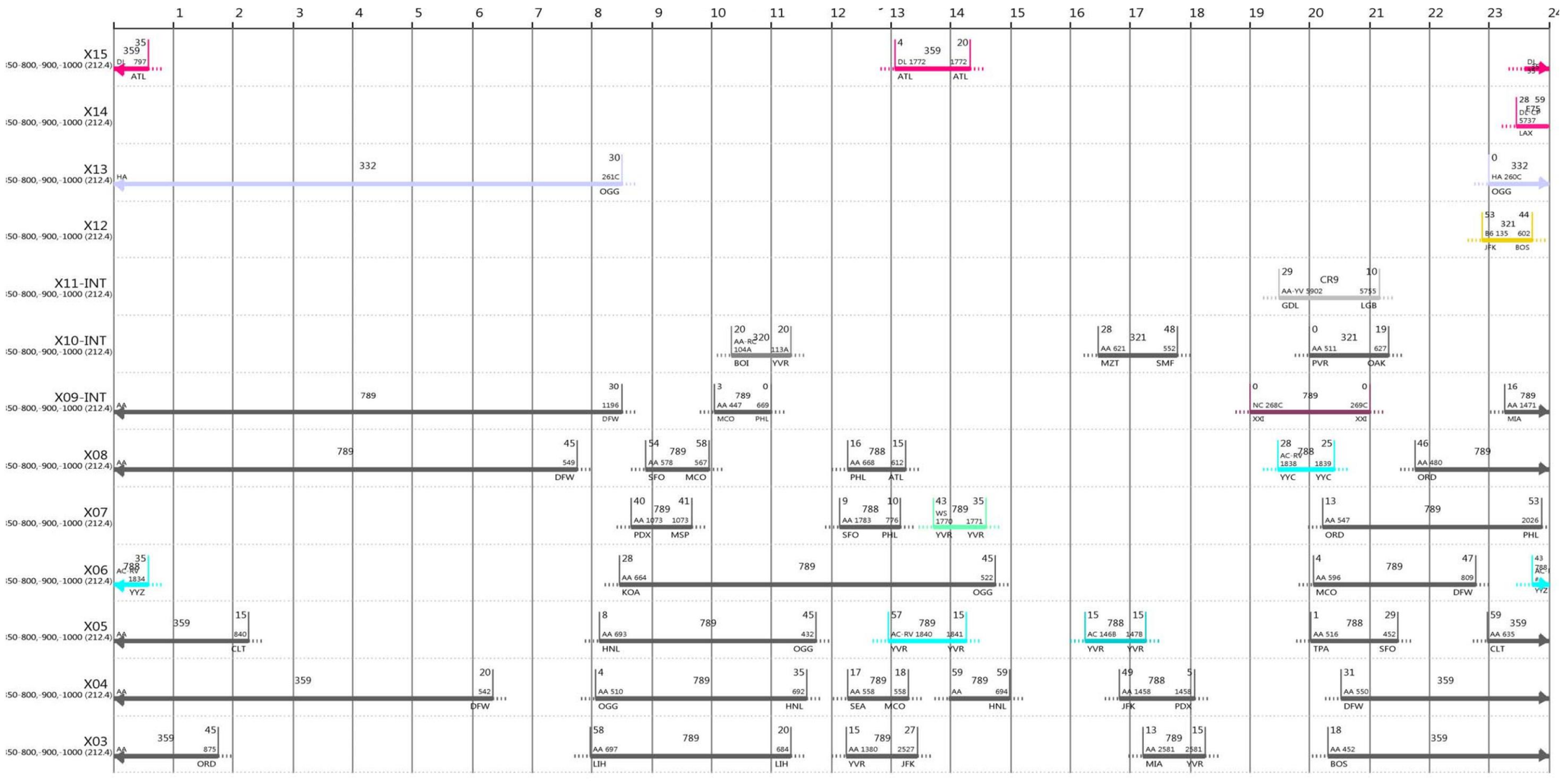


EXHIBIT C-3 PAL 3 RAMP CHARTS (2 OF 11)

