DOWNTOWN SAN JOSÉ AIRSPACE & DEVELOPMENT CAPACITY STUDY (PROJECT CAKE)

EXISTING CONDITIONS ASSESSMENT

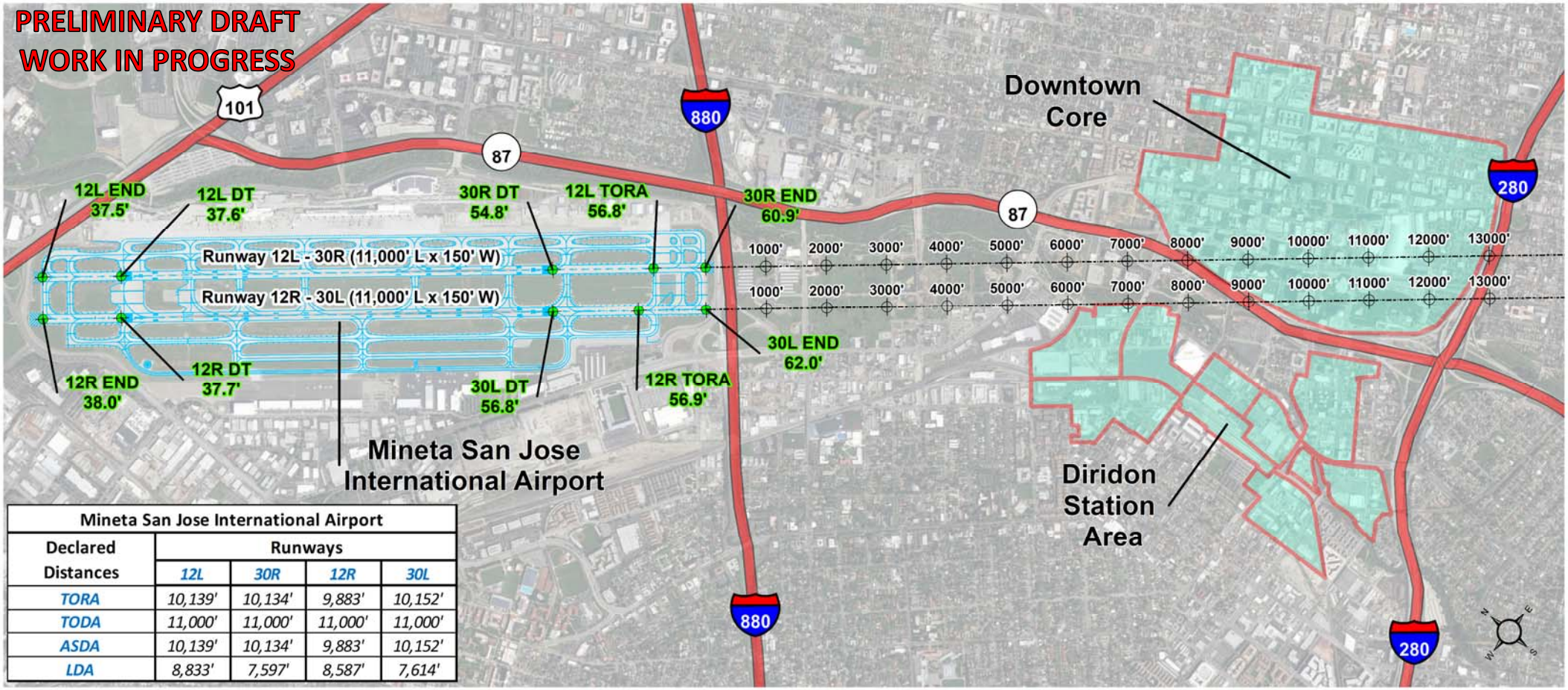


March 8, 2018

AGENDA

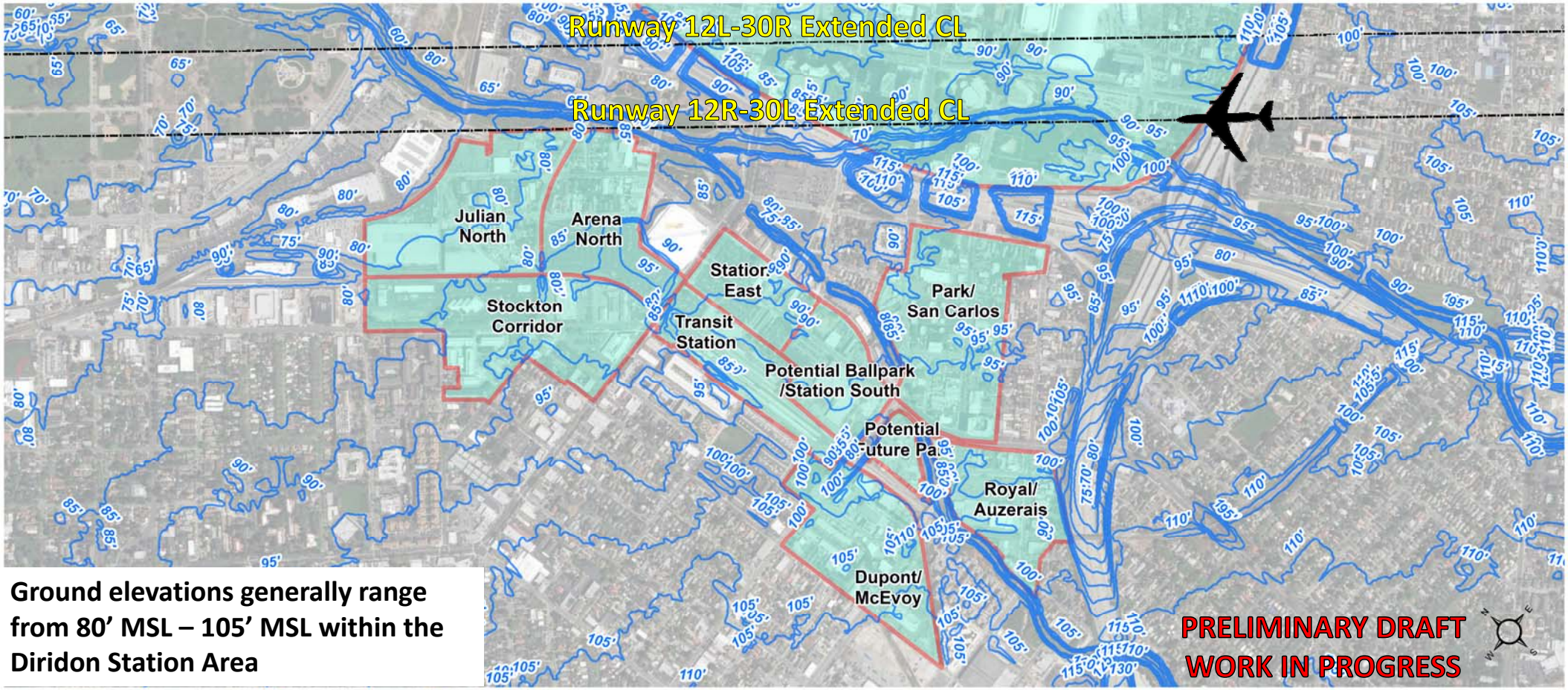
- Introduction
- One-Engine Inoperative (OEI) Overview
- SJC Aircraft Fleet and Markets
- Airspace Protection Surface Analysis
- Next Steps

EXISTING AIRPORT LAYOUT & STUDY EVALUTION AREA



Mineta San Jose International Airport				
Declared Distances	Runways			
	12L	30R	12R	30L
TORA	10,139'	10,134'	9,883'	10,152'
TODA	11,000'	11,000'	11,000'	11,000'
ASDA	10,139'	10,134'	9,883'	10,152'
LDA	8,833'	7,597'	8,587'	7,614'

DIRIDON STATION GROUND ELEVATIONS (MSL)



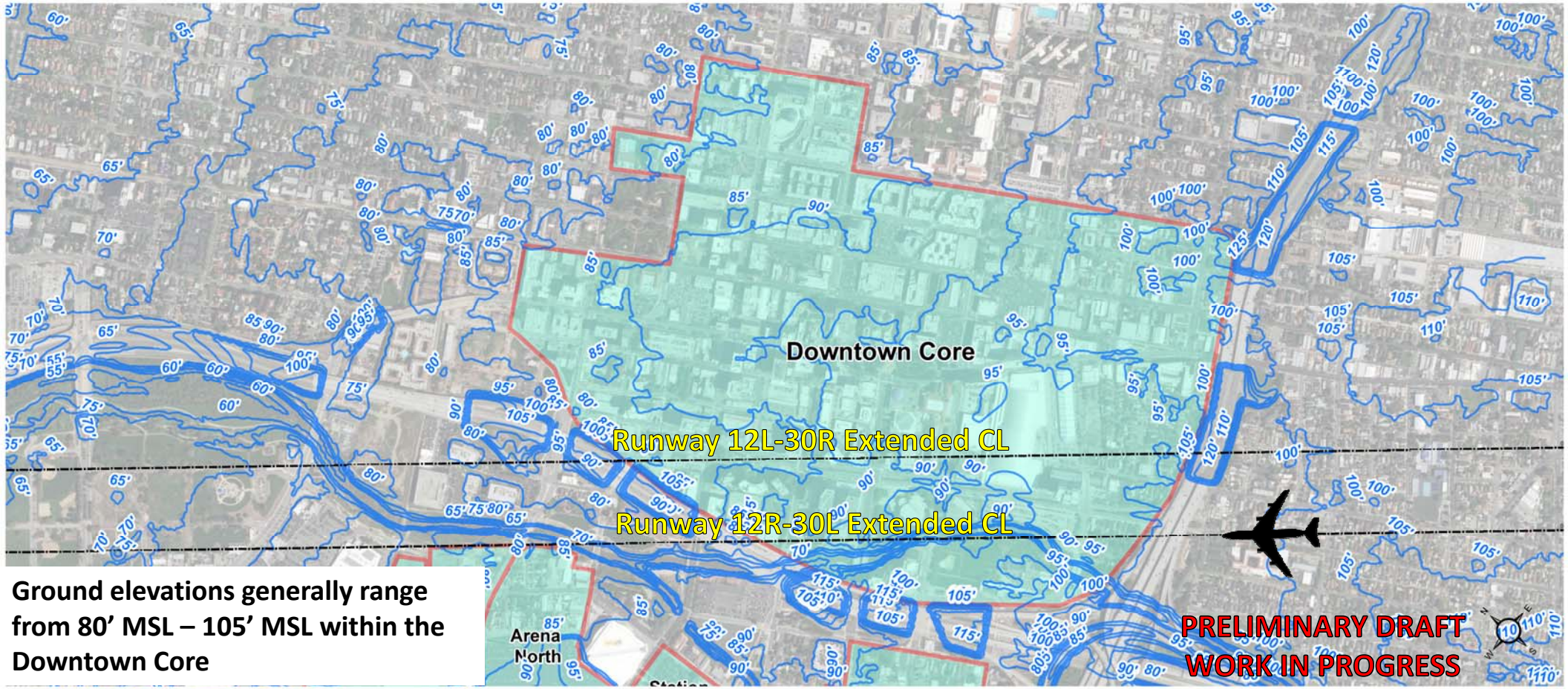
Ground elevations generally range from 80' MSL – 105' MSL within the Diridon Station Area

Source: USGS 1/3 arc-second Contour Downloadable Data Collection, 2014

Ground contour data obtained from USGC "The National Map" Staged Products Directory:

https://prd-tnm.s3.amazonaws.com/index.html?prefix=StagedProducts/Contours/Shape/

DOWNTOWN CORE GROUND ELEVATIONS (MSL)



Ground elevations generally range from 80’ MSL – 105’ MSL within the Downtown Core

Source: USGS 1/3 arc-second Contour Downloadable Data Collection, 2014

Ground contour data obtained from USGC “The National Map” Staged Products Directory:

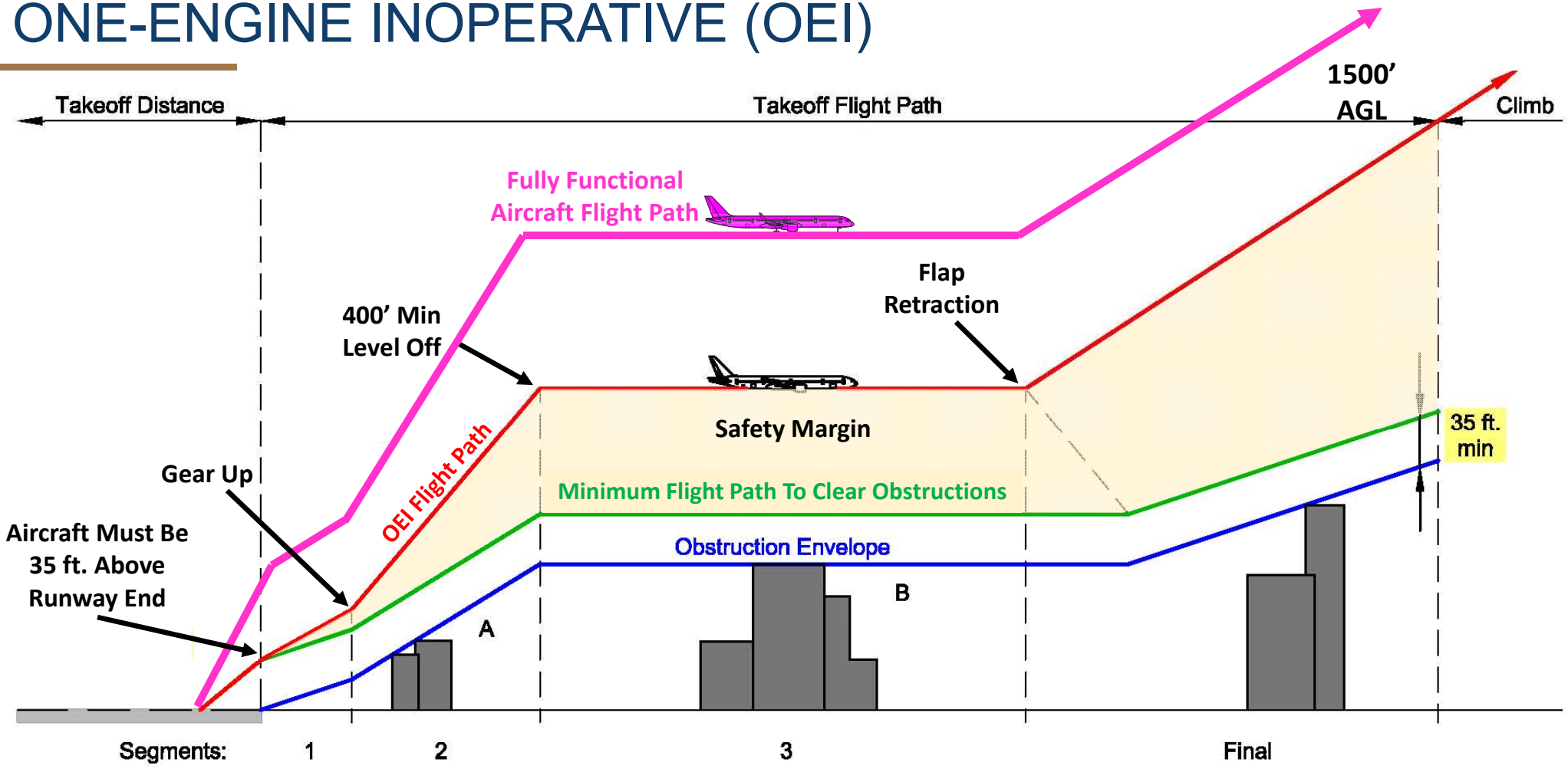
https://prd-tnm.s3.amazonaws.com/index.html?prefix=StagedProducts/Contours/Shape/

One-Engine Inoperative (OEI) Overview

ONE-ENGINE INOPERATIVE(OEI)

- Every air carrier departure must be able to clear obstacles with one engine inoperative
- Emergency procedure may or may not follow standard departure flight paths
- Not an FAA obstruction evaluation criteria
- Takes aircraft performance, weather, obstructions, and runway geometry into account
- Specific to each airline and runway end

ONE-ENGINE INOPERATIVE (OEI)



ENGINE OUT PROCEDURES

- Federal regulations dictate aircraft performance requirements
- Balances allowable passenger/cargo load and safety margins
- Provides escape routing
- Developed by the individual air carrier operators



ENGINE OUT PROCEDURE GUIDELINES

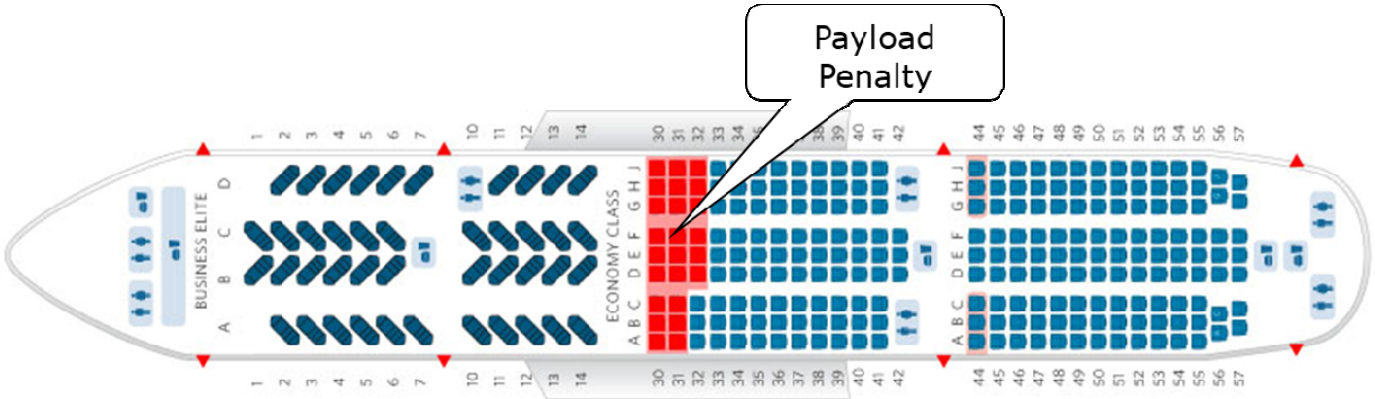
- Engine out procedure regulatory guidelines
  - FAA AC 120-91, Airport Obstacle Analysis
  - ICAO Annex 6, Operation of Aircraft
  - Airline variations of FAA and ICAO standards
  - Code of Federal Regulations Sections 25.109, 25.115, 25.121, 121.177, 121.189, 135.367, 135.379 and 135.398
- Applies to air carrier, commuter, and large cargo aircraft operators

ENGINE OUT PROCEDURE GUIDELINES

- Consider that an engine out or failure can occur at any point along the departure flight track
- Develop routing should an aircraft experience engine failure during its take-off
- Identify airspace obstacles located off of each runway which will negatively impact their operations and determine the maximum allowable take-off weight for that runway

AIRLINE RESPONSES TO OEI OBSTACLES

- Request another runway (wind, weather, air traffic permitting)
- Off-load passengers and/or cargo (weight penalty)
- Make a refueling stop
- Cancelling current day's flight
- Change aircraft
- Change OEI procedure
- Cancel air service if payload loss affects financial viability



SJC Aircraft Fleet and Markets

EXISTING FLEET AND MARKETS

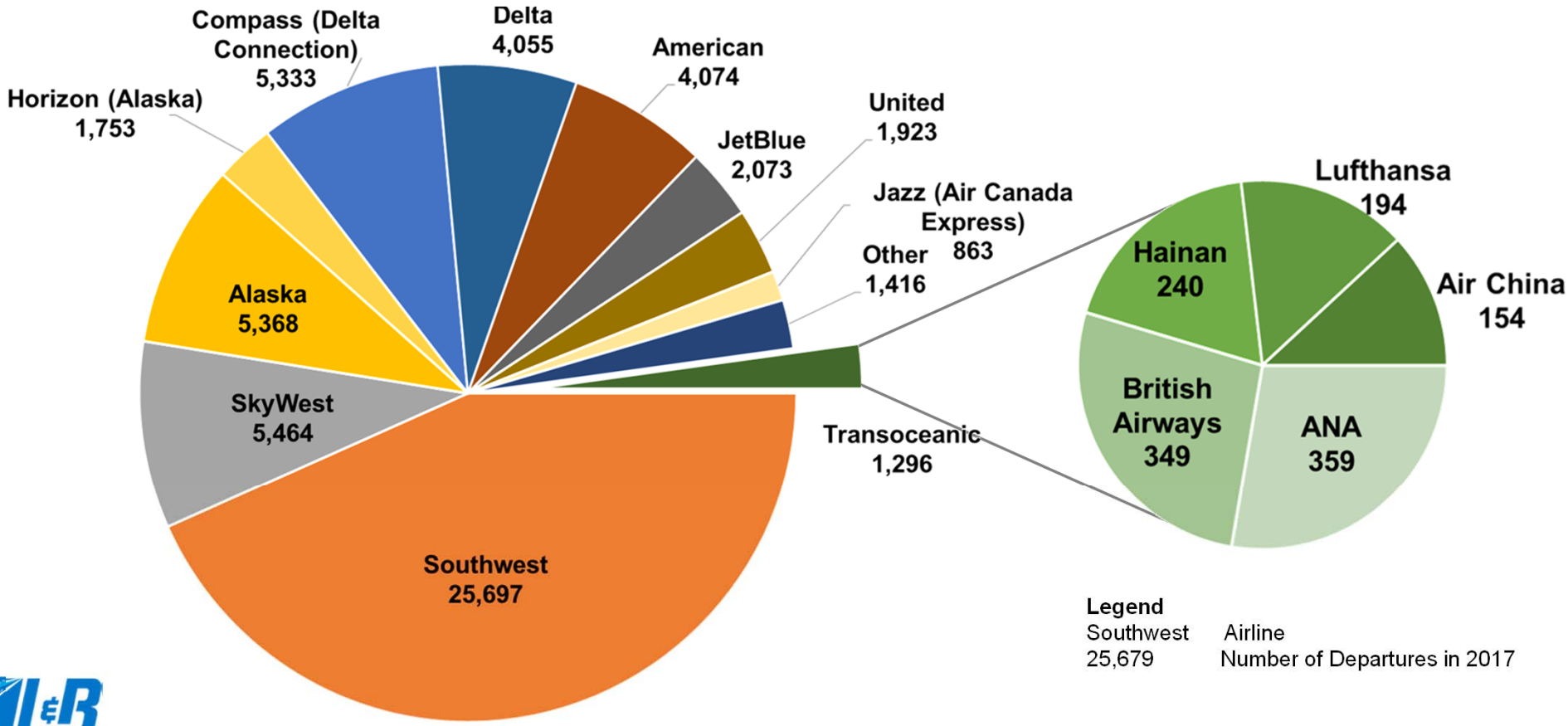
- Review aircraft operations information since 2003
- Frequency of southeast runway flow (Runways 12L/12R)

DATA SOURCES

- Runway Use Information:
  - Federal Aviation Administration (FAA) Airport System Performance Metrics (ASPM) (2003 – 2017)
- Runway Use and Aircraft Fleet Information:
  - Airport Noise Monitoring System (ANOMS) operations data (2003 – 2017)

AIRLINE MARKET SHARE – PASSENGER

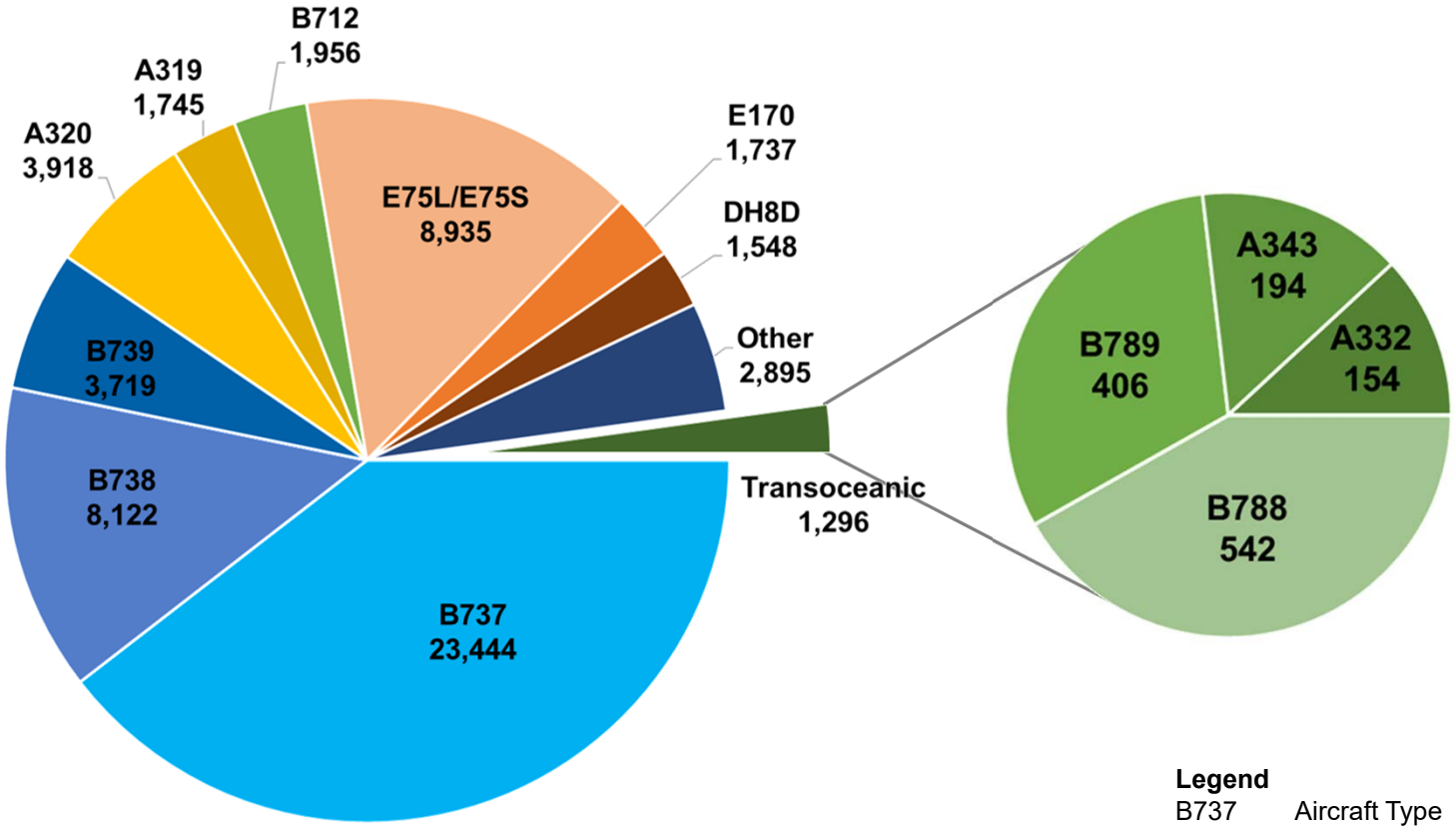
- Passenger airline market share in 2017



Source: ANOMS

AIRCRAFT PROFILE – PASSENGER

Aircraft types operating at SJC in 2017



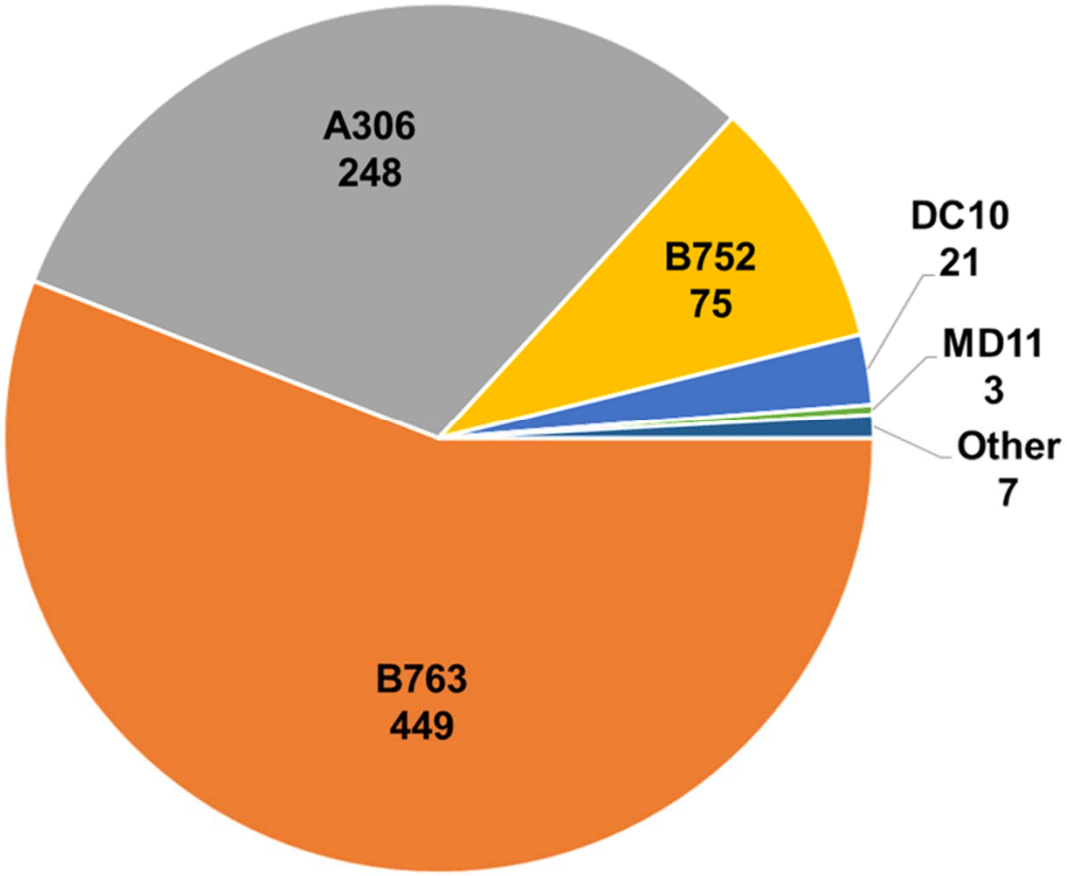
Aircraft Type Abbreviations	
A319	Airbus A319
A320	Airbus A320
A332	Airbus A330-200
A343	Airbus A340-300
B712	Boeing 717-200
B737	Boeing 737-700
B738	Boeing 737-800
B739	Boeing 737-900
B788	Boeing 787-8
B789	Boeing 787-9
DH8D	Bombardier Dash 8
E170	Embraer 170
E75L/E75S	Embraer 175

Legend
B737 Aircraft Type
23,444 Number of Departures in 2017

Source: ANOMS

AIRCRAFT PROFILE – CARGO

Aircraft types operating at SJC in 2017



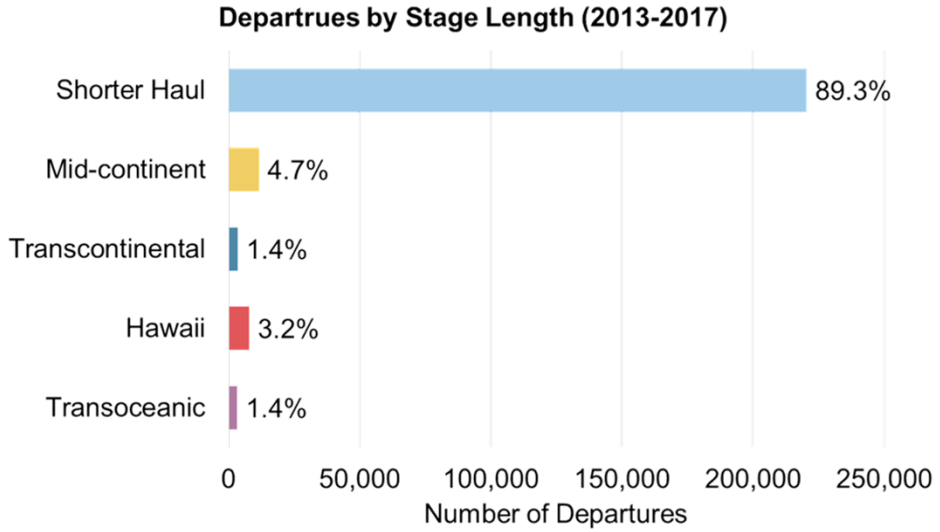
Aircraft Type Abbreviations	
A306	Airbus A300-600
B752	Boeing 757-200
B763	Boeing 767-300
DC10	McDonnell Douglas DC-10
MD11	McDonnell Douglas MD-11

Legend
B763 Aircraft Type
449 Number of Departures in 2017

Source: ANOMS

STAGE LENGTH CATEGORIES

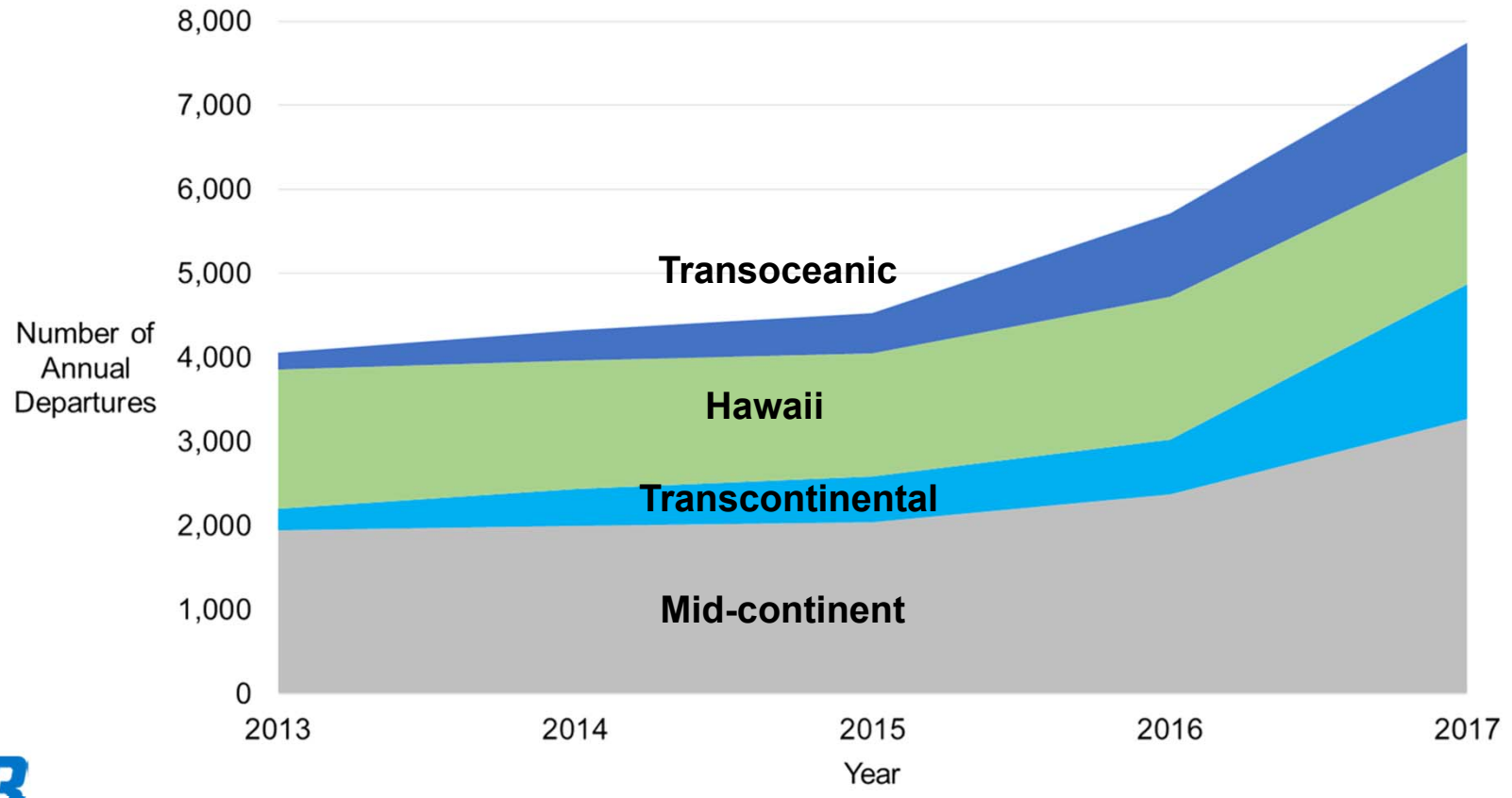
- Stage lengths grouped by nautical miles (nm)
  - Up to 1500nm: “Shorter” haul
  - 1500-2000nm: Mid-continent
    - e.g. Chicago, Atlanta
  - 2000-2500nm: Transcontinental
    - e.g. New York, Boston
  - 2000-2500nm: Hawaii
    - Honolulu, Kahului, Lihue, Kona
  - 4000nm+: Transoceanic
    - Europe (London, Frankfurt)
    - Asia (Tokyo, Beijing, Shanghai)



Source: ANOMS

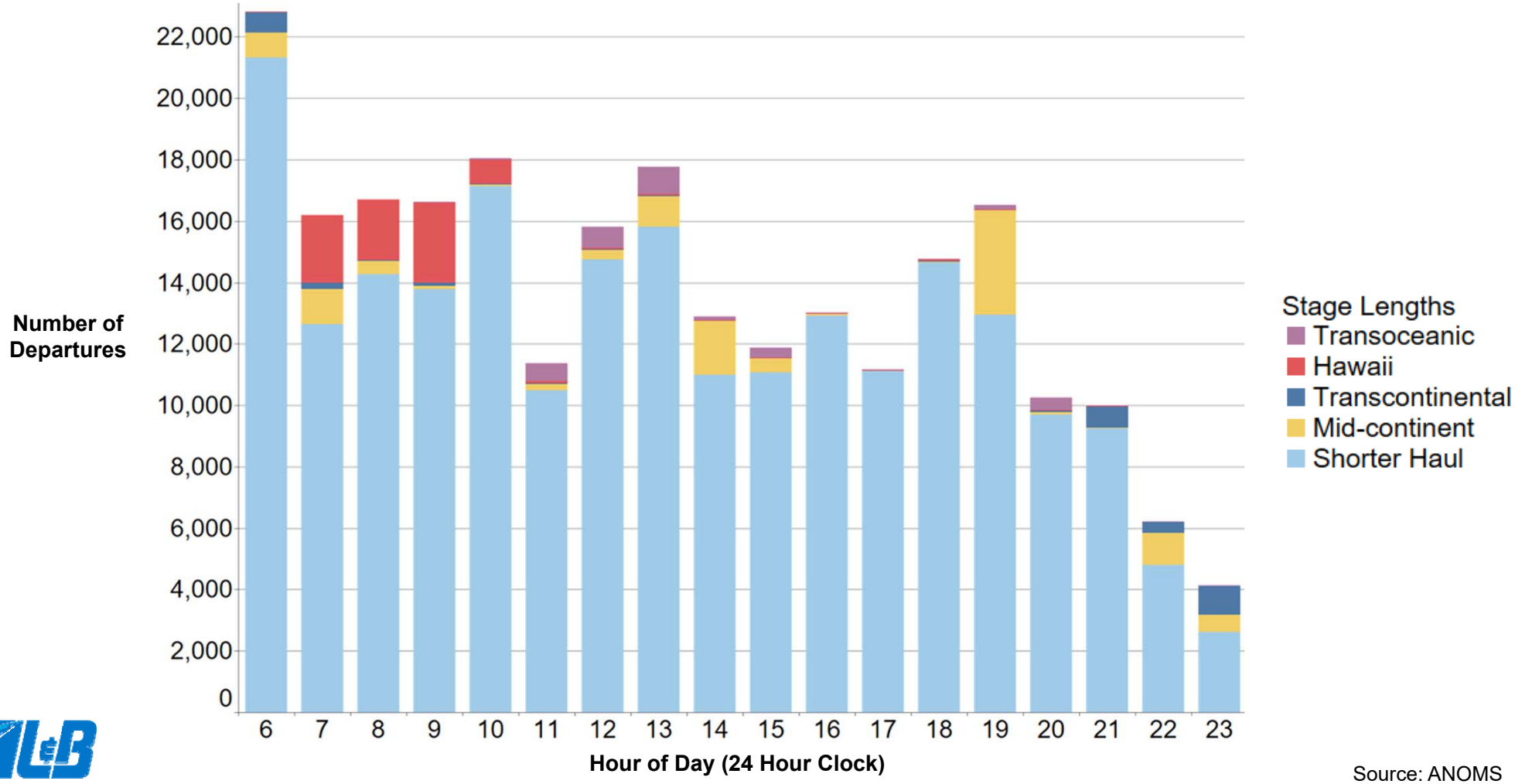
LONG HAUL DEPARTURE TREND

Significant increase in the number of long haul flights since 2013



Source: ANOMS

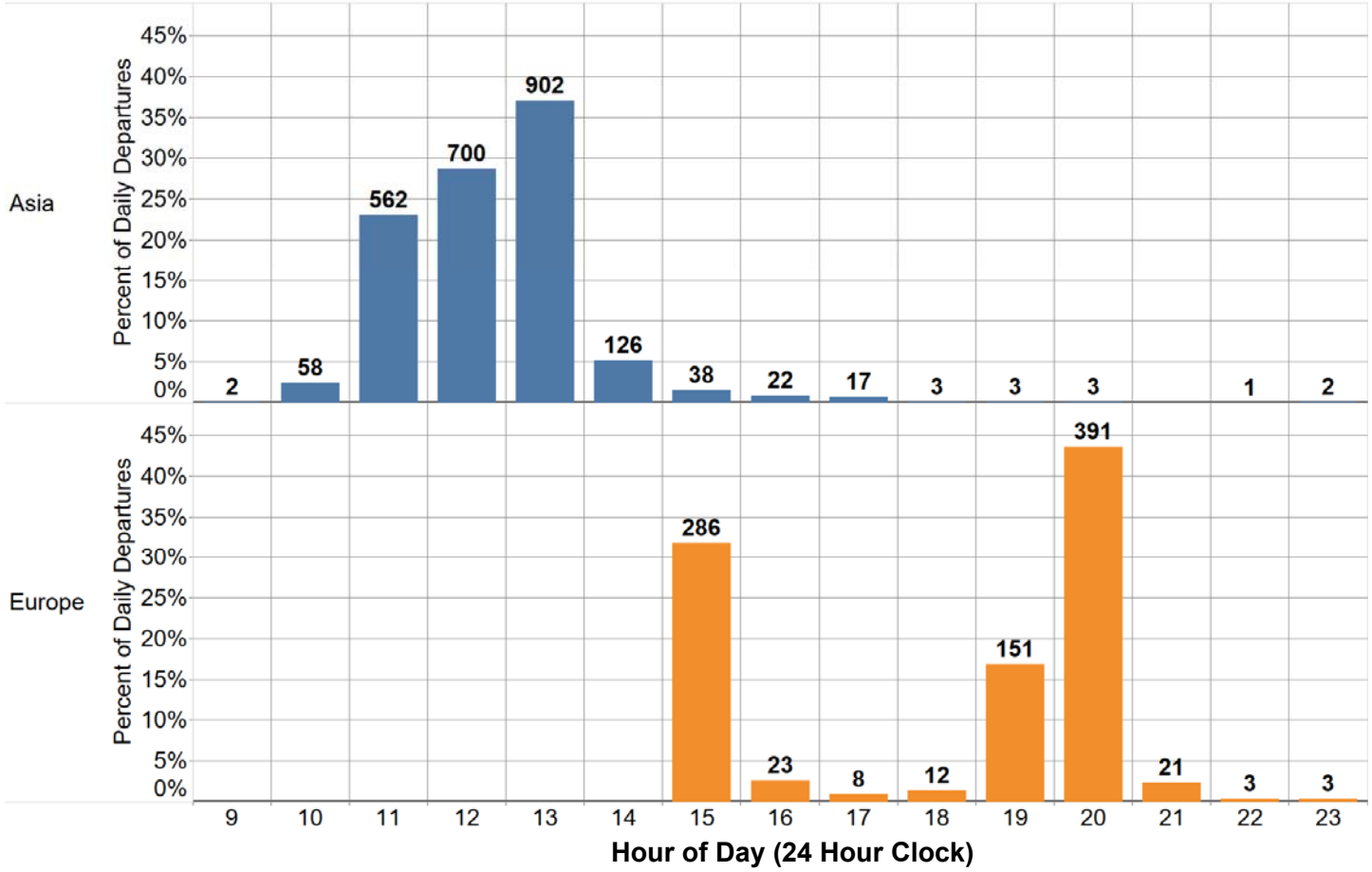
HOURLY DEPARTURES BY STAGE LENGTH (2013 TO 2017)



Source: ANOMS

DEPARTURE PATTERN BY STAGE LENGTH

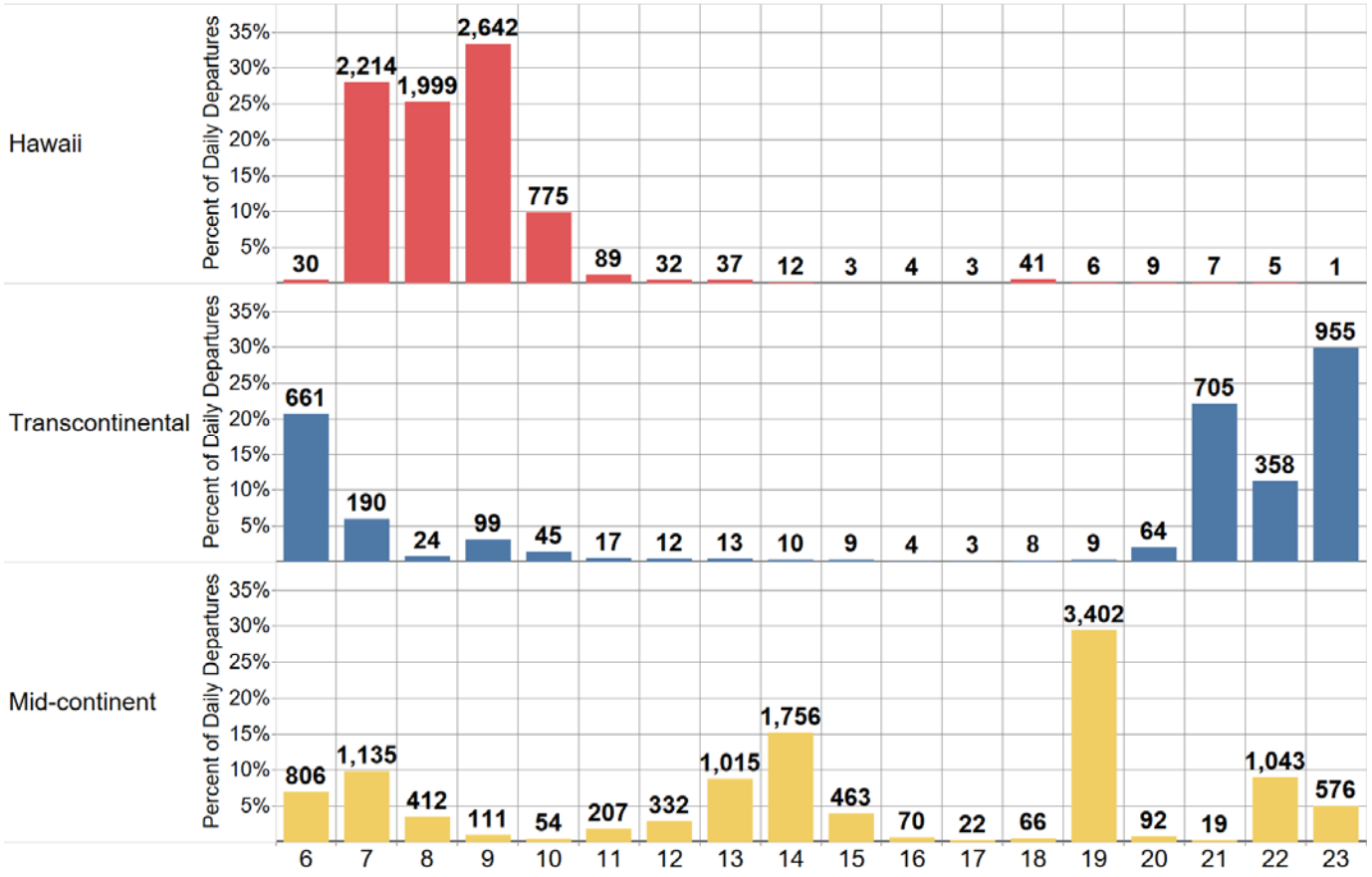
Transoceanic peak departure hours (2013 to 2017)



Source: ANOMS

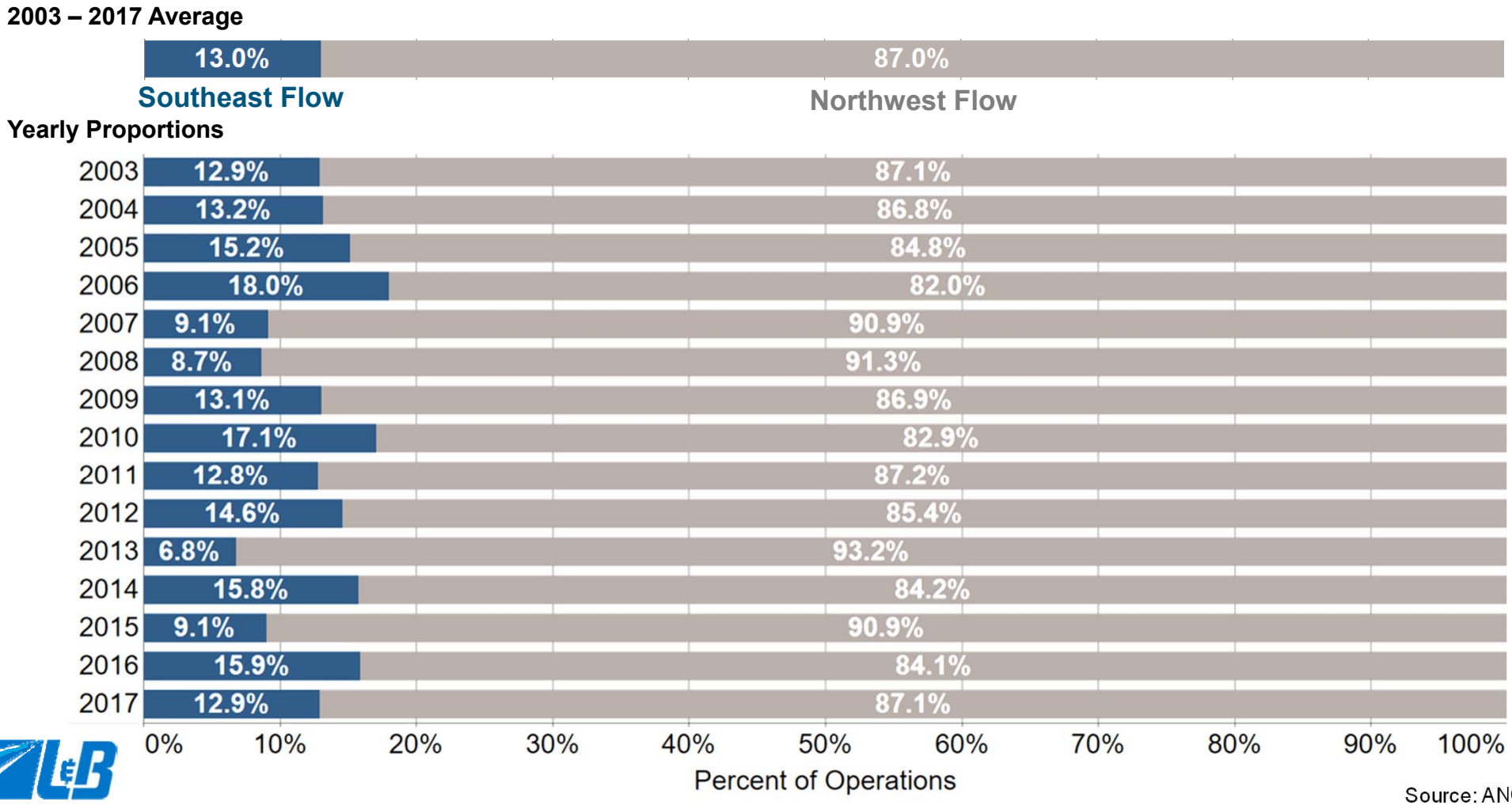
DEPARTURE PATTERN BY STAGE LENGTH

Hawaii, Transcontinental, and Mid-continent peak departure hours (2013 to 2017)