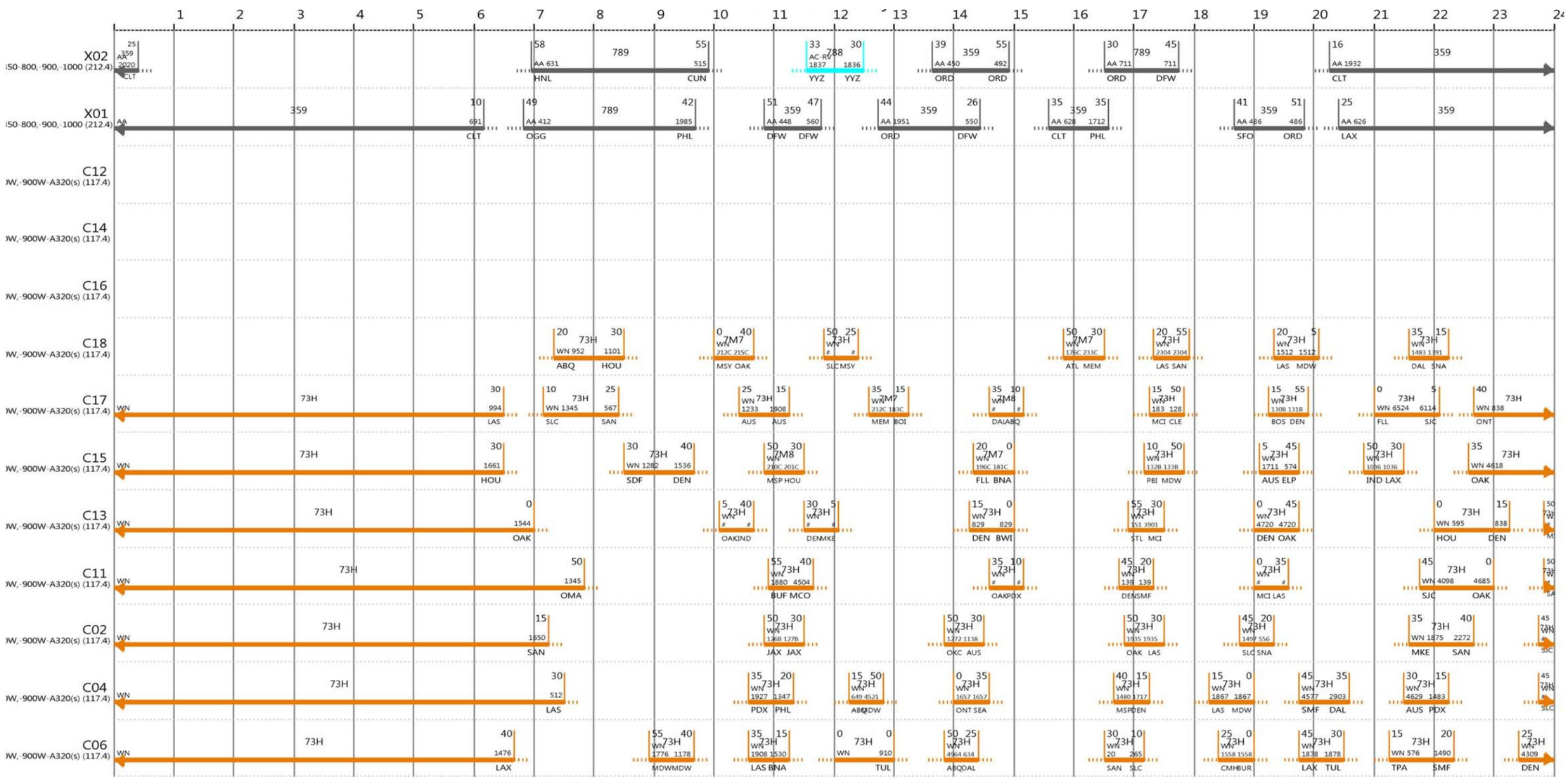


EXHIBIT C-3 PAL 3 RAMP CHARTS (3 OF 11)

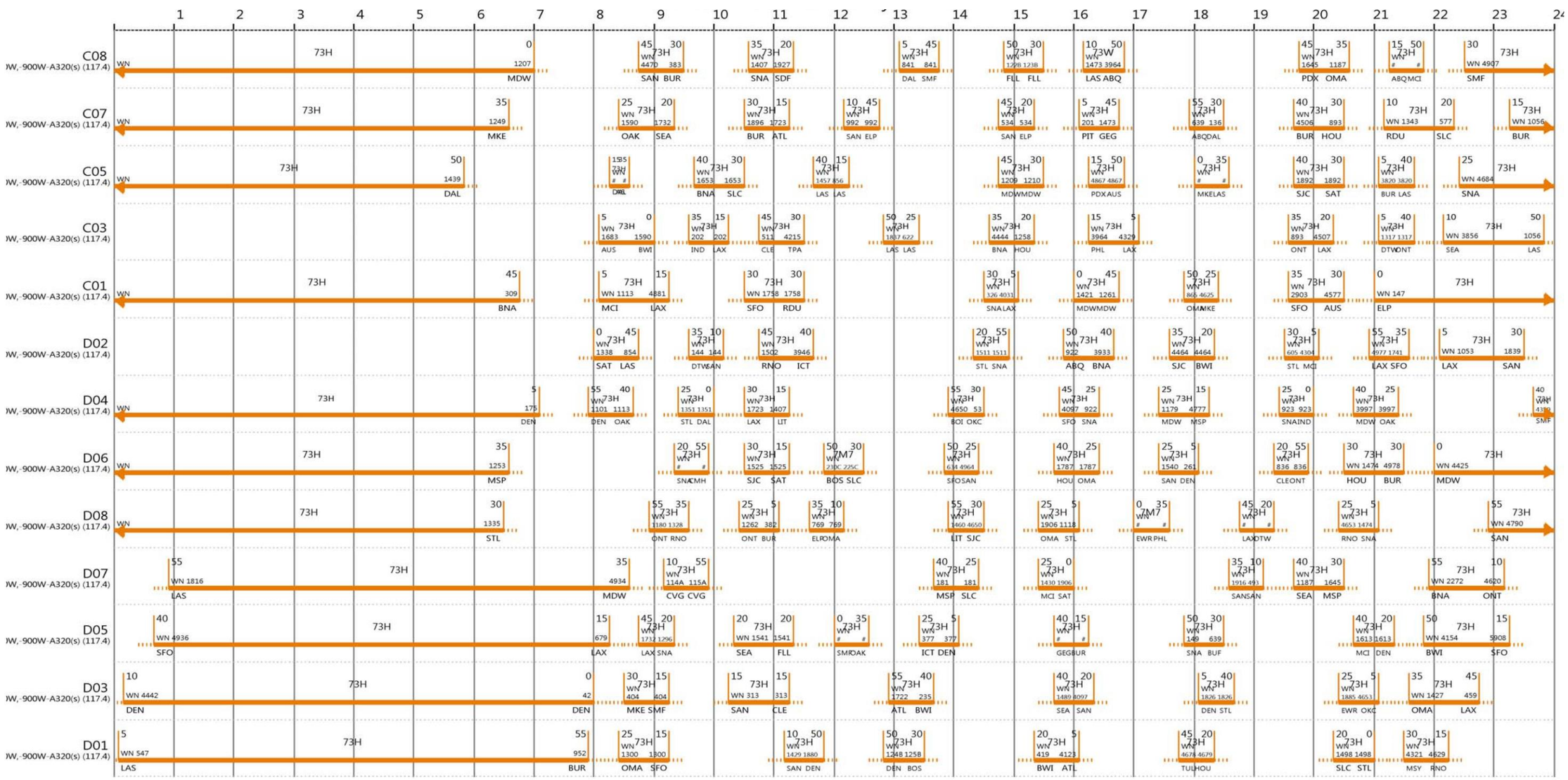


EXHIBIT C-3 PAL 3 RAMP CHARTS (4 OF 11)