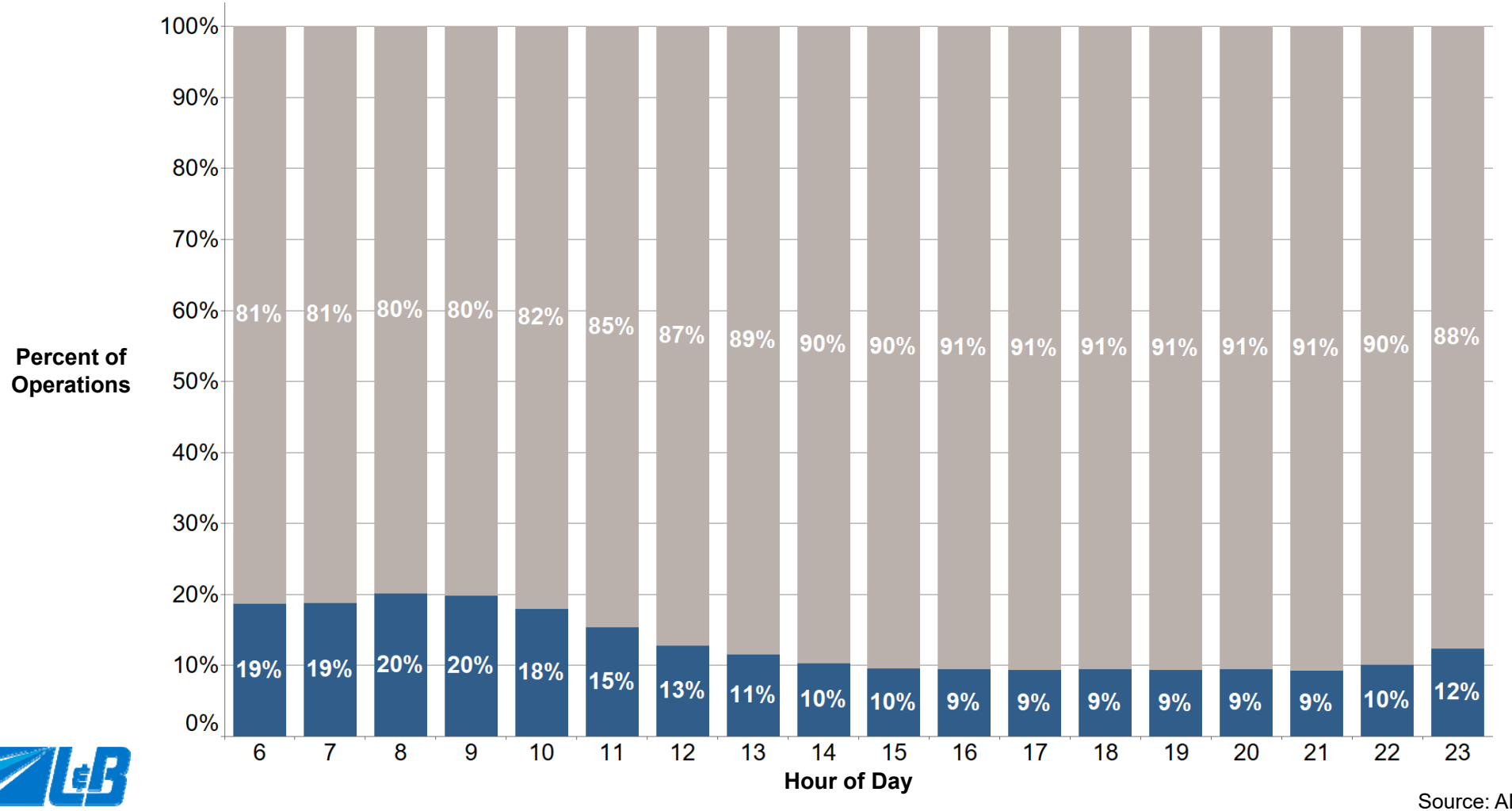
Source: ANOMS

YEARLY OPERATIONS BY FLOW



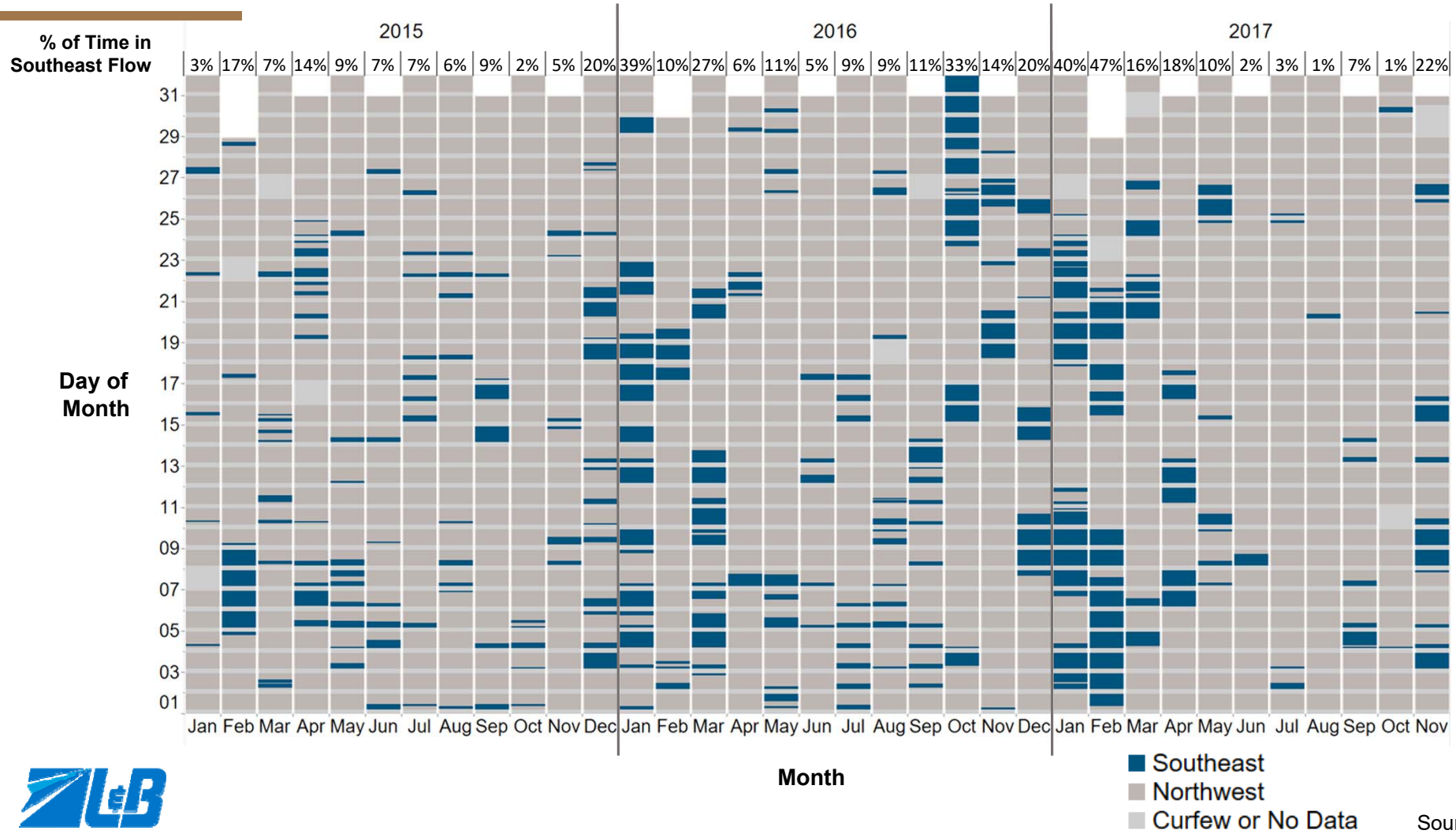
Source: ANOMS

SOUTHEAST FLOW BY HOUR OF DAY (2003 – 2017)



Source: ANOMS

FLOW BY CALENDAR HOUR



Source: FAA ASPM

SOUTHEAST FLOW

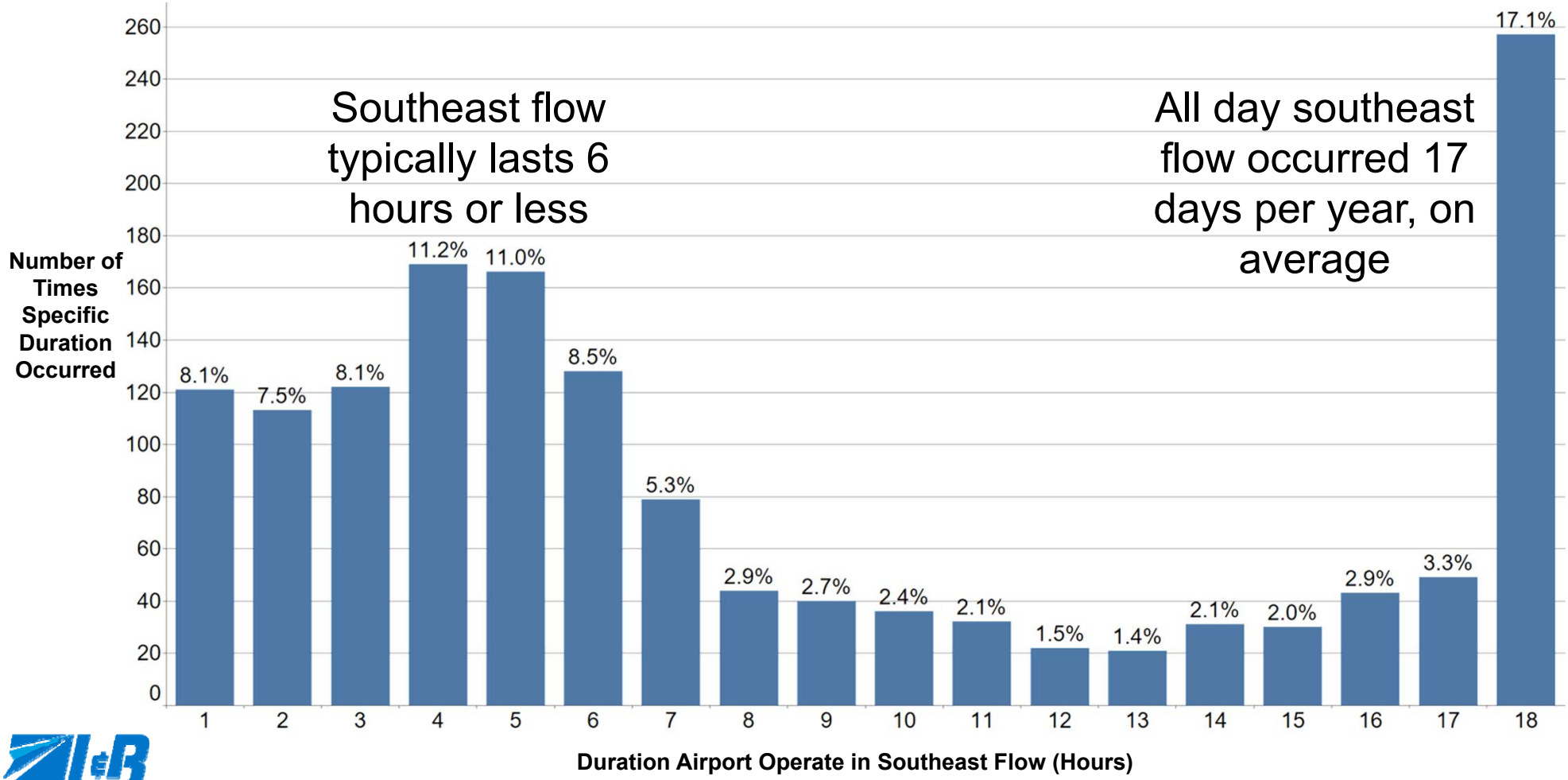
- During winter season, airfield operated in southeast flow for multiple days at a time
- On average, there are about 100 days in each year when Southeast flow occurs

Year	Number of Days When Southeast Flow Occurred
2003*	37
2004	101
2005	112
2006	129
2007	89
2008	72
2009	100
2010	127
2011	110
2012	110
2013	66
2014	119
2015	98
2016	119
2017**	87

Note:
*2013 only includes data for August - December
**2017 only includes data for January - November

Source: FAA ASPM

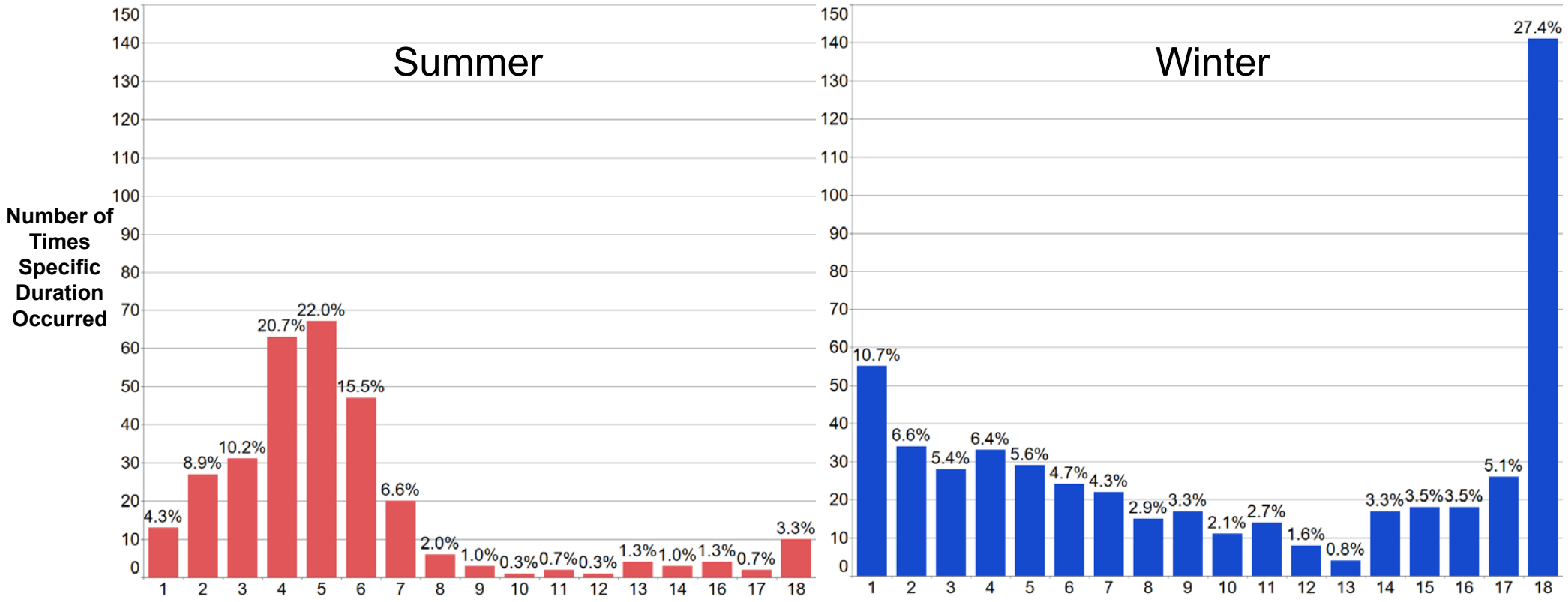
AVERAGE DURATION OF SOUTHEAST FLOW (2003 – 2017)



Source: FAA ASPM

SEASONAL DURATION OF SOUTHEAST FLOW (2003 – 2017)

Typically shorter durations during summer and longer duration during winter



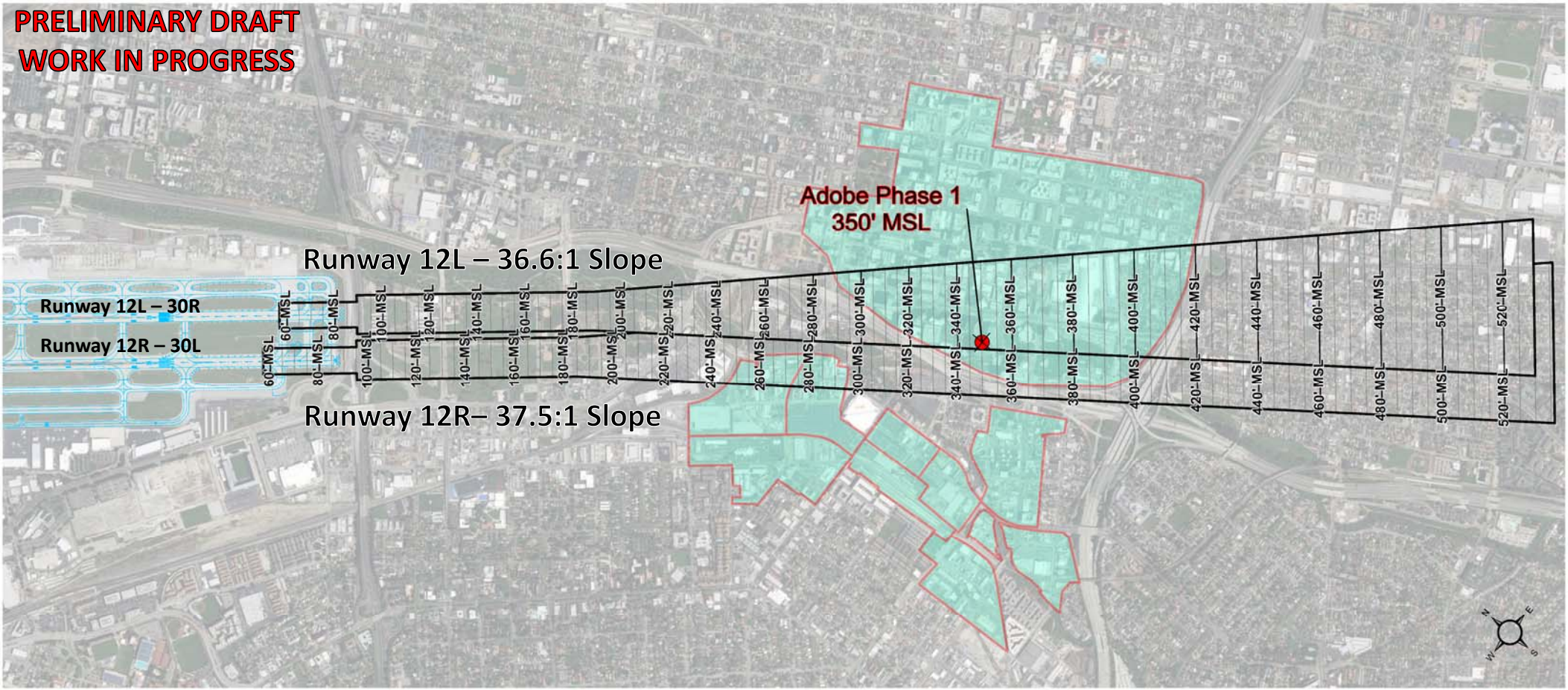
Source: FAA ASPM (June – August, December – February)

Airspace Protection Surface Analysis

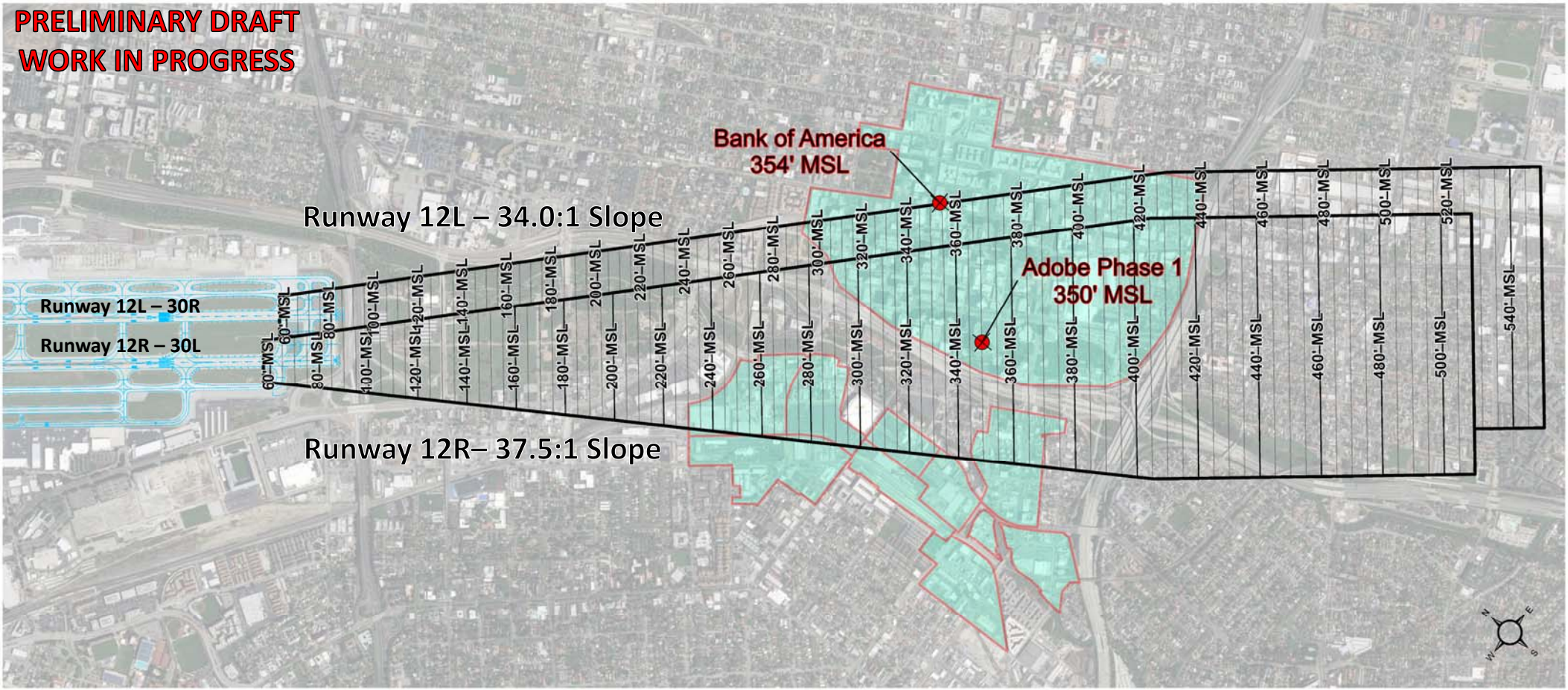
AIRSPACE SURFACES – WORK IN PROGRESS

- OEI Surfaces – Runway 12L/12R
  - FAA AC 120-91 Obstacle Accountability Area
  - ICAO OEI Surface
  - West OEI Corridor
- Initial TERPS Surfaces – Runways 12L/12R
  - TERPS Initial Climb Area Departure Surface
  - TERPS ILS Final and Missed Approach Surfaces
- Part 77 Approach, Transitional and Horizontal Surfaces

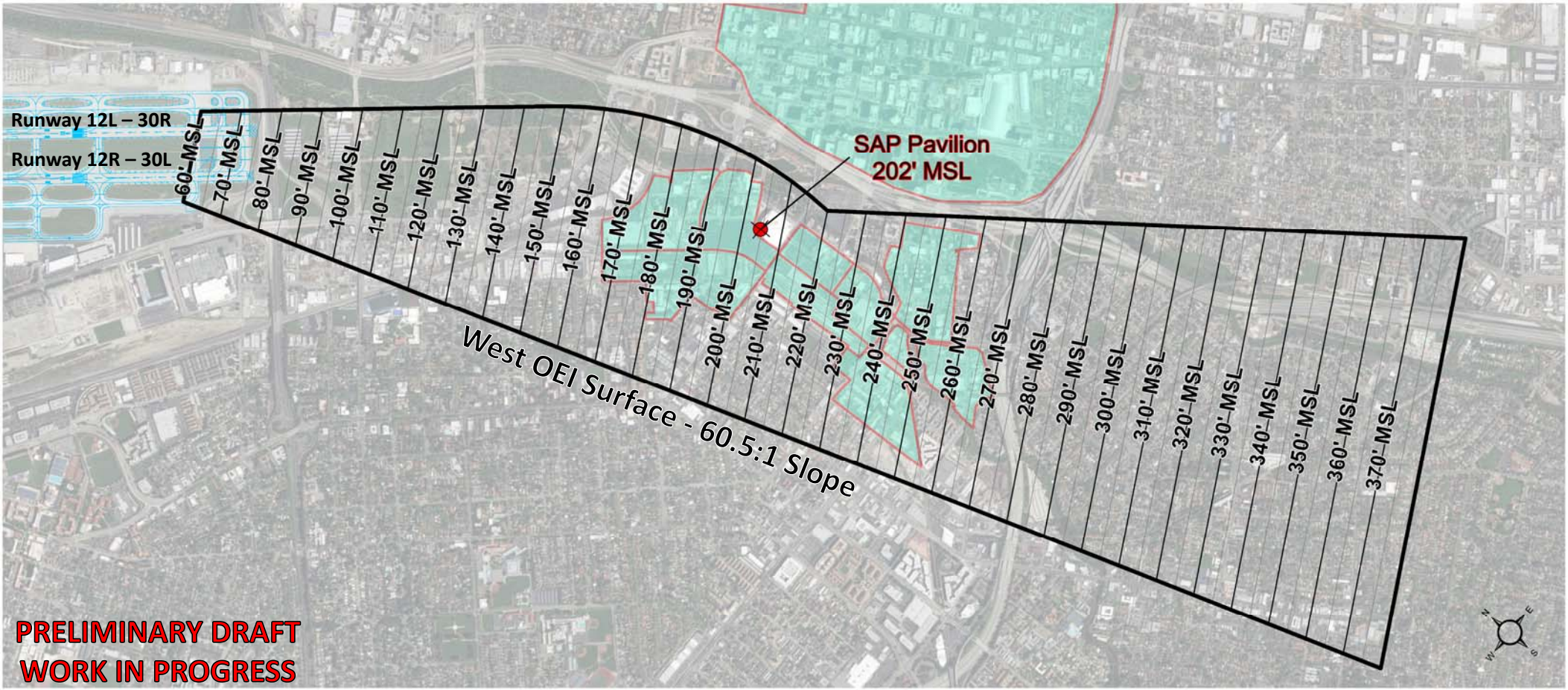
FAA AC 120-91 OEI SURFACE – RUNWAY 12L & 12R



ICAO OEI SURFACE –RUNWAY 12L & 12R COMPOSITE



WEST OEI CORRIDOR



AIRLINES OEI PROCEDURE FOR SOUTHEAST FLOW

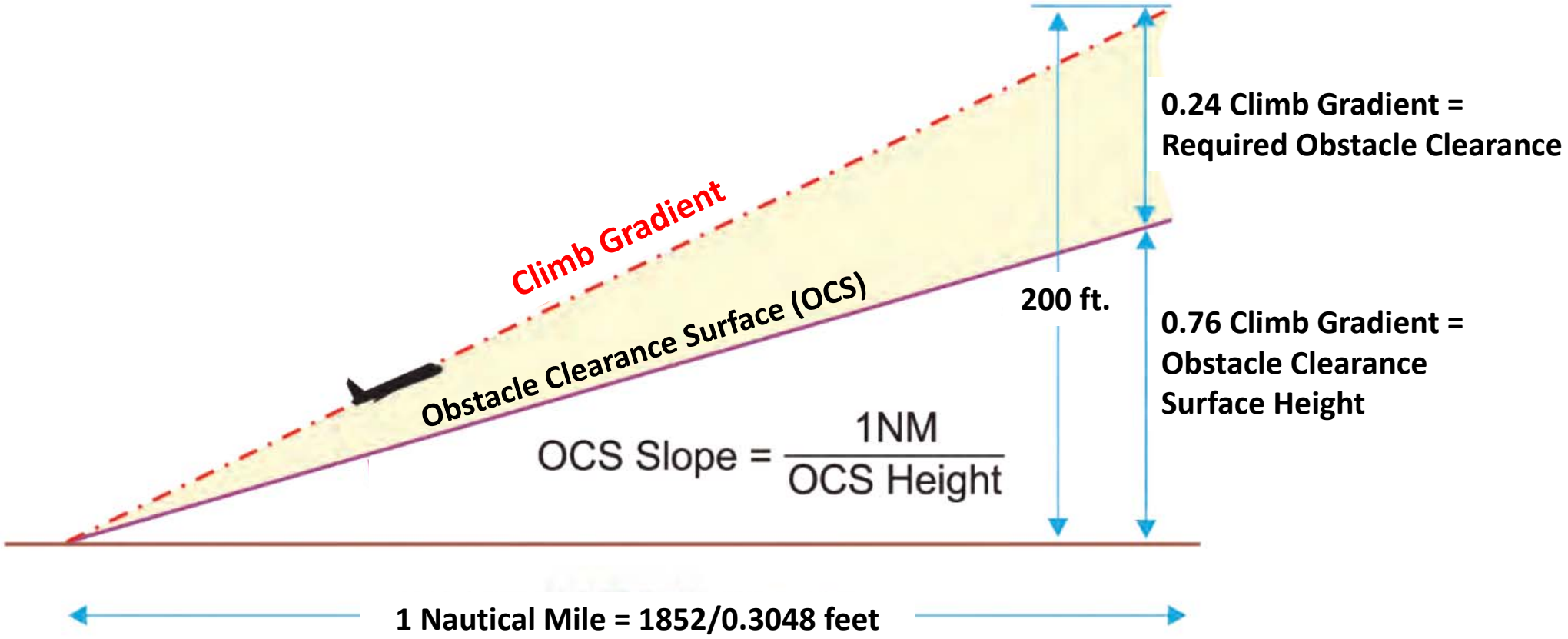
Current Airline	***OEI Procedure (12L & 12R)***
Alaska	West Turn (AC 120-91 w/course correction)
Aero Mexico	East Turn for 12L, West Turn for 12R (ICAO w/ course correction)
Air China	West Turn (ICAO w/ course correction)
American	West Turn (AC 120-91 w/course correction)
British Airways	Straight Out (ICAO) and West Turn (ICAO w/ course correction**)
Hainan	Straight Out for 12L (ICAO), West Turn for 12R (ICAO w/ course correction)
Hawaiian	West Turn (AC 120-91 w/course correction)
Air Canada	Straight Out (ICAO)
ANA	Straight Out (ICAO)
Lufthansa	Straight Out (ICAO)
Volaris	Straight Out (ICAO)
Fedex	Straight Out (ICAO)
UPS	Straight Out (ICAO)
Delta	Straight Out (AC 120-91)
JetBlue	Straight Out (AC 120-91)
Southwest	Straight Out (AC 120-91)
United	Straight Out (AC 120-91)
Frontier	TBD

** updated August 2017*
***BA utilizes the West Corridor in specific engine-out scenarios.*

WHAT IS TERPS?

- United States Terminal Standard for Terminal Instrument Procedures (TERPS) provides standards for designing and evaluating instrument flight procedures
- Used for standard aircraft operations assuming all engines are operating
- Protects the approach and departure airspace at airport from incompatible obstacles
- FAA use TERPS for 7460 obstacle evaluation process
- Multiple TERPS procedures (15 at SJC)

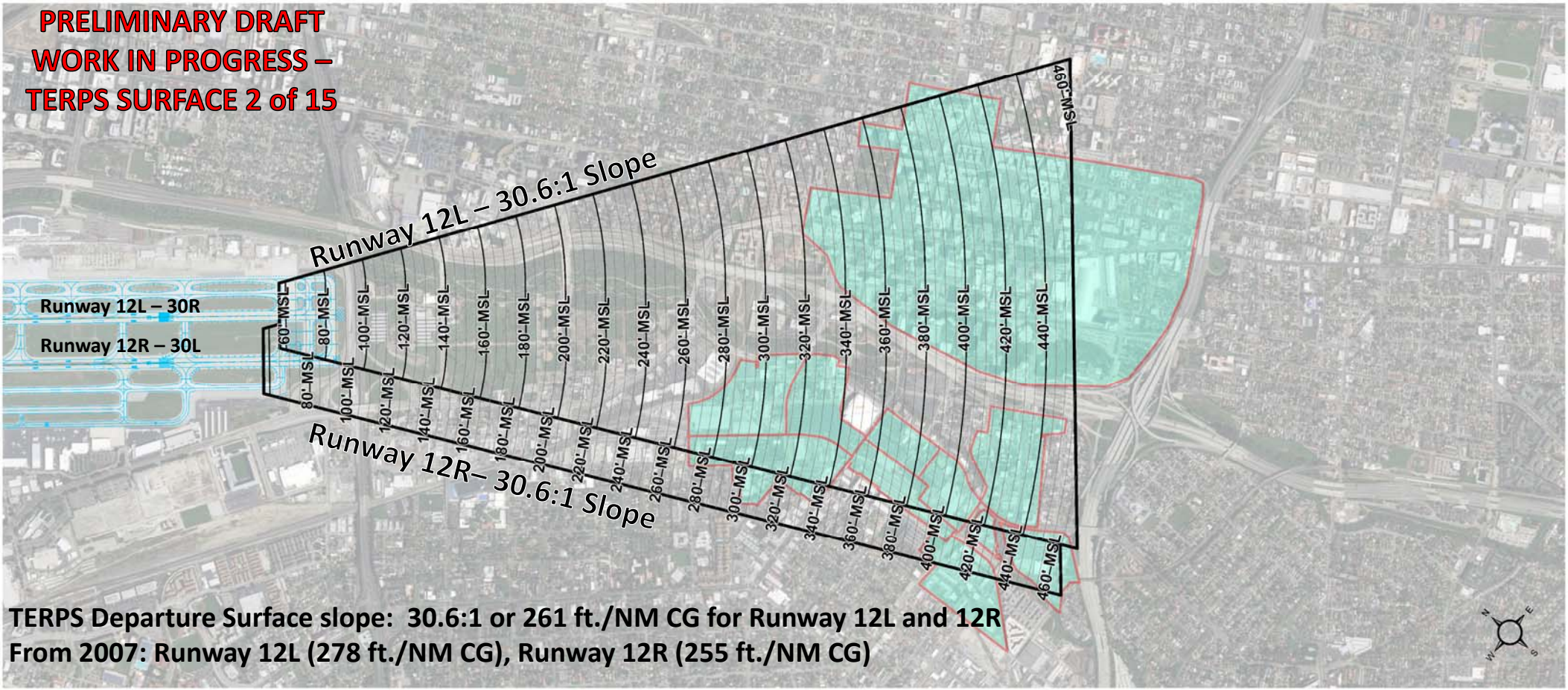
TERPS DEPARTURE SURFACE OCS CRITERIA



Source: United States Standard for Terminal Instrument Procedures (TERPS), Order 8260.3C – Chapter 2. General Criteria

TERPS DEPARTURE SURFACE – RUNWAY 12L & 12R

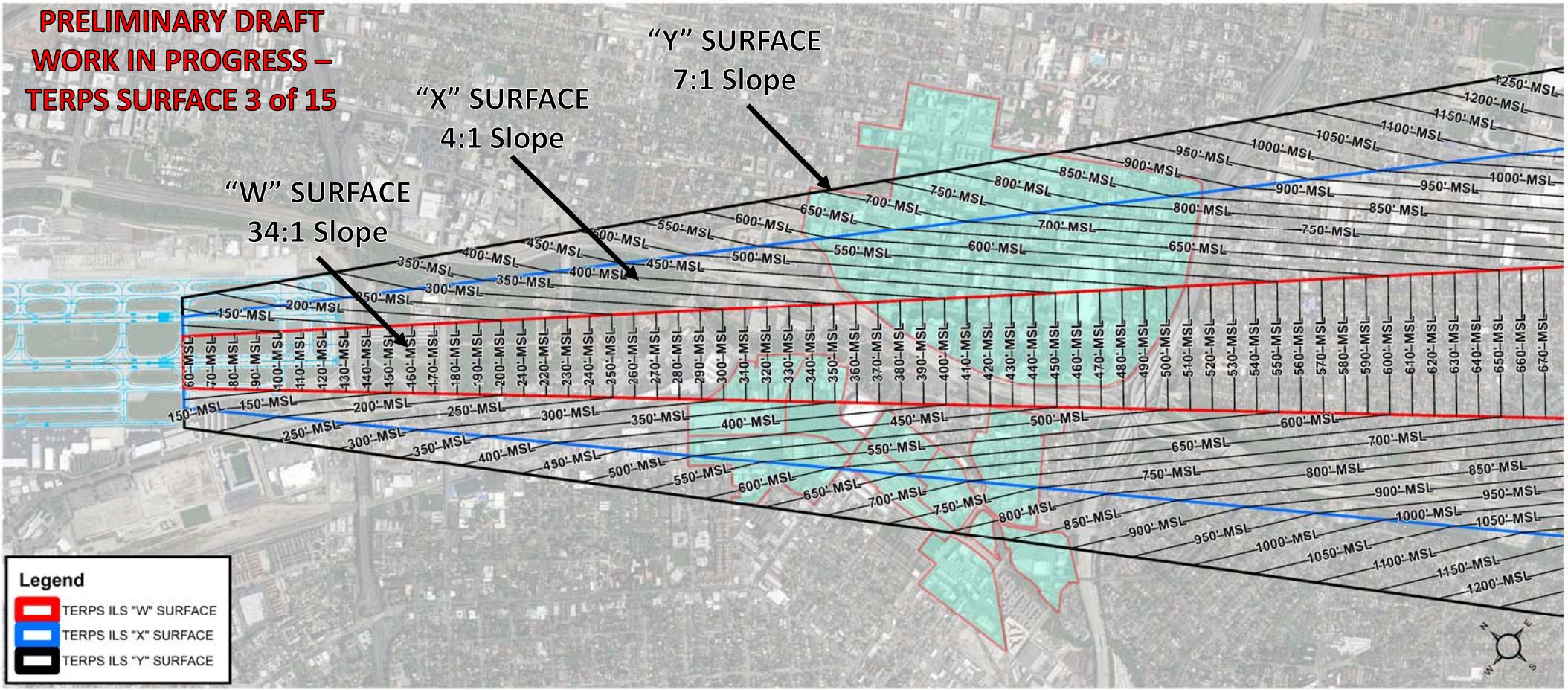
PRELIMINARY DRAFT
WORK IN PROGRESS –
TERPS SURFACE 2 of 15



TERPS Departure Surface slope: 30.6:1 or 261 ft./NM CG for Runway 12L and 12R
From 2007: Runway 12L (278 ft./NM CG), Runway 12R (255 ft./NM CG)

The 2018 TERPS 12L departure procedure is approximately 25 feet lower in overall elevation as compared to the 2007 departure procedure.
The 2018 TERPS 12R departure procedure is approximately 10 feet higher in overall elevation as compared to the 2007 departure procedure.

TERPS ILS CAT I/II – FINAL SEGMENT – RUNWAY 30L



NEXT STEPS TO BE COMPLETED BEFORE APRIL MEETING

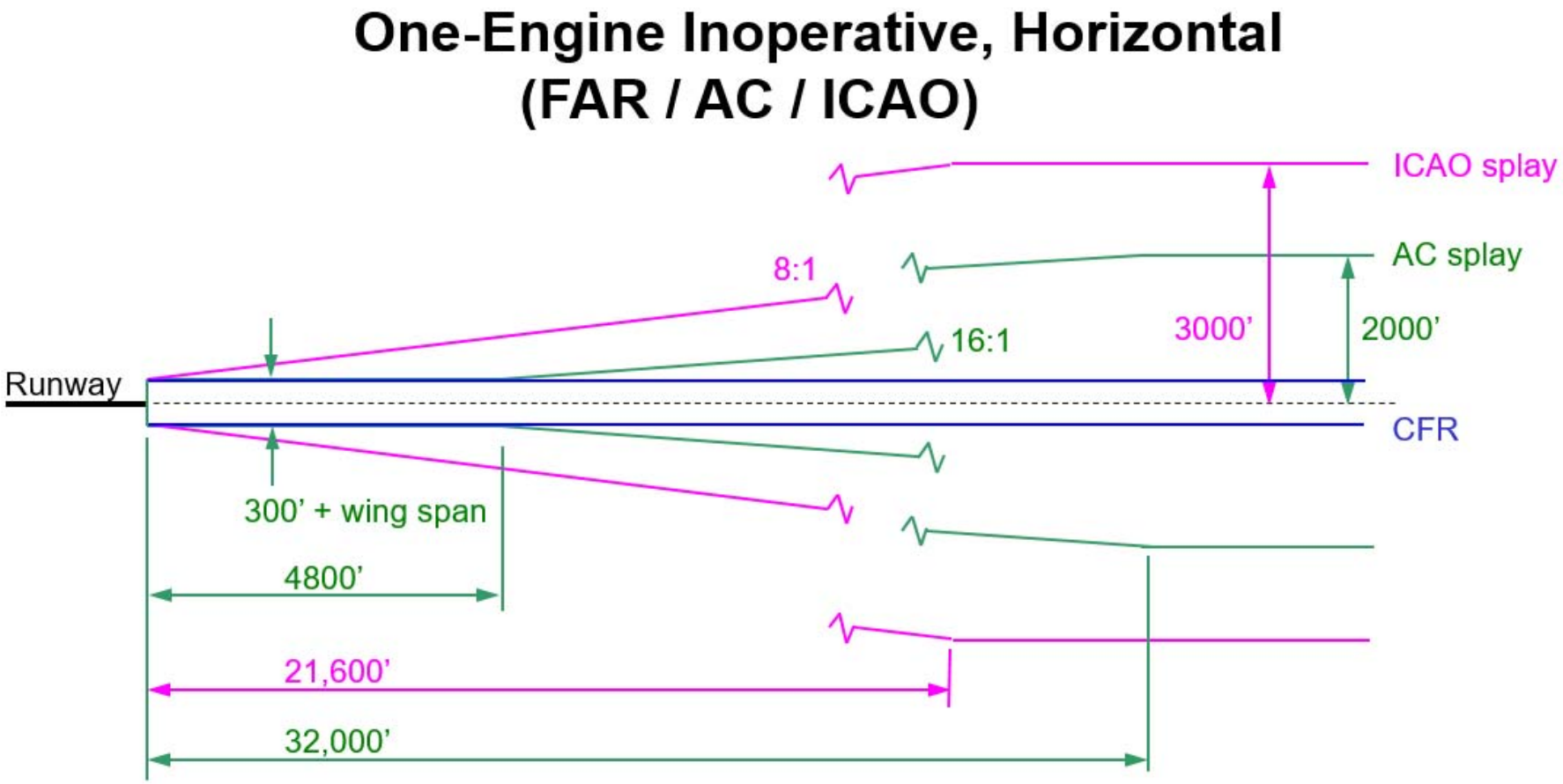
- Complete the analysis of all 15 TERPS surfaces
- Begin composite of TERPS surfaces
- Complete the analysis of the OEI surfaces
- Begin composite of OEI and TERPS surfaces
- Allowable height assessment for Downtown and Diridon Station development
- Potential OEI case studies
- Economic analysis data collection

POTENTIAL OEI CASE STUDIES

- Miami International Airport
- Las Vegas McCarran International Airport
- Phoenix Sky Harbor International Airport
- Boston Logan International Airport
- Fort Lauderdale Hollywood International Airport
- San Francisco International Airport

BACKGROUND SLIDES

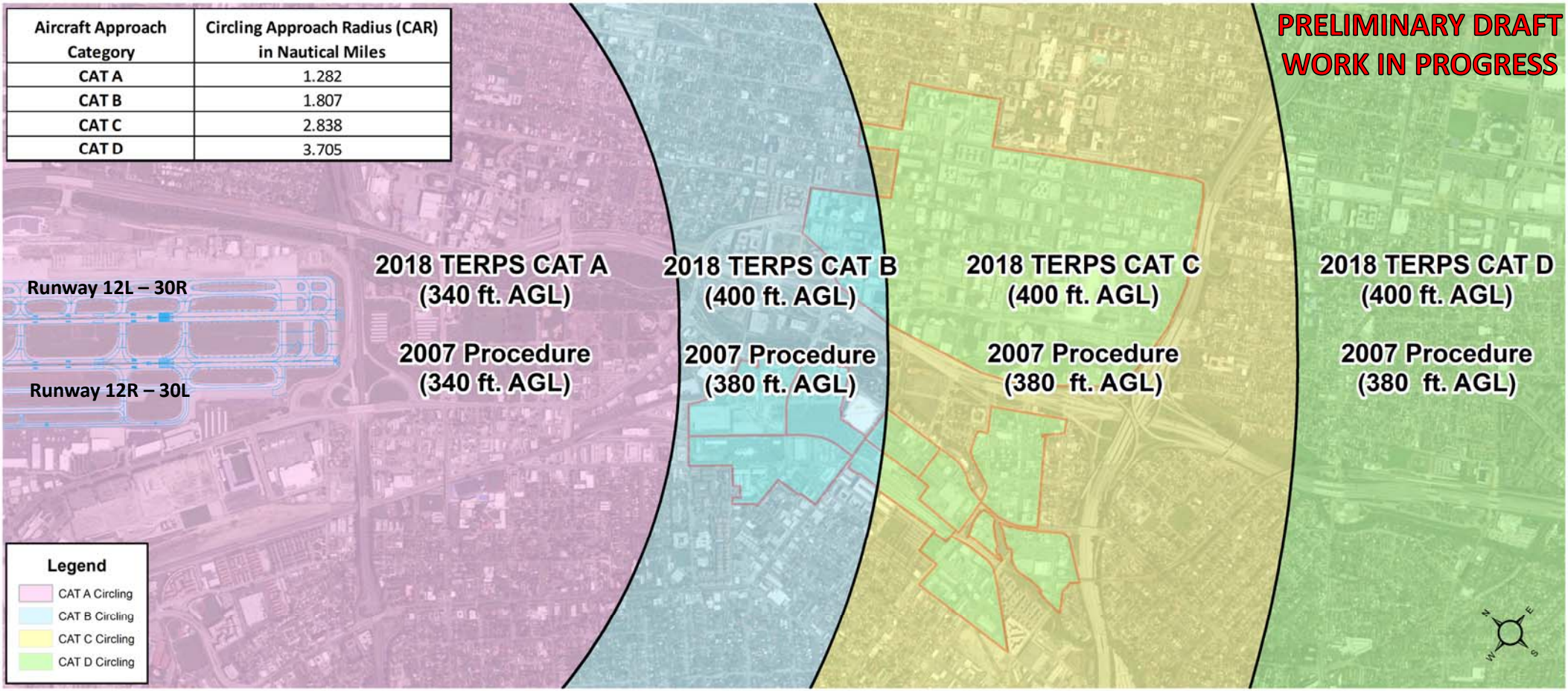
ONE-ENGINE INOPERATIVE(OEI)



Source: Airport Obstacle Analysis – FAA AFS-400 – August 3, 2006

TERPS NON-PRECISION APPROACH CIRCLING MINIMUMS

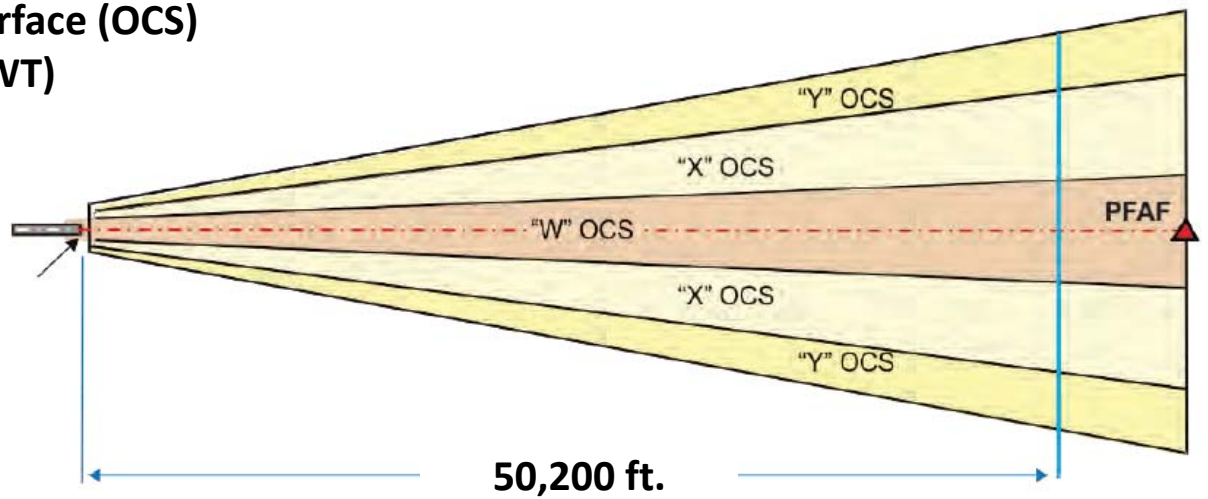
Aircraft Approach Category	Circling Approach Radius (CAR) in Nautical Miles
CAT A	1.282
CAT B	1.807
CAT C	2.838
CAT D	3.705



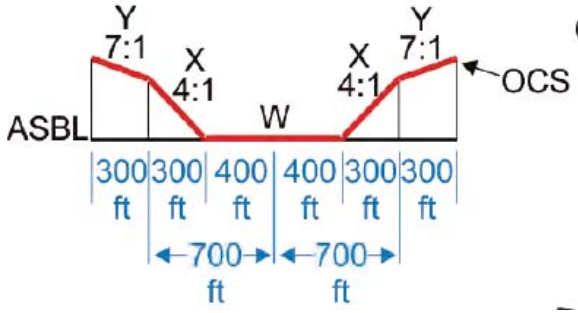
The 2018 CAT B, C and D circling minimums have increased 20 feet as compared to the 2007 circling minimums.

TERPS ILS CAT I/II – FINAL SEGMENT – RUNWAY 30L

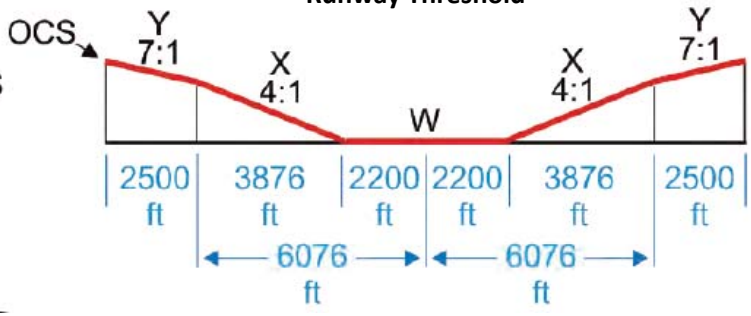
Obstacle Clearance Surface (OCS)
Runway Threshold (RWT)



Cross Section At 200 ft. from Runway Threshold



Cross Section At 50,200 ft. from Runway Threshold



Source: United States Standard for Terminal Instrument Procedures (TERPS), Order 8260.3D – Chapter 10. Precision Approach and LDA with Glide Slope

LONG HAUL AIRCRAFT COMPOSITION

- Transoceanic

Aircraft	Airlines	Destinations	Number of Departures in 2017
B788	ANA, Hainan	Tokyo, Beijing	542
B789	British Airways, Hainan	London, Beijing	406
A343	Lufthansa	Frankfurt	194
A332	Air China	Shanghai	154

- Transcontinental

Aircraft	Airlines	Destinations	Number of Departures in 2017
B737/738	Alaska, United, Southwest	Newark, Baltimore	794
A320	JetBlue	New York, Boston	516
B739	Alaska, United	Newark	136
A321	JetBlue	New York	124

- Hawaii

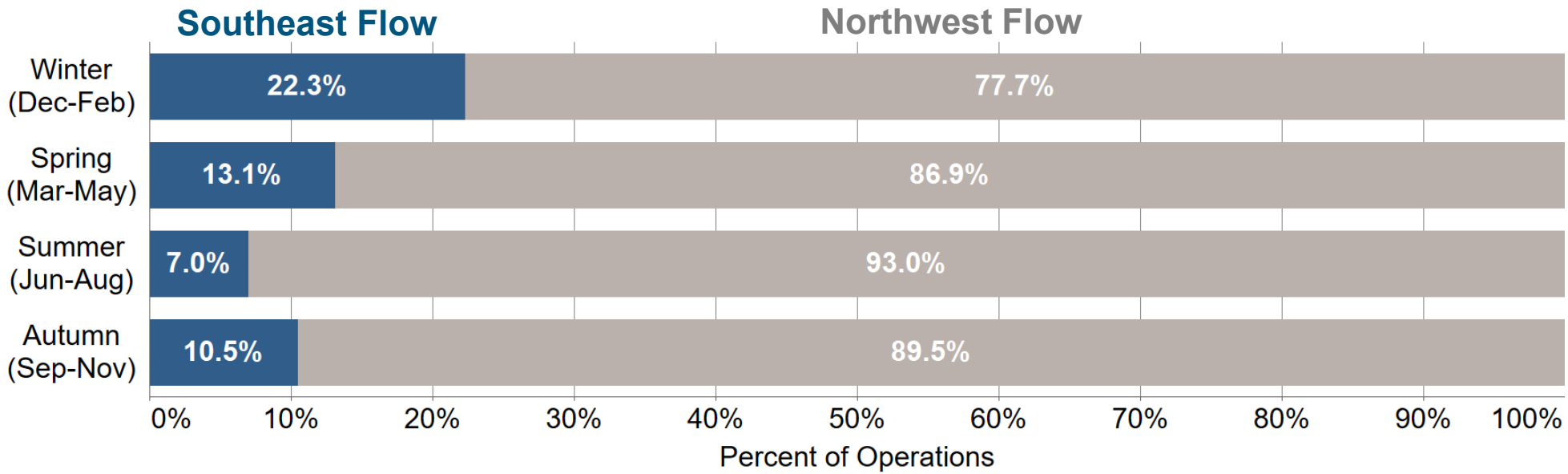
Aircraft	Airlines	Destinations	Number of Departures in 2017
B738	Alaska	Honolulu, Kahului, Lihue, Kona	700
B763	Hawaiian	Honolulu, Kahului	647
B739	Alaska	Honolulu, Kona	219

Source: ANOMS

WIDE-BODY AIRCRAFT SEAT COUNT

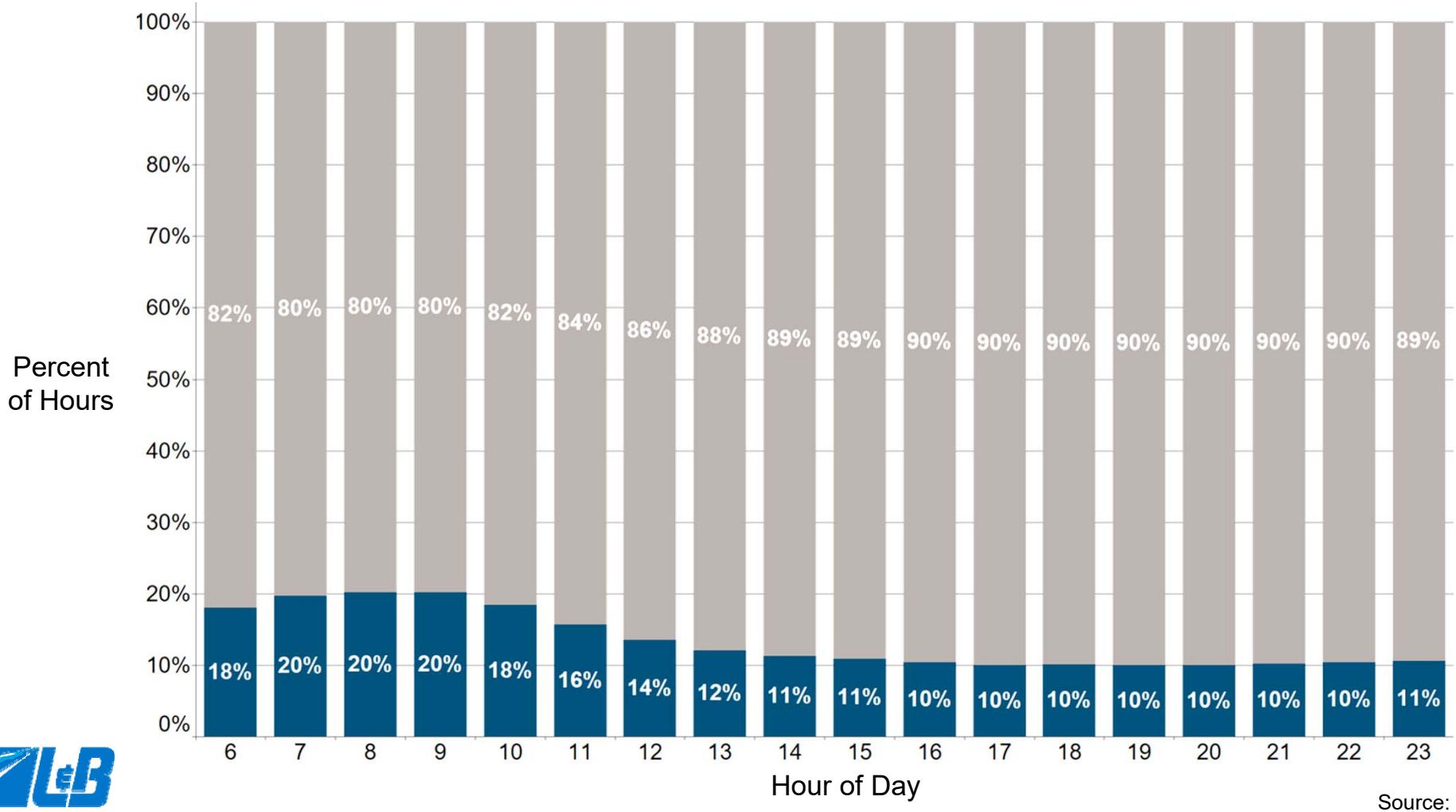
Source: ANOMS

SEASONAL OPERATIONS BY FLOW (2003 – 2017)



Source: ANOMS

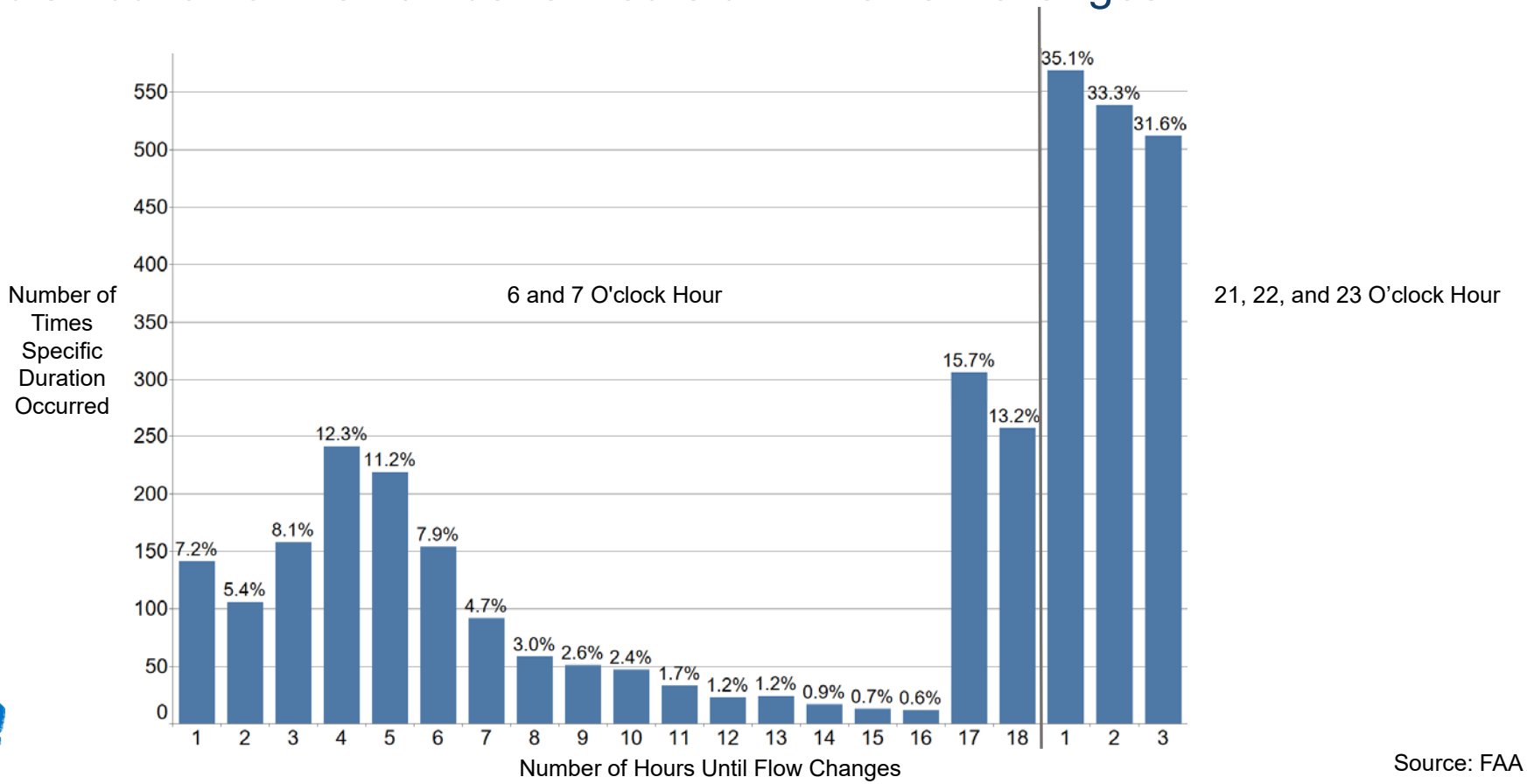
SOUTHEAST FLOW BY HOUR OF DAY (2003 – 2017)



Source: FAA ASPM

EXPECTED FLOW DURATION (2003 – 2017)

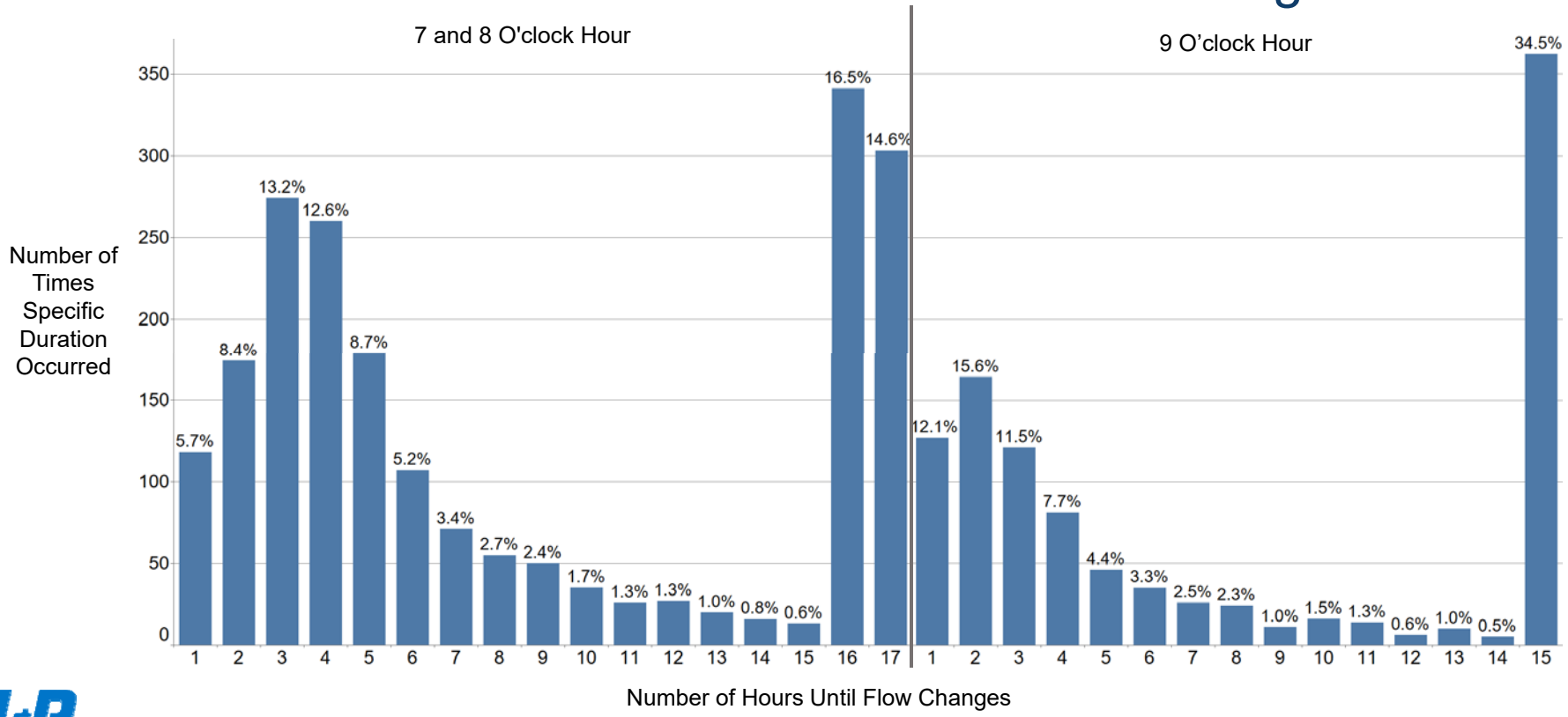
For the Transcontinental departure peak (6, 7, 21, 22, and 23 o'clock hours), the distribution of the number of hours until the flow changes



Source: FAA ASPM

EXPECTED FLOW DURATION (2003 – 2017)

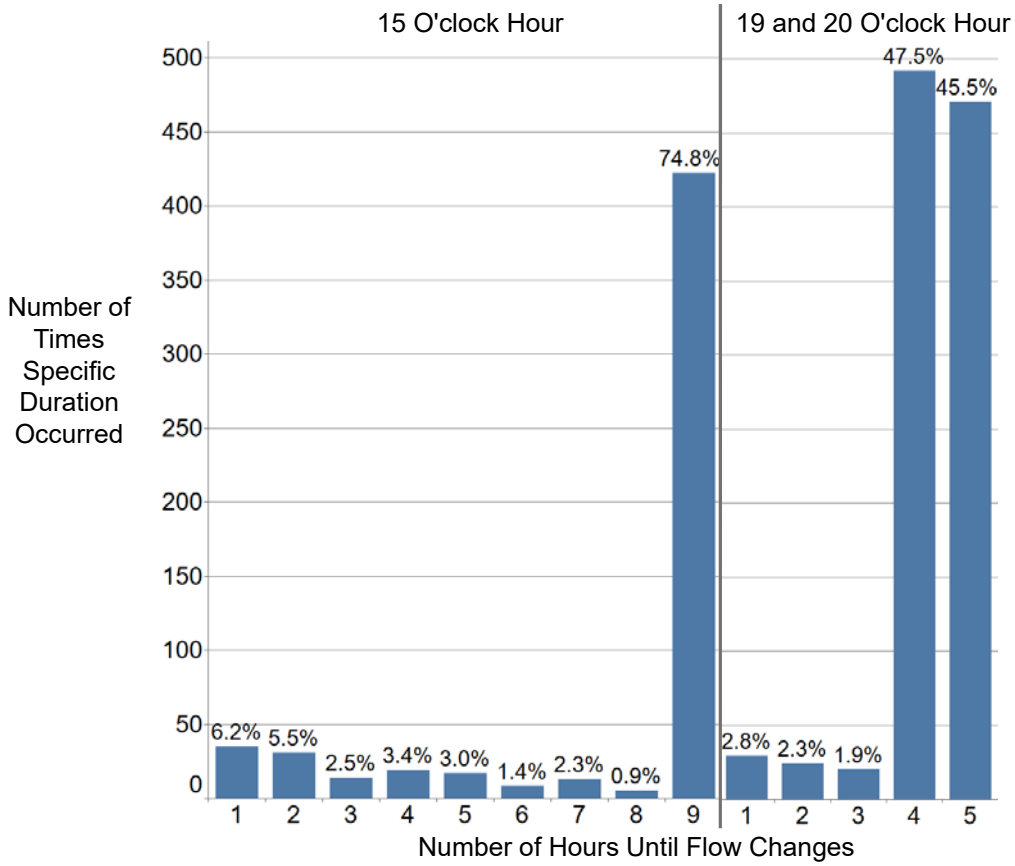
For the Hawaii departure peak (7, 8, and 9 o'clock hours), the distribution of the number of hours until the flow changes



Source: FAA ASPM

EXPECTED FLOW DURATION (2003 – 2017)

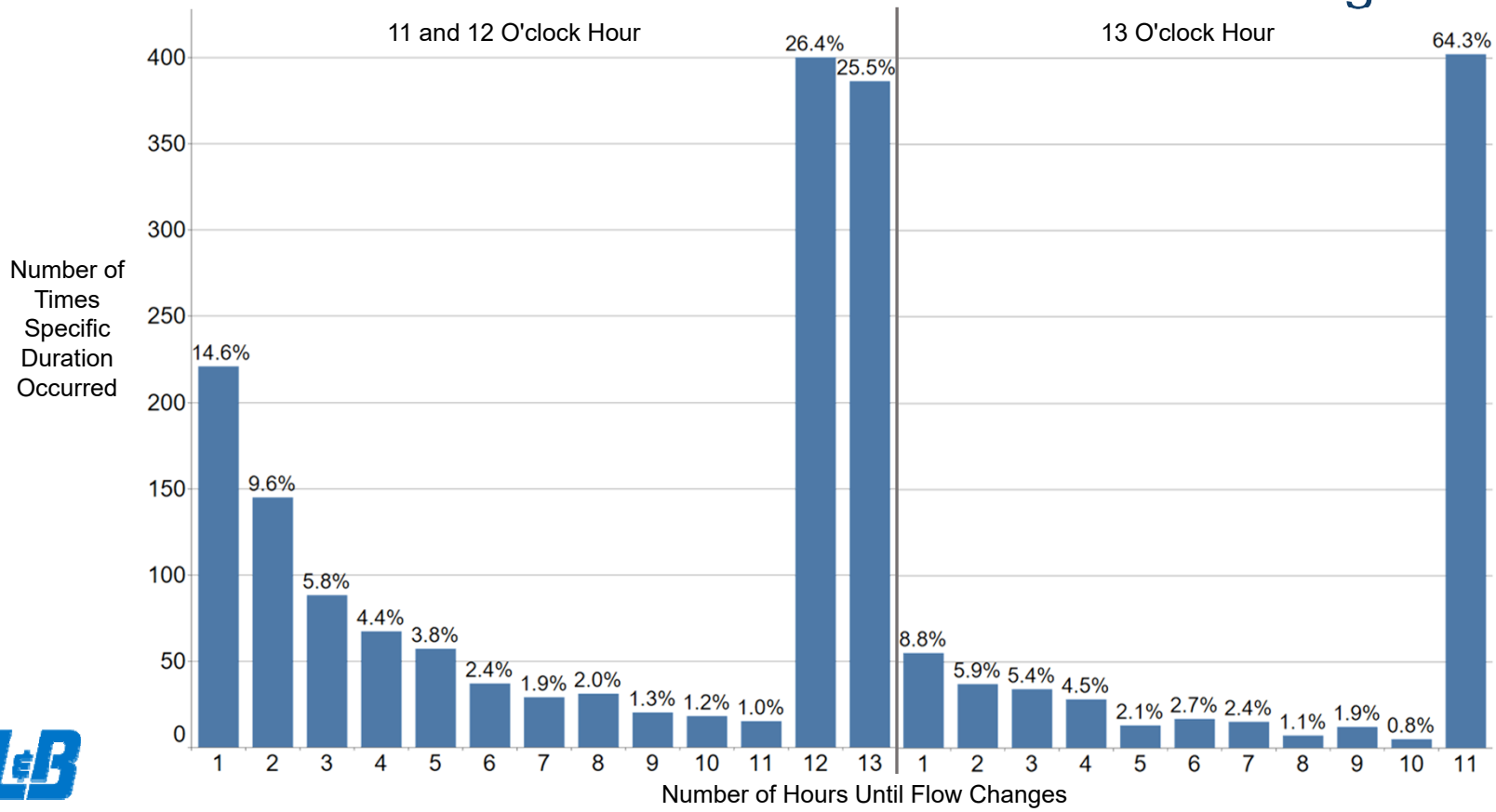
For the Europe departure peak (15, 19, and 20 o'clock hours), the distribution of the number of hours until the flow changes



Source: FAA ASPM

EXPECTED FLOW DURATION (2003 – 2017)

For the Asian departure peak (11, 12, and 13 o'clock hours), the distribution of the number of hours until the flow changes



Source: FAA ASPM

WHAT ENGINE OUT PROCEDURES **ARE NOT**

- EOPs are not TERPS criteria
- EOPs do not provide take-off data
- EOPs do not provide standard ATC departure
- EOPs are not developed or flight checked
- EOPs are not promulgated under CFR Part 97
- EOPs are not “approved” by the FAA, they are “accepted”

Source: Airport Obstacle Analysis – FAA AFS-400 – August 3, 2006

EOP VERTICAL & HORIZONTAL CLEARANCE

- Vertical Clearance Requirements For Two-Engine Turbojet Aircraft
  - CFR Part 25: Min Gross Flight Path: 2.4%
  - CFR Part 25: Min Net Flight Path: 2.4% - 0.8%=1.6% (62.5:1 Slope)
  - CFR Part 121.189.D(2): Net flight path must clear all obstacles vertically by 35 feet
- Horizontal Requirements
  - FAA AC 120-91 (many major US carriers)
    - Incorporates best industry practices to provide an operationally realistic horizontal clearance plane
    - 16:1 'splay' reaching maximum +/- 2,000'
- ICAO Annex 6 (some major US carriers and international)
  - 8:1 'splay' reaching maximum +/- 3,000'

Source: Airport Obstacle Analysis – FAA AFS-400 – August 3, 2006

TYPICAL OEI QUESTIONS

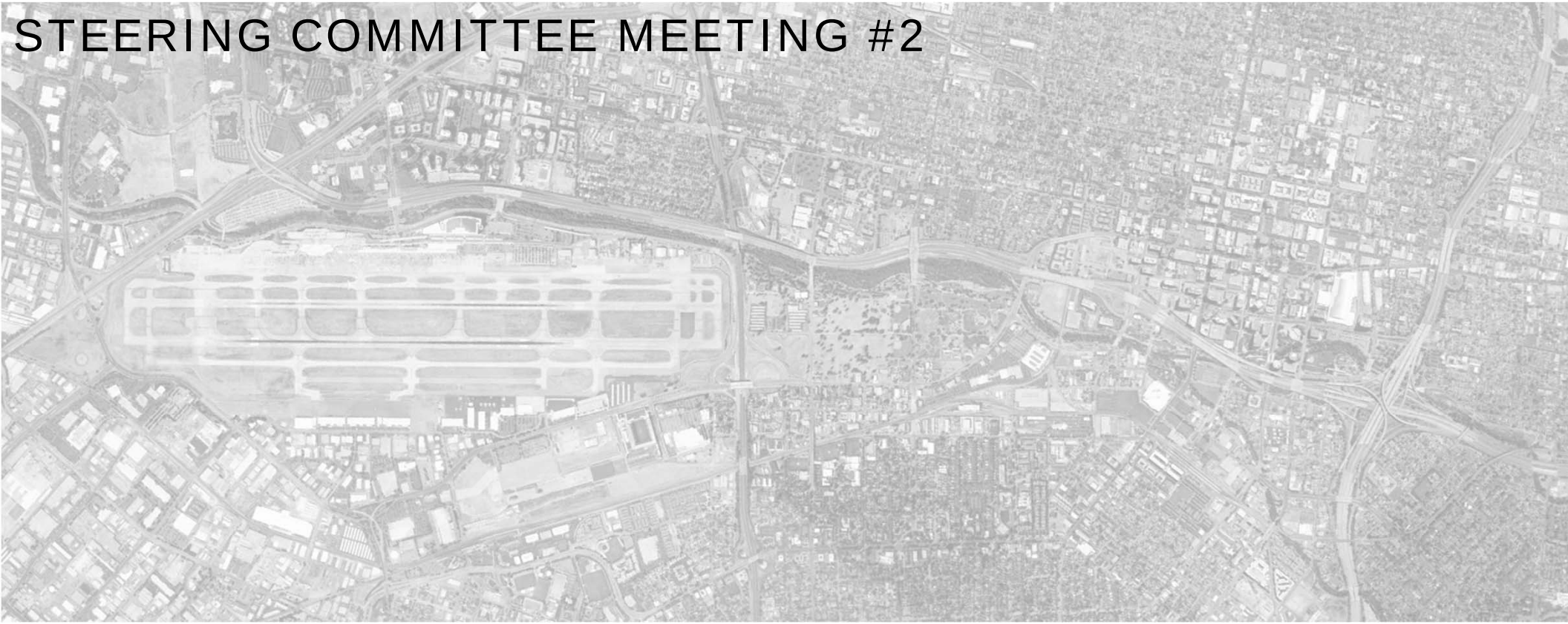
- How does it affect the air service capability of my airport?
- Is it a safety or economic issue?
- Is it all or some aircraft?
  - New vs. old aircraft
  - Variety of engines types available for an aircraft model
  - International vs. domestic
- Is there precedent to protect for OEI?

AIRSPACE OBSTACLE ANALYSIS AT SJC

- Previous airspace obstruction study for SJC and downtown San Jose was completed in 2008
- Established the West OEI corridor protection surface
- Composite airspace height map was developed consisting of controlling Part 77, OEI and TERPS areas south of SJC including downtown

DOWNTOWN SAN JOSÉ AIRSPACE & DEVELOPMENT CAPACITY STUDY (PROJECT CAKE)

STEERING COMMITTEE MEETING #2

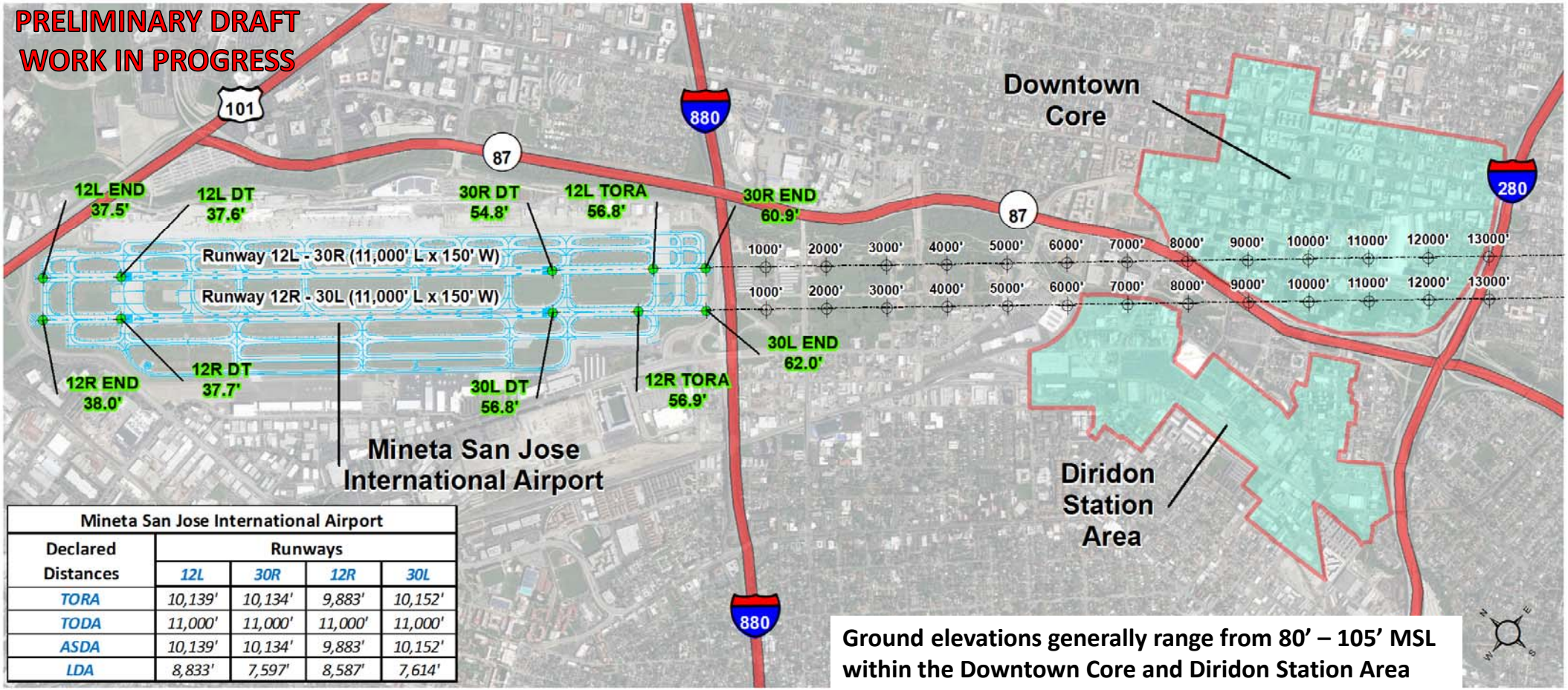


April 19, 2018

AGENDA

- Introduction
- Case Studies
  - Miami International Airport (MIA)
  - Ronal Reagan Washington National Airport (DCA)
  - Las Vegas McCarran International Airport (LAS)
- Composite Airspace Surfaces (Preliminary)
- Next Steps

EXISTING AIRPORT LAYOUT & STUDY EVALUTION AREA



Mineta San Jose International Airport				
Declared Distances	Runways			
	12L	30R	12R	30L
TORA	10,139'	10,134'	9,883'	10,152'
TODA	11,000'	11,000'	11,000'	11,000'
ASDA	10,139'	10,134'	9,883'	10,152'
LDA	8,833'	7,597'	8,587'	7,614'

Graphic Source: Landrum & Brown
Aerial Image Source: Bing

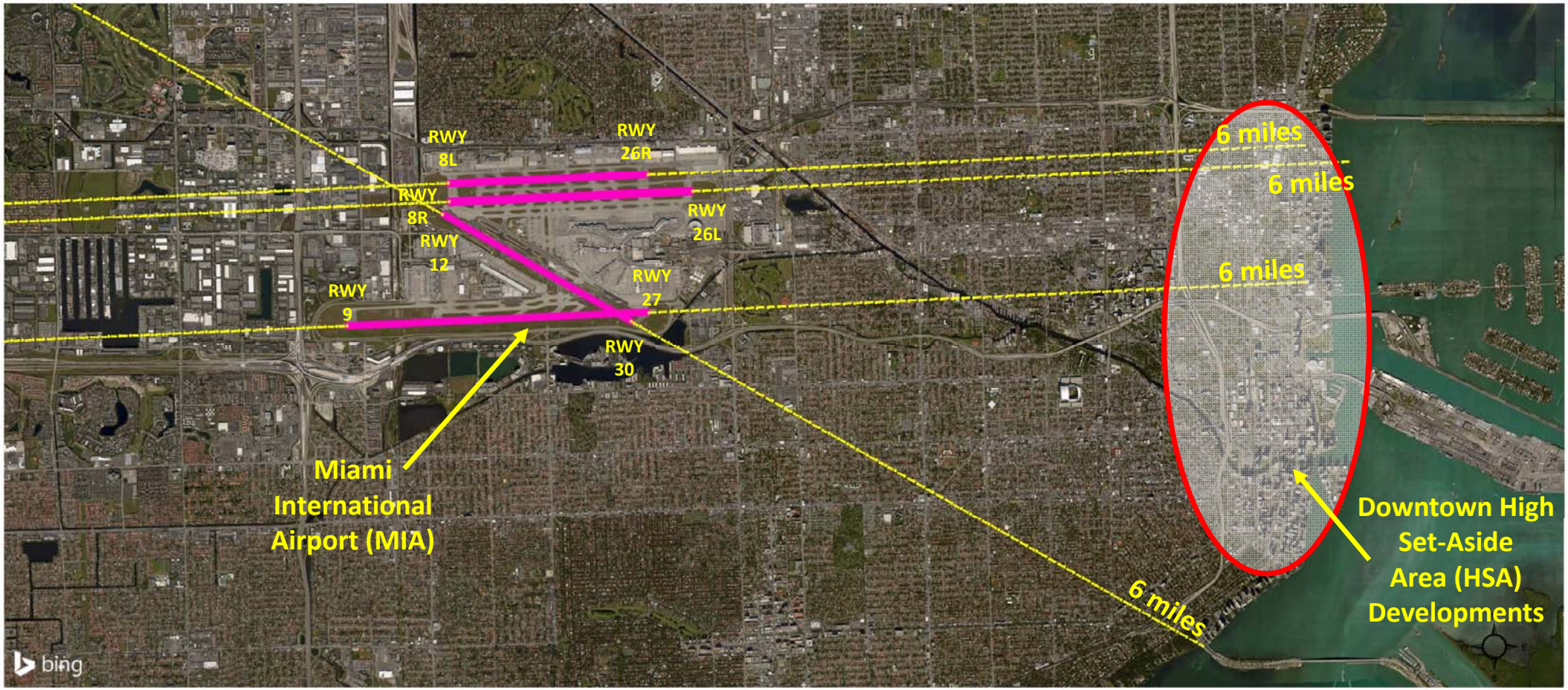
CASE STUDIES

- Staff from the following airports were interviewed as part of the case studies:
  - Miami International Airport (MIA)
  - Washington Reagan National Airport (DCA)
  - Las Vegas McCarran International Airport (LAS)
- Best practices for the protection of airspace
- Best practices for accommodating community development

MIAMI INTERNATIONAL AIRPORT (MIA) CASE STUDY

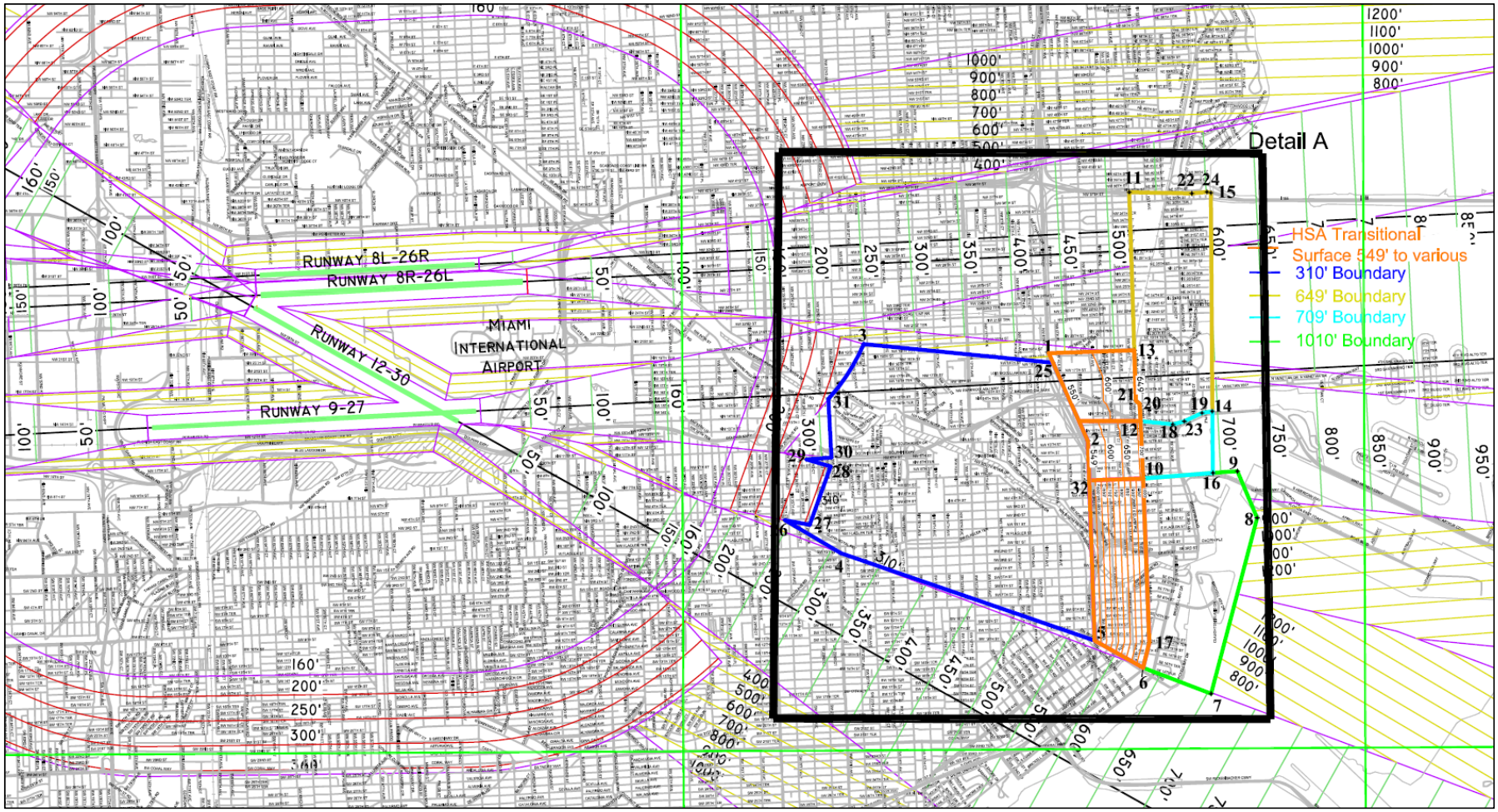
Similarities	Airport works with developers identifying available heights Development community and airport rely on one another Protects for OEI
Differences	High-rise development is 6 miles from runways and off runway centerlines Ordinance-based Primarily Part 77 and OEI surfaces for arrivals and departures Straight-out OEI on all runways at 65:1 slopes for first 10,000 feet
Best Practices	Identified "High Structure Set-Aside" (HSA) area HSA based on TERPS and OEI criteria Airport worked with development community, airlines, and FAA to create HSA

MIA CASE STUDY – AIRPORT OVERVIEW



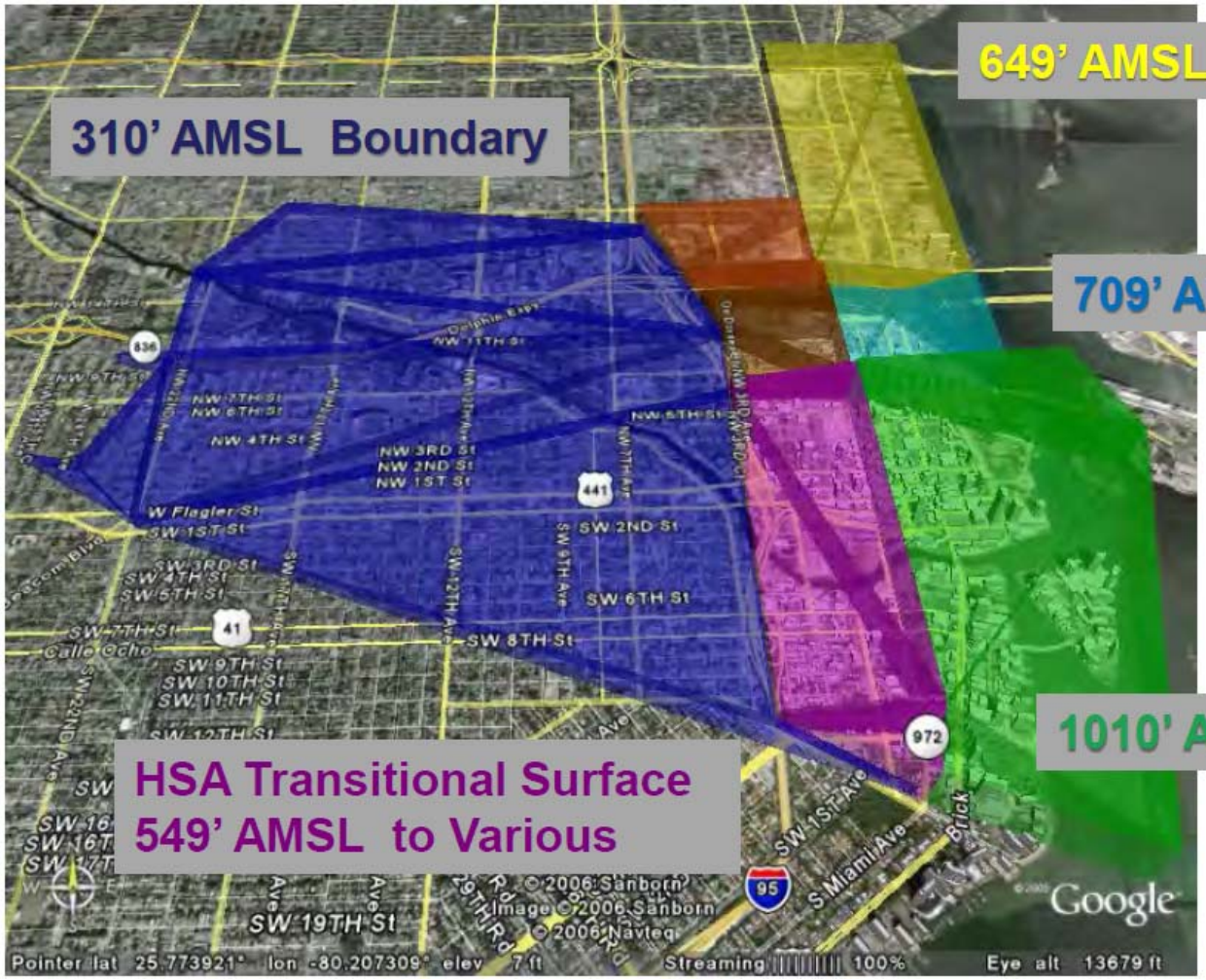
Graphic Source: Landrum & Brown
Aerial Image Source: Bing

MIA CASE STUDY - HEIGHT ZONING MAP



Graphic Source: Miami International Airport – Height Zoning Map – September 2006

MIA CASE STUDY – HSA DISTRICT ELEVATIONS

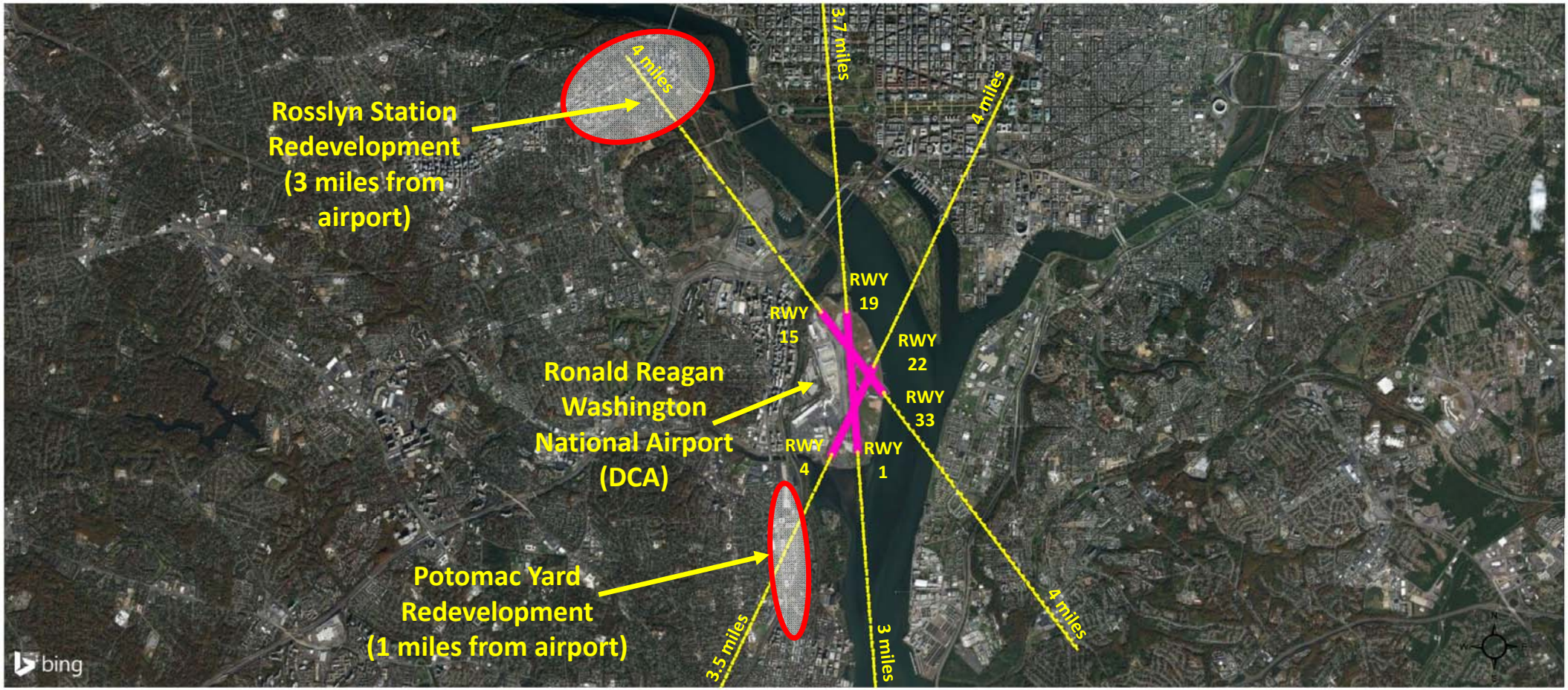


Graphic Source: Miami Airport – Airspace Solutions & Protection in the City of Miami "Changes in Zoning Surfaces and UAV Restrictions" Presentation. Jose A. Ramos, December 16, 2015

RONALD REAGAN WASHINGTON NATIONAL AIRPORT (DCA) CASE STUDY

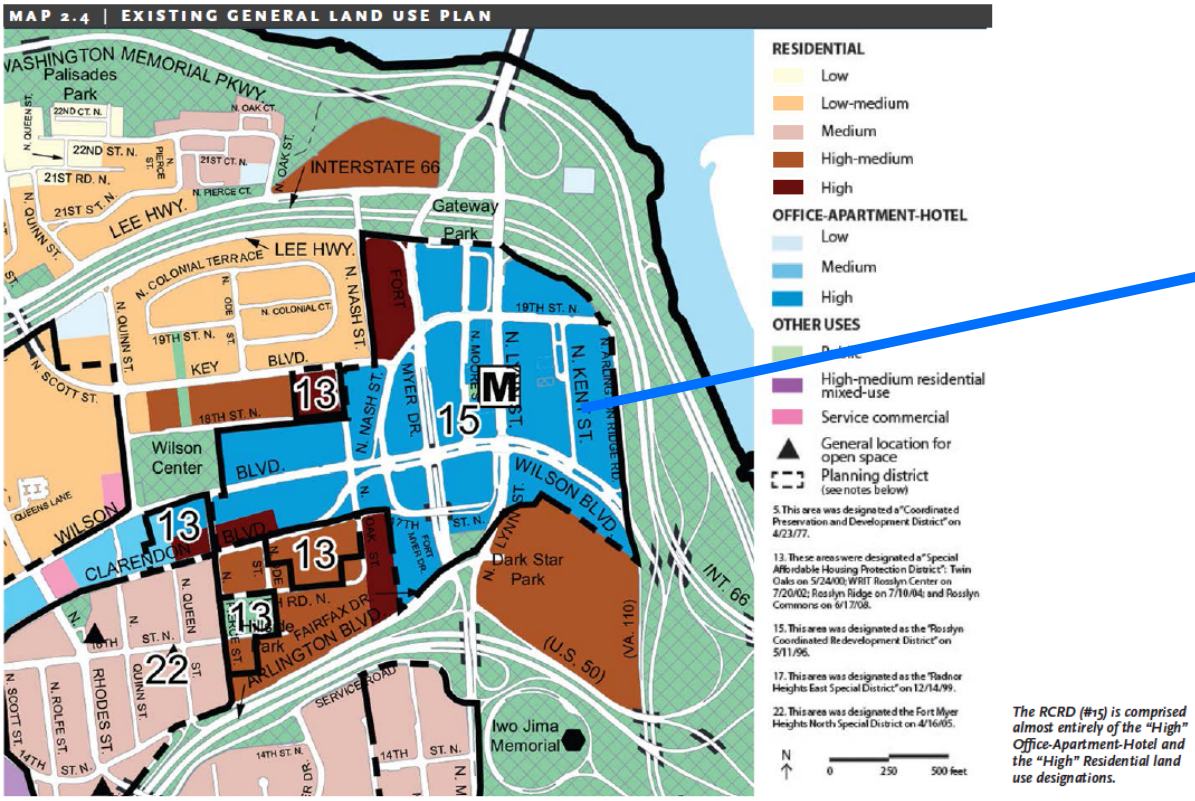
Similarities	Airport works with developers identifying available heights Use of TERPS and OEI composite airspace height mapping Rosslyn high-rise development area 3.0 miles from runway along flight path Potomac Yard redevelopment area 1.0 miles from runway along flight path Policy-based
Differences	Unique OEI corridors based on restricted airspace
Best Practices	Redevelopment plans integrating airspace protection surfaces FAA, Airport and development community coordination to adjust procedures

DCA CASE STUDY – AIRPORT OVERVIEW



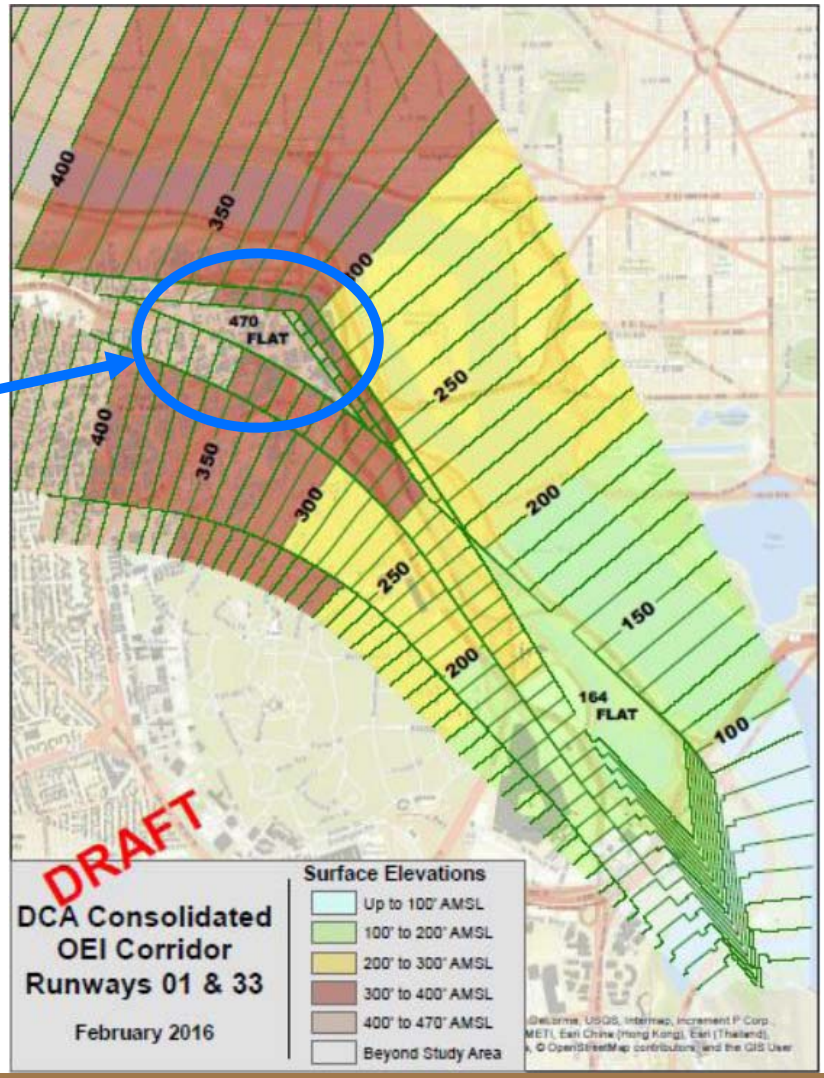
Graphic Source: Landrum & Brown
Aerial Image Source: Bing

DCA CASE STUDY – ROSSLYN STATION REDEVELOPMENT



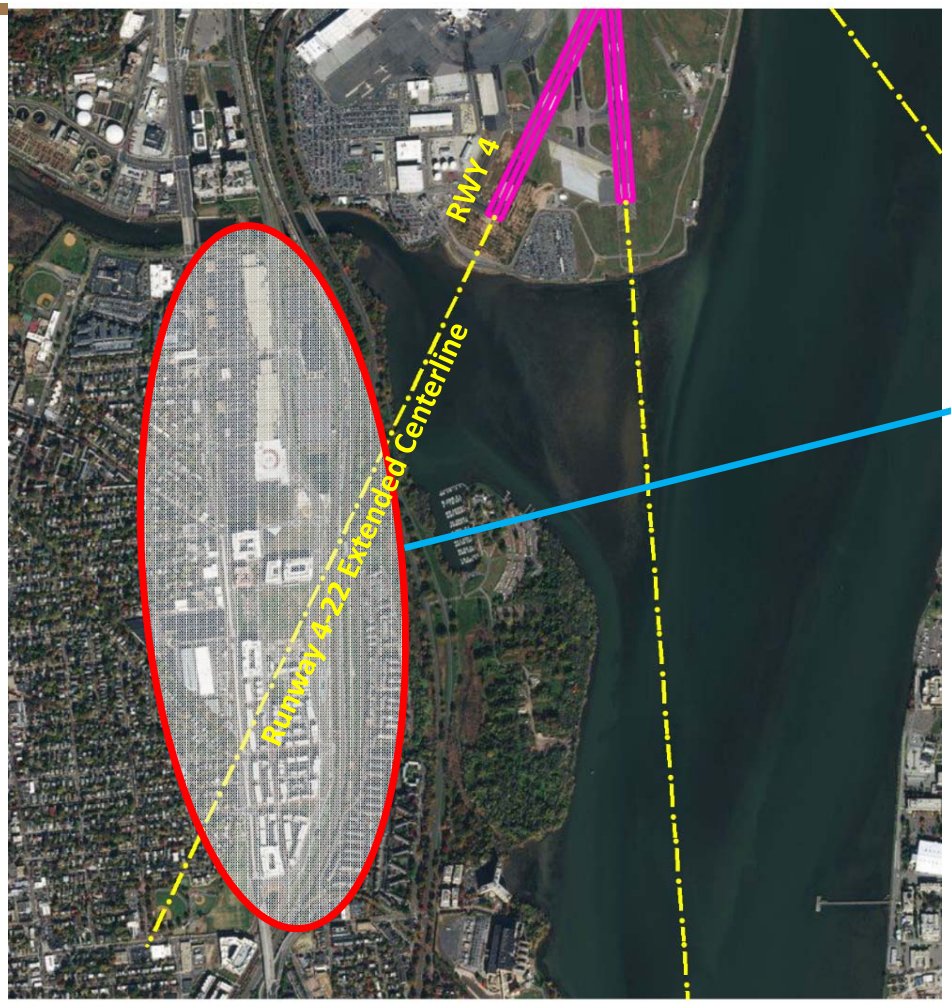
The RCRD (#15) is comprised almost entirely of the "High" Office-Apartment-Hotel and the "High" Residential land use designations.