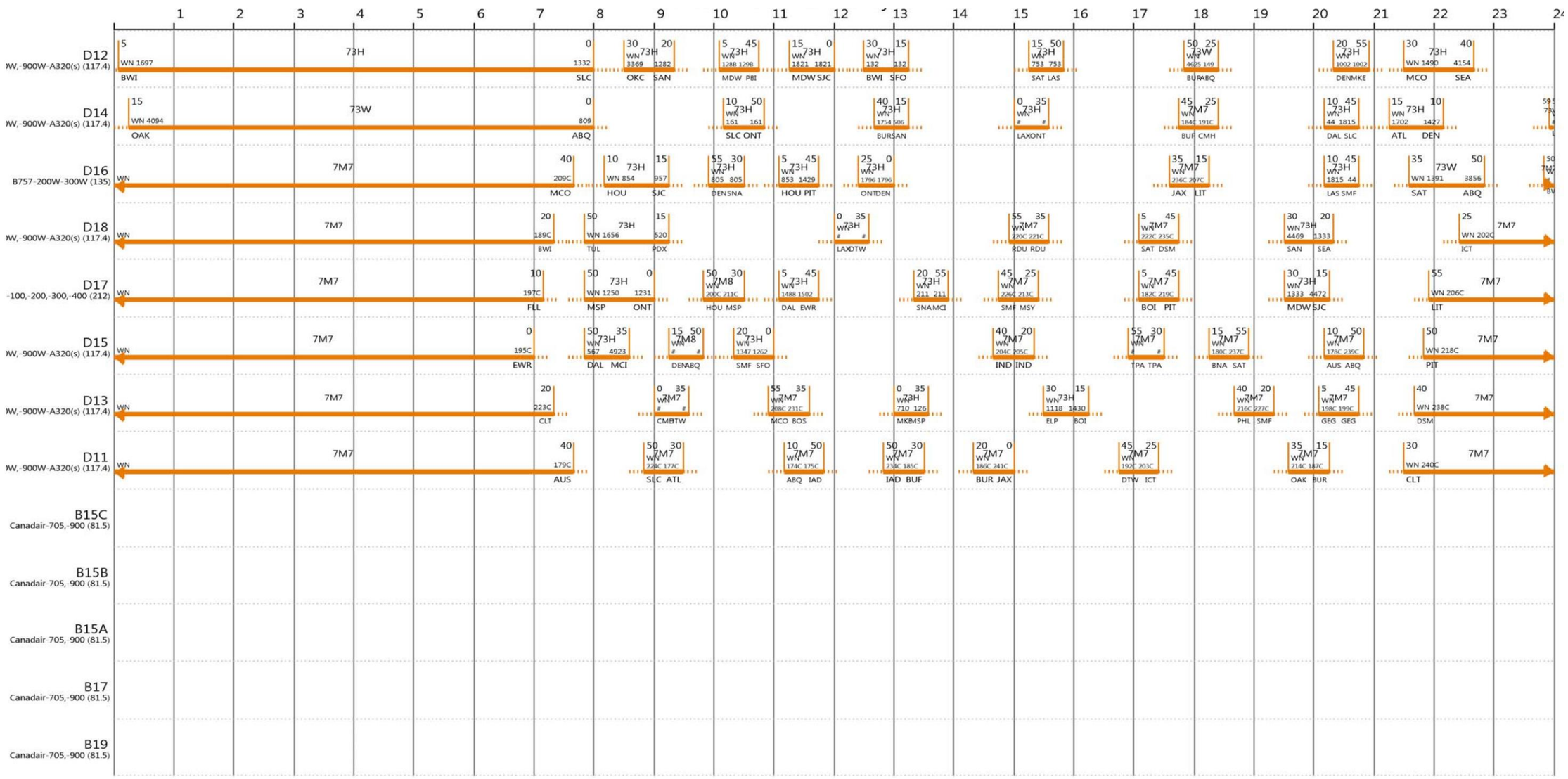


EXHIBIT C-3 PAL 3 RAMP CHARTS (5 OF 11)

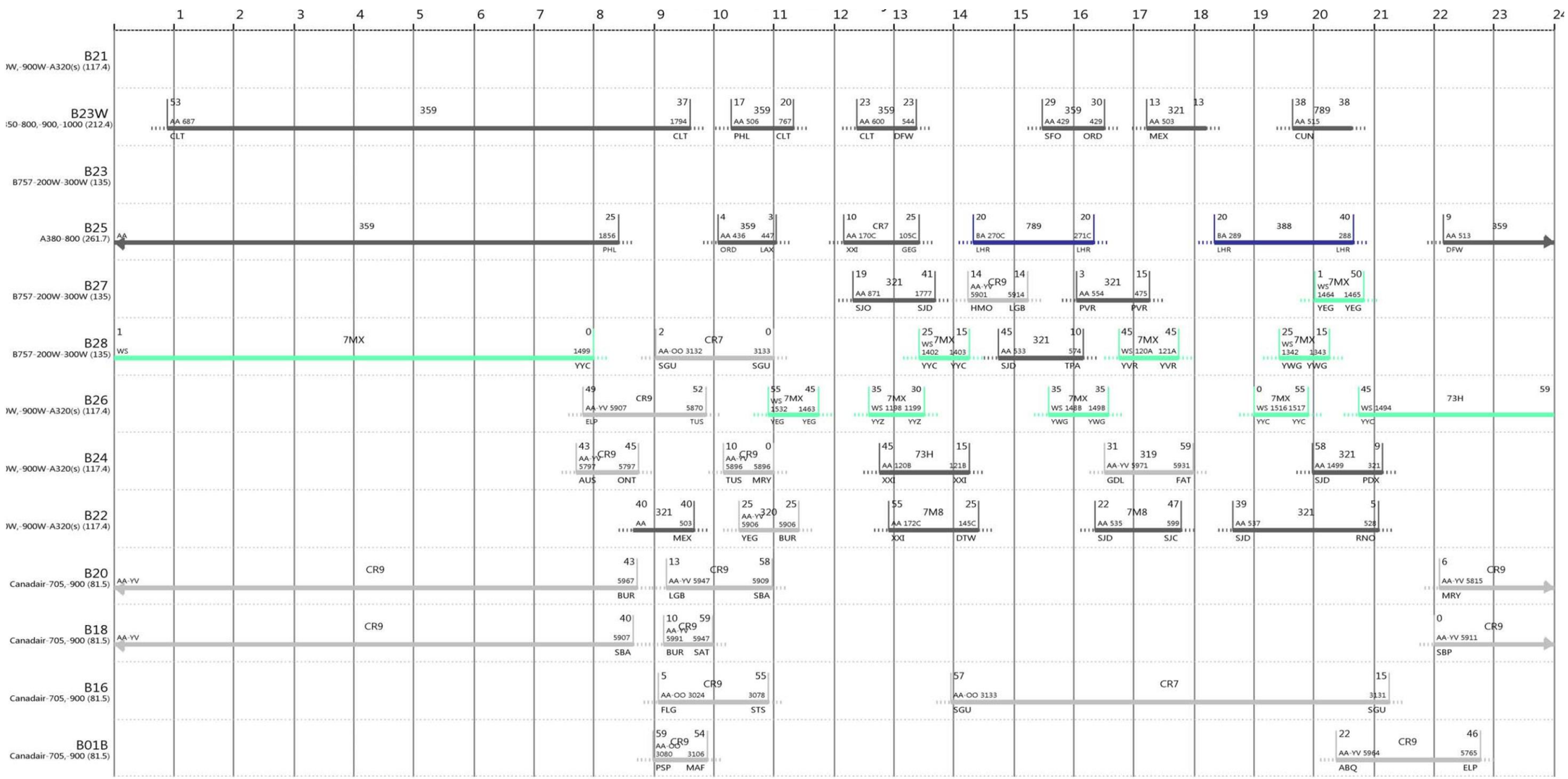


EXHIBIT C-3 PAL 3 RAMP CHARTS (6 OF 11)

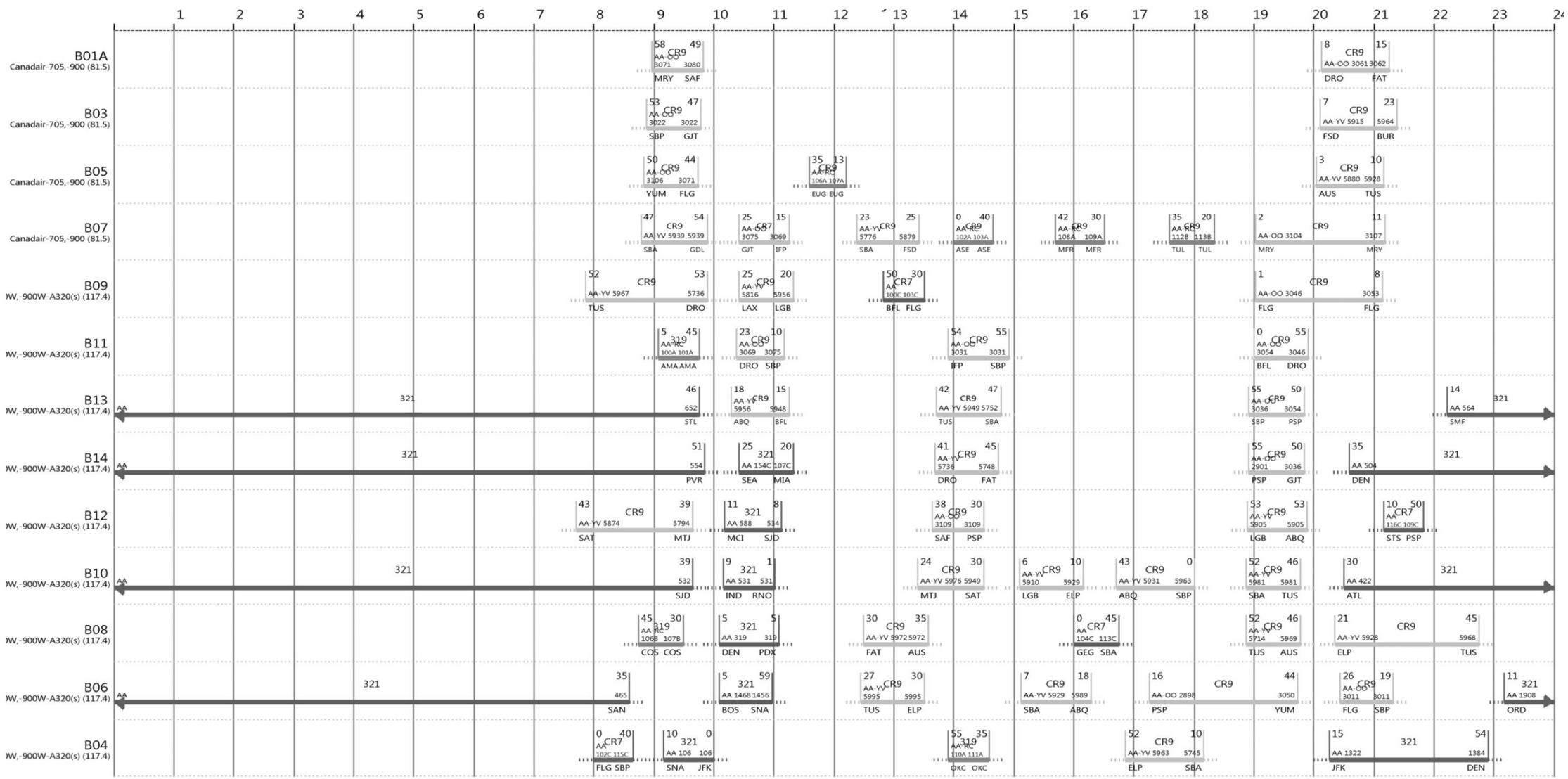


EXHIBIT C-3 PAL 3 RAMP CHARTS (7 OF 11)