Graphic Source: http://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/31/2015/12/151208_RosslynSectorPlan-HI.pdf



Graphic Source: Metropolitan Washington Airports Authority

DCA CASE STUDY – POTOMAC COURTYARD REDEVELOPMENT





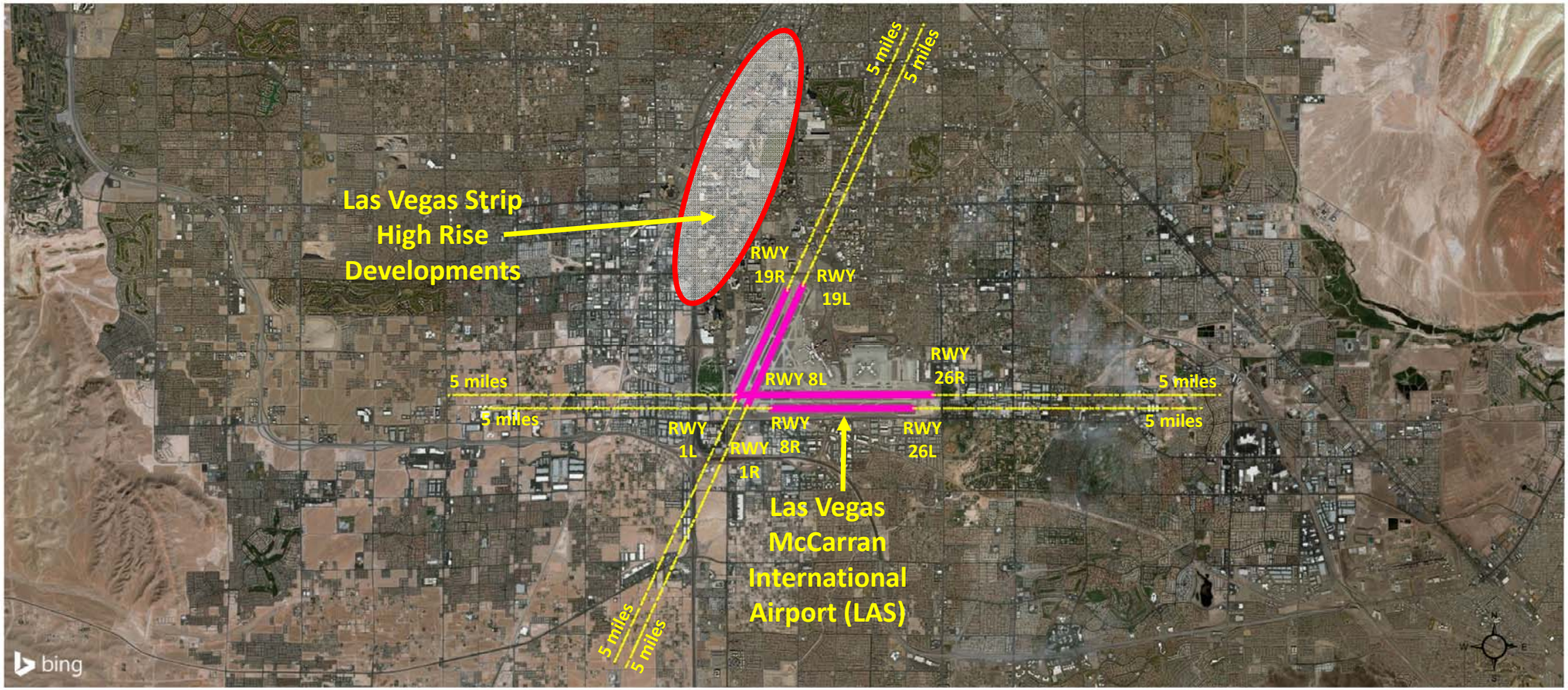
Graphic Source: Landrum & Brown
Aerial Image Source: Bing

Graphic Source: https://www.alexandriava.gov/uploadedFiles/

LAS VEGAS MCCARRAN INTERNATIONAL AIRPORT (LAS) CASE STUDY

Similarities	Development community and airport rely on one another Protects for OEI Airlines use straight-out and course corrections for OEI procedures
Differences	High-rise development is generally off runway centerline (about 0.5 to 1.2 miles) Airport Directors Permit needed for development No height mapping provided – rely on FAA determinations and airline input on OEI
Best Practices	Airport works to be a good neighbor to development community High-rise design adapted to airspace surfaces or runway protection zones Works with airlines to determine if project would have OEI impacts Maintaining air service capability and runway capacity is a priority

LAS CASE STUDY – AIRPORT OVERVIEW



Graphic Source: Landrum & Brown
Aerial Image Source: Bing

LAS CASE STUDY – BUILDING DESIGN EXAMPLES

Hard Rock Cafe



Image Source http://hospitalitybusinessnews.com/wp-content/uploads/2015/05/hard-rock-las-vegas.jpg

The Stratosphere Hotel and Casino



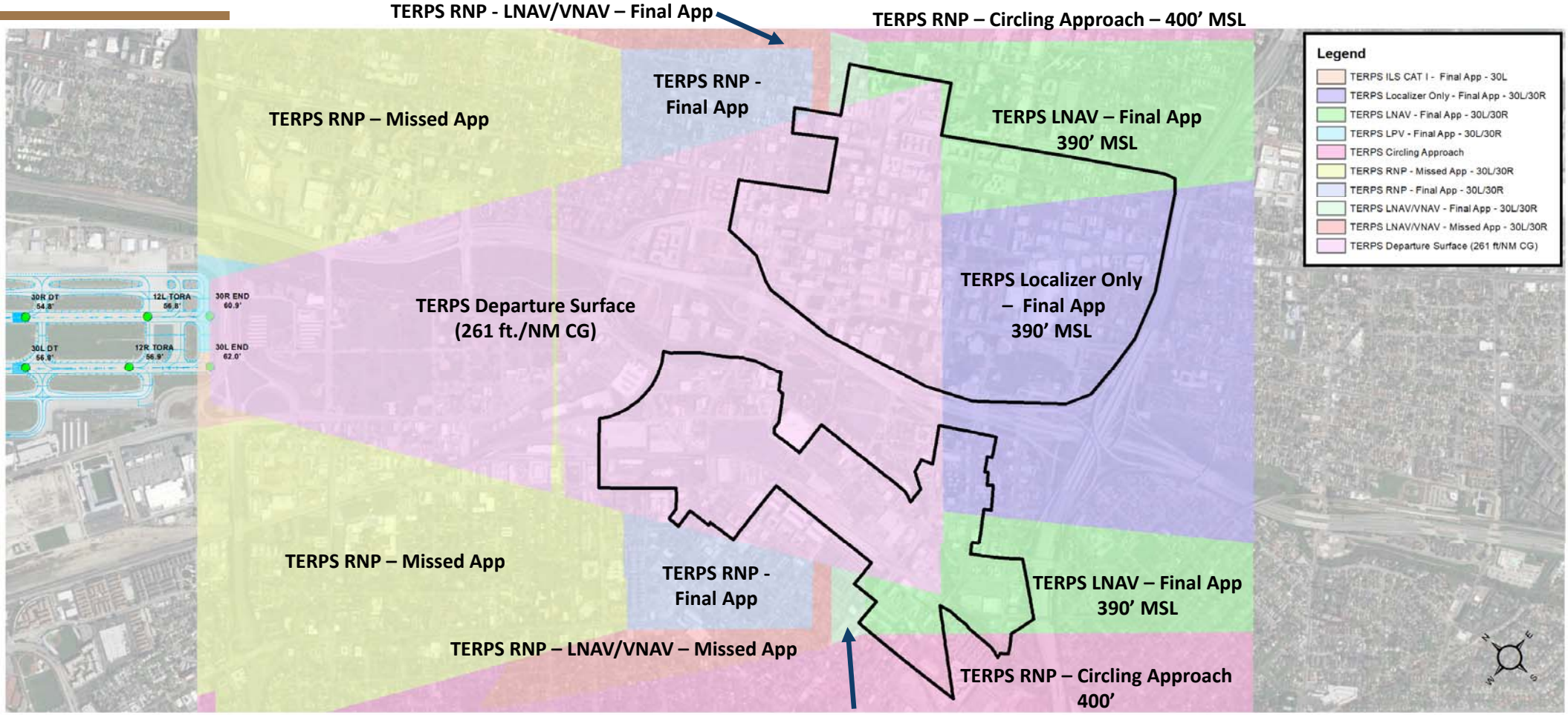
Image Source https://www.casino.org/news/stratosphere-las-vegas-strip-owner-county-disagree

Composite Airspace Surfaces (Preliminary)

TERPS SURFACE ASSESSMENT

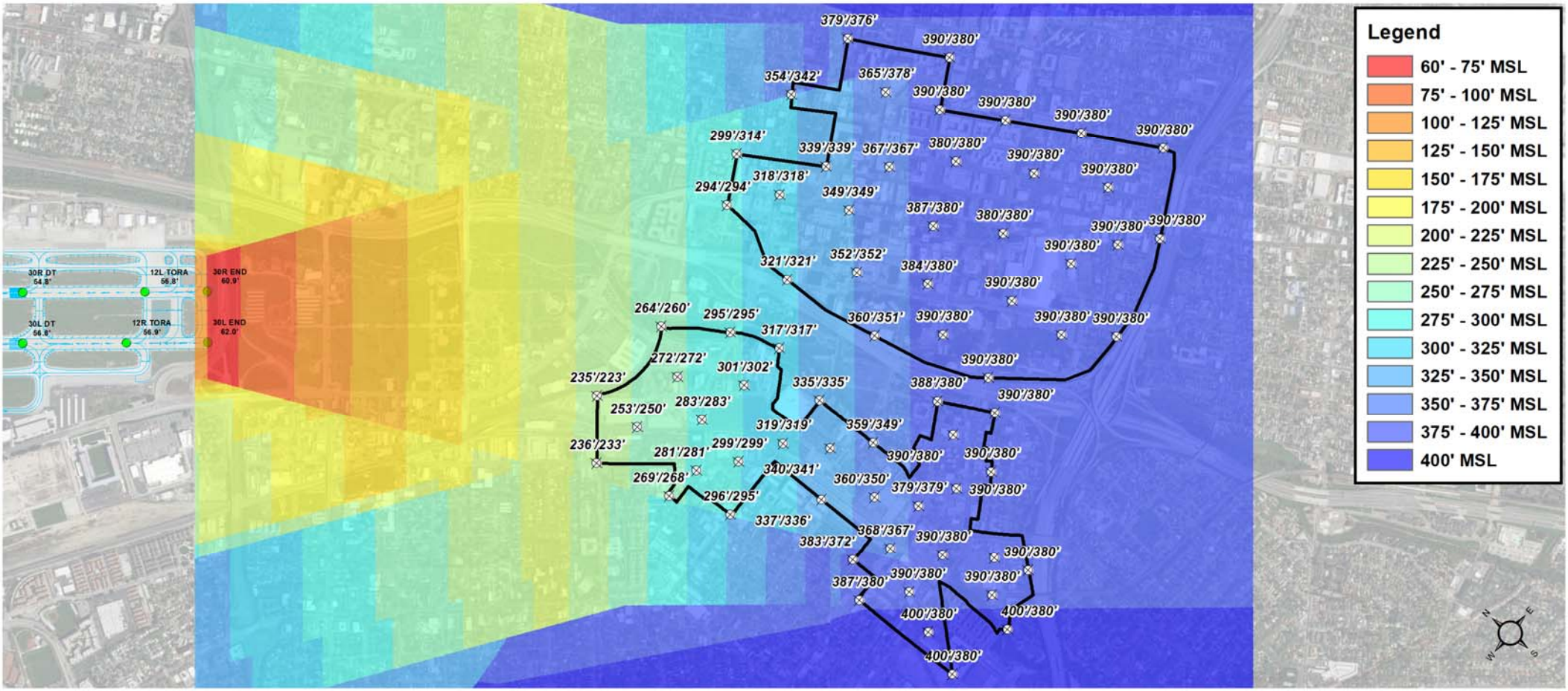
- Various TERPS surfaces were evaluated and constructed based on review of current published arrival and departure procedures at SJC
  - ILS Instrument Approach (CAT I & II)
  - Localizer Only (LOC)
  - Lateral Navigation (LNAV)
  - Lateral Navigation/Vertical Navigation (LNAV-VNAV)
  - Required Navigation Performance (RNP)
  - Instrument Departure Procedures
- Identification of lowest controlling TERPS and OEI surfaces over the Downtown Core and Diridon Station Area developments

TERPS COMPOSITE - LOWEST CONTROLLING SURFACES



Graphic Source: Landrum & Brown
Aerial Image Source: Bing

TERPS COMPOSITE – ELEVATION PROFILE



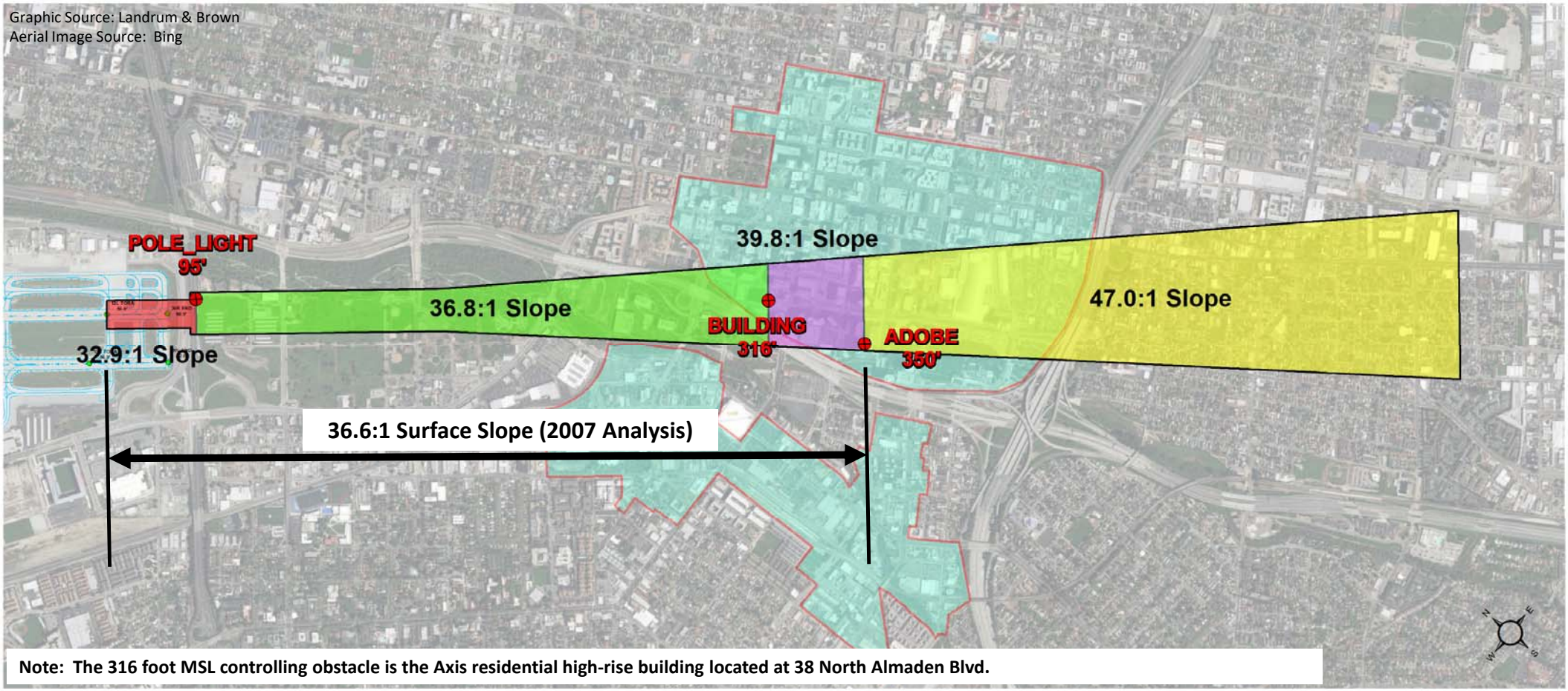
Graphic Source: Landrum & Brown
Aerial Image Source: Bing

Random Spot Elevation Comparison:
000' (2018 TERPS COMPOSITE)/000' (2007 TERPS COMPOSITE)

OEI SURFACES

- Conducted an obstacle analysis using the recently approved Airport obstacle data set
- Compared new obstacles against existing OEI surface slopes
- Identified penetrations of critical man-made obstacles
- Recommended OEI surface slopes to clear critical obstacles

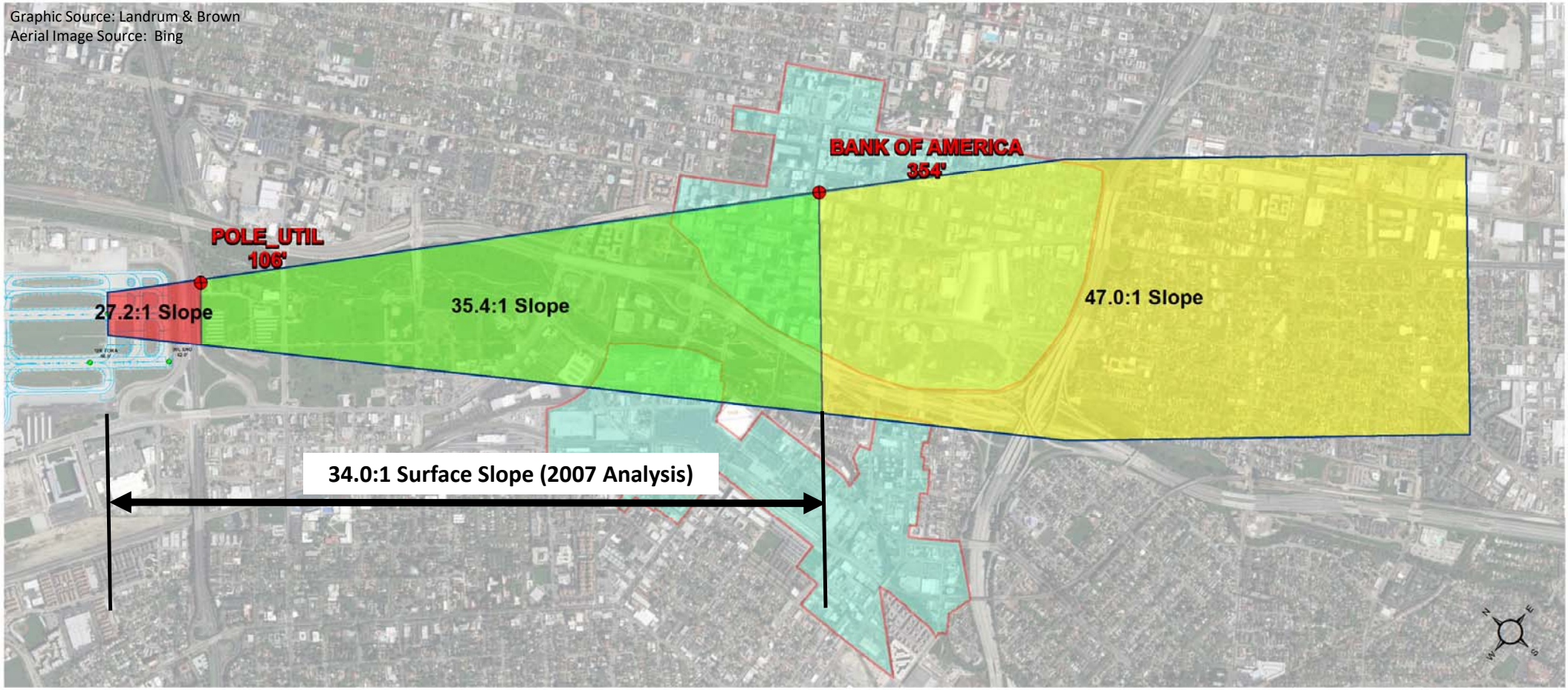
OEI SURFACE – AC 120-91 RUNWAY 12L



Note: The 316 foot MSL controlling obstacle is the Axis residential high-rise building located at 38 North Almaden Blvd.

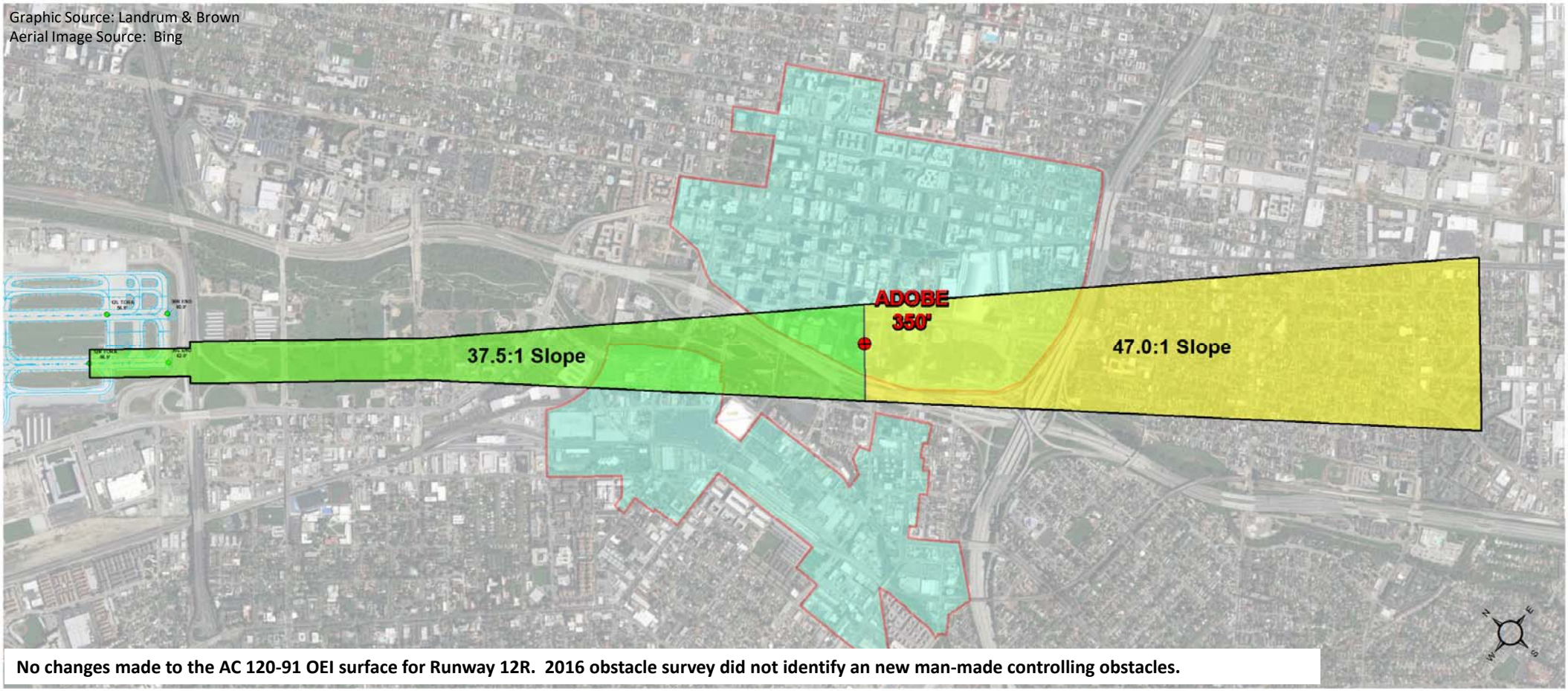
Note: The Adobe building was the original controlling obstacle for the AC 120-91 Runway 12L surface in 2007. Changes to the slope of the surface beyond Adobe remain consistent with 2007 analysis as there are no other controlling obstacles over the Downtown Core.

OEI SURFACE – ICAO OEI RUNWAY 12L



Note: The Bank of America building was the original controlling obstacle for the ICAO OEI Runway 12L surface in 2007. Changes to the slope of the surface beyond Bank of America remain consistent with 2007 analysis as there are no other controlling obstacles over the Downtown Core.

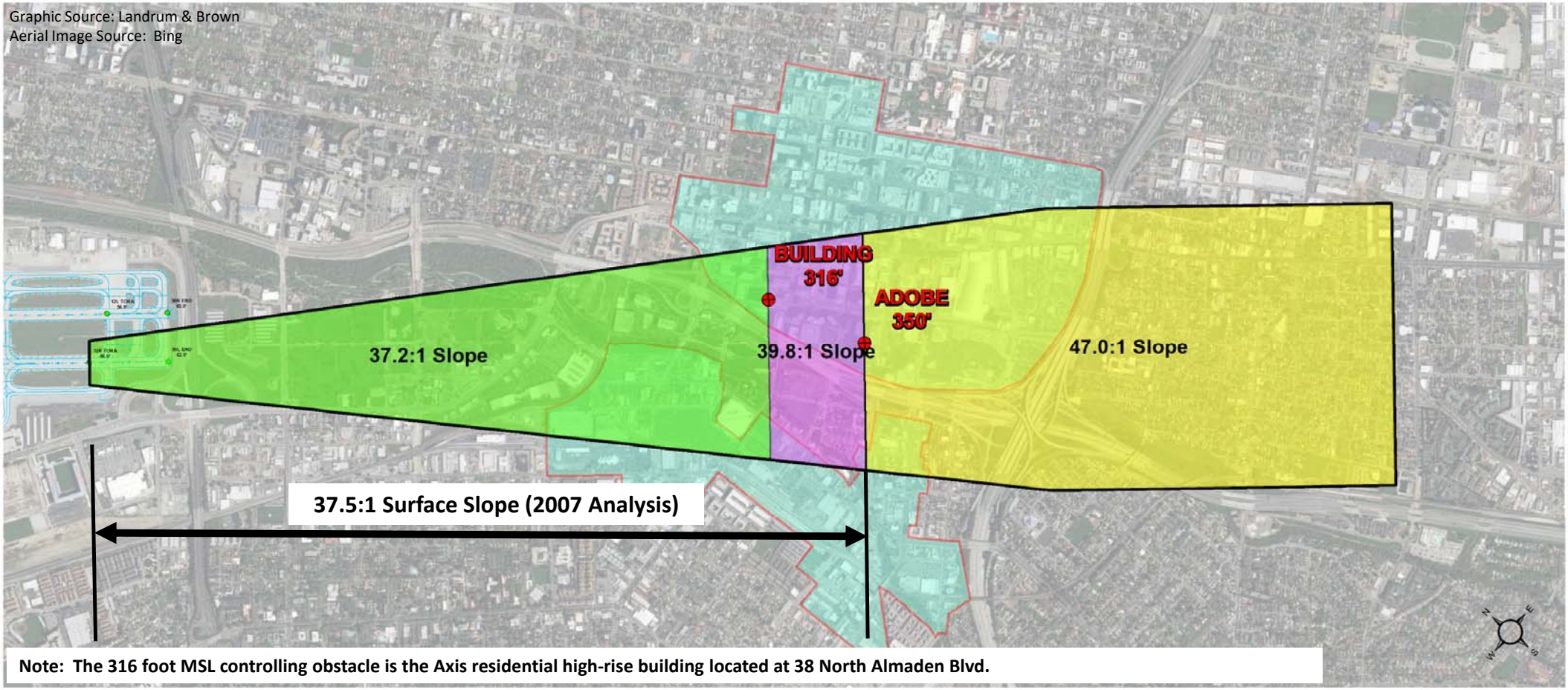
OEI SURFACE – AC 120-91 RUNWAY 12R



No changes made to the AC 120-91 OEI surface for Runway 12R. 2016 obstacle survey did not identify an new man-made controlling obstacles.

Note: The Adobe building was the original controlling obstacle for the AC 120-91 Runway 12R surface in 2007. Changes to the slope of the surface beyond Adobe remain consistent with 2007 analysis as there are no other controlling obstacles over the Downtown Core.

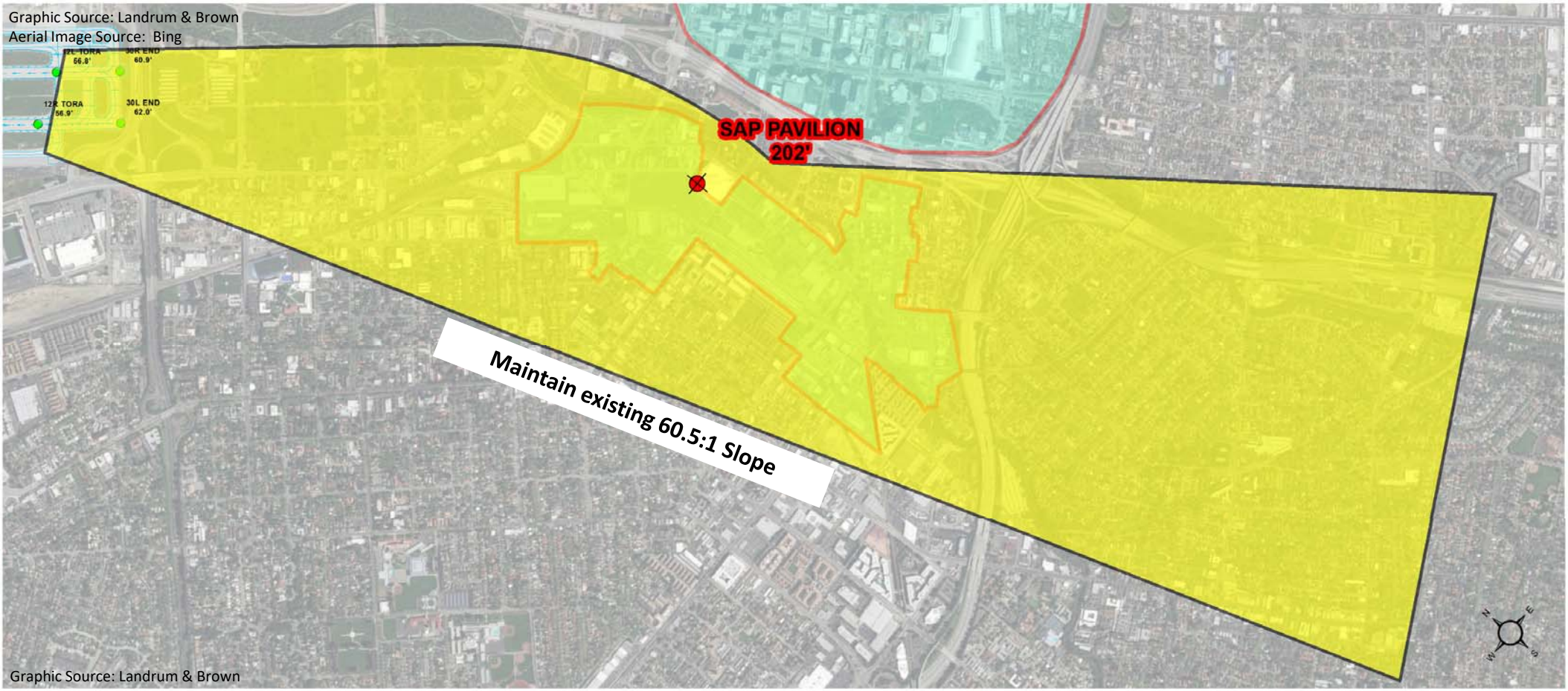
OEI SURFACE – ICAO OEI RUNWAY 12R



Note: The 316 foot MSL controlling obstacle is the Axis residential high-rise building located at 38 North Almaden Blvd.

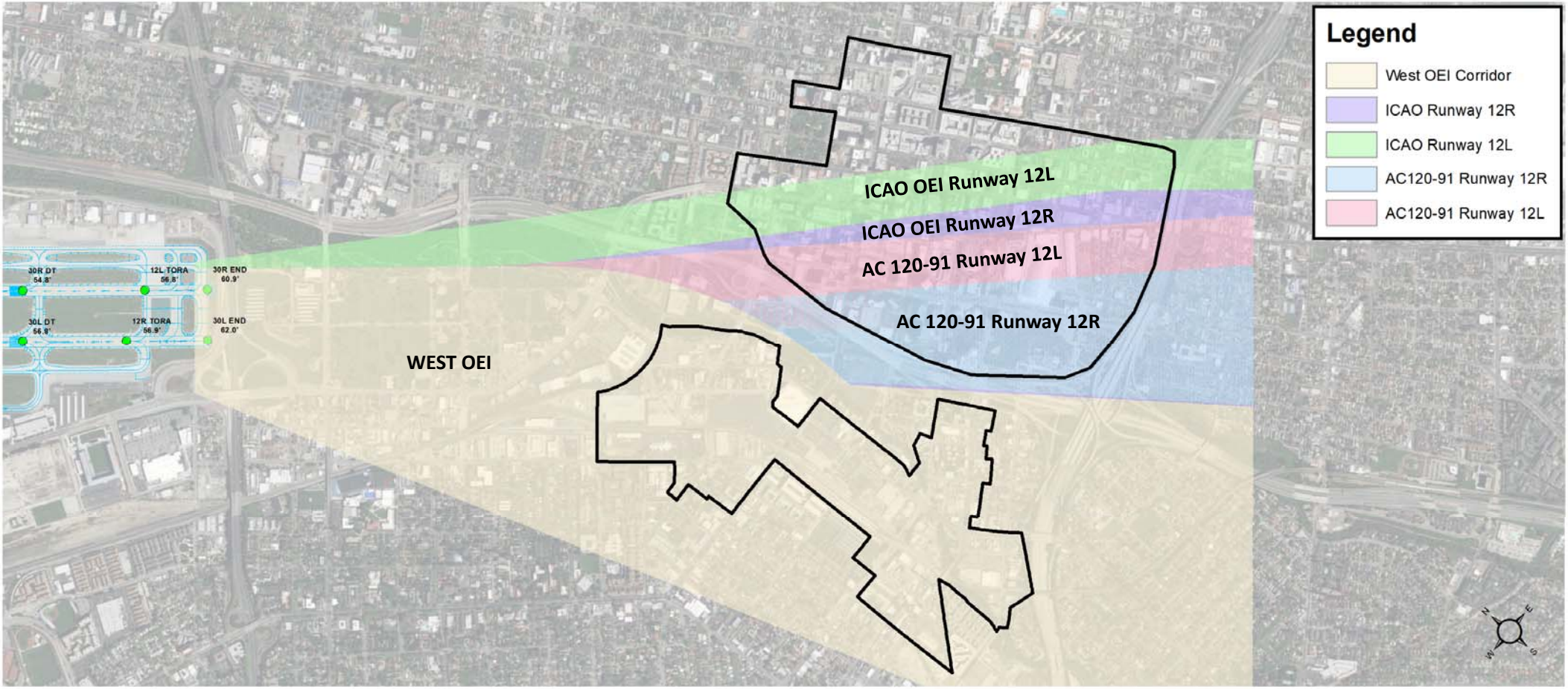
Note: The Adobe building was the original controlling obstacle for the ICAO OEI Runway 12R surface in 2007. Changes to the slope of the surface beyond Adobe remain consistent with 2007 analysis as there are no other controlling obstacles over the Downtown Core.

OEI SURFACE – WEST OEI CORRIDOR



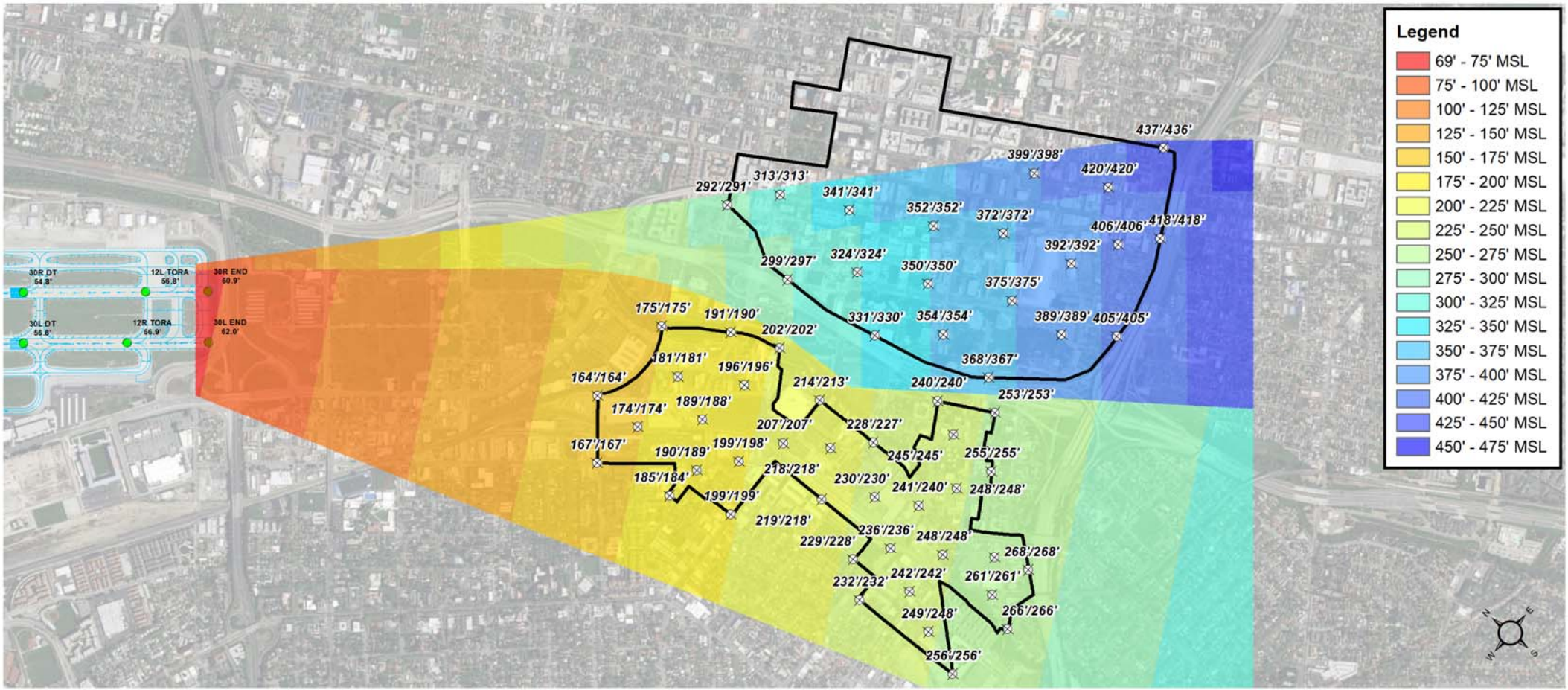
Note: The SAP Pavilion building was the original controlling obstacle for the West OEI Corridor surface in 2007.