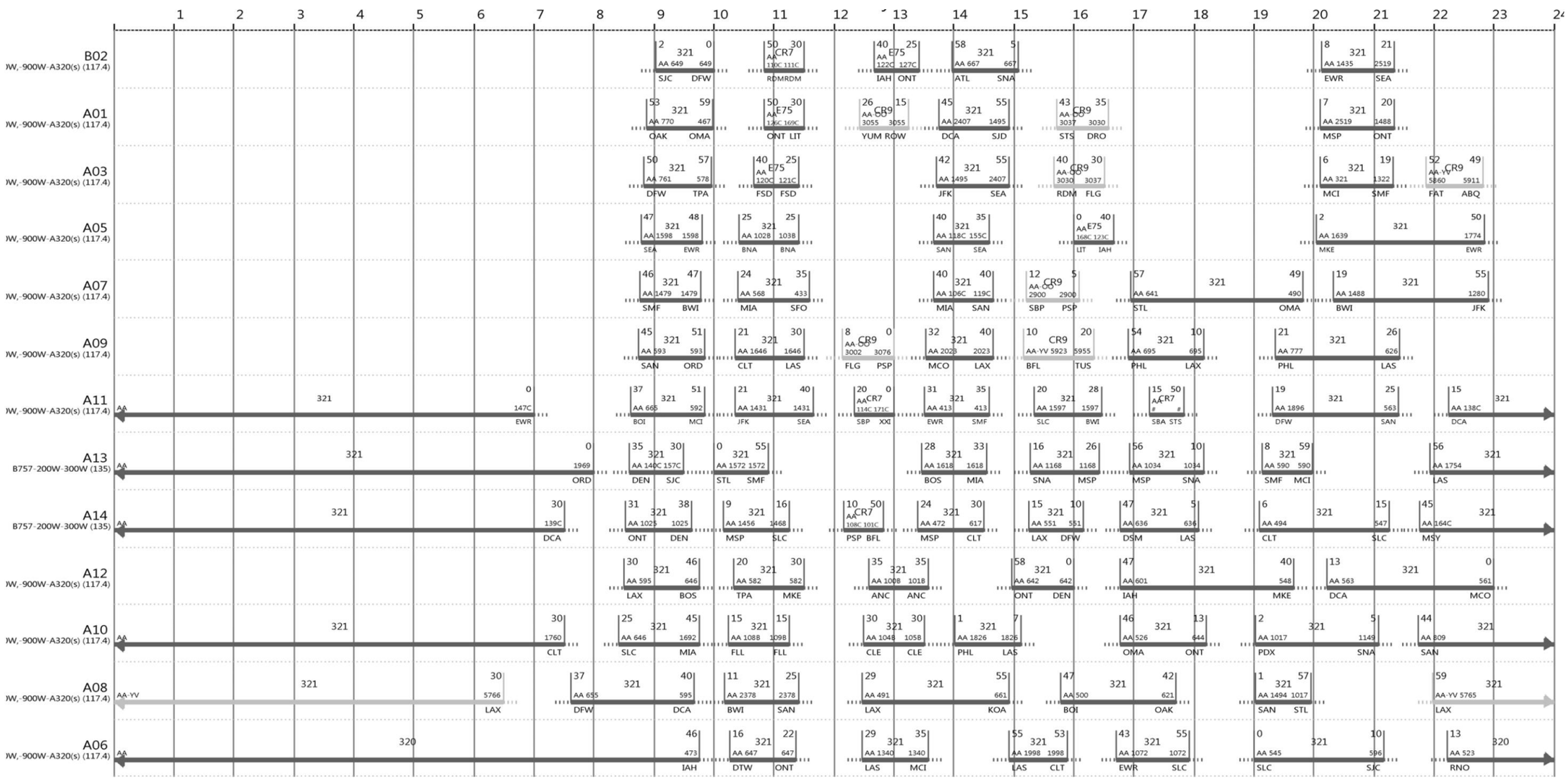


EXHIBIT C-3 PAL 3 RAMP CHARTS (8 OF 11)