OEI COMPOSITE - LOWEST CONTROLLING SURFACES



Graphic Source: Landrum & Brown
Aerial Image Source: Bing

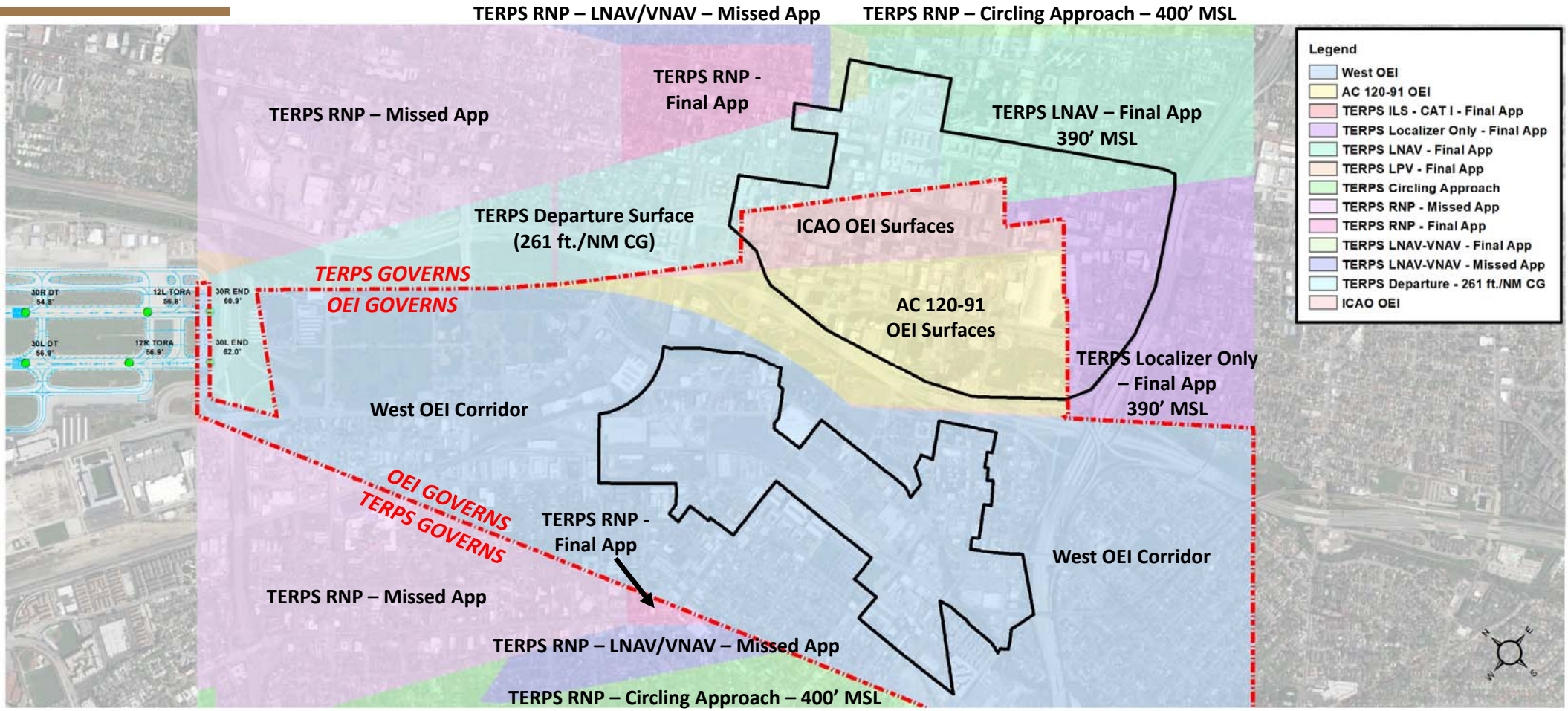
OEI COMPOSITE - LOWEST CONTROLLING SURFACES - ELEVATION



Graphic Source: Landrum & Brown
Aerial Image Source: Bing

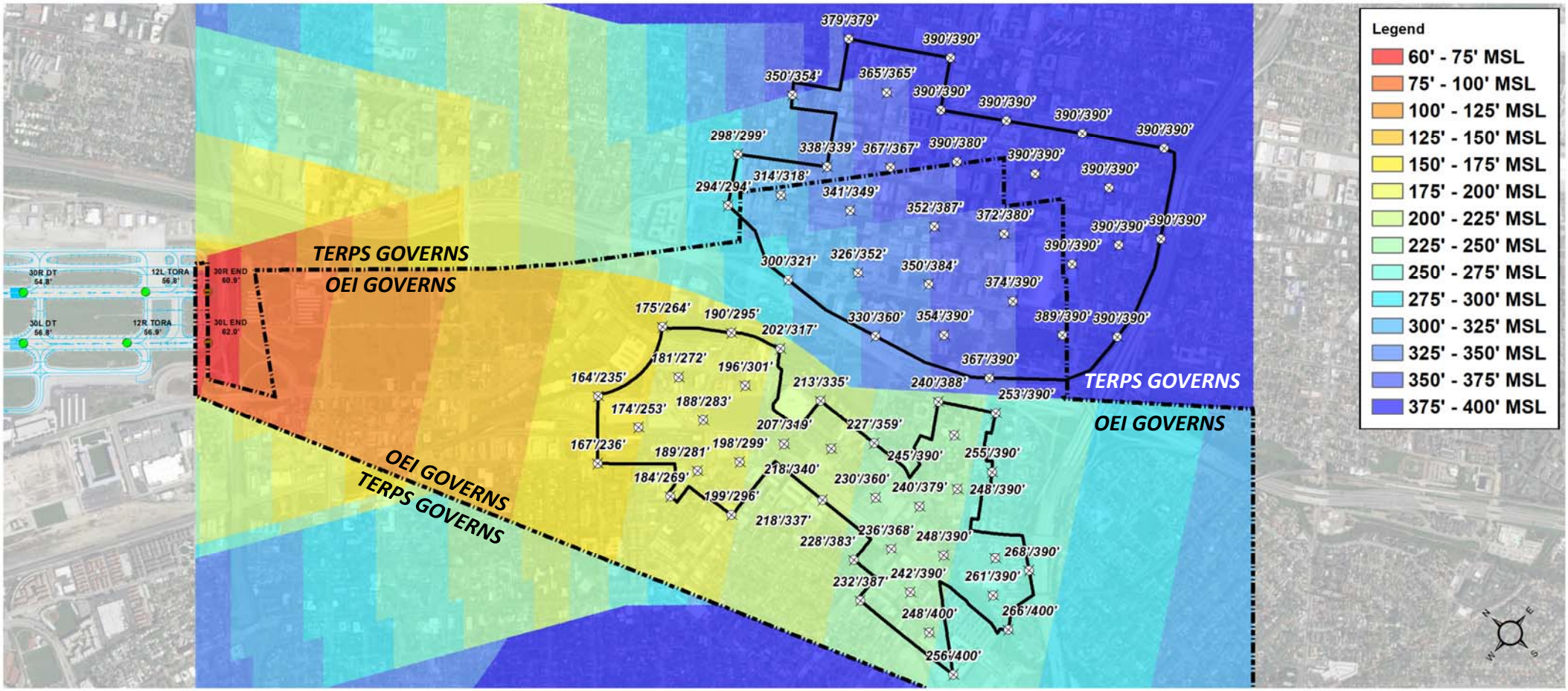
Random Spot Elevation Comparison:
000' (2018 OEI)/000' (2007 OEI)

TERPS/OEI COMPOSITE - LOWEST CONTROLLING SURFACES



Graphic Source: Landrum & Brown
Aerial Image Source: Bing

TERPS/OEI COMPOSITE – ELEVATION PROFILE



Graphic Source: Landrum & Brown

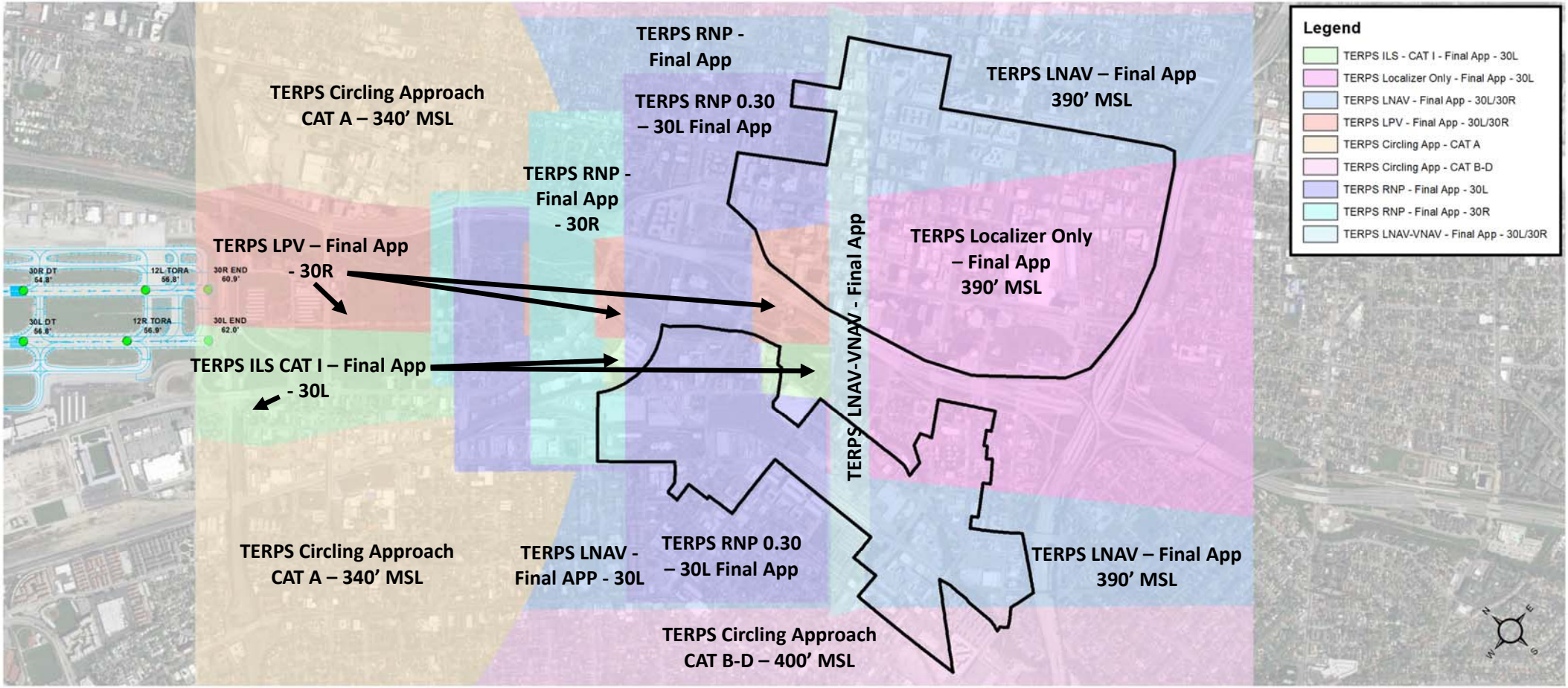
Random Spot Elevation Comparison:

000' (2018 TERPS/OEI COMPOSITE)/000' (2018 TERPS COMPOSITE)

NEXT STEPS

- Critical Aircraft Discussion
- Framework for Scenario Review
- Building Heights
- Relationship between OAK, SFO and SJC

TERPS ARRIVALS COMPOSITE - LOWEST CONTROLLING SURFACES

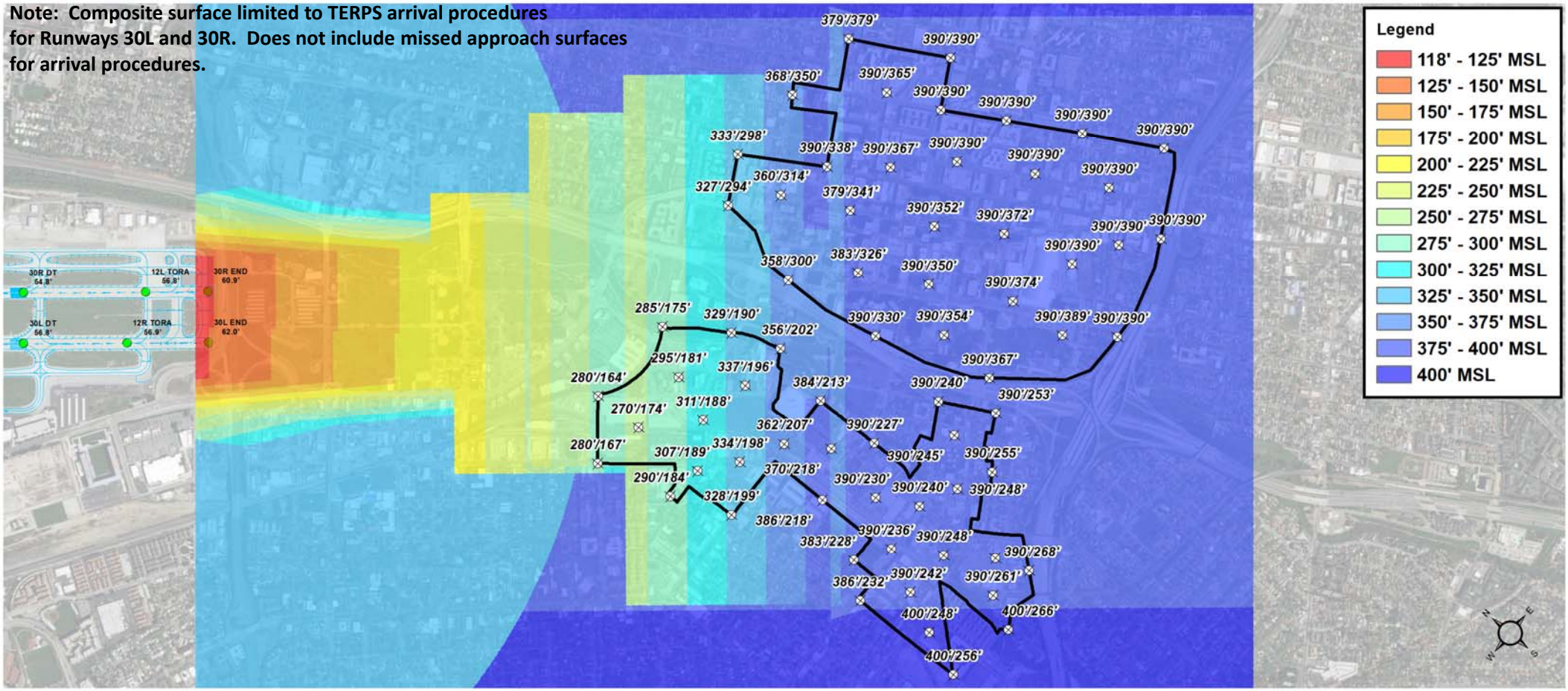


Graphic Source: Landrum & Brown
Aerial Image Source: Bing

Note: Composite surface limited to TERPS arrival procedures for Runways 30L and 30R. Does not include missed approach surfaces for arrival procedures.

TERPS ARRIVALS COMPOSITE – ELEVATION PROFILE

Note: Composite surface limited to TERPS arrival procedures for Runways 30L and 30R. Does not include missed approach surfaces for arrival procedures.

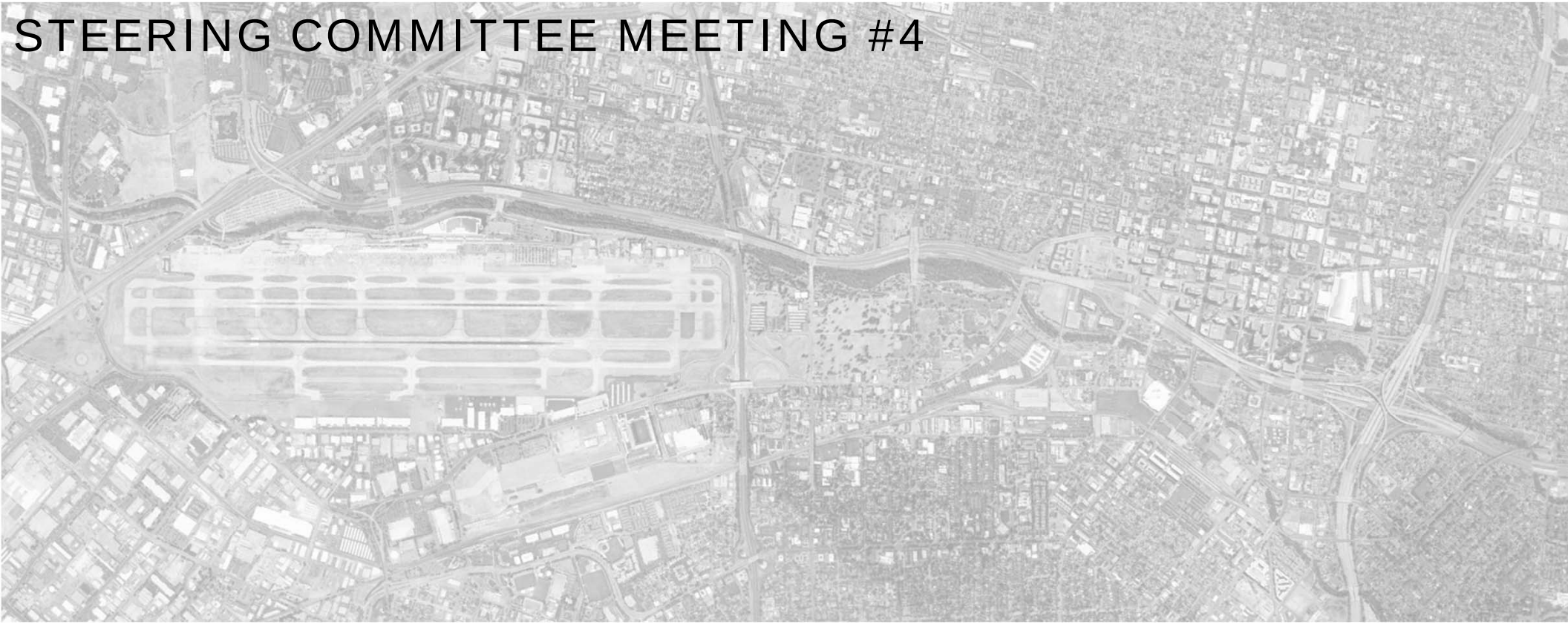


Graphic Source: Landrum & Brown
Aerial Image Source: Bing

Random Spot Elevation Comparison:
000' (2018 TERPS ARRIVALS)/000' (2018 (TERPS/OEI COMPOSITE)

DOWNTOWN SAN JOSÉ AIRSPACE & DEVELOPMENT CAPACITY STUDY (PROJECT CAKE)

STEERING COMMITTEE MEETING #4



May 10, 2018

AGENDA

- Introduction
- Potential Airspace Protection Scenarios
- Next Steps

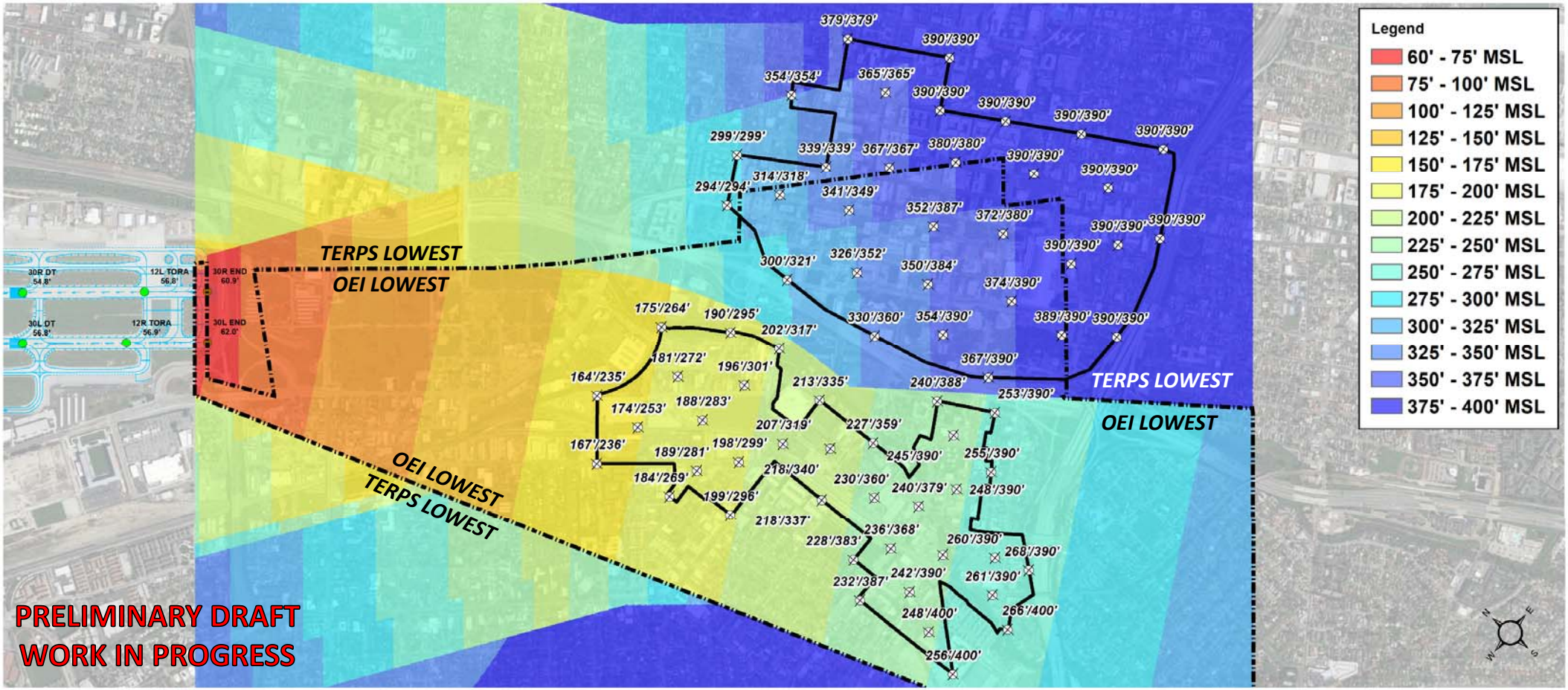
POTENTIAL AIRSPACE PROTECTION SCENARIOS (1 OF 2)

1. Existing airspace protection
2. West OEI Corridor with increased surface slopes
3. East OEI Corridor with a TERPS only scenario over Diridon Station Area
4. Straight-out OEI surface protection without West OEI Corridor
5. West OEI Corridor surface protection without Straight-out OEI
6. West OEI Corridor with greater than 15 degree turn

POTENTIAL AIRSPACE PROTECTION SCENARIOS (2 OF 2)

7. TERPS only
8. TERPS only with increased TERPS departure climb gradients
9. TERPS only with increased TERPS departure climb gradients and approach procedure minima
10. Defined development heights
11. Extend the approach ends of Runways 12L and/or 12R to the north

SCENARIO #1 – EXISTING AIRSPACE PROTECTION

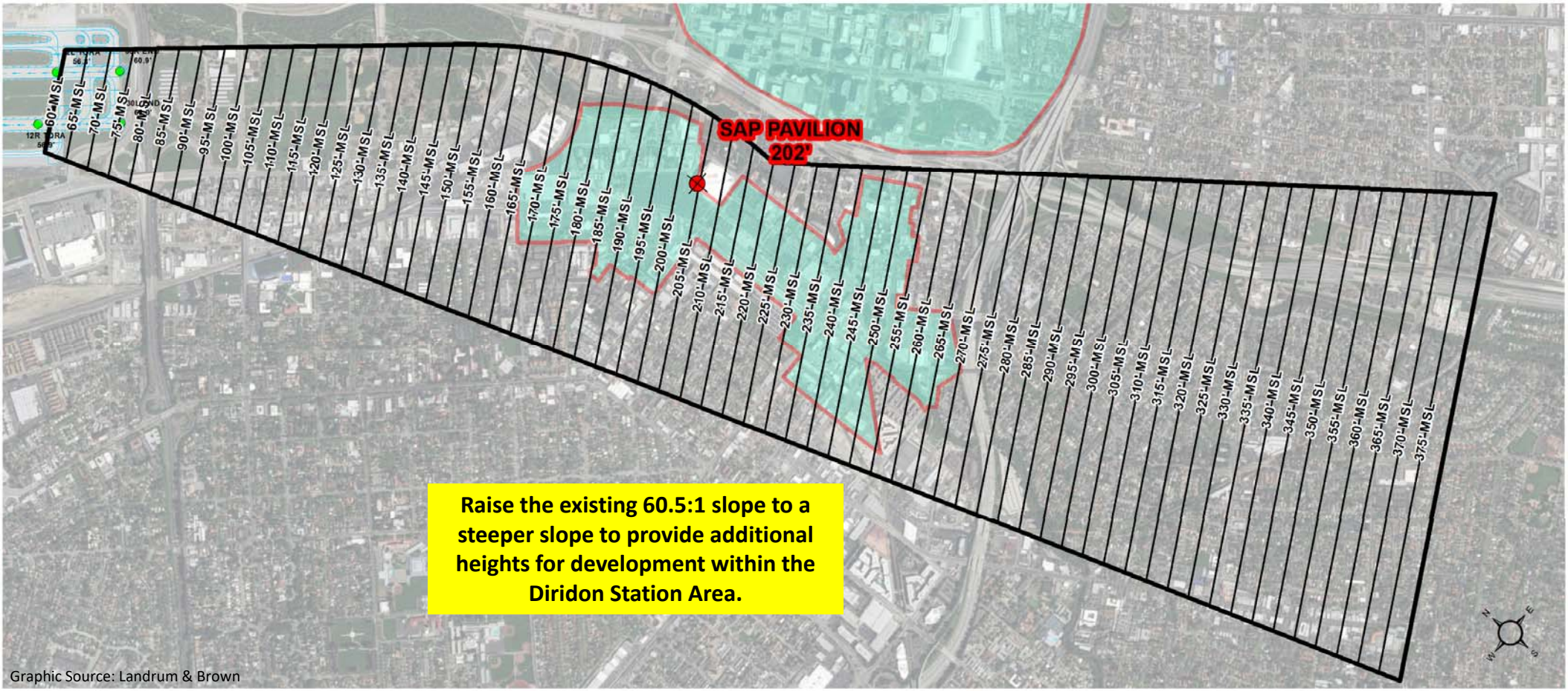


Graphic Source: Landrum & Brown

Random Spot Elevation Comparison:

000' (2018 TERPS/OEI COMPOSITE)/000' (2018 TERPS COMPOSITE)

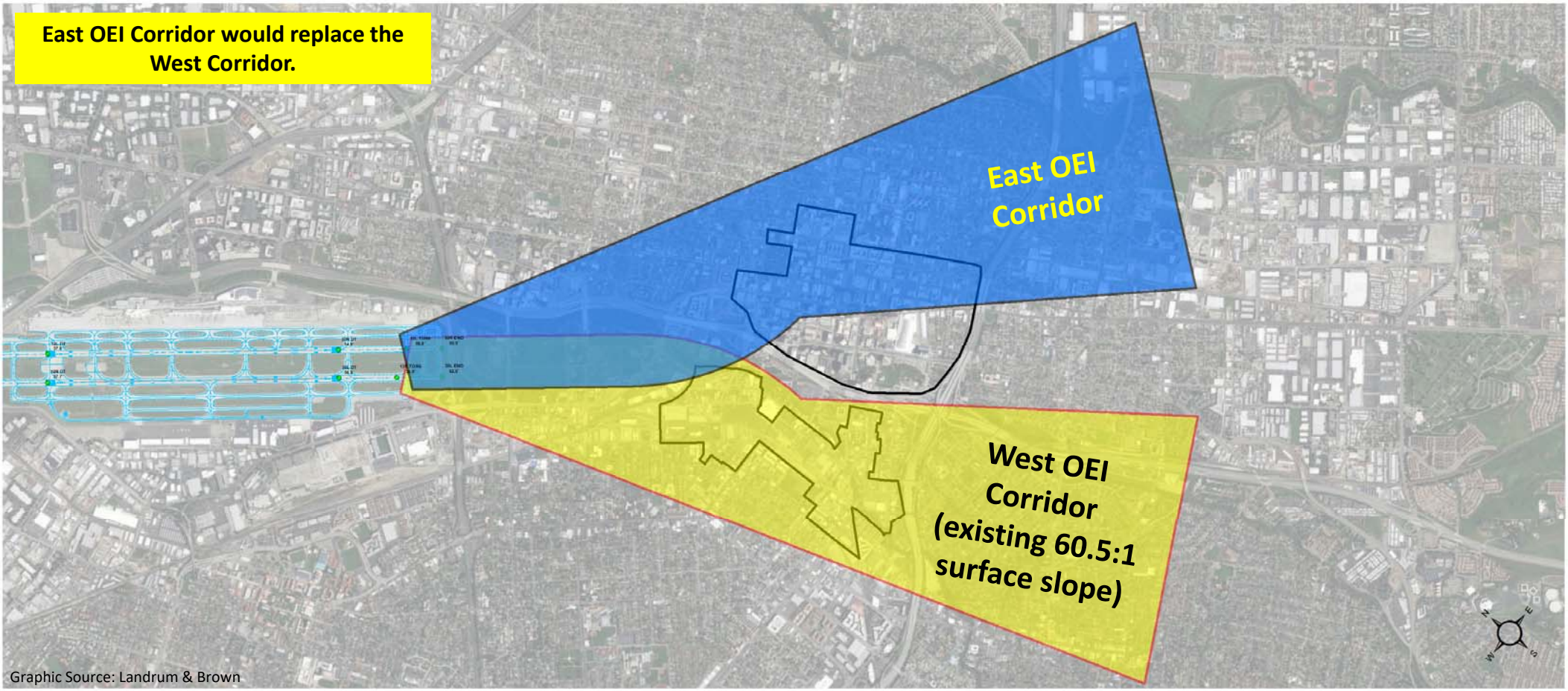
SCENARIO #2 – WEST OEI CORRIDOR WITH INCREASED SURFACE SLOPES



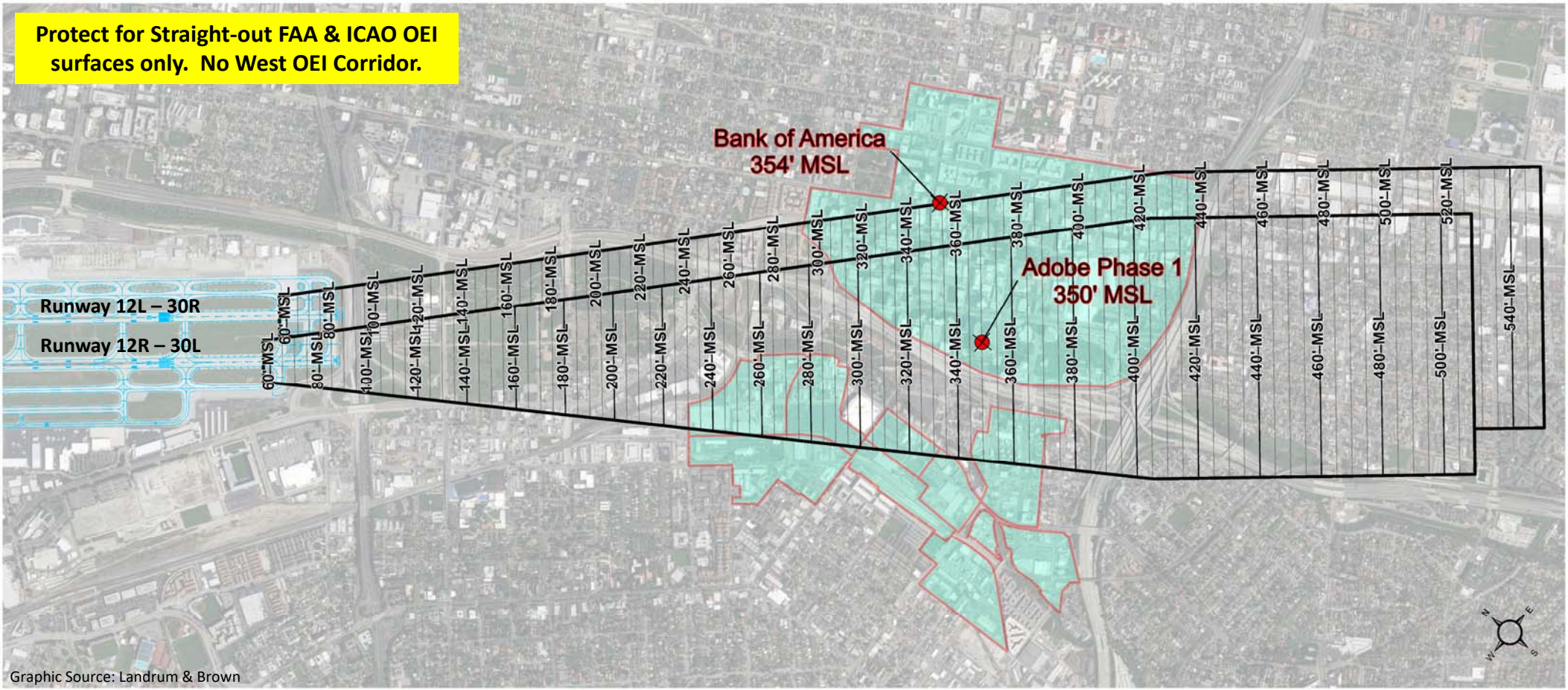
Graphic Source: Landrum & Brown

Note: The SAP Pavilion building was the original controlling obstacle for the West OEI Corridor surface in 2007.

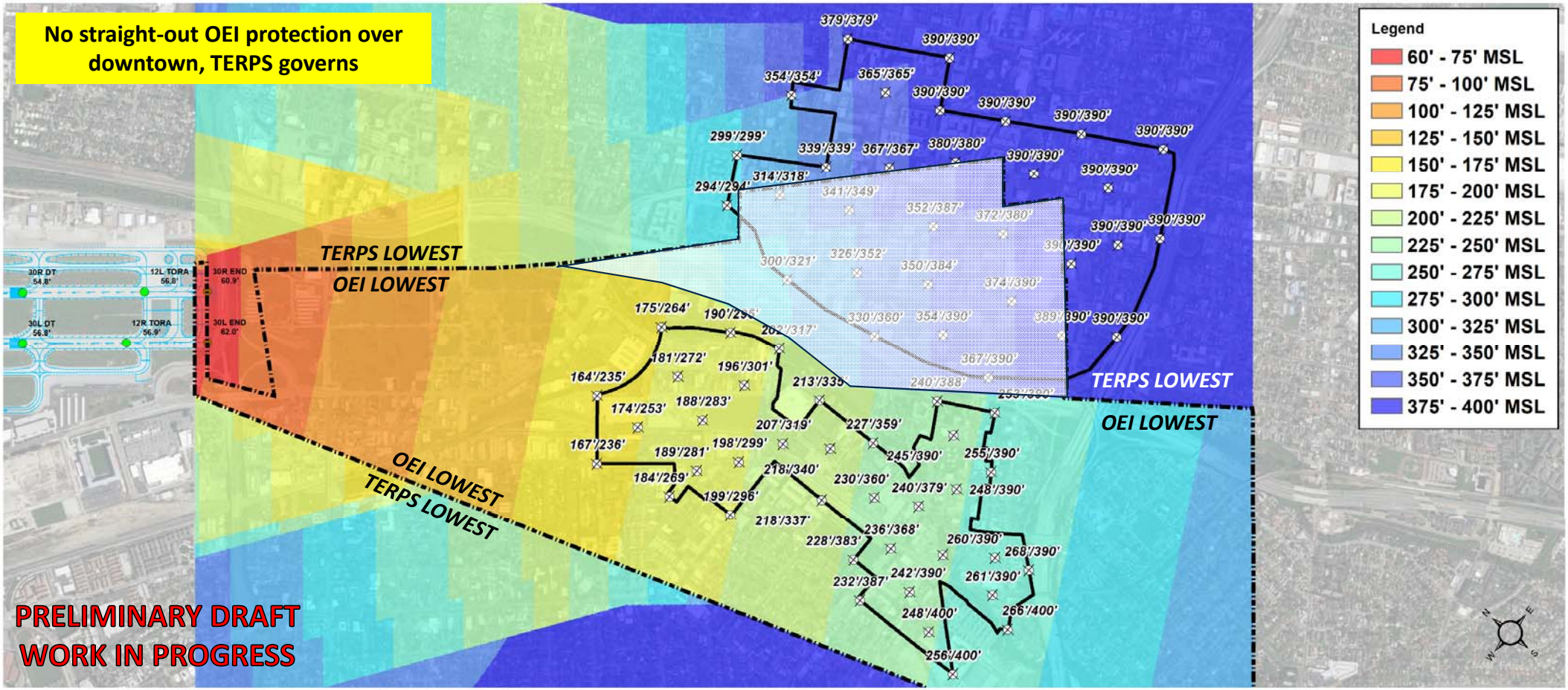
SCENARIO #3 – EAST OEI CORRIDOR WITH TERPS ONLY SCENARIOS OVER DIRIDON STATION AREA



SCENARIO #4 – STRAIGHT-OUT OEI SURFACE PROTECTION WITHOUT WEST OEI CORRIDOR



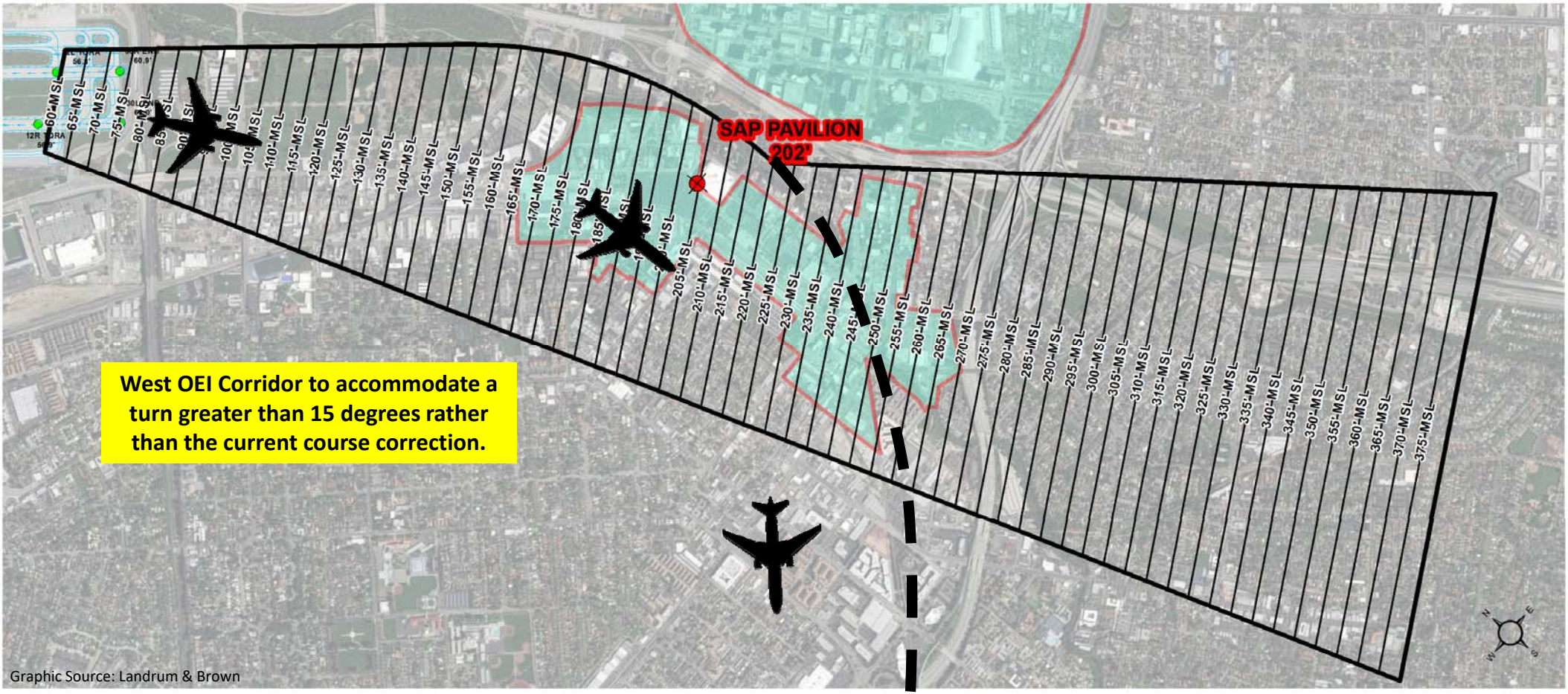
SCENARIO #5 - WEST OEI CORRIDOR SURFACE PROTECTION WITHOUT STRAIGHT-OUT OEI



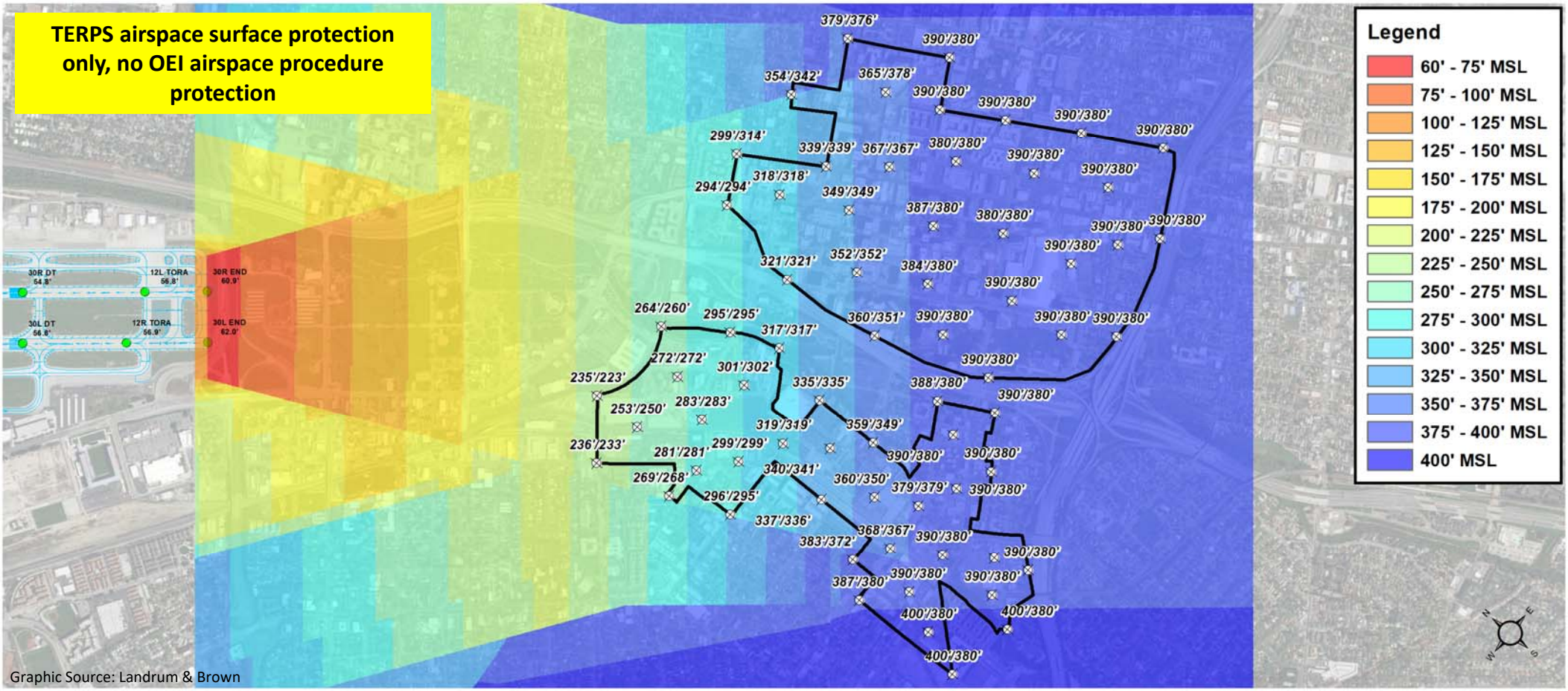
Graphic Source: Landrum & Brown

⊗ ***Random Spot Elevation Comparison:***
000' (2018 TERPS/OEI COMPOSITE)/000' (2018 TERPS COMPOSITE)

SCENARIO #6 – WEST OEI CORRIDOR WITH GREATER THAN 15 DEGREE TURN



SCENARIO #7 – TERPS ONLY



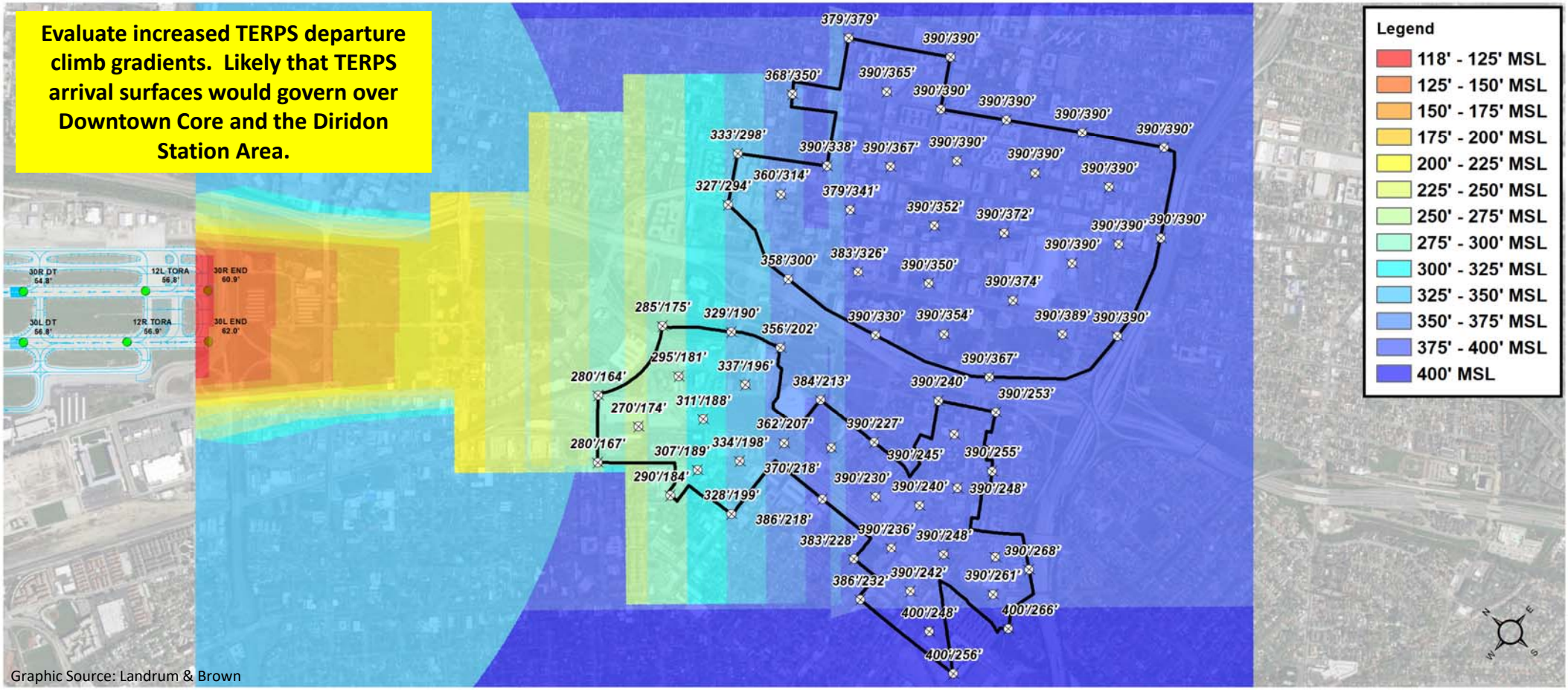
Graphic Source: Landrum & Brown

Random Spot Elevation Comparison:

000' (2018 TERPS COMPOSITE)/000' (2007 TERPS COMPOSITE)

SCENARIO #8 – TERPS ONLY WITH INCREASED TERPS DEPARTURE CLIMB GRADIENTS

Evaluate increased TERPS departure climb gradients. Likely that TERPS arrival surfaces would govern over Downtown Core and the Diridon Station Area.



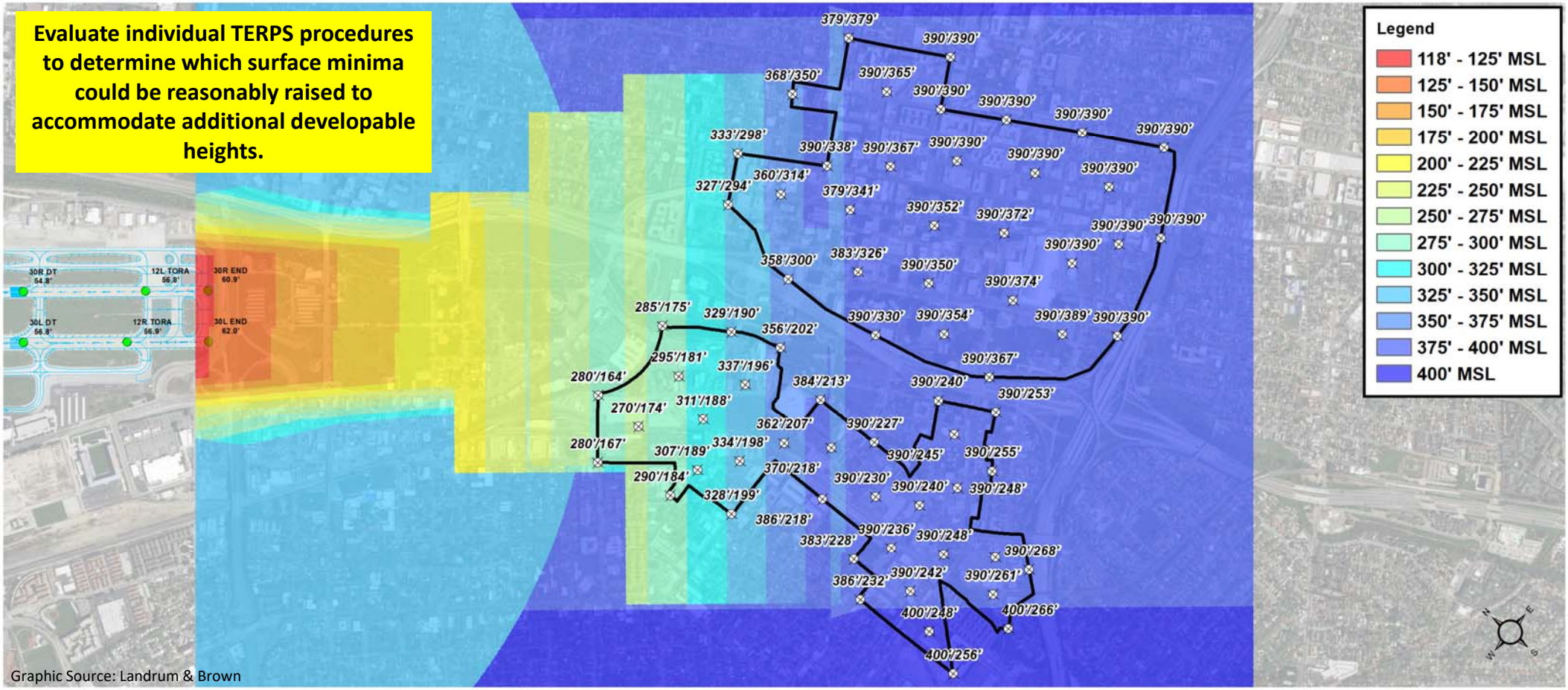
Graphic Source: Landrum & Brown

Random Spot Elevation Comparison:

000' (2018 TERPS ARRIVALS)/000' (2018 (TERPS/OEI COMPOSITE)

SCENARIO #9 – TERPS ONLY WITH INCREASED TERPS DEPARTURE CLIMB GRADIENTS AND APPROACH PROCEDURE MINIMA

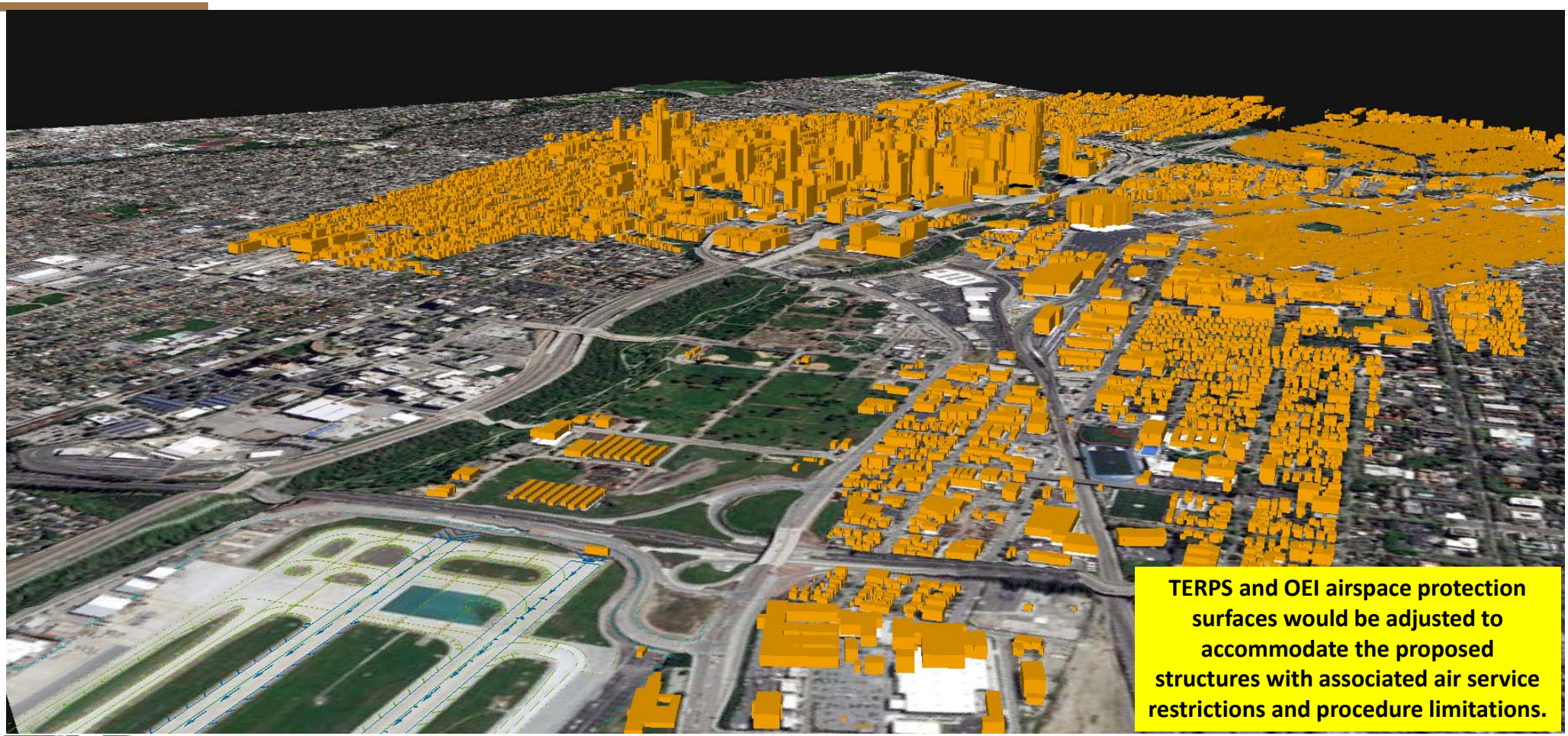
Evaluate individual TERPS procedures to determine which surface minima could be reasonably raised to accommodate additional developable heights.