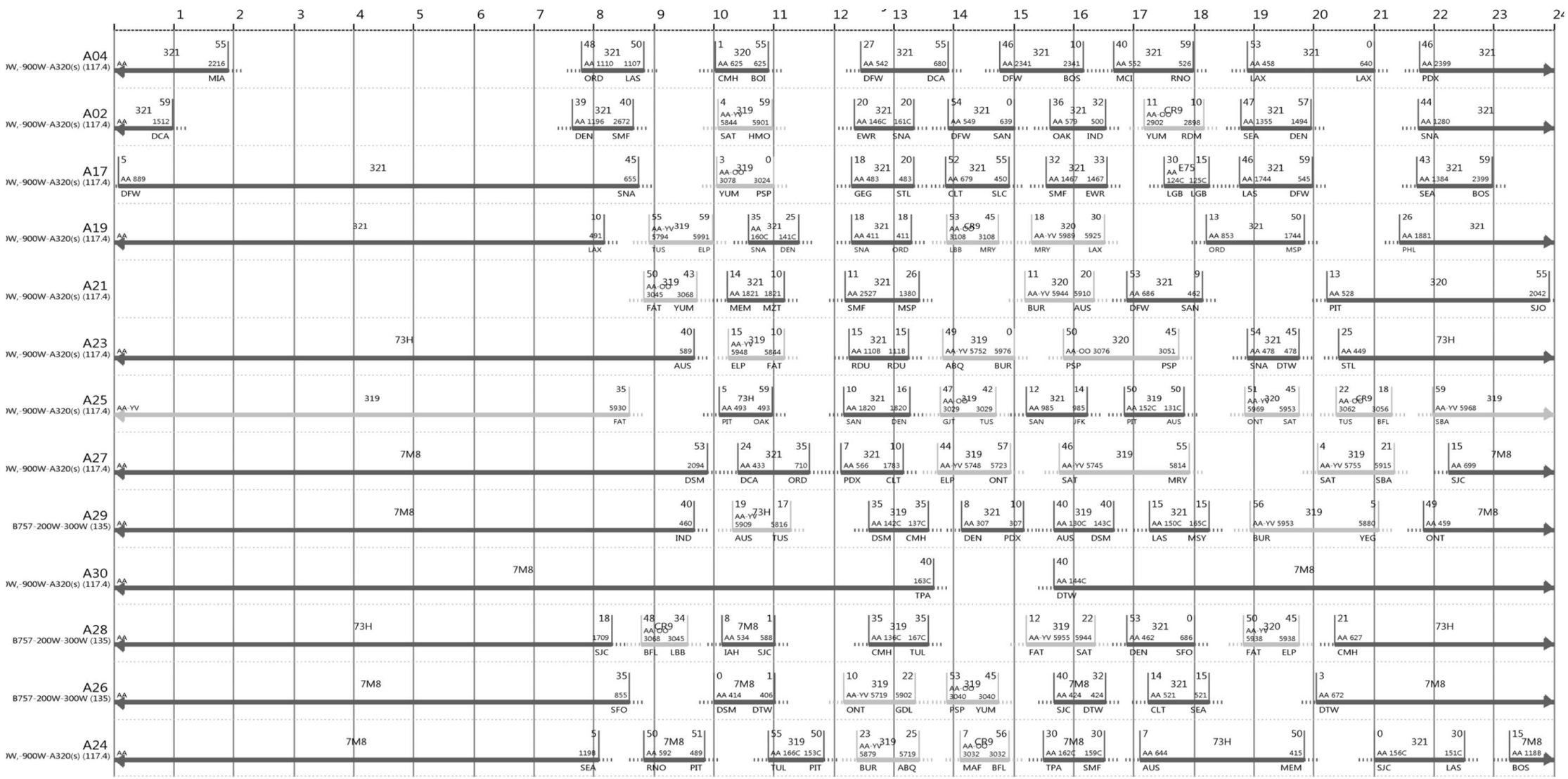


EXHIBIT C-3 PAL 3 RAMP CHARTS (9 OF 11)

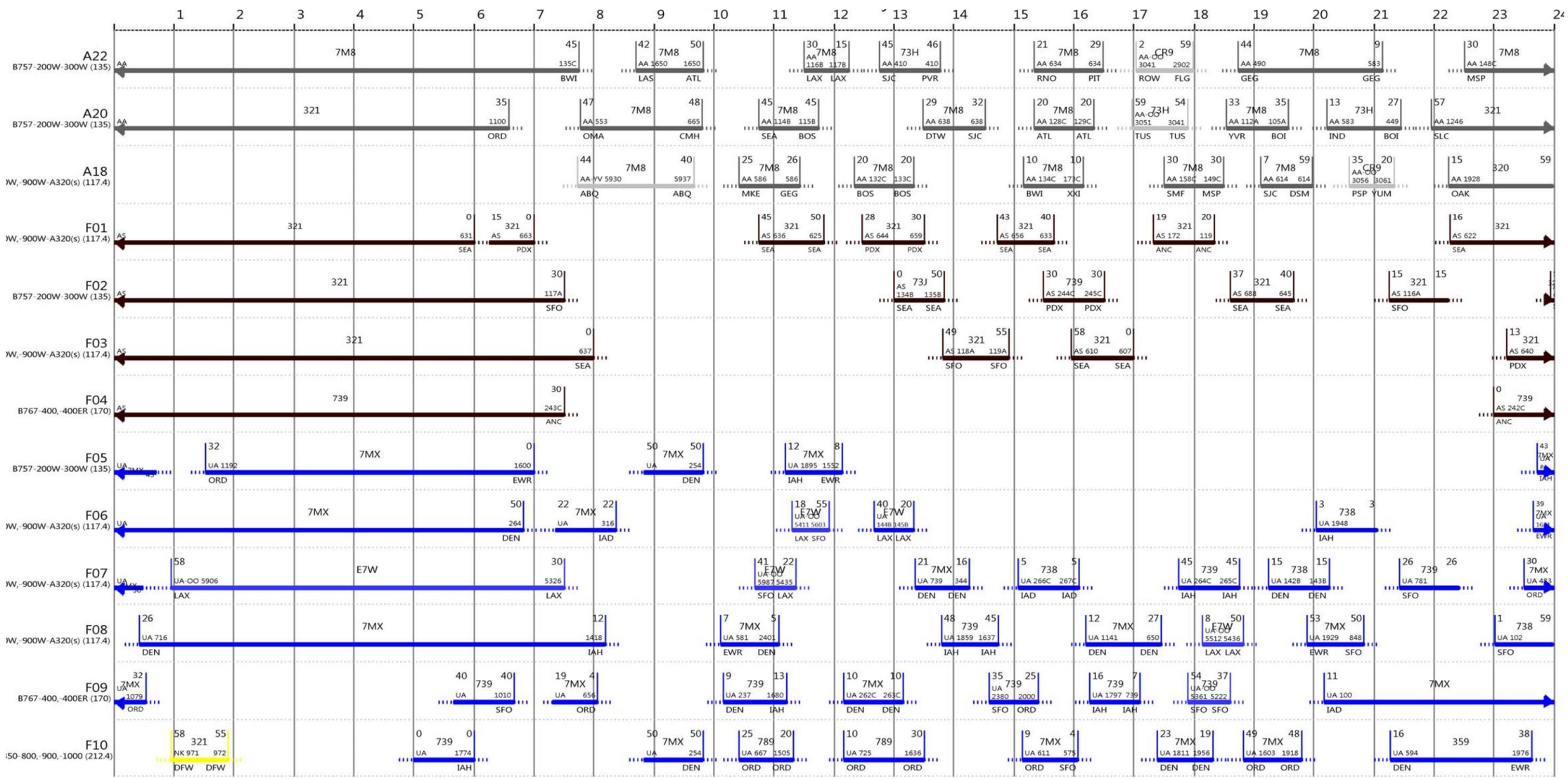


EXHIBIT C-3 PAL 3 RAMP CHARTS (10 OF 11)

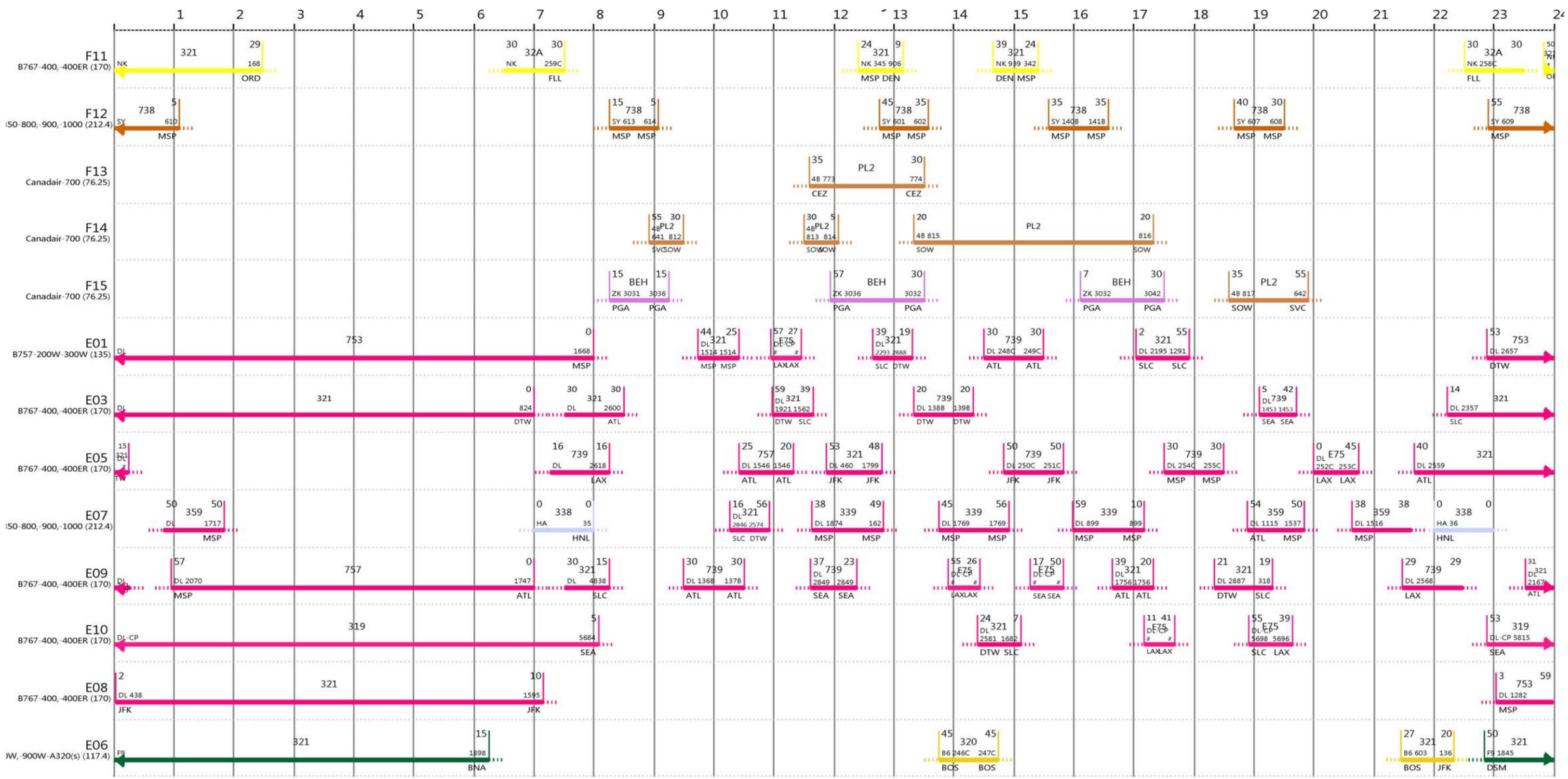


EXHIBIT C-3 PAL 3 RAMP CHARTS (11 OF 11)