Graphic Source: Landrum & Brown

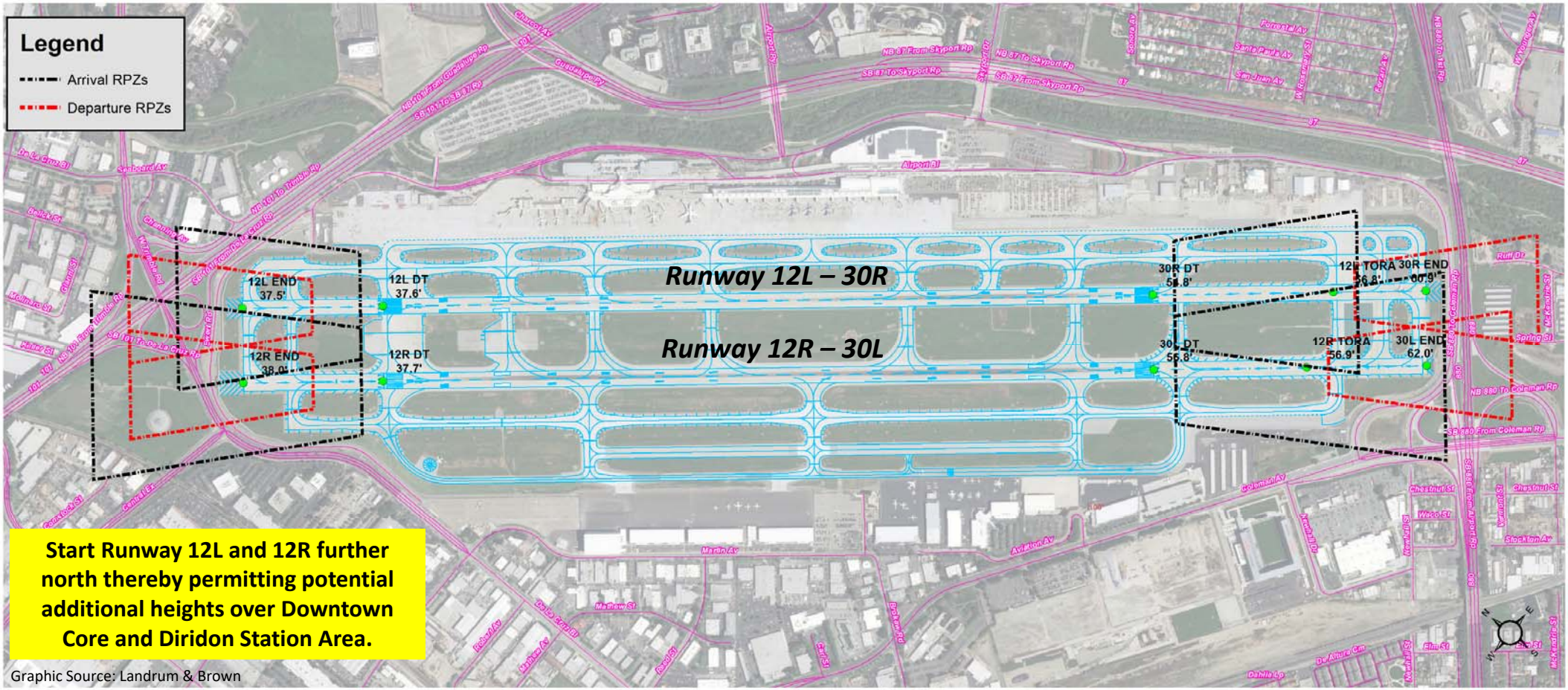
⊗ ***Random Spot Elevation Comparison:***
000' (2018 TERPS ARRIVALS)/000' (2018 (TERPS/OEI COMPOSITE)

SCENARIO #10 – DEFINED DEVELOPMENT HEIGHTS



TERPS and OEI airspace protection surfaces would be adjusted to accommodate the proposed structures with associated air service restrictions and procedure limitations.

SCENARIO #11 – EXTEND THE APPROACH ENDS OF RUNWAYS 12L AND/OR 12R TO THE NORTH



Graphic Source: Landrum & Brown

AIRSPACE SCENARIO SUMMARY MATRIX

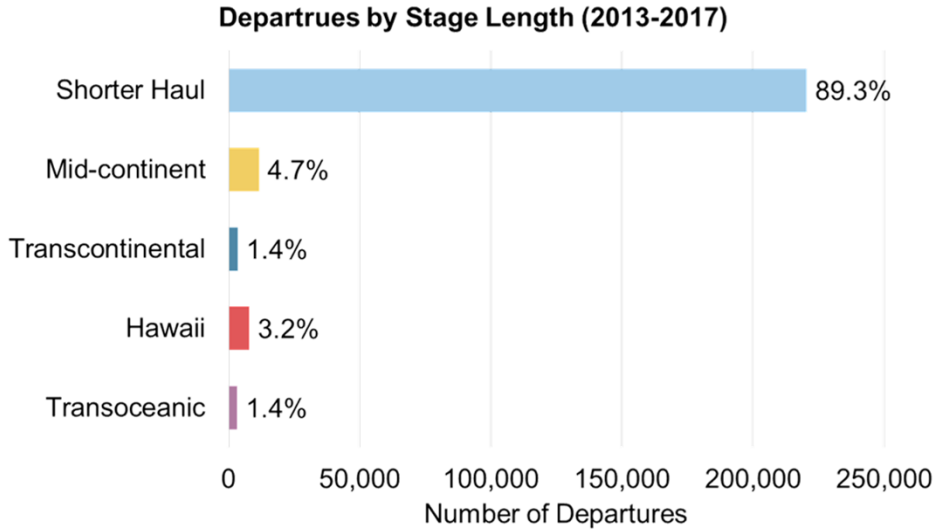
- Review of selected evaluation criteria to rank each of the eleven proposed scenarios
- Evaluation criteria include the following metrics:
  - Potential gain in building heights (Downtown Core)
  - Potential gain in building heights (Diridon Station Area)
  - Potential loss of air service
  - Timeframe for action
  - Degree of difficulty

NEXT STEPS

- Aircraft selection and decision-making framework (May 24, 2018)
- Scenario Analysis and Development (June – August)
- Email correspondence
  - Technical memorandums
    - Draft Existing Conditions
    - Draft Case Studies
    - Draft Relationships between SJC, SFO, and OAK
- Timing of stakeholder meeting

STAGE LENGTH CATEGORIES

- Stage lengths grouped by nautical miles (nm)
  - Up to 1500nm: “Shorter” haul
  - 1500-2000nm: Mid-continent
    - e.g. Chicago, Atlanta
  - 2000-2500nm: Transcontinental
    - e.g. New York, Boston
  - 2000-2500nm: Hawaii
    - Honolulu, Kahului, Lihue, Kona
  - 4000nm+: Transoceanic
    - Europe (London, Frankfurt)
    - Asia (Tokyo, Beijing, Shanghai)



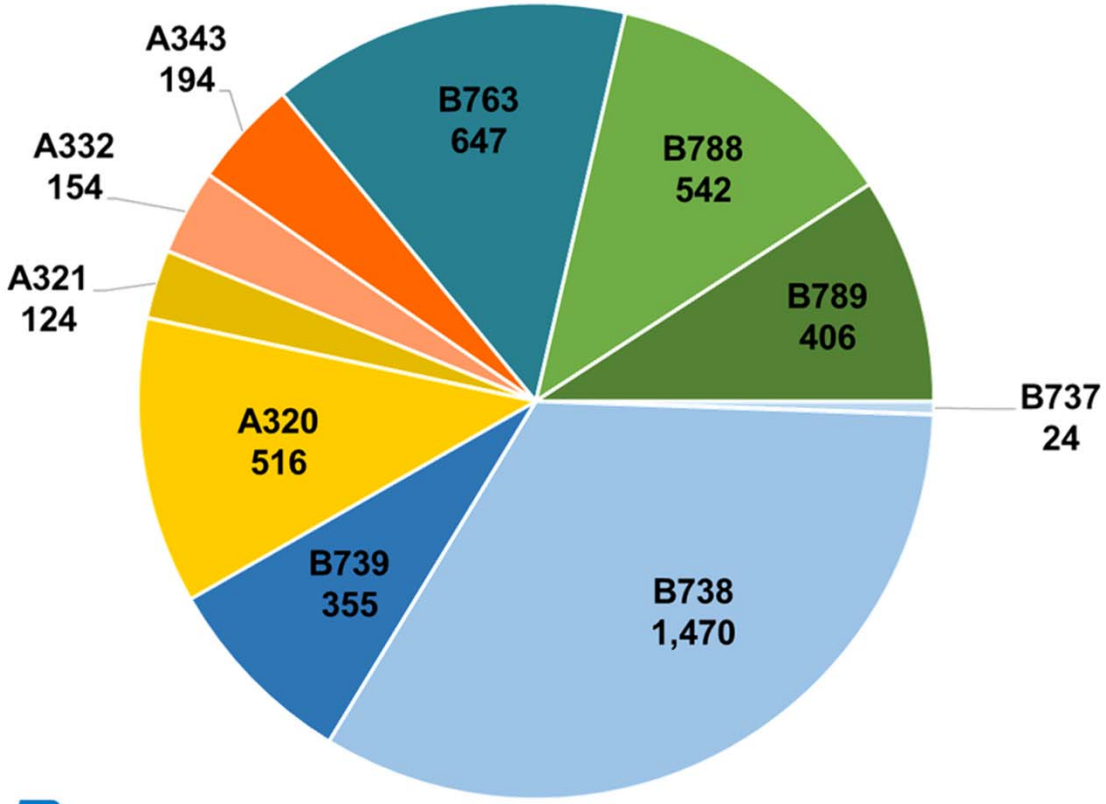
Source: ANOMS

AIRCRAFT EVALUATION FOR SELECTED SCENARIOS

- As part of the three (3) preferred scenarios, three aircraft types will be chosen for evaluation
- Evaluation of aircraft performance as it pertains to changes in OEI/TERPS procedures
- Payload/range impacts will be identified

AIRCRAFT PROFILE – PASSENGER FLIGHTS IN 2017

Aircraft types operating on Hawaii, Transcontinental, and Transoceanic Routes



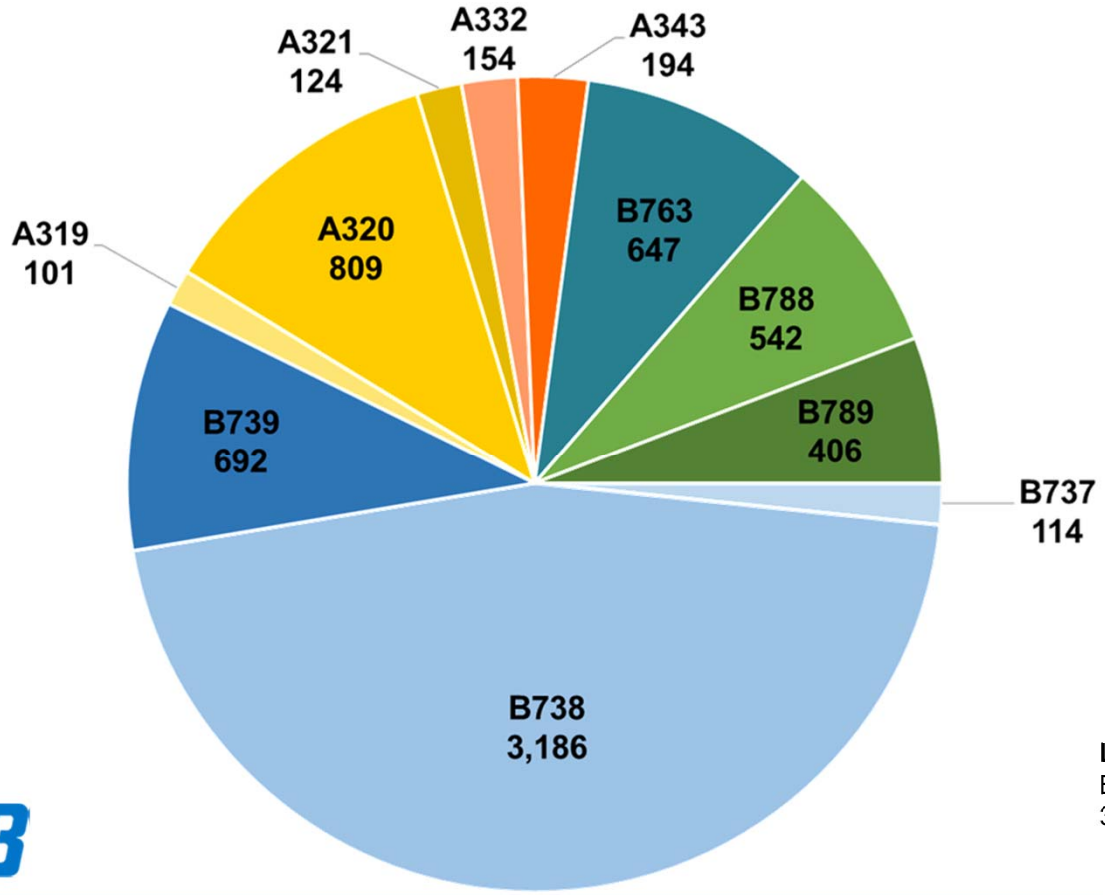
Aircraft Type Abbreviations	
A320	Airbus A320
A321	Airbus A321
A332	Airbus A330-200
A343	Airbus A340-300
B737	Boeing 737-700
B738	Boeing 737-800
B739	Boeing 737-900
B763	Boeing 767-300
B788	Boeing 787-8
B789	Boeing 787-9

Legend
B738 Aircraft Type
1,470 Number of Departures in 2017

Source: ANOMS

AIRCRAFT PROFILE – PASSENGER FLIGHTS IN 2017

Aircraft types operating on Mid-continent, Hawaii, Transcontinental, and Transoceanic Routes



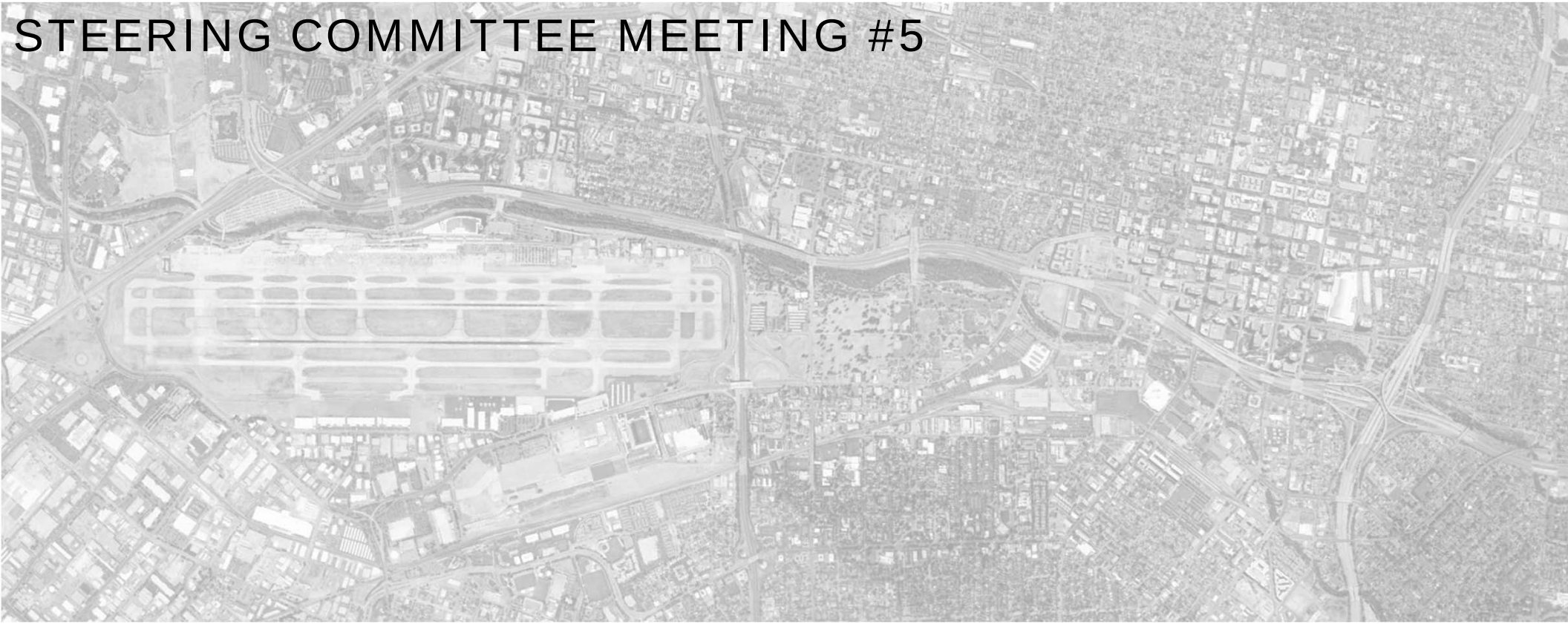
Aircraft Type Abbreviations	
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A320	Airbus A320
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B763	Boeing 767-300
B788	Boeing 787-8
B789	Boeing 787-9

Legend
B738 Aircraft Type
3,186 Number of Departures in 2017

Source: ANOMS

DOWNTOWN SAN JOSÉ AIRSPACE & DEVELOPMENT CAPACITY STUDY (PROJECT CAKE)

STEERING COMMITTEE MEETING #5



May 24, 2018

AGENDA

- Introduction
- Critical aircraft selection
- Establish decision making criteria
- Next steps

AIRCRAFT EVALUATION FOR SELECTED SCENARIOS

- As part of the three (3) preferred scenarios, three aircraft types will be chosen for evaluation
- Evaluation of aircraft performance as it pertains to changes in OEI/TERPS procedures
- Payload/range impacts will be identified

WORLDWIDE WIDE-BODY FLEET

Aircraft Model	Number of Aircraft			
	In-Service	Orders	Total	% of Total
Airbus A300	211	0	211	3%
Airbus A310	37	0	37	1%
Airbus A330	**1,214**	**225**	**1,439**	**20%**
Airbus A340	176	0	176	2%
Airbus A350	**92**	**718**	**810**	**11%**
Airbus A380	212	71	283	4%
Boeing 747	489	19	508	7%
Boeing 767	744	65	809	11%
Boeing 777	**1,387**	**391**	**1,778**	**24%**
Boeing 787	**554**	**556**	**1,110**	**15%**
Boeing MD-11	120	0	120	2%
Ilyushin Il-96	4	0	4	0%
McDonnell Douglas DC-10	43	0	43	1%
Grand Total	**5,283**	**2,045**	**7,328**	**100%**

Notes: Data is updated through August 2017. Includes freighter and passenger aircraft.
Source: FlightGlobal, World Airliner Census, 2017.

WEST COAST SCHEDULED WIDE-BODY OPERATIONS (2018)

2018 Scheduled Aircraft (Departures)								
Airport	**B777**	**B747**	**B787**	**A330**	**A340**	**A350**	**A380**	**Total (Airport)**
LAX	18,369	3,287	13,736	6,662	3,221	2,647	5,947	**53,869**
SFO	12,860	1,413	5,245	2,340	887	1,456	1,197	**25,398**
OAK	122	0	975	212	0	0	0	**1,309**
SJC	0	0	910	135	189	0	0	**1,234**
SAN	218	146	365	365	261	0	0	**1,355**
SEA	2,255	506	1,436	1,683	0	89	0	**5,969**
Total (Aircraft)	**33,824**	**5,352**	**22,667**	**11,397**	**4,558**	**4,192**	**7,144**	**89,134**
% of Total (Aircraft)	**38%**	**6%**	**25%**	**13%**	**5%**	**5%**	**8%**	**100%**

Note: Data is updated through August 2017.
Source: Airbus's & Boeing's Orders and Deliveries.

WIDE-BODY AIRCRAFT SEAT COUNT

Aircraft	Aircraft Seat Count (Typical)
A330-200	247
A330-300	277
A330-800	287
A330-900	287
A340-200	261
A340-300	277
A340-500	293
A340-600	326
A350-900	325
A350-1000	366
A380-800	544

Source: Airbus

Aircraft	Aircraft Seat Count (Typical)
B747-400	416
B747-8	410
B777-200	317
B777-300	396
B777-8X	350-375
B777-9X	400-425
B787-8	242
B787-9	290
B787-10	330

Source: Boeing

LONG HAUL AIRCRAFT COMPOSITION (SJC)

- Transoceanic

Aircraft	Airlines	Destinations	Number of Departures in 2017
B788	ANA, Hainan	Tokyo, Beijing	542
B789	British Airways, Hainan	London, Beijing	406
A343	Lufthansa	Frankfurt	194
A332	Air China	Shanghai	154

- Transcontinental

Aircraft	Airlines	Destinations	Number of Departures in 2017
B738	Alaska, United, Southwest	Newark, Baltimore	794
A320	JetBlue	New York, Boston	516
B739	Alaska, United	Newark	136
A321	JetBlue	New York	124

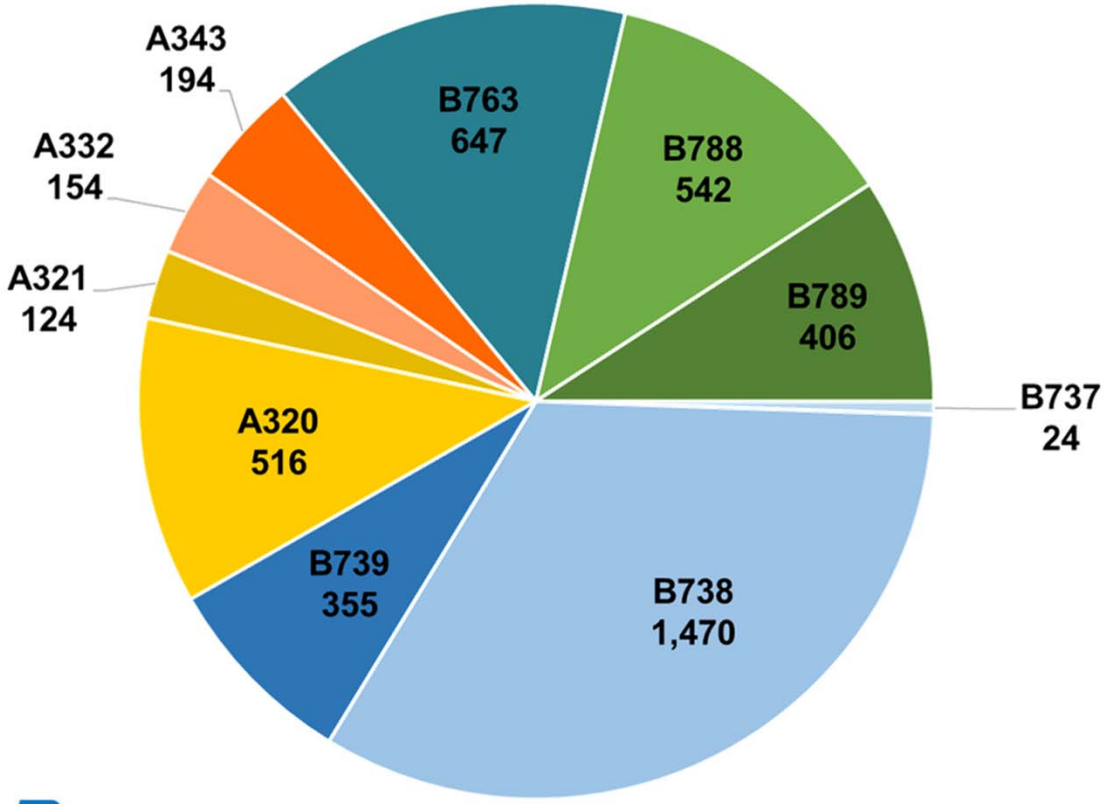
- Hawaii

Aircraft	Airlines	Destinations	Number of Departures in 2017
B738	Alaska	Honolulu, Kahului, Lihue, Kona	700
B763	Hawaiian	Honolulu, Kahului	647
B739	Alaska	Honolulu, Kona	219

Source: ANOMS

AIRCRAFT PROFILE – PASSENGER FLIGHTS IN 2017

Aircraft types operating on Hawaii, Transcontinental, and Transoceanic Routes



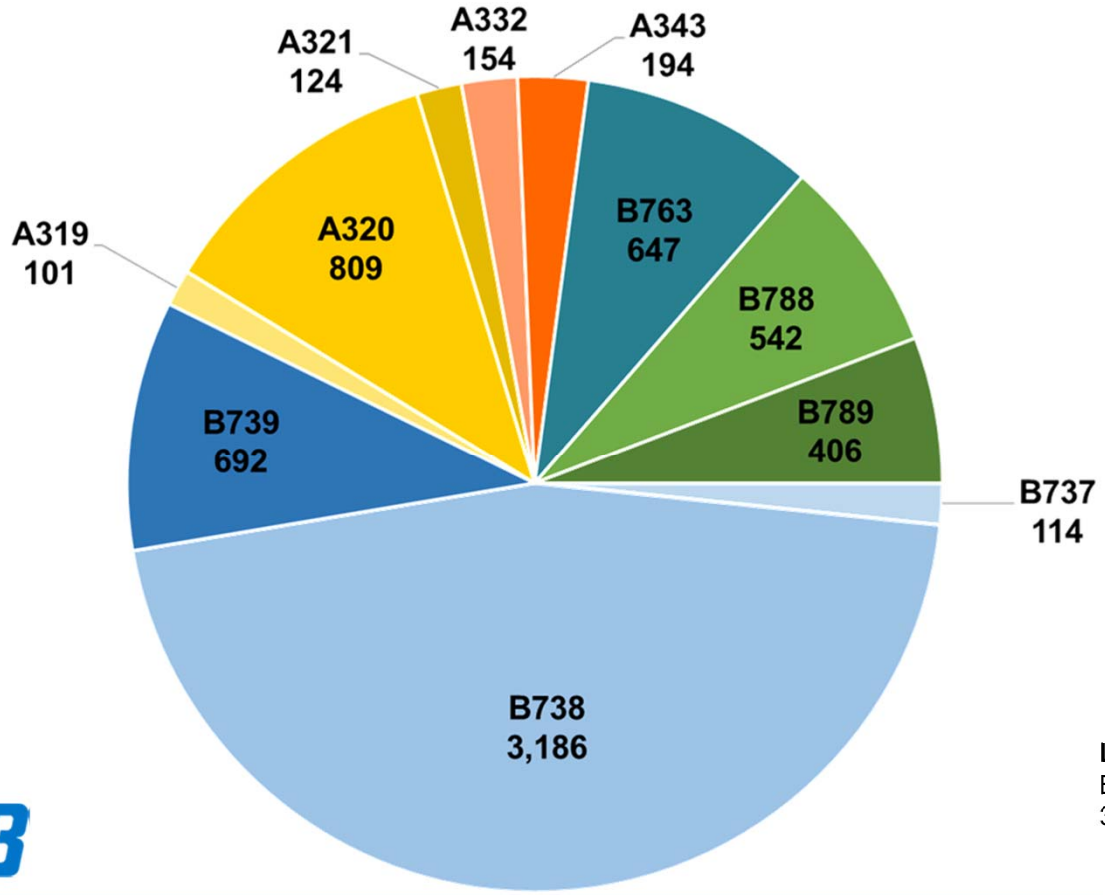
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Legend
B738 Aircraft Type
1,470 Number of Departures in 2017

Source: ANOMS

AIRCRAFT PROFILE – PASSENGER FLIGHTS IN 2017

Aircraft types operating on Mid-continent, Hawaii, Transcontinental, and Transoceanic Routes



Aircraft Type Abbreviations	
A319	Airbus A319
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B763	Boeing 767-300
B788	Boeing 787-8
B789	Boeing 787-9

Legend
B738 Aircraft Type
3,186 Number of Departures in 2017

Source: ANOMS

POTENTIAL AIRCRAFT FOR SCENARIO EVALUATION

- Wide-body Aircraft
  - A330-200
  - A350-900
  - B777-200ER/300ER
  - B787-8/9
- Narrow-body Aircraft
  - A320-200
  - A321-200
  - B737-800/900

AIRCRAFT SELECTION – WIDE-BODY

A330

- Currently operating at SJC and serving Asia

A350

- Likely replacement by Lufthansa for the A340
- New entrant carrier in negotiations to add A350 service at SJC

B777

- Previously operated at SJC to Asia (Tokyo) and is likely to return in the near future
- When a route is successful and air carriers want to increase seats they will upguage to B777

B787

- Currently operating at SJC and serving Asia and Europe

AIRCRAFT SELECTION – NARROW-BODY

A320

- Currently the narrow-body aircraft with the longest transcontinental flight distance operating at SJC (Boston non-stop)
- Second most heavily used aircraft for transcontinental operations

A321

- Highest seating capacity long-haul narrow-body aircraft
- Currently serves New York
- Likely to be Hawaiian Airlines preferred aircraft for service to Hawaii

B737-800

- Most heavily used aircraft at SJC for transcontinental operations

B737-900

- Used for transcontinental markets with need for higher seat capacity routes
- Southwest will be certified for Hawaii service by end of the calendar year (B737-800 or -900 aircraft service)

ESTABLISH DECISION MAKING CRITERIA

1. Tolerance for air service loss
2. Tolerance for aircraft weight penalties
3. Gain in building heights
4. Airline buy-in
5. Other agency buy-in (FAA)
6. Timeframe for decision
7. Comparative economic impact – gain or loss to airport vs gain or loss of potential development
8. Other evaluation criteria that come from the project Steering Committee

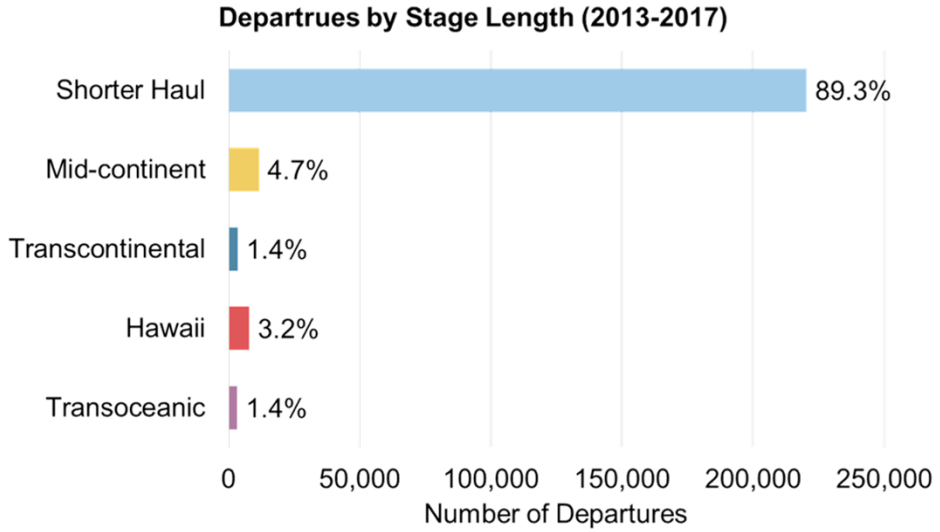
NEXT STEPS

- Scenario analysis and development (June – August)
- Email correspondence
  - Technical memorandums
    - Draft existing conditions
    - Draft case studies
    - Draft relationships between SJC, SFO, and OAK
- Timing of stakeholder meeting (September 2018)

APPENDIX

STAGE LENGTH CATEGORIES

- Stage lengths grouped by nautical miles (nm)
  - Up to 1500nm: “Shorter” haul
  - 1500-2000nm: Mid-continent
    - e.g. Chicago, Atlanta
  - 2000-2500nm: Transcontinental
    - e.g. New York, Boston
  - 2000-2500nm: Hawaii
    - Honolulu, Kahului, Lihue, Kona
  - 4000nm+: Transoceanic
    - Europe (London, Frankfurt)
    - Asia (Tokyo, Beijing, Shanghai)



Source: ANOMS

WIDE-BODY FLEET MIX ASSESSMENT

- Assessment of wide-body aircraft operations operating at west coast airports including
  - Mineta San Jose International Airport (SJC)
  - Los Angeles International Airport (LAX)
  - Oakland International Airport (OAK)
  - San Diego International Airport (SAN)
  - Seattle Tacoma International Airport (SEA)
  - San Francisco International Airport (SFO)
- 2017 operation data was gathered from aircraft manufacturer as well as OAG data sources

WIDE-BODY FLEET MIX ASSESSMENT

- Summary of operations for the following aircraft are provided:
  - Airbus A330
  - Airbus A340
  - Airbus A350
  - Airbus A380
  - Boeing 747
  - Boeing 777
  - Boeing 787

WORLDWIDE WIDE-BODY FLEET CENSUS

Aircraft Model	Number of Aircraft			Percent of Fleet		
	In-Service	Orders	Total	In-Service	Orders	Total
Airbus A300	211	0	**211**	4.0%	0.0%	**2.9%**
Airbus A310	37	0	**37**	0.7%	0.0%	**0.5%**
Airbus A330-200	560	23	**583**	10.6%	1.1%	**8.0%**
Airbus A330-300	654	41	**695**	12.4%	2.0%	**9.5%**
Airbus A330neo	0	161	**161**	0.0%	7.9%	**2.2%**
Airbus A340-200	1	0	**1**	0.0%	0.0%	**0.0%**
Airbus A340-300	104	0	**104**	2.0%	0.0%	**1.4%**
Airbus A340-500	4	0	**4**	0.1%	0.0%	**0.1%**
Airbus A340-600	67	0	**67**	1.3%	0.0%	**0.9%**
Airbus A350-800	0	8	**8**	0.0%	0.4%	**0.1%**
Airbus A350-900	92	504	**596**	1.7%	24.6%	**8.1%**
Airbus A350-1000	0	206	**206**	0.0%	10.1%	**2.8%**
Airbus A380	212	71	**283**	4.0%	3.5%	**3.9%**
Boeing 747-200	8	0	**8**	0.2%	0.0%	**0.1%**
Boeing 747-300	5	0	**5**	0.1%	0.0%	**0.1%**
Boeing 747-400	370	0	**370**	7.0%	0.0%	**5.0%**
Boeing 747-8	106	19	**125**	2.0%	0.9%	**1.7%**
Boeing 747SP	0	0	**0**	0.0%	0.0%	**0.0%**
Boeing 767-200	77	0	**77**	1.5%	0.0%	**1.1%**
Boeing 767-300	630	65	**695**	11.9%	3.2%	**9.5%**
Boeing 767-400	37	0	**37**	0.7%	0.0%	**0.5%**

Aircraft Model	Number of Aircraft			Percent of Fleet		
	In-Service	Orders	Total	In-Service	Orders	Total
Boeing 777-200/200ER	416	0	**416**	7.9%	0.0%	**5.7%**
Boeing 777-200LR	55	0	**55**	1.0%	0.0%	**0.8%**
Boeing 777-300	49	0	**49**	0.9%	0.0%	**0.7%**
Boeing 777-300ER	739	64	**803**	14.0%	3.1%	**11.0%**
Boeing 777-8X	0	53	**53**	0.0%	2.6%	**0.7%**
Boeing 777-9X	0	243	**243**	0.0%	11.9%	**3.3%**
Boeing 777F	128	31	**159**	2.4%	1.5%	**2.2%**
Boeing 787-8	331	69	**400**	6.3%	3.4%	**5.5%**
Boeing 787-9	223	363	**586**	4.2%	17.8%	**8.0%**
Boeing 787-10	0	124	**124**	0.0%	6.1%	**1.7%**
Boeing MD-11	120	0	**120**	2.3%	0.0%	**1.6%**
Ilyushin Il-96	4	0	**4**	0.1%	0.0%	**0.1%**
McDonnell Douglas DC-10	43	0	**43**	0.8%	0.0%	**0.6%**
Grand Total	**5,283**	**2,045**	**7,328**	**100.0%**	**100.0%**	**100.0%**

Notes: Data is updated through August 2017. Includes freighter and passenger aircraft.
Source: FlightGlobal, World Airliner Census, 2017.

AIRBUS A330

AIRBUS A330 FLEET DETAILS

Aircraft Model	Number of Aircraft			Percent of Fleet		
	In-Service	Orders	Total	In-Service	Orders	Total
Airbus A330-200	560	23	**583**	46.1%	10.2%	**40.5%**
Airbus A330-300	654	41	**695**	53.9%	18.2%	**48.3%**
Airbus A330neo	0	161	**161**	0.0%	71.6%	**11.2%**
Grand Total	**1,214**	**225**	**1,439**	**100.0%**	**100.0%**	**100.0%**

Note: Data is updated through August 2017.
Source: Airbus's Orders and Deliveries.

AIRBUS A330 OPERATORS (1 OF 3)

Airline	In Fleet				On Order			
	A330-200	A330-300	A330-900	Total	A330-200	A330-300	A330-900	Total
Aercap	11	15		**26**				**0**
Aercap Ireland		5		**5**				**0**
Aer Lingus	3	9		**12**				**0**
Aeroflot Russian Airlines		11		**11**				**0**
Aerolineas Argentinas	4			**4**				**0**
Afriqiyah Airways	4	2		**6**				**0**
Air Algerie	8			**8**				**0**
Airasia X		20		**20**			66	**66**
Aircalin	2			**2**			2	**2**
Air Canada		8		**8**				**0**
Air Caraibes		3		**3**				**0**
Aircastle Advisor Llc	7			**7**				**0**
Air China	30	26		**56**				**0**
Air France	8			**8**				**0**
Air Inter		4		**4**				**0**
Air Mauritius	2			**2**				**0**
Air Senegal				**0**			2	**2**
Altavair Ltd		3		**3**				**0**
Arkia				**0**			2	**2**
Asiana Airlines		6		**6**				**0**
Austrian Airlines	3			**3**				**0**
Avianca	10			**10**				**0**
Awas	5	7		**12**				**0**
Bmi	1			**1**				**0**
Capital Airlines	2	2		**4**				**0**
Casc				**0**		13		**13**
Cathay Dragon		5		**5**				**0**
Cathay Pacific		49		**49**				**0**
Cebu Pacific Air		2		**2**				**0**
China Airlines		14		**14**				**0**
China Eastern Airlines	33	28		**61**				**0**
China Southern Airlines	16	32		**48**				**0**
Corsair	2			**2**				**0**

Source: Airbus's Orders and Deliveries.

AIRBUS A330 OPERATORS (2 OF 3)

Airline	In Fleet				On Order			
	A330-200	A330-300	A330-900	Total	A330-200	A330-300	A330-900	Total
Delta Air Lines		10		**10**			25	**25**
Egyptair	7	4		**11**		1		**1**
Emirates	28			**28**				**0**
Etihad Airways	14	6		**20**				**0**
Eva Air	3			**3**				**0**
Fiji Airways	3			**3**				**0**
Finnair		8		**8**				**0**
Garuda Indonesia	3	17		**20**			14	**14**
Gecas	21	12		**33**				**0**
Groupe Dubreuil		1		**1**				**0**
Grupo Marsans	4			**4**				**0**
Gulf Air	6			**6**				**0**
Hainan Airlines	3	10		**13**				**0**
Hawaiian Airlines	19			**19**				**0**
Hifly X Ireland				**0**	2			**2**
Hong Kong Airlines	9	9		**18**		9		**9**
Hong Kong International Aviation Le		4		**4**		4		**4**
Iag				**0**	3			**3**
Iberia	14	8		**22**				**0**
Ilfc	68	30		**98**				**0**
Intrepid Aviation Group	4	16		**20**				**0**
Iran Air				**0**	8		28	**36**
Jet Airways	10			**10**	5			**5**
Kingfisher Airlines	5			**5**				**0**
Klm Royal Dutch Airlines	7	1		**8**				**0**
Korean Air	8	22		**30**				**0**
Latam Airlines Brasil	15			**15**				**0**
Libyan Airlines	4			**4**				**0**
Lion Air		6		**6**				**0**
Ltu		5		**5**				**0**
Lufthansa		19		**19**				**0**
Malaysia Airlines		25		**25**				**0**
Middle East Airlines	5			**5**				**0**

Source: Airbus's Orders and Deliveries.

AIRBUS A330 OPERATORS (3 OF 3)

Airline	In Fleet				On Order			
	A330-200	A330-300	A330-900	Total	A330-200	A330-300	A330-900	Total
Mng Airlines				**0**				**0**
Monarch Airlines	2			**2**				**0**
Mytravel Airways	4	3		**7**				**0**
Northwest Airlines	11	21		**32**				**0**
Oman Air	2	6		**8**				**0**
Pembroke Aircraft Leasing 4 Ltd		2		**2**				**0**
Philippine Airlines		23		**23**				**0**
Qantas Airways	10	10		**20**				**0**
Qatar Airways	13	13		**26**				**0**
Rwandair	1	1		**2**				**0**
Sabena	3			**3**				**0**
Saudia		12		**12**				**0**
Scandinavian Airlines		8		**8**		1		**1**
Shenzhen Airlines		3		**3**				**0**
Sichuan Airlines	2	2		**4**				**0**
South African Airways		5		**5**				**0**
Srilankan Airlines	6	5		**11**				**0**
Swiss		16		**16**				**0**
Swissair	4			**4**				**0**
Synergy Aerospace Corporation	6			**6**				**0**
Tap Air Portugal	5			**5**			10	**10**
Thai Airways International		27		**27**				**0**
Tianjin Airlines	4			**4**				**0**
Tibet Airlines	5			**5**				**0**
Transasia Airways		2		**2**				**0**
Tunisair	2			**2**				**0**
Turkish Airlines	6	30		**36**				**0**
Us Airways	15	9		**24**				**0**
Virgin Atlantic		6		**6**				**0**
Waha Capital		2		**2**				**0**

Source: Airbus's Orders and Deliveries.

AIRBUS A330 WEST COAST DEPARTURES

Origin	Scheduled Departures	
	2017	2018
LAX	6,271	6,662
SFO	2,180	2,340
OAK	535	212
SJC	155	135
SAN	365	365
SEA	2,358	1,683
Total	**11,864**	**11,397**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

AIRBUS A330 WEST COAST OPERATIONS - SJC

Destination		Scheduled Departures	
		2017	2018
PVG	Shanghai Pudong International Apt	154	135
HNL	Honolulu	1	0
SJC Total		**155**	**135**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

AIRBUS A330 WEST COAST OPERATIONS – LAX/SFO

Destination		Scheduled Departures	
		2017	2018
HNL	Honolulu	1,096	1,041
OGG	Kahului	371	365
NAN	Nadi	361	365
ARN	Stockholm Arlanda Apt	336	329
DUB	Dublin	248	314
KEF	Reykjavik Keflavik International Apt	270	276
JFK	New York J F Kennedy International Apt	256	177
SVO	Moscow Sheremetyevo International Apt	198	145
NKG	Nanjing	156	156
MAD	Madrid Adolfo Suarez-Barajas Apt	98	209
PHL	Philadelphia International Apt	0	278
HGH	Hangzhou	114	156
TNA	Jinan	114	155
HND	Tokyo Intl (Haneda)	64	185
DUS	Duesseldorf International Airport	231	0
KOA	Kona	44	124
MAN	Manchester (GB)	77	75
ATL	Atlanta Hartsfield-jackson Intl Apt	58	90
CDG	Paris Charles de Gaulle Apt	44	82
BCN	Barcelona Apt	43	61
AMS	Amsterdam	0	59
TXL	Berlin Tegel Apt	58	0
YYZ	Toronto Lester B Pearson Intl	12	0
BOG	Bogota	3	2
LGW	London Gatwick Apt	2	0
LAX Total		**6,271**	**6,662**

Destination		Scheduled Departures	
		2017	2018
HNL	Honolulu	366	365
OGG	Kahului	365	365
DUB	Dublin	339	347
KEF	Reykjavik Keflavik International Apt	261	259
PHL	Philadelphia International Apt	68	357
TAO	Qingdao	156	154
MAN	Manchester (GB)	128	127
NAN	Nadi	74	110
DUS	Duesseldorf International Airport	164	0
HEL	Helsinki-Vantaa	52	83
CDG	Paris Charles de Gaulle Apt	41	34
TXL	Berlin Tegel Apt	69	0
MAD	Madrid Adolfo Suarez-Barajas Apt	0	68
WUH	Wuhan	0	57
ATL	Atlanta Hartsfield-jackson Intl Apt	53	0
CLT	Charlotte	17	7
DTW	Detroit Metropolitan Wayne County	22	1
JFK	New York J F Kennedy International Apt	0	6
PVG	Shanghai Pudong International Apt	4	0
MSP	Minneapolis/St Paul International Apt	1	0
SFO Total		**2,180**	**2,340**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

AIRBUS A330 WEST COAST OPERATIONS – OAK/SAN/SEA

OAKLAND

Destination		Scheduled Departures 2017	2018
HNL	Honolulu	289	93
BCN	Barcelona Apt	82	97
OGG	Kahului	164	9
TER	Terceira	0	13
OAK Total		**535**	**212**

SAN DIEGO

Destination		Scheduled Departures 2017	2018
HNL	Honolulu	365	365
SAN Total		**365**	**365**

SEATTLE

Destination		Scheduled Departures 2017	2018
AMS	Amsterdam	572	386
HNL	Honolulu	386	375
OGG	Kahului	365	366
CDG	Paris Charles de Gaulle Apt	335	97
PEK	Beijing Capital Intl Apt	291	101
HKG	Hong Kong International Apt	323	63
DUB	Dublin	0	119
ICN	Seoul Incheon International Airport	58	11
CGN	Cologne/Bonn Apt	22	38
FRA	Frankfurt International Apt	0	60
MAN	Manchester (GB)	0	34
LHR	London Heathrow Apt	0	28
NRT	Tokyo Narita Intl	1	4
ATL	Atlanta Hartsfield-jackson Intl Apt	2	1
DTW	Detroit Metropolitan Wayne County	1	0
LAS	Las Vegas McCarran International Apt	1	0
MSP	Minneapolis/St Paul International Apt	1	0
SEA Total		**2,358**	**1,683**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

AIRBUS A340

AIRBUS A340 FLEET DETAILS

Aircraft Model	Number of Aircraft			Percent of Fleet		
	In-Service	Orders	Total	In-Service	Orders	Total
Airbus A340-200	1	0	**1**	0.6%	0.0%	**0.6%**
Airbus A340-300	104	0	**104**	59.1%	0.0%	**59.1%**
Airbus A340-500	4	0	**4**	2.3%	0.0%	**2.3%**
Airbus A340-600	67	0	**67**	38.1%	0.0%	**38.1%**
Grand Total	**176**	**0**	176	**100.0%**	**0.0%**	**100.0%**

Note: Data is updated through August 2017.
Source: Airbus's Orders and Deliveries.

AIRBUS A340 OPERATORS

Airline	In Fleet			On Order		
	A340-200/300	A340-500/600	Total	A340-200/300	A340-500/600	Total
Air Canada	8	2	**10**			**0**
Air China	3		**3**			**0**
Air China Southwest Company	3		**3**			**0**
Air France	14		**14**			**0**
Air Mauritius	5		**5**			**0**
Air Tahiti Nui	4		**4**			**0**
Arik Air		2	**2**			**0**
Austrian Airlines	4		**4**			**0**
Cathay Pacific	11		**11**			**0**
China Airlines	6		**6**			**0**
China Eastern Airlines	5	5	**10**			**0**
Egyptair	3		**3**			**0**
Emirates		10	**10**			**0**
Etihad Airways		11	**11**			**0**
Finnair	4		**4**			**0**
Gulf Air	6		**6**			**0**
Iberia	18	16	**34**			**0**
Ilfc	16	13	**29**			**0**
Kuwait Airways	4		**4**			**0**
Latam Airlines Group	4		**4**			**0**
Lufthansa	35	24	**59**			**0**
Olympic Airlines	4		**4**			**0**
Philippine Airlines	8		**8**			**0**
Qatar Airways		4	**4**			**0**
Sabena	5		**5**			**0**
Scandinavian Airlines	7		**7**			**0**
Singapore Airlines	17	5	**22**			**0**
South African Airways	6	6	**12**			**0**
Srilankan Airlines	3		**3**			**0**
Swiss	9		**9**			**0**
Tap Air Portugal	4		**4**			**0**
Thai Airways International		10	**10**			**0**
Turkish Airlines	7		**7**			**0**
U.T.A.	7		**7**			**0**
Virgin Atlantic	7	14	**21**			**0**

Source: Airbus's Orders and Deliveries.

AIRBUS A340 WEST COAST DEPARTURES

Origin	Scheduled Departures	
	2017	2018
LAX	3,281	3,221
SFO	1,128	887
OAK	13	0
SJC	196	189
SAN	30	261
SEA	24	0
Total	**4,672**	**4,558**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

AIRBUS A340 WEST COAST OPERATIONS

LOS ANGELES

Destination		Scheduled Departures 2017	2018
PPT	Tahiti	532	510
CDG	Paris Charles de Gaulle Apt	236	270
MUC	Munich International Airport	352	143
FRA	Frankfurt International Apt	0	217
MNL	Manila Ninoy Aquino International Apt	34	55
CEB	Cebu	63	0
MAD	Madrid Adolfo Suarez-Barajas Apt	44	0
ARN	Stockholm Arlanda Apt	2	8
LHR	London Heathrow Apt	1	0
LAX Total		**3,281**	**3,221**

SAN DIEGO

Destination		Scheduled Departures 2017	2018
FRA	Frankfurt International Apt	0	200
ZRH	Zurich Airport	30	61
SAN Total		**30**	**261**

SEATTLE

Destination		Scheduled Departures 2017	2018
LHR	London Heathrow Apt	24	0
SEA Total		**24**	**0**

OAK

Destination		Scheduled Departures 2017	2018
TER	Terceira	13	0
OAK Total		**13**	**0**

SAN JOSE

Destination		Scheduled Departures 2017	2018
FRA	Frankfurt International Apt	196	189
SJC Total		**196**	**189**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

AIRBUS A350

AIRBUS A350 FLEET DETAILS

Aircraft Model	Number of Aircraft			Percent of Fleet		
	In-Service	Orders	Total	In-Service	Orders	Total
Airbus A350-800	0	8	**8**	0.0%	1.1%	**1.0%**
Airbus A350-900	92	504	**596**	100.0%	70.2%	**73.6%**
Airbus A350-1000	0	206	**206**	0.0%	28.7%	**25.4%**
Grand Total	**92**	**718**	**810**	**100.0%**	**100.0%**	**100.0%**

Note: Data is updated through August 2017.
Source: Airbus's Orders and Deliveries.

AIRBUS A350 OPERATORS

Airline	In Fleet			On Order		
	A350-900	A350-1000	Total	A350-900	A350-1000	Total
Aercap	17		**17**	3		**3**
Aer Lingus			**0**	9		**9**
Aeroflot Russian Airlines			**0**	14		**14**
Afriqiyah Airways			**0**	10		**10**
Airasia X			**0**	10		**10**
Air Caraibes			**0**		3	**3**
Air China			**0**	10		**10**
Air France			**0**	21		**21**
Air Mauritius			**0**	4		**4**
Alafco	6		**6**	6		**6**
Asiana Airlines	5		**5**	16	9	**25**
British Airways			**0**		18	**18**
Cathay Pacific	20		**20**	6	20	**26**
China Airlines	12		**12**	2		**2**
China Eastern Airlines			**0**	20		**20**
China Southern Airlines			**0**	20		**20**
Delta Air Lines	9		**9**	16		**16**
Ethiopian Airlines	6		**6**	16		**16**
Etihad Airways			**0**	40	22	**62**
Finnair	11		**11**	8		**8**
Groupe Dubreuil	1		**1**			**0**

Airline	In Fleet			On Order		
	A350-900	A350-1000	Total	A350-900	A350-1000	Total
Hong Kong Airlines			**0**	15		**15**
Iberia			**0**	16		**16**
Iran Air			**0**		16	**16**
Japan Airlines			**0**	18	13	**31**
Klm Royal Dutch Airlines			**0**	7		**7**
Kuwait Airways			**0**	10		**10**
Latam Airlines Group	8		**8**	7	12	**19**
Libyan Airlines			**0**	6		**6**
Lufthansa	8		**8**	17		**17**
Philippine Airlines			**0**	6		**6**
Qatar Airways	23	1	**24**	16	36	**52**
Scandinavian Airlines			**0**	8		**8**
Singapore Airlines	21		**21**	46		**46**
Srilankan Airlines			**0**	4		**4**
Thai Airways International	3		**3**	1		**1**
United Airlines			**0**	45		**45**
Vietnam Airlines	8		**8**	2		**2**
Virgin Atlantic			**0**		8	**8**
Yemenia - Yemen Airways			**0**	10		**10**

Source: Airbus's Orders and Deliveries.

AIRBUS A350 WEST COAST DEPARTURES

Origin	Scheduled Departures	
	2017	2018
LAX	2,025	2,647
SFO	856	1,456
OAK	0	0
SJC	0	0
SAN	0	0
SEA	0	89
Total	**2,881**	**4,192**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

AIRBUS A350 WEST COAST OPERATIONS – LAX/SEA/SFO

LOS ANGELES

Destination		Scheduled Departures 2017	2018
HKG	Hong Kong International Apt	8	359
PVG	Shanghai Pudong International Apt	0	166
ICN	Seoul Incheon International Airport	0	104
LAX Total		**2,025**	**2,647**

SEATTLE

Destination		Scheduled Departures 2017	2018
ICN	Seoul Incheon International Airport	0	89
SEA Total		**0**	**89**

SAN FRANCISCO

Destination		Scheduled Departures 2017	2018
SIN	Singapore Changi Apt	365	365
HKG	Hong Kong International Apt	57	500
ICN	Seoul Incheon International Airport	140	365
TPE	Taipei Taiwan Taoyuan International Apt	294	35
ORY	Paris Orly Apt	0	101
PPT	Tahiti	0	90
SFO Total		**856**	**1,456**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

AIRBUS A380

AIRBUS A380 FLEET DETAILS

Aircraft Model	Number of Aircraft			Percent of Fleet		
	In-Service	Orders	Total	In-Service	Orders	Total
Airbus A380	212	71	**283**	100.0%	100.0%	**100.0%**
Grand Total	**212**	**71**	**283**	**100.0%**	**100.0%**	**100.0%**

Note: Data is updated through August 2017.
Source: Airbus's Orders and Deliveries.

AIRBUS A380 OPERATORS

Airline	In Fleet		On Order	
	A380	Total	A380	Total
Air Accord		**0**	3	**3**
Air France	10	**10**		**0**
All Nippon Airways		**0**	3	**3**
Amedeo		**0**	20	**20**
Asiana Airlines	6	**6**		**0**
British Airways	12	**12**		**0**
China Southern Airlines	5	**5**		**0**
Emirates	103	**103**	59	**59**
Etihad Airways	10	**10**		**0**
Korean Air	10	**10**		**0**
Lufthansa	14	**14**		**0**
Malaysia Airlines	6	**6**		**0**
Qantas Airways	12	**12**	8	**8**
Qatar Airways	10	**10**		**0**
Singapore Airlines	22	**22**	2	**2**
Thai Airways International	6	**6**		**0**

Source: Airbus's Orders and Deliveries.

AIRBUS A380 WEST COAST DEPARTURES

Origin	Scheduled Departures	
	2017	2018
LAX	6,223	5,947
SFO	1,266	1,197
OAK	0	0
SJC	0	0
SAN	0	0
SEA	0	0
Total	**7,489**	**7,144**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

AIRBUS A380 WEST COAST OPERATIONS

LOS ANGELES

Destination		Scheduled Departures	
		2017	2018
ICN	Seoul Incheon International Airport	1,435	1,300
LHR	London Heathrow Apt	619	530
DXB	Dubai International	402	351
CAN	Guangzhou	365	363
CDG	Paris Charles de Gaulle Apt	352	364
MEL	Melbourne Airport	361	336
SYD	Sydney Kingsford Smith Apt	310	323
FRA	Frankfurt International Apt	362	146
MUC	Munich International Airport	0	216
LAX Total		**6,223**	**5,947**

SAN FRANCISCO

Destination		Scheduled Departures	
		2017	2018
DXB	Dubai International	365	365
FRA	Frankfurt International Apt	358	300
LHR	London Heathrow Apt	327	281
CDG	Paris Charles de Gaulle Apt	216	189
MUC	Munich International Airport	0	62
SFO Total		**1,266**	**1,197**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

BOEING 747

BOEING 747 FLEET DETAILS

Aircraft Model	Number of Aircraft			Percent of Fleet		
	In-Service	Orders	Total	In-Service	Orders	Total
Boeing 747-200	8	0	**8**	1.6%	0.0%	**1.6%**
Boeing 747-300	5	0	**5**	1.0%	0.0%	**1.0%**
Boeing 747-400	370	0	**370**	75.7%	0.0%	**72.8%**
Boeing 747-8	106	19	**125**	21.7%	100.0%	**24.6%**
Boeing 747SP	0	0	**0**	0.0%	0.0%	**0.0%**
Grand Total	**489**	**19**	**508**	**100.0%**	**100.0%**	**100.0%**

Note: Data is updated through August 2017.
Source: Boeing's Orders and Deliveries.

BOEING 747 OPERATORS

Airline	In Fleet							On Order						
	747-100	747-200	747-300	747-400	747-8	747-SP	Total	747-100	747-200	747-300	747-400	747-8	747-SP	Total
Air Canada	5	2		3			**10**							**0**
Air China		1		14	7		**22**							**0**
Air France	16	13		12			**41**							**0**
Air India		11	2	6			**19**							**0**
Air New Zealand		5		4			**9**							**0**
Alitalia	2	14					**16**							**0**
American Airlines	16						**16**							**0**
Asiana Airlines				8			**8**							**0**
British Airways	18	18		57			**93**							**0**
Cathay Pacific Airways		8	6	17			**31**							**0**
China Airlines		4		17		4	**25**							**0**
Delta Air Lines	5						**5**							**0**
EgyptAir			2				**2**							**0**
EL AL Israel Airlines		6		4			**10**							**0**
EVA Air				15			**15**							**0**
Garuda Indonesia		6		2			**8**							**0**
GECAS				1			**1**							**0**
Japan Airlines	20	24	13	42			**99**							**0**
KLM Royal Dutch Airlines		17	3	22			**42**							**0**
Korean Air		6	3	28	10	2	**49**							**0**
Kuwait Airways		4		1			**5**							**0**
Lufthansa	3	21		32	19		**75**							**0**
Malaysia Airlines			1	21			**22**							**0**
Pakistan International Airline		2					**2**							**0**
Philippine Airlines		4		4			**8**							**0**
Saudi Arabian Airlines	8		10	5		2	**25**							**0**
Singapore Airlines		19	14	42			**75**							**0**
Thai Airways International		6	2	18			**26**							**0**
United Airlines	22	2		44			**68**							**0**

Source: Boeing's Orders and Deliveries.

BOEING 747 WEST COAST DEPARTURES

Origin	Scheduled Departures	
	2017	2018
LAX	3,584	3,287
SFO	3,314	1,413
OAK	0	0
SJC	0	0
SAN	143	146
SEA	581	506
Total	**7,622**	**5,352**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

BOEING 747 WEST COAST OPERATIONS – LAX/SAN/SEA

LOS ANGELES

Destination		Scheduled Departures	
		2017	2018
AMS	Amsterdam	497	365
BNE	Brisbane	354	266
JFK	New York J F Kennedy International Apt	351	237
LHR	London Heathrow Apt	107	193
FRA	Frankfurt International Apt	144	144
SYD	Sydney Kingsford Smith Apt	66	57
ICN	Seoul Incheon International Airport	22	7
MEL	Melbourne Airport	22	0
MDT	Harrisburg International Apt	2	0
DTW	Detroit Metropolitan Wayne County	1	0
PEK	Beijing Capital Intl Apt	1	0
LAX Total		**3,584**	**3,287**

SEATTLE

Destination		Scheduled Departures	
		2017	2018
FRA	Frankfurt International Apt	348	290
LHR	London Heathrow Apt	191	216
TPE	Taipei Taiwan Taoyuan International Apt	40	0
BIF	El Paso Biggs Aaf	1	0
NRT	Tokyo Narita Intl	1	0
SEA Total		**581**	**506**

SAN DIEGO

Destination		Scheduled Departures	
		2017	2018
LHR	London Heathrow Apt	143	146
SAN Total		**143**	**146**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

BOEING 747 WEST COAST OPERATIONS - SFO

Destination		Scheduled Departures	
		2017	2018
PEK	Beijing Capital Intl Apt	613	365
LHR	London Heathrow Apt	519	366
ICN	Seoul Incheon International Airport	540	154
SYD	Sydney Kingsford Smith Apt	306	311
FRA	Frankfurt International Apt	468	0
AMS	Amsterdam	147	217
PVG	Shanghai Pudong International Apt	210	0
TPE	Taipei Taiwan Taoyuan International Apt	210	0
NRT	Tokyo Narita Intl	164	0
HKG	Hong Kong International Apt	83	0
GRK	Killeen/Fort Hood Regional/R. Gray AAF	9	0
AEX	Alexandria International Apt	6	0
VCV	Victorville	6	0
HNL	Honolulu	5	0
BIF	El Paso Biggs Aaf	4	0
RIV	Riverside March JARB	4	0
SVN	Savannah Hunter Aaf	3	0

Destination		Scheduled Departures	
		2017	2018
AUS	Austin-Bergstrom International Apt	2	0
EIL	Fairbanks Eielson AFB	2	0
HHN	Frankfurt Hahn Airport	2	0
EDF	Anchorage Elmendorf AFB	1	0
HOP	Hopkinsville	1	0
LAX	Los Angeles International Apt	1	0
LSV	Las Vegas Nellis AFB	1	0
MIB	Minot AFB	1	0
NGU	Norfolk NS (Chambers Field)	1	0
OKC	Oklahoma City Will Rogers Apt	1	0
SEA	Seattle-Tacoma International Apt	1	0
SLN	Salina	1	0
SSC	Sumter Shaw AFB	1	0
TCM	Tacoma McChord Field	1	0
SFO Total		**3,314**	**1,413**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

BOEING 777

BOEING 777 FLEET DETAILS

Aircraft Model	Number of Aircraft			Percent of Fleet		
	In-Service	Orders	Total	In-Service	Orders	Total
Boeing 777-200/200ER	416	0	**416**	30.0%	0.0%	**23.4%**
Boeing 777-200LR	55	0	**55**	4.0%	0.0%	**3.1%**
Boeing 777-300	49	0	**49**	3.5%	0.0%	**2.8%**
Boeing 777-300ER	739	64	**803**	53.3%	16.4%	**45.2%**
Boeing 777-8X	0	53	**53**	0.0%	13.6%	**3.0%**
Boeing 777-9X	0	243	**243**	0.0%	62.1%	**13.7%**
Boeing 777F	128	31	**159**	9.2%	7.9%	**8.9%**
Grand Total	**1,387**	**391**	**1,778**	**100.0%**	**100.0%**	**100.0%**

Note: Data is updated through August 2017.
Source: Boeing's Orders and Deliveries.

BOEING 777 OPERATORS (1 OF 2)

	In Fleet							On Order						
Airline	777-300ER	777-300	777-200LR	777-200	777-200ER	777X	Total	777-300ER	777-300	777-200LR	777-200	777-200ER	777X	Total
Aeroflot - Russian Airlines	16						**16**	6						**6**
Air Austral			1				**1**							**0**
Air Canada	17		6				**23**							**0**
Air China	26			10			**36**							**0**
Air France	36				18		**54**							**0**
Air France-KLM Group	1						**1**							**0**
Air India	15		8				**23**							**0**
Air New Zealand	5				4		**9**							**0**
Alitalia					6		**6**							**0**
All Nippon Airways	22	7		16	12		**57**						1	**1**
Altavair LLC	1						**1**							**0**
American Airlines	20				47		**67**							**0**
ANA Holdings							**0**	6					19	**25**
Asiana Airlines					10		**10**							**0**
Austrain Airlines					1		**1**							**0**
Biman Bangladesh Airlines	4						**4**							**0**
British Airways	6			5	44		**55**							**0**
Cathay Pacific Airways	49	12		5			**66**						21	**21**
Ceiba Intercontinental			1				**1**							**0**
China Airlines	6						**6**							**0**
China Eastern Airlines	20						**20**							**0**
China Southern Airlines	10			4	2		**16**							**0**
Delta Air Lines			10		8		**18**							**0**
Dream Aviation Ltd.					1		**1**							**0**
EgyptAir					5		**5**							**0**
EL AL Israel Airlines					6		**6**							**0**
Emirates	108		10	3	6		**127**	12					150	**162**
Ethiopian Airlines			6				**6**							**0**
Etihad Airways	18						**18**						25	**25**
EVA Air	20						**20**							**0**
Garuda Indonesia	10						**10**							**0**

Source: Boeing's Orders and Deliveries.

BOEING 777 OPERATORS (2 OF 2)

	In Fleet							On Order						
Airline	777-300ER	777-300	777-200LR	777-200	777-200ER	777X	Total	777-300ER	777-300	777-200LR	777-200	777-200ER	777X	Total
GECAS	49				4		**53**							**0**
Intrepid Aviation	4						**4**							**0**
Japan Airlines	13	7		15	11		**46**							**0**
Jet Airways	10						**10**							**0**
Kenya Airways	1				4		**5**							**0**
KLM Royal Dutch Airlines	9				6		**15**							**0**
Korean Air	20	4			18		**42**	3						**3**
Kuwait Airways	10				2		**12**							**0**
LATAM Airlines Brasil	10						**10**							**0**
Lauda Air					3		**3**							**0**
Lufthansa							**0**						20	**20**
Malaysia Airlines					15		**15**							**0**
Mid East Jet					1		**1**							**0**
Pakistan International Airline	3		2		3		**8**	5						**5**
Philippine Airlines	4						**4**							**0**
Qatar Airways	41		9				**50**	7					60	**67**
Republic of Iraq			1				**1**							**0**
Saudi Arabian Airlines	20				23		**43**							**0**
Singapore Airlines	27	12			46		**85**						20	**20**
Swiss International Air Lines	10						**10**							**0**
TAAG	5				3		**8**							**0**
Thai Airways International	6	6		8	6		**26**							**0**
Turkish Airlines	30						**30**							**0**
Turkmenistan Airlines			3				**3**							**0**
United Airlines	17			22	58		**97**	1						**1**
Vietnam Airlines					4		**4**							**0**
Virgin Australia	4						**4**							**0**

Source: Boeing's Orders and Deliveries.

BOEING 777 WEST COAST DEPARTURES

Origin	Scheduled Departures	
	2017	2018
LAX	19,812	18,369
SFO	11,282	12,860
OAK	143	122
SJC	0	0
SAN	216	218
SEA	1,929	2,255
Total	**33,382**	**33,824**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

BOEING 777 WEST COAST OPERATIONS - LAX

Destination		Scheduled Departures 2017	2018
TPE	Taipei Taiwan Taoyuan International Apt	1,804	1,529
HKG	Hong Kong International Apt	1,673	1,450
NRT	Tokyo Narita Intl	1,435	1,505
LHR	London Heathrow Apt	1,136	1,078
PVG	Shanghai Pudong International Apt	1,087	896
SYD	Sydney Kingsford Smith Apt	999	703
HND	Tokyo Intl (Haneda)	982	552
AKL	Auckland International Apt	724	722
PEK	Beijing Capital Intl Apt	561	723
MNL	Manila Ninoy Aquino International Apt	475	640
EWR	Newark Liberty International Apt	414	505
ICN	Seoul Incheon International Airport	435	414
CDG	Paris Charles de Gaulle Apt	404	429
DOH	Doha	365	365
ZRH	Zurich Airport	365	365
IST	Istanbul Ataturk Airport	359	365
GTP	Grants Pass	333	365
AUH	Abu Dhabi International Apt	365	291
HNL	Honolulu	382	267
BNE	Brisbane	324	311
DEN	Denver Intl Apt	318	317
ATL	Atlanta Hartsfield-jackson Intl Apt	364	232
MIA	Miami International Apt	302	247
FCO	Rome Fiumicino Apt	199	239
MEL	Melbourne Airport	188	248
TLV	Tel Aviv-yafo Ben Gurion International	203	209

Destination		Scheduled Departures 2017	2018
SVO	Moscow Sheremetyevo International Apt	167	217
JED	Jeddah	153	186
AMS	Amsterdam	63	272
VIE	Vienna International	153	181
PPT	Tahiti	156	156
CAN	Guangzhou	153	150
GRU	Sao Paulo Guarulhos Intl Apt	224	0
DFW	Dallas Dallas/Fort Worth Intl Apt	212	10
ORD	Chicago O'Hare International Apt	118	0
IAH	Houston George Bush Intercont.	1	116
RAR	Rarotonga Island	52	47
DXB	Dubai International	83	14
RUH	Riyadh King Khalid Intl	37	0
YYZ	Toronto Lester B Pearson Intl	6	30
MEX	Mexico City Juarez Intl	8	0
IAD	Washington Dulles International Apt	4	1
JFK	New York J F Kennedy International Apt	4	1
MED	Madinah	1	1
OKC	Oklahoma City Will Rogers Apt	0	2
PHX	Phoenix Sky Harbor Intl Apt	2	0
DTW	Detroit Metropolitan Wayne County	1	0
MDT	Harrisburg International Apt	1	0
LAX Total		**19,812**	**18,369**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

BOEING 777 WEST COAST OPERATIONS - SFO

Destination		Scheduled Departures	
		2017	2018
HKG	Hong Kong International Apt	1,484	1,452
TPE	Taipei Taiwan Taoyuan International Apt	1,078	1,743
HNL	Honolulu	850	932
EWR	Newark Liberty International Apt	688	775
NRT	Tokyo Narita Intl	566	730
LHR	London Heathrow Apt	429	726
ICN	Seoul Incheon International Airport	571	469
AKL	Auckland International Apt	516	508
PVG	Shanghai Pudong International Apt	425	512
ORD	Chicago O'Hare International Apt	672	260
HND	Tokyo Intl (Haneda)	432	426
CDG	Paris Charles de Gaulle Apt	291	527
DEL	Delhi	313	434
IST	Istanbul Ataturk Airport	355	365
MNL	Manila Ninoy Aquino International Apt	354	364
ZRH	Zurich Airport	281	365
BOS	Boston Edward L Logan Intl Apt	425	205
DEN	Denver Intl Apt	291	305
FRA	Frankfurt International Apt	78	513

Destination		Scheduled Departures	
		2017	2018
IAD	Washington Dulles International Apt	311	260
PEK	Beijing Capital Intl Apt	149	365
CAN	Guangzhou	196	247
WUH	Wuhan	120	99
OGG	Kahului	134	22
TLV	Tel Aviv-yafo Ben Gurion International	0	151
AUH	Abu Dhabi International Apt	147	0
AMS	Amsterdam	70	0
IAH	Houston George Bush Intercont.	0	53
KIX	Osaka Kansai International Airport	47	0
YYZ	Toronto Lester B Pearson Intl	0	39
LAS	Las Vegas McCarran International Apt	6	6
KOA	Kona	0	4
LAX	Los Angeles International Apt	1	1
OKC	Oklahoma City Will Rogers Apt	2	0
COS	Colorado Springs Municipal	0	1
CVS	Clovis Cannon AFB	0	1
SFO Total		**11,282**	**12,860**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

BOEING 777 WEST COAST OPERATIONS – OAK/SAN/SEA

OAKLAND

Destination		Scheduled Departures 2017	2018
LGW	London Gatwick Apt	143	122
OAK Total		**143**	**122**

SAN DIEGO

Destination		Scheduled Departures 2017	2018
LHR	London Heathrow Apt	216	216
CDG	Paris Charles de Gaulle Apt	0	2
SAN Total		**216**	**218**

SEATTLE

Destination		Scheduled Departures 2017	2018
ICN	Seoul Incheon International Airport	577	576
DXB	Dubai International	506	365
TPE	Taipei Taiwan Taoyuan International Apt	455	370
LHR	London Heathrow Apt	390	364
CDG	Paris Charles de Gaulle Apt	0	327
HKG	Hong Kong International Apt	0	243
AMS	Amsterdam	0	8
ATL	Atlanta Hartsfield-jackson Intl Apt	1	1
PVG	Shanghai Pudong International Apt	0	1
SEA Total		**1,929**	**2,255**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

BOEING 787

BOEING 787 FLEET DETAILS

Aircraft Model	Number of Aircraft			Percent of Fleet		
	In-Service	Orders	Total	In-Service	Orders	Total
Boeing 787-8	331	69	**400**	59.7%	12.4%	**36.0%**
Boeing 787-9	223	363	**586**	40.3%	65.3%	**52.8%**
Boeing 787-10	0	124	**124**	0.0%	22.3%	**11.2%**
Grand Total	**554**	**556**	**1,110**	**100.0%**	**100.0%**	**100.0%**

Note: Data is updated through August 2017.
Source: Boeing's Orders and Deliveries.

BOEING 787 OPERATORS

Airline	In Fleet				On Order			
	787-8	787-9	787-10	Total	787-8	787-9	787-10	Total
Aeroflot - Russian Airlines				**0**	18	4		**22**
Air Austral	2			**2**				**0**
Air Canada	8	25		**33**		4		**4**
Air China		14		**14**		1		**1**
Air France-KLM Group		6		**6**		11	8	**19**
Air India	27			**27**				**0**
Air New Zealand		11		**11**		1		**1**
American Airlines	20	15		**35**		32		**32**
Biman Bangladesh Airlines				**0**	4			**4**
British Airways	9	17		**26**	3	1	12	**16**
China Southern Airlines	10	1		**11**				**0**
EL AL Israel Airlines		1		**1**	2	3		**5**
Ethiopian Airlines	16			**16**				**0**
Etihad Airways		20		**20**		21	30	**51**
EVA Air				**0**			18	**18**
GECAS				**0**		6	4	**10**
Japan Airlines	25	11		**36**	4	9		**13**
Jet Airways				**0**		10		**10**
Kenya Airways	9			**9**				**0**
Korean Air	1	5		**6**		5		**5**
LATAM Airlines Group	10	8		**18**		8		**8**
Qatar Airways	30			**30**		30		**30**
Republic of Iraq				**0**	10			**10**
Saudi Arabian Airlines		8		**8**				**0**
Singapore Airlines			2	**2**			47	**47**
Turkish Airlines				**0**		25		**25**
United Airlines	12	25		**37**			14	**14**
Vietnam Airlines		8		**8**				**0**

Source: Boeing's Orders and Deliveries.

BOEING 787 WEST COAST DEPARTURES

Origin	Scheduled Departures	
	2017	2018
LAX	9,940	13,736
SFO	4,624	5,245
OAK	556	975
SJC	963	910
SAN	365	365
SEA	1,060	1,436
Total	**17,508**	**22,667**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

BOEING 787 WEST COAST OPERATIONS - LAX

Destination		Scheduled Departures	
		2017	2018
LHR	London Heathrow Apt	1,213	1,548
PVG	Shanghai Pudong International Apt	672	729
PEK	Beijing Capital Intl Apt	513	678
SYD	Sydney Kingsford Smith Apt	429	730
NRT	Tokyo Narita Intl	451	685
MEL	Melbourne Airport	380	604
YYZ	Toronto Lester B Pearson Intl	273	539
LGW	London Gatwick Apt	333	470
KIX	Osaka Kansai International Airport	365	365
DFW	Dallas Dallas/Fort Worth Intl Apt	312	388
BOG	Bogota	299	363
LIM	Lima	287	261
AKL	Auckland International Apt	304	146
SIN	Singapore Changi Apt	66	365
WAW	Warsaw Frederic Chopin	152	256
HND	Tokyo Intl (Haneda)	46	358
CDG	Paris Charles de Gaulle Apt	150	239
GRU	Sao Paulo Guarulhos Intl Apt	56	319
DUB	Dublin	177	177
SCL	Santiago (CL)	160	171
CPH	Copenhagen Kastrup Apt	142	146
ARN	Stockholm Arlanda Apt	138	146
IAH	Houston George Bush Intercont.	1	280
BCN	Barcelona Apt	79	198
XMN	Xiamen	87	154
OSL	Oslo Gardermoen Airport	102	117

Destination		Scheduled Departures	
		2017	2018
CTU	Chengdu	84	128
CSX	Changsha	104	104
ORD	Chicago O'Hare International Apt	184	3
CKG	Chongqing	82	104
FCO	Rome Fiumicino Apt	15	151
TAO	Qingdao	9	157
BNE	Brisbane	0	145
SZX	Shenzhen	11	133
JFK	New York J F Kennedy International Apt	4	122
MXP	Milan Malpensa Apt	0	115
MEX	Mexico City Juarez Intl	113	0
DEN	Denver Intl Apt	103	0
MAD	Madrid Adolfo Suarez-Barajas Apt	0	88
SFO	San Francisco	25	2
PPT	Tahiti	0	23
EZE	Buenos Aires Ministro Pistarini	0	6
RAR	Rarotonga Island	0	5
EWR	Newark Liberty International Apt	2	0
LAX Total		**9,940**	**13,736**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

BOEING 787 WEST COAST OPERATIONS - SFO

Destination		Scheduled Departures	
		2017	2018
LHR	London Heathrow Apt	562	681
PVG	Shanghai Pudong International Apt	455	582
SIN	Singapore Changi Apt	365	365
SYD	Sydney Kingsford Smith Apt	365	365
YYZ	Toronto Lester B Pearson Intl	145	457
HND	Tokyo Intl (Haneda)	295	304
KIX	Osaka Kansai International Airport	276	319
TLV	Tel Aviv-yafo Ben Gurion International	364	224
ICN	Seoul Incheon International Airport	63	472
AMS	Amsterdam	241	262
IAH	Houston George Bush Intercont.	456	30
CDG	Paris Charles de Gaulle Apt	321	149
CTU	Chengdu	168	155
MUC	Munich International Airport	103	176
DEN	Denver Intl Apt	120	48
DFW	Dallas Dallas/Fort Worth Intl Apt	0	165
IAD	Washington Dulles International Apt	16	149
ZRH	Zurich Airport	0	142
HGH	Hangzhou	123	0
FRA	Frankfurt International Apt	0	104
XIY	Xi'an Xianyang Apt	75	0
MEL	Melbourne Airport	0	67
CAN	Guangzhou	48	0
WUH	Wuhan	36	0
LAX	Los Angeles International Apt	27	2
PPT	Tahiti	0	27
SFO Total		**4,624**	**5,245**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

BOEING 787 WEST COAST OPERATIONS – OAK/SAN/SEA/SJC

OAKLAND

Destination		Scheduled Departures 2017	2018
LGW	London Gatwick Apt	222	267
BCN	Barcelona Apt	70	225
ARN	Stockholm Arlanda Apt	142	117
CDG	Paris Charles de Gaulle Apt	0	151
CPH	Copenhagen Kastrup Apt	61	61
OSL	Oslo Gardermoen Airport	61	61
FCO	Rome Fiumicino Apt	0	93
OAK Total		**556**	**975**

SEATTLE

Destination		Scheduled Departures 2017	2018
NRT	Tokyo Narita Intl	365	365
LHR	London Heathrow Apt	237	333
PVG	Shanghai Pudong International Apt	201	156
PEK	Beijing Capital Intl Apt	60	239
LGW	London Gatwick Apt	61	209
SZX	Shenzhen	136	134
SEA Total		**1,060**	**1,436**

SAN DIEGO

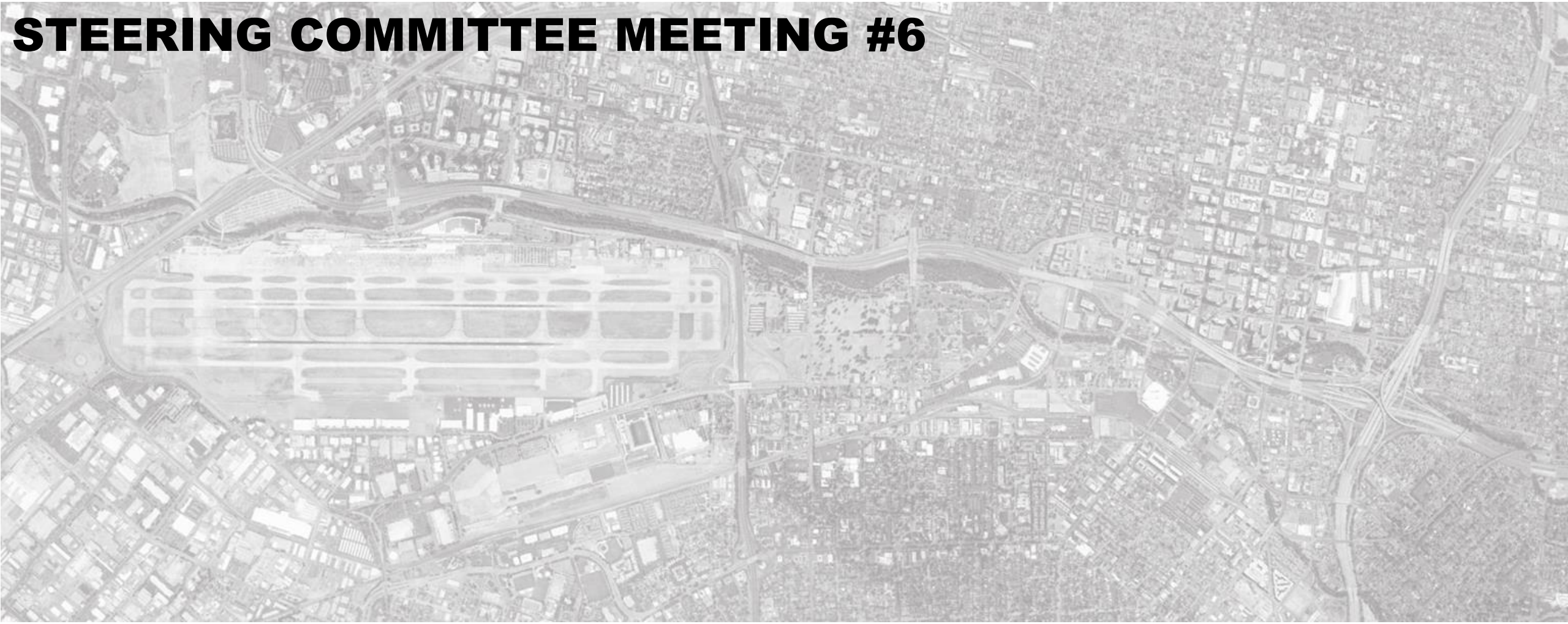
Destination		Scheduled Departures 2017	2018
NRT	Tokyo Narita Intl	365	365
SAN Total		**365**	**365**

SAN JOSE

Destination		Scheduled Departures 2017	2018
NRT	Tokyo Narita Intl	365	365
LHR	London Heathrow Apt	358	336
PEK	Beijing Capital Intl Apt	240	209
SJC Total		**963**	**910**

Source: OAG Aviation Worldwide Ltd, OAG Schedules Analyser

DOWNTOWN SAN JOSÉ AIRSPACE & DEVELOPMENT CAPACITY STUDY (PROJECT CAKE)



STEERING COMMITTEE MEETING #6

September 7, 2018

AGENDA

- Introduction
- Airspace Protection Scenarios
- Aircraft Performance City Pair Assessment
- Airline Aircraft Performance Assessment
- Comments on Existing Conditions and Bay Area Airports Comparison Reports

AIRSPACE PROTECTION SCENARIOS

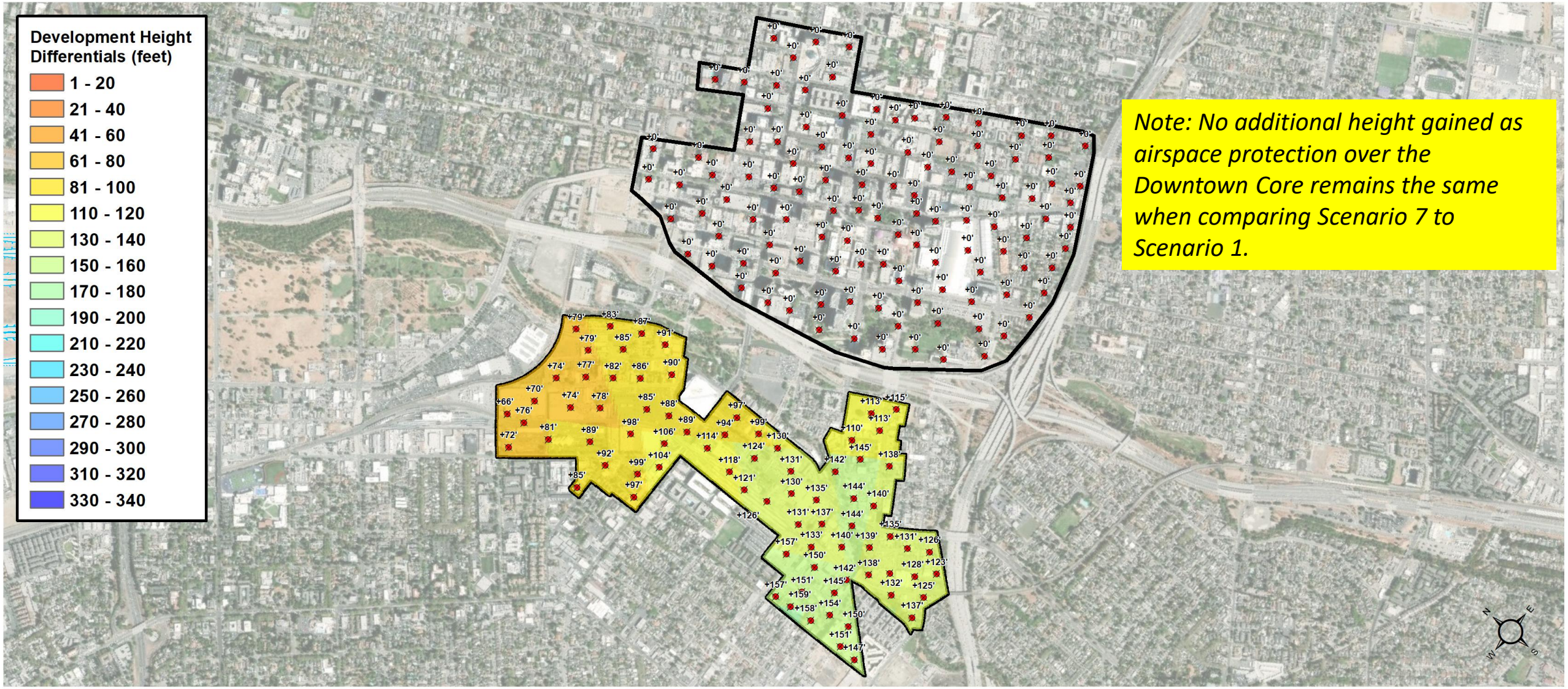
- Five Airspace Scenarios
  - **Scenario 1**: Existing
  - **Scenario 4**: No OEI
  - **Scenario 7**: Straight-out OEI
  - **Scenario 10**: Straight-out OEI with West OEI Corridor alternatives
  - **Scenario 9**: No OEI, increased FAA height limits

SCENARIO 4 – NO OEI - DEVELOPMENT HEIGHT DIFFERENTIALS



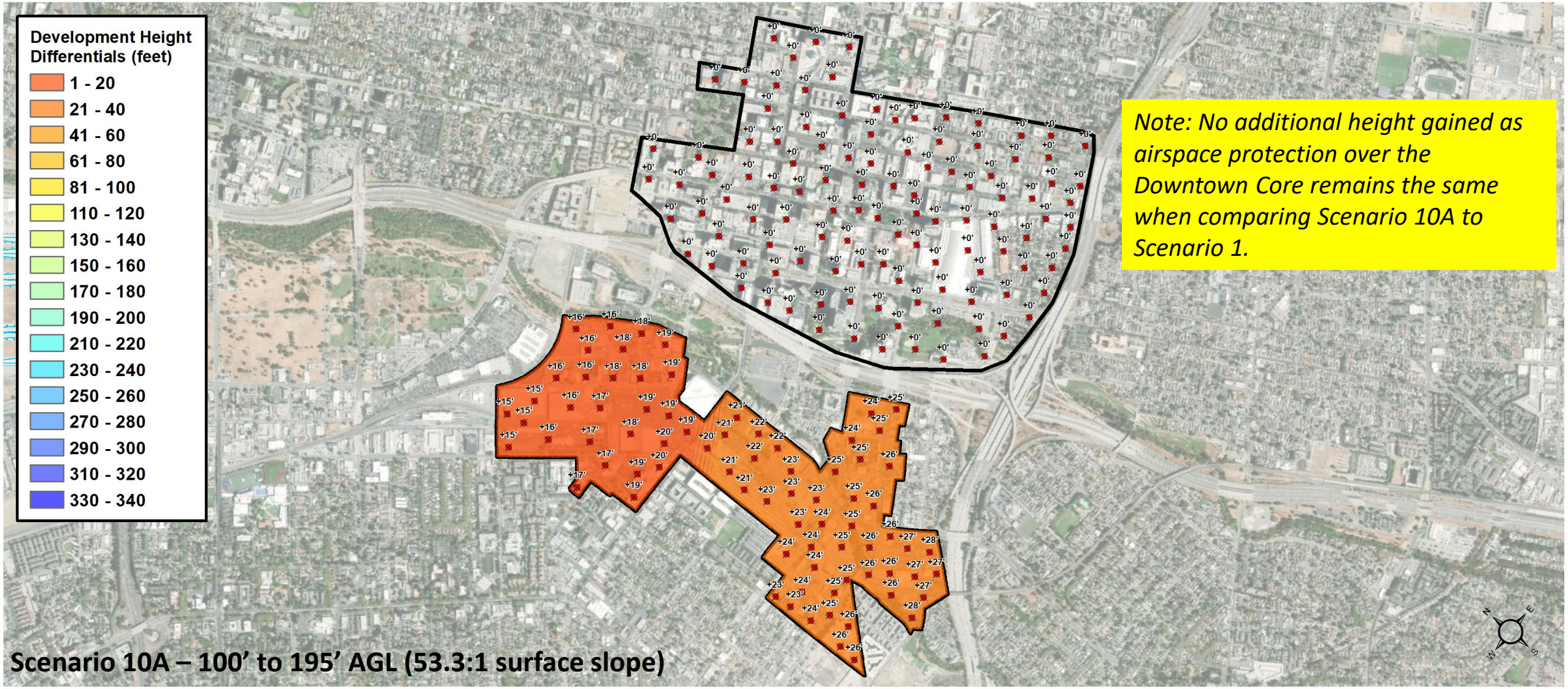
Note: Differential height increases represent the additional developable heights as compared to Scenario 1 (existing airspace protection)

SCENARIO 7 - STRAIGHT-OUT OEI - DEVELOPMENT HEIGHT DIFFERENTIALS



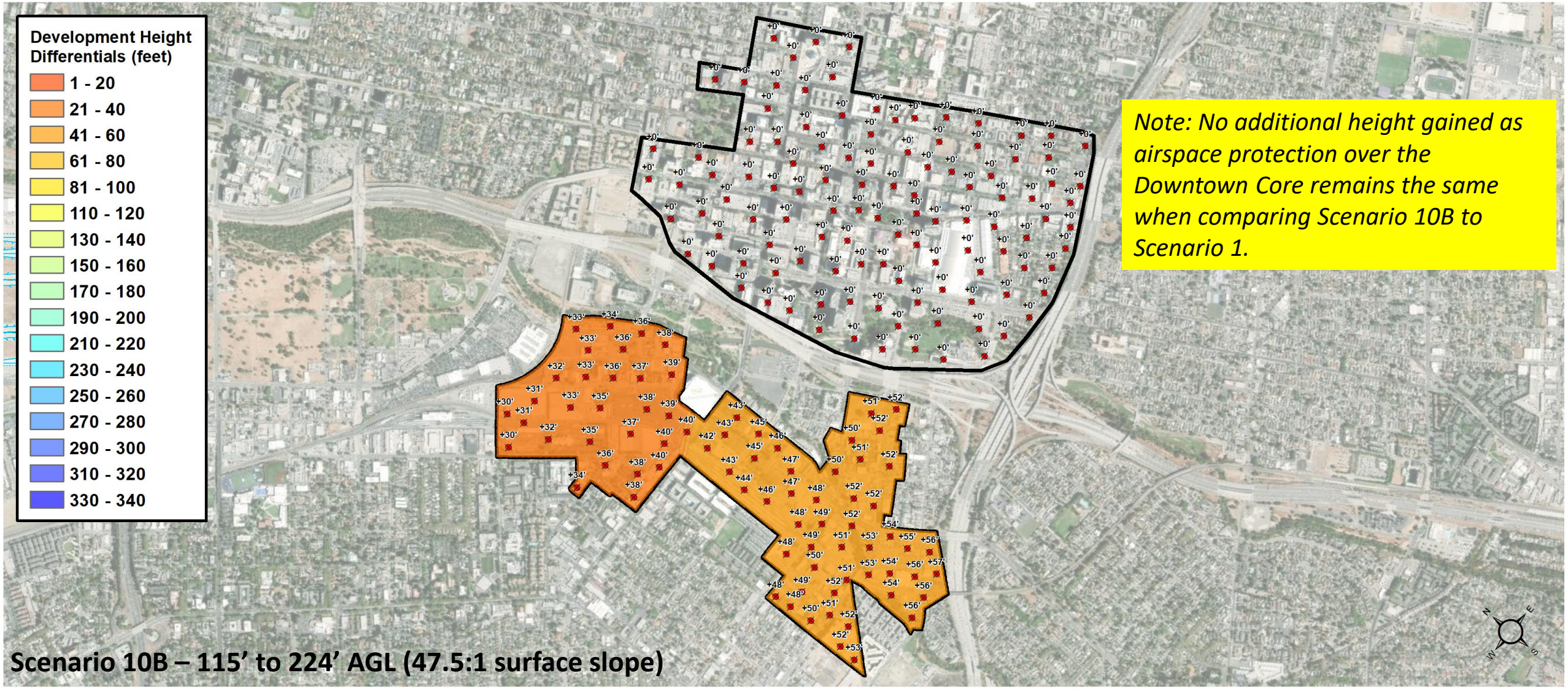
Note: Differential height increases represent the additional developable heights as compared to Scenario 1 (existing airspace protection)

SCENARIO 10A – STRAIGHT-OUT OEI WITH OEI WEST CORRIDOR ALTERNATIVES (PRESERVE STRAIGHT-OUT OEI) – DEVELOPMENT HEIGHT DIFFERENTIALS



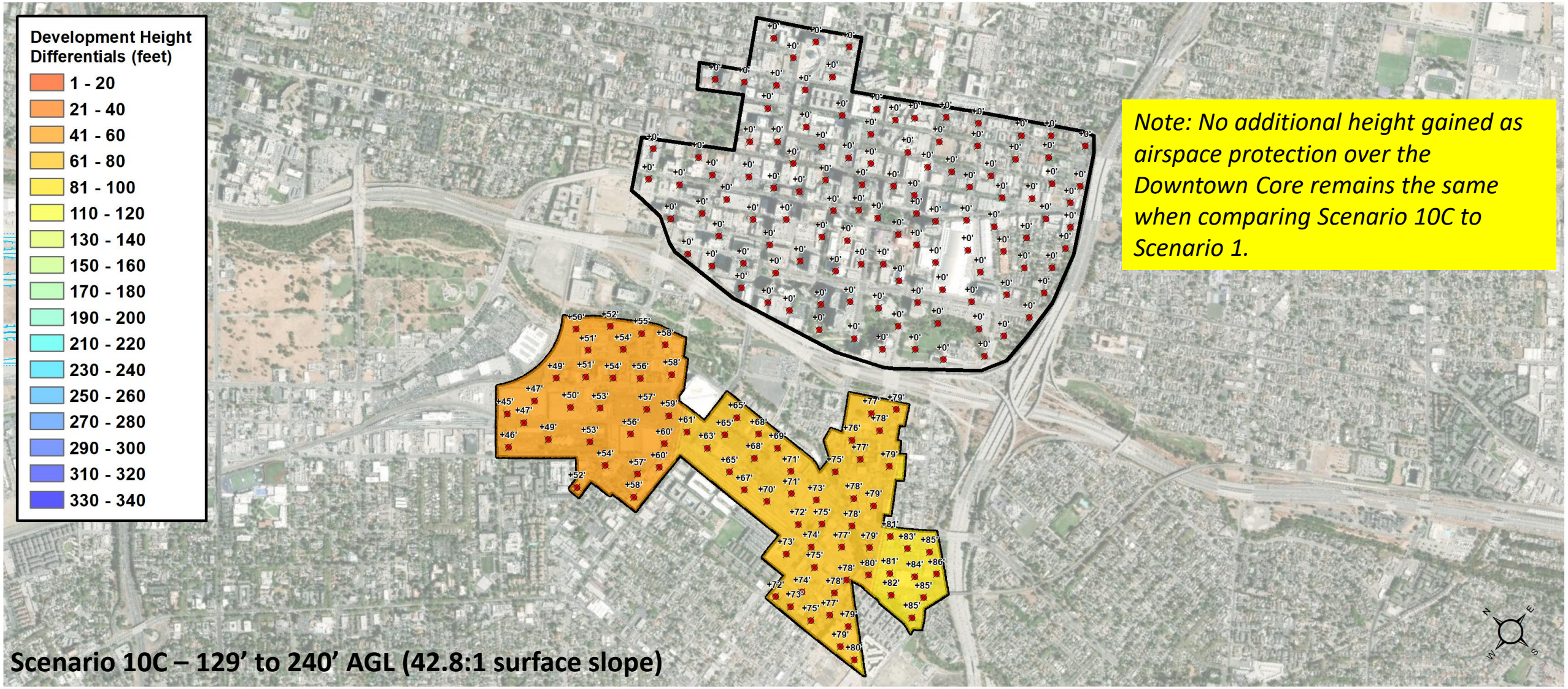
Note: Differential height increases represent the additional developable heights as compared to Scenario 1 (existing airspace protection)

SCENARIO 10B – STRAIGHT-OUT OEI WITH OEI WEST CORRIDOR ALTERNATIVES (PRESERVE STRAIGHT-OUT OEI) – DEVELOPMENT HEIGHT DIFFERENTIALS



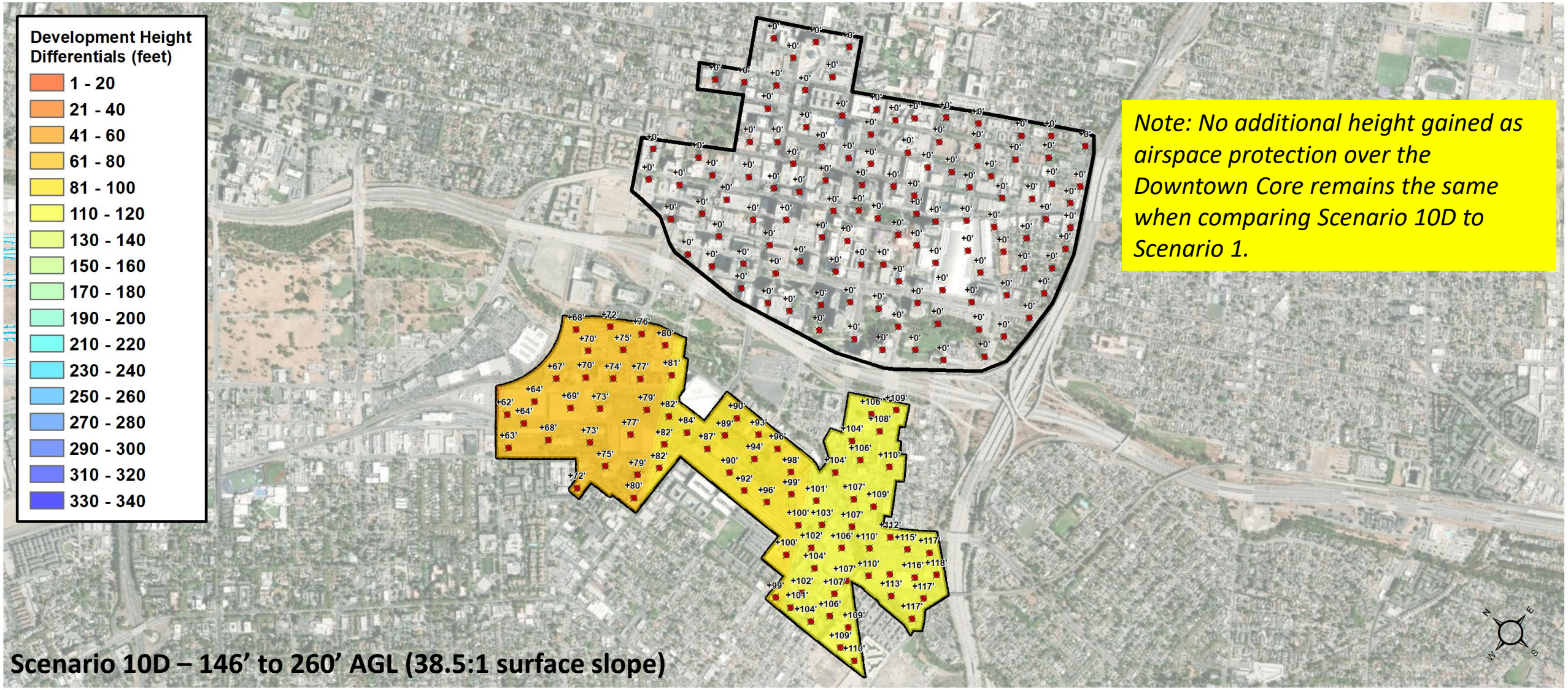
Note: Differential height increases represent the additional developable heights as compared to Scenario 1 (existing airspace protection)

SCENARIO 10C – STRAIGHT-OUT OEI WITH OEI WEST CORRIDOR ALTERNATIVES (PRESERVE STRAIGHT-OUT OEI) – DEVELOPMENT HEIGHT DIFFERENTIALS



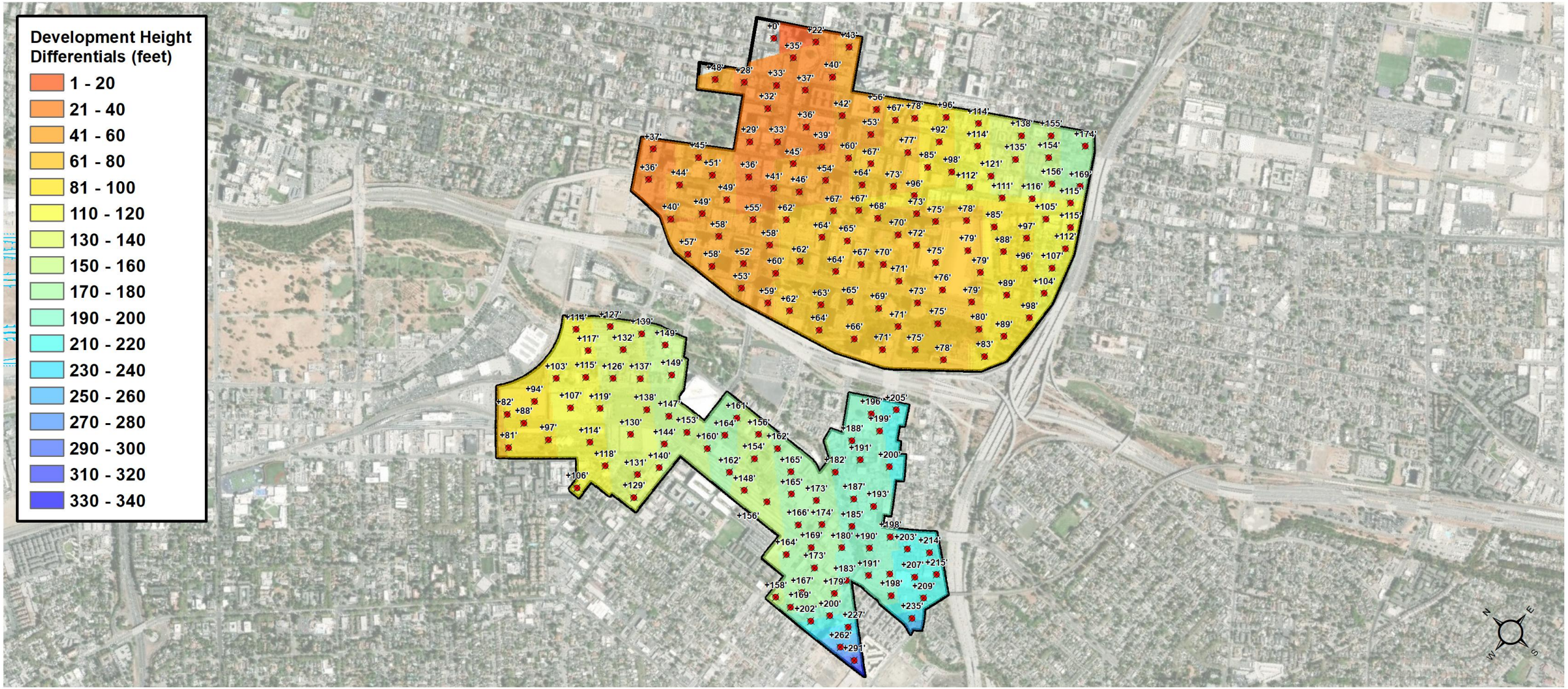
Note: Differential height increases represent the additional developable heights as compared to Scenario 1 (existing airspace protection)

SCENARIO 10D – STRAIGHT-OUT OEI WITH OEI WEST CORRIDOR ALTERNATIVES (PRESERVE STRAIGHT-OUT OEI) – DEVELOPMENT HEIGHT DIFFERENTIALS



Note: Differential height increases represent the additional developable heights as compared to Scenario 1 (existing airspace protection)

SCENARIO 9 – NO OEI, INCREASED FAA HEIGHT LIMITS – DEVELOPMENT HEIGHT DIFFERENTIALS



Note: Differential height increases represent the additional developable heights as compared to Scenario 1 (existing airspace protection)

AIRCRAFT PERFORMANCE CITY PAIR ASSESSMENT

AIRCRAFT PERFORMANCE CITY PAIR ASSESSMENT

- Aircraft performance assessment to evaluate the impacts of proposed obstacles heights under various airspace scenarios was conducted
- Various aircraft types, city pairs and seasonal temperature variations were assessed to identify impacts to aircraft payload and range
- Passenger (PAX) and cargo penalties were computed for each scenario

AIRCRAFT PERFORMANCE CITY PAIR ASSESSMENT

AIRCRAFT FLEET EVALUATION

Aircraft	Engine	Maximum Takeoff Weight (MTOW) (lbs.)	Seats
A320-200	CFM56-5B4	171,960	150
B737-800	CFM56-7B26	174,200	175
B787-9	GENX-1B74-7	560,000	290
B777-300ER	GE90-115BL	775,000	370

SEASONAL TEMPERATURES

Winter		
Aircraft Type	**Temperature (°F)**	**Notes**
A320-200 & B737-800	63°F	Early morning and evening departures
B787-9 & B777-300ER	68°F	Morning and afternoon departures
Summer		
A320-200 & B737-800	81.3°F	Boeing 85% reliability temperature
B787-9 & B777-300ER	81.3°F	Boeing 85% reliability temperature

CITY PAIR ASSESSMENT

Origin	Destination	Distance (Statue Miles)
Domestic		
SJC	JFK	2,569
SJC	HNL	2,417
International		
SJC	FRA	5,703
SJC	PEK	5,942

JFK: John F. Kennedy International Airport (New York)
HNL: Honolulu International Airport (Hawaii)
FRA: Frankfurt International Airport (Germany)
PEK: Peking International Airport (China)

PRELIMINARY FINDINGS - TRANSCONTINENTAL

- A320-200 operation to JFK results in PAX and minor cargo penalties under **Scenarios 4 and 9** in both summer and winter.
- B737-800 operation to JFK results in PAX and minor cargo penalties under **Scenario 9** in the summer.

TRANSCONTINENTAL WEIGHT PENALTY ASSESSMENT

New York - JFK Winter (63° F)		A320-200 (150 seats/2,384 lbs. cargo)		B737-800 (175 seats/1,604 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	-	**1,067**	-	-
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	-	-	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	-	-	-
	Opt 10B: 115' - 224' AGL	-	-	-	-
	Opt 10C: 129' - 240' AGL	-	-	-	-
	Opt 10D: 146' - 260' AGL	-	**106**	-	-
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	**8**	**2,384**	-	**583**

New York - JFK Summer (81.3° F)		A320-200 (150 seats/2,384 lbs. cargo)		B737-800 (175 seats/1,138 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	**3**	**2,384**	-	-
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	-	-	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	-	-	-
	Opt 10B: 115' - 224' AGL	-	-	-	-
	Opt 10C: 129' - 240' AGL	-	-	-	-
	Opt 10D: 146' - 260' AGL	-	**1,378**	-	-
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	**13**	**2,384**	**3**	**860**

PRELIMINARY FINDINGS - HAWAII

- A320-200 operation to HNL results in significant PAX penalties under **Scenarios 4, 7, 9 and 10D** in the summer.
- B737-800 operation to HNL results in minor PAX and minor cargo penalties under **Scenario 9**.

HAWAII WEIGHT PENALTY ASSESSMENT

Hawaii - HNL Winter (63° F)		A320-200 (124 seats[1]/No Cargo)		B737-800 (173 seats[2]/No Cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	3	-	-	-
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	-	-	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	-	-	-
	Opt 10B: 115' - 224' AGL	-	-	-	-
	Opt 10C: 129' - 240' AGL	-	-	-	-
	Opt 10D: 146' - 260' AGL	-	-	-	-
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	14	-	3	-

Hawaii - HNL Summer (81.3° F)		A320-200 (150 seats/No Cargo)		B737-800 (175 seats/1,599 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	8	-	-	-
Scenario 4	TERPS Only	25	-	-	-
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	16	-	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	8	-	-	-
	Opt 10A: 100' - 195' AGL	8	-	-	-
	Opt 10B: 115' - 224' AGL	8	-	-	-
	Opt 10C: 129' - 240' AGL	9	-	-	-
	Opt 10D: 146' - 260' AGL	18	-	-	-
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	36	-	1	1,599

Notes:

1. **HNL is fuel capacity limited in Feb because of winter winds to 124 PAX and no cargo (i.e., not a takeoff weight limitation).**

2. **HNL is fuel capacity limited in Feb to 173 PAX a no cargo (i.e., not a takeoff weight limitation).**

PRELIMINARY FINDINGS - ASIA

- B787-9 operation to Asia results in significant PAX and cargo penalties under **Scenarios 4, 7, 9, 10C and 10D** in both summer and winter.
- B777-300ER incurs no PAX penalties under any scenarios, however cargo penalties are incurred in all scenarios with **Scenarios 4, 7 and 10D** being most significant.

ASIA WEIGHT PENALTY ASSESSMENT

Peking - PEK Winter (68° F)		B787-9 (290 seats/10,853 lbs. cargo)		B777-300ER (370 seats/56,089 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	**51**	**10,853**	-	**19,278**
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	**25**	**10,853**	-	**11,801**
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	**4,534**	-	**5,479**
	Opt 10B: 115' - 224' AGL	-	**9,408**	-	**6,673**
	Opt 10C: 129' - 240' AGL	**13**	**10,853**	-	**10,537**
	Opt 10D: 146' - 260' AGL	**34**	**10,853**	-	**16,929**
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	**93**	**10,853**	-	**26,672**

Peking - PEK Summer (81.3° F)		B787-9 (290 seats/9,542 lbs. cargo)		B777-300ER (370 seats/55,588 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	**56**	**9,542**	-	**20,597**
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	**30**	**9,542**	-	**13,268**
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	**3,933**	-	**5,293**
	Opt 10B: 115' - 224' AGL	-	**8,725**	-	**10,223**
	Opt 10C: 129' - 240' AGL	**15**	**9,542**	-	**11,020**
	Opt 10D: 146' - 260' AGL	**36**	**9,542**	-	**17,545**
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	**95**	**9,542**	-	**28,076**

PRELIMINARY FINDINGS - EUROPE

- B787-9 operation to Europe results in significant PAX and cargo penalties under **Scenario 9** and significant cargo penalties under **Scenarios 4, 7, 9, 10C and 10D**.
- B777-300ER incurs no PAX penalties under any scenarios, however cargo penalties are incurred in **Scenarios 4, 9 and 10D** with **Scenario 9** being most significant.

EUROPE WEIGHT PENALTY ASSESSMENT

Frankfurt - FRA Winter (68° F)		B787-9 (290 seats/26,198 lbs. cargo)		B777-300ER (370 seats/62,240 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	-	**21,580**	-	**4,400**
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	-	**15,338**	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	-	**10,000**	-	-
	Opt 10A: 100' - 195' AGL	-	-	-	-
	Opt 10B: 115' - 224' AGL	-	**9,349**	-	-
	Opt 10C: 129' - 240' AGL	-	**14,096**	-	-
	Opt 10D: 146' - 260' AGL	-	**19,282**	-	**2,027**
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	**29**	**26,198**	-	**11,735**

Frankfurt - FRA Summer (81.3° F)		B787-9 (290 seats/23,514 lbs. cargo)		B777-300ER (370 seats/62,240 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	**2**	**22,911**	-	**7,811**
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	-	**16,407**	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	**4,217**	-	-
	Opt 10B: 115' - 224' AGL	-	**9,353**	-	-
	Opt 10C: 129' - 240' AGL	-	**14,270**	-	-
	Opt 10D: 146' - 260' AGL	-	**19,612**	-	**3,876**
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	**41**	**23,514**	-	**15,397**

AIRLINE AIRCRAFT PERFORMANCE ASSESSMENT

AIRLINES RESPONSES

- The following airlines participated in the aircraft performance assessment for the various airspace scenarios presented:
  - Southwest Airlines
  - Alaska Airlines
  - American Airlines
  - British Airways
  - Hainan Airways

SOUTHWEST AIRLINES

- Evaluated the B737-800 aircraft
- Southwest utilizes the FAA AC120-91 straight-out OEI corridor
- Maximum temperature and structural takeoff weight was evaluated against each airspace scenario and associated obstacles
- Very high temperatures would be required to result in weight penalties for SWA operations to destinations served from SJC (91.4°F – 96.8°F)

ALASKA AIRLINES

- Alaska Airlines evaluated the B737-800 aircraft performance
- For Runway 12L, two obstacle points are within the splay
  - Parcels 30 and 31
  - No impact heights limited to 117’ AGL and 108’ AGL respectively
- Runway 12R OEI turn not impacted by DSAP development

AMERICAN AIRLINES

- American evaluated the following aircraft in their assessment:
  - Airbus A319, A320 and A321
  - Boeing B737-800
  - Bombardier CRJ-900
  - Embraer E175
- American Airlines performance assessment for Scenarios 1, 4, 7 and 9 resulted in no weight penalties under straight-out or West OEI corridor scenarios

BRITISH AIRWAYS

- British Airways indicates that Scenarios 4 and 7 have no impact to the current operation or the payloads can be achieved when departing Runways 12L/12R.
- Scenario 9 has the greatest impact to British's operation from both runways.
  - When departing Runway 12L, an average Take-off Performance Limiting Weight (TOPL) reduction of 13,000 lbs. and a maximum of just under 15,432 lbs. is required.
  - When departing Runway 12R, an average Take-off Performance Limiting Weight (TOPL) reduction of 9,700 lbs. and a maximum of just under 12,125 lbs. is required.

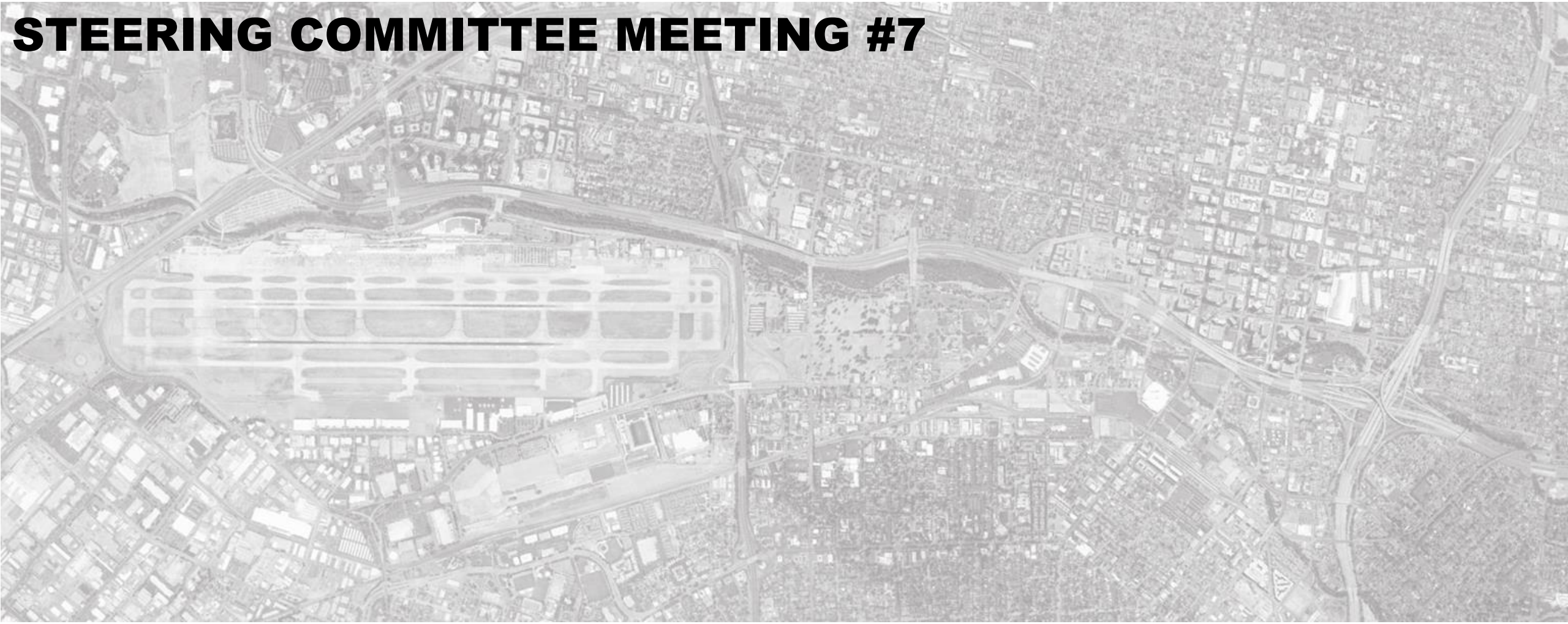
HAINAN AIRWAYS

- Hainan evaluated both the B787-8 and B787-9 aircraft types
- Utilizes ICAO straight-out OEI surface for Runways 12L
- No additional takeoff weight impacts on Runway 12L
- Takeoff weight and payload impacts when departing Runway 12R
- Results of analysis based upon Scenario 4 – No OEI airspace protection

NEXT STEPS

- Community Stakeholder meeting – September 13, 2018
- City Council Committee update – September 24, 2018
- Economic impact analysis

DOWNTOWN SAN JOSÉ AIRSPACE & DEVELOPMENT CAPACITY STUDY (PROJECT CAKE)



STEERING COMMITTEE MEETING #7

November 13, 2018

AGENDA

- Introduction
- Real Estate Economic Impact Assessment
- Aircraft Performance Assessment
- Aviation Direct Economic Impacts

PRELIMINARY REAL ESTATE ECONOMIC IMPACT ASSESSMENT

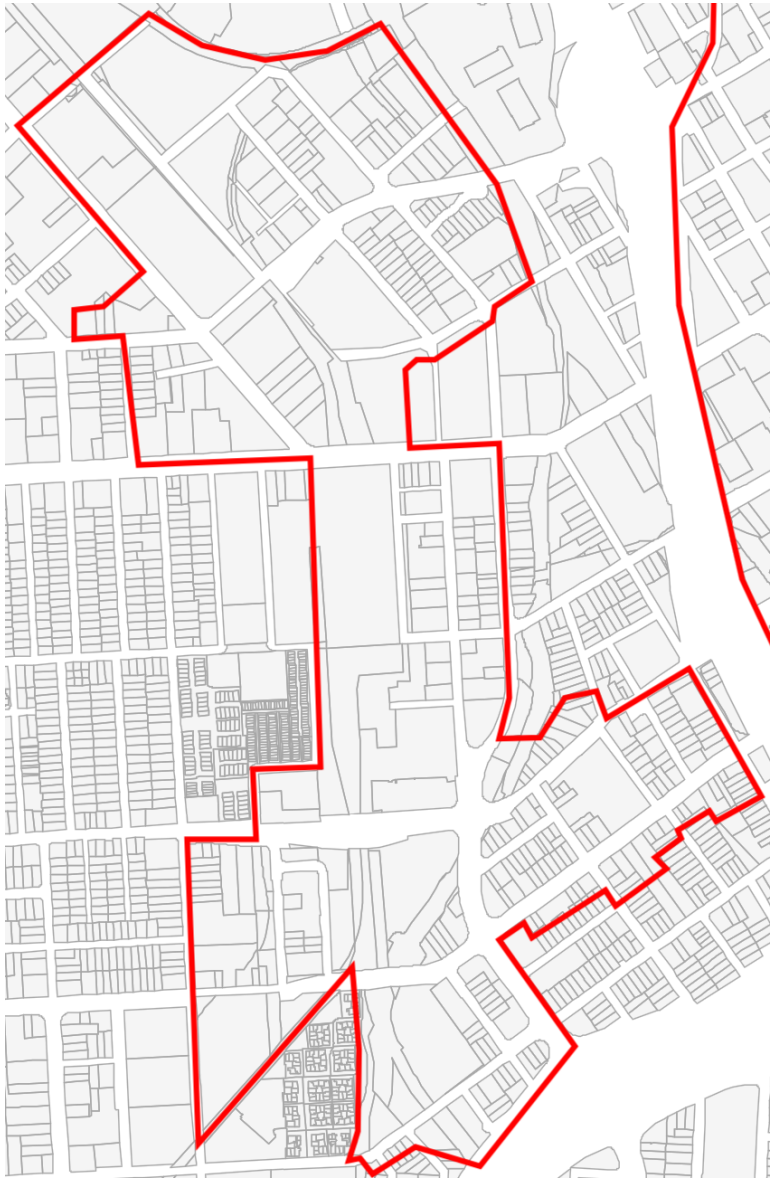
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PURPOSE AND SCOPE OF REAL ESTATE ECONOMIC IMPACT ASSESSMENT

- Identify potential development sites in both Downtown Core and Diridon Station development areas
- Assess the local real estate market to understand the pace and feasibility of new development
- Estimate the increase in new development density for development areas due to airspace protection scenarios
- Support an economic impact assessment by providing key outputs to be used as IMPLAN inputs

DIRIDON STATION AREA

- JLL assessed the impact on total development potential of the Diridon Station area of each airspace protection scenario
- Analysis focuses on APN's that are underutilized or vacant and larger than 0.2 acres
- Analysis is agnostic to any specific development project, focusing instead on development potential in the aggregate



DENSITY INCREASE IN DIRIDON STATION AREA

Scenario	Net New Square Feet
4: No OEI	8,600,000
7: Straight-Out OEI	8,500,000
9: No OEI, incr. height limits	10,000,000
10A: Straight-Out OEI w/ West OEI Alts.	1,100,000
10B: Straight-Out OEI w/ West OEI Alts.	3,100,000
10C: Straight-Out OEI w/ West OEI Alts.	4,900,000
10D: Straight-Out OEI w/ West OEI Alts.	6,800,000

Note: Includes both office and residential development.

CONSTRUCTION VALUE AND TAX REVENUE IN DIRIDON STATION AREA

Scenario	Net New Construction Value	Net New Annual Tax Revenue
4: No OEI	$4,380,000,000	$5,550,000
7: Straight-Out OEI	$4,300,000,000	$5,450,000
9: No OEI, incr. height limits	$5,030,000,000	$6,370,000
10A: Straight-Out OEI w/ West OEI Alts.	$560,000,000	$710,000
10B: Straight-Out OEI w/ West OEI Alts.	$1,590,000,000	$2,020,000
10C: Straight-Out OEI w/ West OEI Alts.	$2,500,000,000	$3,160,000
10D: Straight-Out OEI w/ West OEI Alts.	$3,490,000,000	$4,420,000

Note: Values represent both office and residential development, are aggregate, and represent the total potential increase without regard to a specific timeframe.

NET NEW ONE-TIME FEES IN DIRIDON STATION AREA

Scenario	Building Fees	Development Taxes	Park Impact Fees	School District Fees
4: No OEI	$7,300,000	$177,150,000	$131,040,000	$4,830,000
7: Straight-Out OEI	$7,170,000	$173,890,000	$128,790,000	$4,740,000
9: No OEI, incr. height limits	$8,340,000	$203,720,000	$148,810,000	$5,580,000
10A: Straight-Out OEI w/ West OEI Alts.	$930,000	$22,660,000	$16,830,000	$620,000
10B: Straight-Out OEI w/ West OEI Alts.	$2,660,000	$64,260,000	$47,920,000	$1,750,000
10C: Straight-Out OEI w/ West OEI Alts.	$4,180,000	$101,050,000	$75,150,000	$2,740,000
10D: Straight-Out OEI w/ West OEI Alts.	$5,810,000	$141,100,000	$104,600,000	$3,830,000

Note: Values represent both office and residential development, are aggregate, and represent the total potential increase without regard to a specific timeframe.

EMPLOYEES AND RESIDENTS IN DIRIDON STATION

Scenario	Net New Employees	Net New Residents
4: No OEI	4,700	12,800
7: Straight-Out OEI	4,500	12,600
9: No OEI, incr. height limits	6,200	14,500
10A: Straight-Out OEI w/ West OEI Alts.	500	1,600
10B: Straight-Out OEI w/ West OEI Alts.	1,600	4,700
10C: Straight-Out OEI w/ West OEI Alts.	2,500	7,300
10D: Straight-Out OEI w/ West OEI Alts.	3,500	10,200

Note: Values are aggregate and represent the total potential increase without regard to a specific timeframe.

DOWNTOWN CORE AREA

- There is already significant density available in the Downtown core.
- Any increase in height restrictions due to airspace protection scenarios will not have an aggregate impact for a long period of time.

	Office*	Residential†
Development Potential	34,800,000 sf	32,900,000 sf
Historical Annual Net Absorption (speculative development)	50,000 sf/year	750 unit/year (637,500 sf @ 850sf/unit)

** Includes parking.*

† Includes parking. In addition, Downtown zoning limits developments to 800 du/acre; at an average of 850 sf/unit, in some cases residential projects will be less dense than office developments

IMPACT ON INDIVIDUAL DOWNTOWN SITES

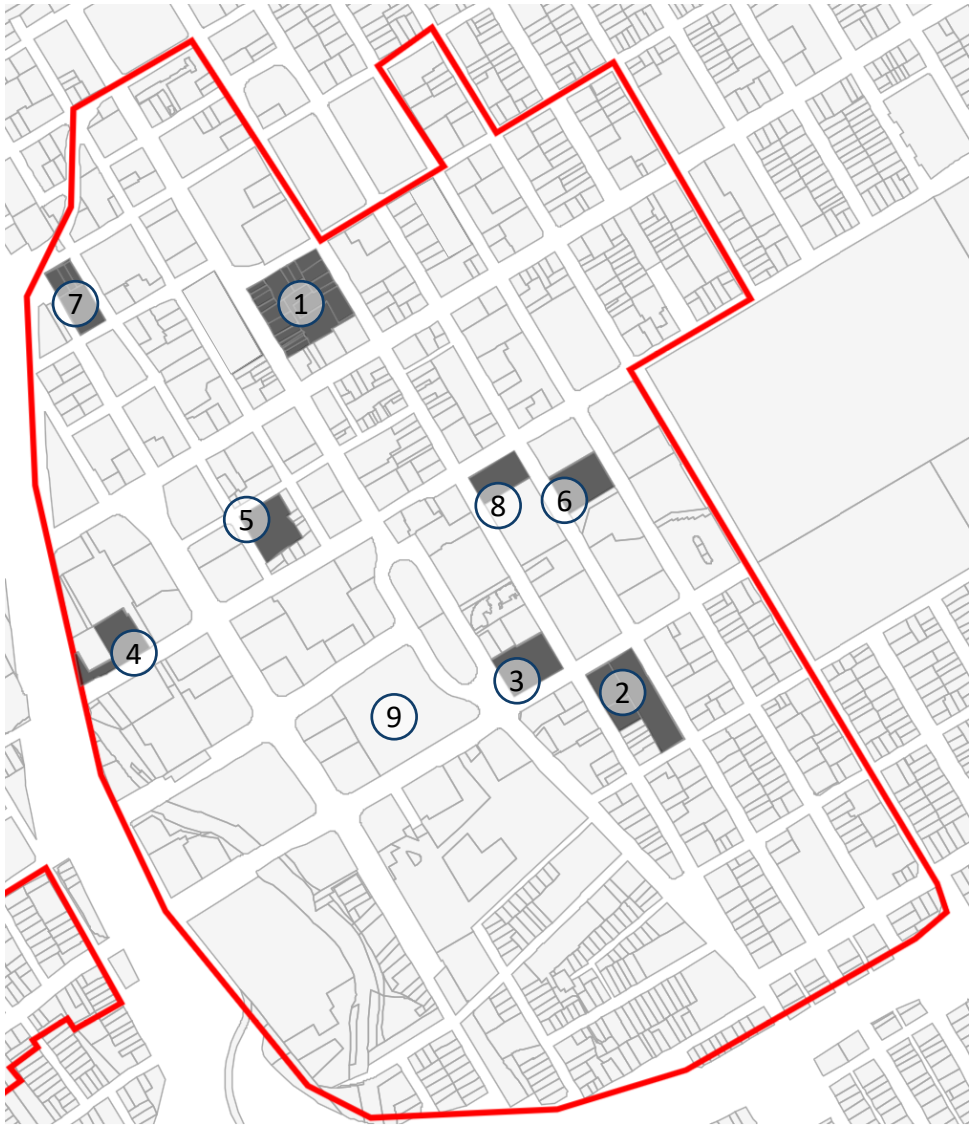
- Though Downtown can accommodate significant development potential under existing height limits, discrete development sites may still be impacted.
- In particular, build-to-suit development opportunities that occur outside of the normal “churn” of demand and supply will be impacted
- JLL and the City identified 9 test case development sites in Downtown and tested how the Scenarios 4 and 9 would impact development potential

Assumptions:

- Sites are “underutilized” or “vacant” – surface parking, parking structures, commercial buildings two stories or less, generally
- Includes contiguous underutilized or vacant spaces
- 14 feet average per story
- 80% lot coverage
- Office land use (residential and hospitality uses are not build-to-suit)
- Test case height limits established by airspace protection scenarios, though no more dense than limits established by the General Plan (3-30 stories and 30 FAR for Downtown)

IMPACT ON INDIVIDUAL DOWNTOWN SITES

	APN(s)	ADDRESS	CURRENT	NOTES	AREA
1	25934007-14, 25934020-31	66 N Market St (Approximate)	Surface Parking + Low-Rise Commercial		170,017 sf
2	46746080-82	345 S 2nd Street, 300 S 1st Street	Surface Parking + Low-Rise Commercial		123,173 sf
3	25942080	282 S Market St	Surface Parking		65,781 sf
4	25939116	333 W San Fernando St	Surface Parking	Planned site of Adobe Tower 4 (750,000sf)	62,242 sf
5	25940012	60 S Almaden Ave	Former Greyhound Terminal	Planned site of 708 residential units and 20,000 SF retail	61,874 sf
6	46722160	174 S 2nd St	Surface Parking	Site of planned Sobrato parking structure	58,456 sf
7	25931072, 25931077-80	115 Terraine St	One-Story industrial, Surface Parking		55,200 sf
8	46722142	8 E San Fernando St	Surface parking		43,513 sf
9	25942023	201 Market Street	Museum	Museum Place Development	107,815 sf

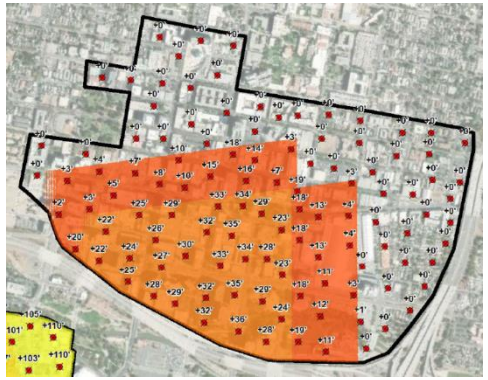


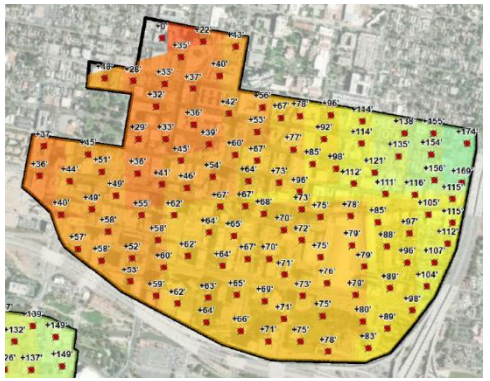
EXISTING DENSITY AND INCREASES FOR DOWNTOWN SITES

Address			Scenario 4		Scenario 9	
	Parcel Area	Existing Potential Density (SF)	Net New SF	% Increase	Net New SF	% Increase
66 N Market St (Approximate)	170,017	2,441,000	0*	0%	300,000	12%
345 S 2nd Street & 300 S 1st Street†	123,173	2,232,000	*Not Impacted*	*Not Impacted*	782,000	35%
282 S Market St	65,781	1,090,000	52,000	5%	363,000	33%
333 W San Fernando St	62,242	910,000	101,000	11%	202,000	22%
60 S Almaden Ave	61,874	966,000	107,000	11%	215,000	22%
174 S 2nd St	58,456	981,000	*Not Impacted*	*Not Impacted*	187,000	19%
115 Terraine St	55,200	653,000	44,000	7%	174,000	27%
8 E San Fernando St	43,513	754,000	36,000	5%	144,000	19%
Museum Place	107,815	988,203 (planned)	100,000	10%	250,000	25%

** An increase of zero square feet means either 1) the height limits imposed by the San Jose General Plan are below either the existing or the altered airspace protection scenarios or 2) an average of at least 14 feet must be achieved for each new floor, and the height increase afforded by a scenario does not meet this minimum.*

† Some parcels included in this test case site do fall under Scenario 4; however the majority do not, and therefore the development site as configured/tested assumes no height gain realized from Scenario 4.

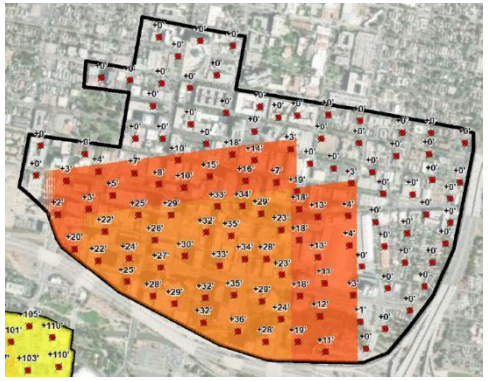


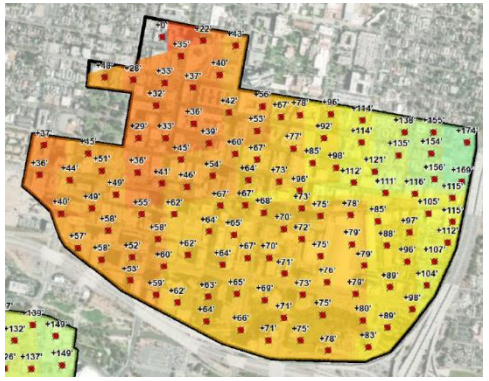


CONSTR. VALUE AND TAXES FOR DOWNTOWN SITES

Address	Scenario 4		Scenario 9	
	Net New Construction Value	Net New Annual Tax Revenue	Net New Construction Value	Net New Annual Tax Revenue
66 N Market St (Approximate)	*Not Impacted*	*Not Impacted*	$91,100,000	$115,000
345 S 2nd Street & 300 S 1st Street	*Not Impacted*	*Not Impacted*	$237,400,000	$301,000
282 S Market St	$15,800,000	$100,000	$110,300,000	$140,000
333 W San Fernando St	$30,700,000	$39,000	$61,300,000	$78,000
60 S Almaden Ave	$32,600,000	$41,000	$65,100,000	$82,000
174 S 2nd St	*Not Impacted*	*Not Impacted*	$56,700,000	$72,000
115 Terraine St	$13,200,000	$17,000	$52,900,000	$67,000
8 E San Fernando St	$10,900,000	$41,000	$43,600,000	$55,000
Museum Place	$30,300,000	$38,000	$75,800,000	$96,000

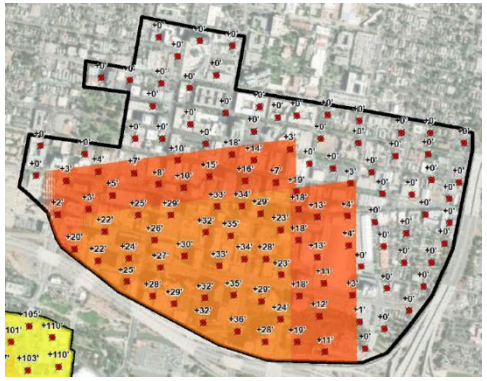
Note: Values represent both office development, are aggregate, and represent the total potential increase without regard to a specific timeframe.

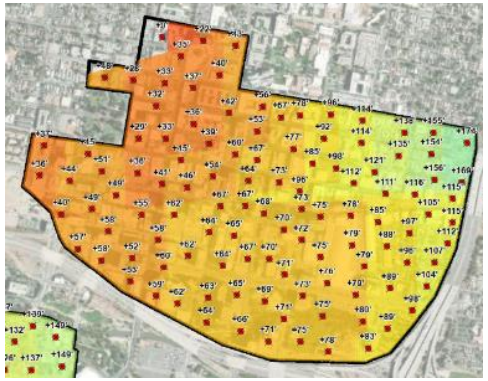




ONE-TIME FEES AND TAXES FOR DOWNTOWN SITES

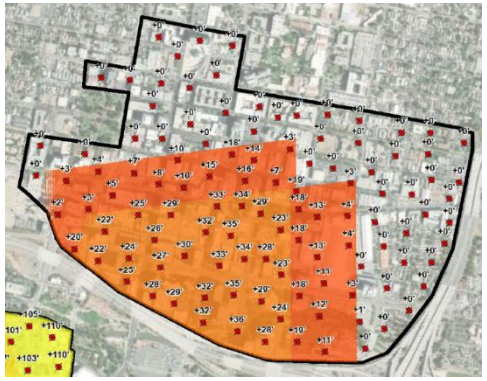
Address	Scenario 4		
	Net New City Building Fees	Net New City Development Taxes	Net New School District Fees
66 N Market St (Approximate)	*Not Impacted*	*Not Impacted*	*Not Impacted*
345 S 2nd Street & 300 S 1st Street	*Not Impacted*	*Not Impacted*	*Not Impacted*
282 S Market St	$14,700	$700,000	$500,000
333 W San Fernando St	$28,700	$1,400,000	$60,000
60 S Almaden Ave	$30,500	$1,500,000	$60,000
174 S 2nd St	*Not Impacted*	*Not Impacted*	*Not Impacted*
115 Terraine St	$12,400	$600,000	$20,000
8 E San Fernando St	$10,200	$500,000	$20,000
Museum Place	$28,400	$1,400,000	$60,000
	Scenario 9		
66 N Market St (Approximate)	$85,300	$4,100,000	$170,000
345 S 2nd Street & 300 S 1st Street	$222,200	$10,700,000	$440,000
282 S Market St	$103,200	$5,000,000	$200,000
333 W San Fernando St	$57,400	$2,800,000	$110,000
60 S Almaden Ave	$61,000	$2,900,000	$120,000
174 S 2nd St	$53,000	$2,600,000	$100,000
115 Terraine St	$49,500	$2,400,000	$100,000
8 E San Fernando St	$40,800	$2,000,000	$80,000
Museum Place	$71,000	$3,400,000	$140,000

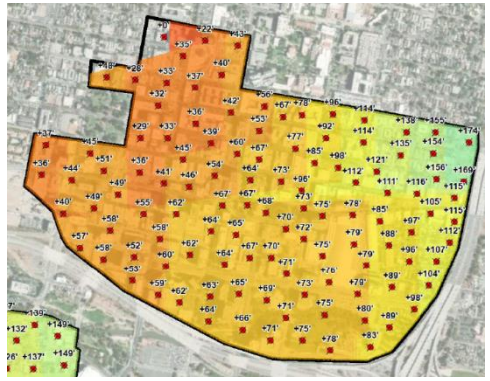




EMPLOYMENT IN DOWNTOWN SITES

Address	Scenario 4	Scenario 9
	Net New Employees	Net New Employees
66 N Market St (Approximate)	*Not Impacted*	1,400
345 S 2nd Street & 300 S 1st Street	*Not Impacted*	3,700
282 S Market St	200	1,700
333 W San Fernando St	500	900
60 S Almaden Ave	500	1,000
174 S 2nd St	*Not Impacted*	900
115 Terraine St	200	800
8 E San Fernando St	200	700
Musem Place	500	1,200





UPDATE AIRCRAFT PERFORMANCE ASSESSMENT

HAWAII WEIGHT PENALTY ASSESSMENT

Hawaii - HNL Winter (63° F)		A321 NEO (189 seats/18,481 lbs.)		B737-800 (173 seats[1]/No Cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	-	-	-	-
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	-	-	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	-	-	-
	Opt 10B: 115' - 224' AGL	-	-	-	-
	Opt 10C: 129' - 240' AGL	-	-	-	-
	Opt 10D: 146' - 260' AGL	-	-	-	-
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	-	**2,537**	**3**	-

Hawaii - HNL Summer (81.3° F)		A321 NEO (189 seats/21,658 lbs.)		B737-800 (175 seats/1,599 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	-	**593**	-	-
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	-	-	-	-
Scenario 10	Existing Conditions: 85' - 166' AGL	-	-	-	-
	Opt 10A: 100' - 195' AGL	-	-	-	-
	Opt 10B: 115' - 224' AGL	-	-	-	-
	Opt 10C: 129' - 240' AGL	-	-	-	-
	Opt 10D: 146' - 260' AGL	-	-	-	-
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	-	**3,565**	**1**	**1,599**

Notes:

1. **HNL is fuel capacity limited in Feb to 173 PAX and no cargo (i.e., not a takeoff weight limitation) for the B737-800.**

WEIGHT PENALTY ASSESSMENT – ANC, BOS AND MIA

Anchorage - ANC Summer (81.3° F)		A320 (150 seats/1,379 lbs. cargo)		B737-800 (175 seats/7,100 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	-	-	-	-
Scenario 4	TERPS Only	-	-	-	-

Boston - BOS Summer (81.3° F)		A320 (150 seats/0 lbs. cargo)		B737-800 (175 seats/0 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	7	-	1	-
Scenario 4	TERPS Only	23		1	-

Miami - MIA Summer (81.3° F)		A320 (150 seats/0 lbs. cargo)		B737-800 (175 seats/0 lbs. cargo)	
		PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Scenario 1	Existing airspace protection	1	-	3	-
Scenario 4	TERPS Only	17		3	-

Notes:

1. **1 and 3 Pax penalties as being due to Max Structural Takeoff Weight limits (and not related to the obstacles or runway length.)**

WEIGHT PENALTY ASSESSMENT – INTERNATIONAL MARKETS

- Assessment is underway to further evaluate Scenario 4
- Review of the following potential SJC markets
  - Rio
  - Taipei
  - Hong Kong
  - Delhi
  - Dubai
- Review of the following aircraft types
  - A350-9
  - A330
  - B787-9
  - B777-300

AVIATION DIRECT ECONOMIC IMPACT ASSESSMENT

METHODOLGY – AIRLINE COST

- Impacted flights calculated using percent of Southeast Flow departures
- Weight penalties for markets in winter and summer
- Account for airline load factors (average occupied seats)
- Annual passengers lost = lost passengers per flight X annual operations impacted
- Lost passenger cost
  - Average revenue per passenger to each market
  - Voucher cost (assume $200, no industry average data available)

Season	Percentage of Southeast Departures
Winter	22.30%
Summer	7.00%
Total	13.00%

Airline Load Factor by Market		
Region	**Winter**	**Summer**
Hawaii – SJC	89.70%	90.50%
Transcontinental – SJC	84.90%	82.20%
Europe – Bay Average	73.00%	87.20%
Asia – Bay Average	78.10%	81.50%

Load factor from BTS T100 = Bureau of Transportation Statistics Air Carrier Statistics Database, U.S. Departure of Transportation

ASSUMPTIONS – AIRLINE COST

- BTS O&D Survey was used to calculate revenue per one-way, nonstop passenger revenue excluding fees and taxes
- Representative aircraft used in weight penalty analysis on routes

Airline Cost Per Passenger

Market	Passenger Revenue	Voucher	Total Airline Cost	Aircraft	Seats
Hawaii	$251	$200	$451	A321 NEO	189
				B737-800	173
Transcontinental	$211	$200	$411	A320-200	150
				B737-800	175
Europe	$658	$200	$858	B787-9	290
Asia	$683	$200	$883	B787-9	290

BTS O&D Survey = Bureau of Transportation Statistics Origin & Destination Survey, U.S. Departure of Transportation

ASSUMPTIONS – AIRPORT REVENUE AND LOCAL ECONOMIC SPENDING

- The number of annual passengers lost was calculated by multiplying the lost passengers by annual operations impacted
- Aircraft operations data based upon 2018 flight operations
- Airport Revenue Loss
  - Passenger Facility Charge (PFC): **$4.39** per outbound passenger
  - Airport concession revenue: **$2.26** per passenger
- Local Economic Spending Loss
  - Terminal Concession Spending: **$13.60** per passenger (includes $2.26 airport concessions portion)
  - Local International Visitor Spending: **$746.94** per passenger
  - Local Domestic Visitor Spending **$433.01** per passenger

Domestic visitor spending is based on the international visitor spend with an assumption on fewer days spent in the region.

SUMMARY OF 2018 ANNUAL DIRECT IMPACTS BY SCENARIO
HISTORICAL LOAD FACTORS

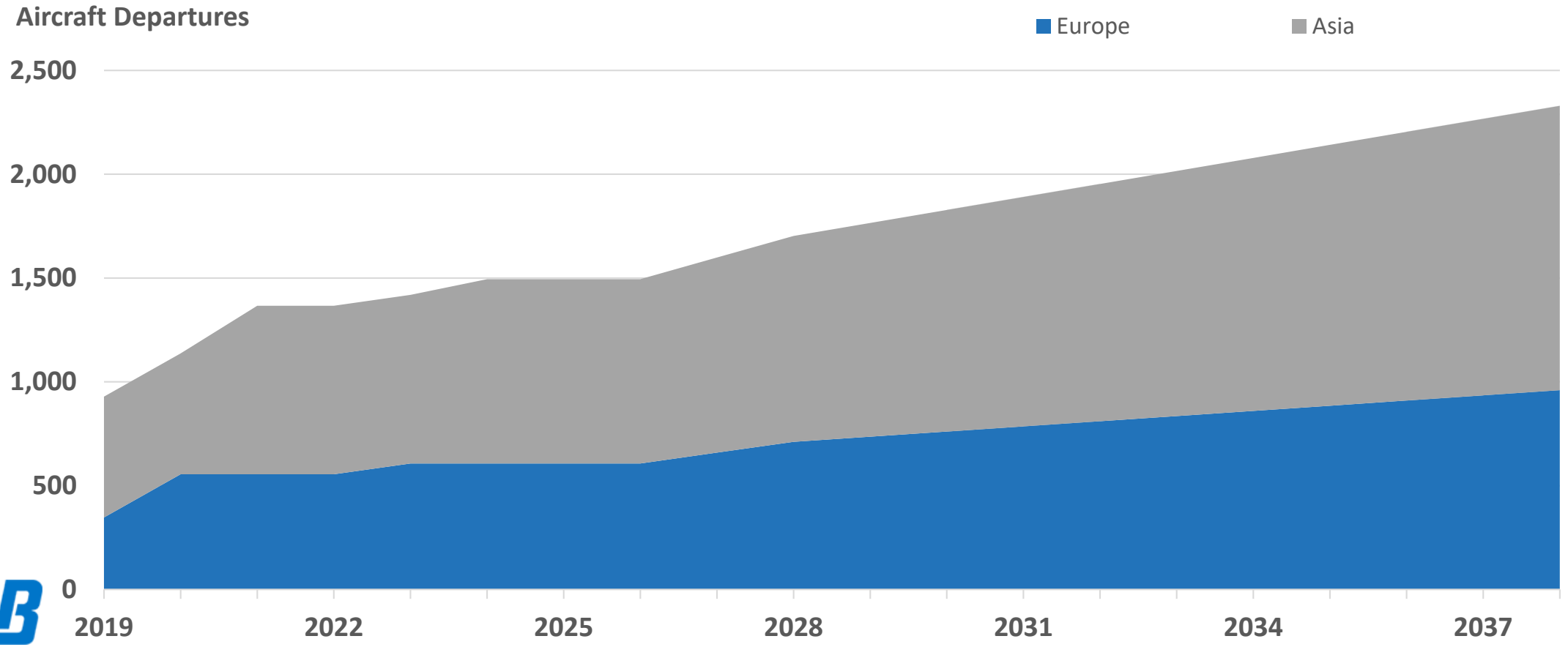
Summary of Losses		Airline Revenue	PFC Revenue	Terminal Concession Spending	Local Visitor Spending	Total
Scenario 1	Existing airspace protection	**$0**	**$0**	**$0**	**$0**	**$0**
Scenario 4	TERPS Only	**$56,000**	**$1,000**	**$2,000**	**$55,000**	**$114,000**
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	**$0**	**$0**	**$0**	**$0**	**$0**
Scenario 10	Existing Conditions: 85' - 166' AGL	**$0**	**$0**	**$0**	**$0**	**$0**
	Opt 10A: 100' - 195' AGL	**$0**	**$0**	**$0**	**$0**	**$0**
	Opt 10B: 115' - 224' AGL	**$0**	**$0**	**$0**	**$0**	**$0**
	Opt 10C: 129' - 240' AGL	**$0**	**$0**	**$0**	**$0**	**$0**
	Opt 10D: 146' - 260' AGL	**$0**	**$0**	**$0**	**$0**	**$0**
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	**$2,247,000**	**$25,000**	**$74,000**	**$1,618,000**	**$3,976,000**

SUMMARY OF 2018 ANNUAL DIRECT IMPACTS
LOAD FACTOR SENSITIVTY TEST

Summary of Losses		Baseline Load Factor	85% Load Factor	90% Load Factor	95% Load Factor
Scenario 1	Existing airspace protection	**$0**	**$0**	**$0**	**$0**
Scenario 4	TERPS Only	**$114,000**	**$1,070,000**	**$2,716,000**	**$4,306,000**
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	**$0**	**$0**	**$79,000**	**$1,439,000**
Scenario 10	Existing Conditions: 85' - 166' AGL	**$0**	**$0**	**$0**	**$0**
	Opt 10A: 100' - 195' AGL	**$0**	**$0**	**$0**	**$0**
	Opt 10B: 115' - 224' AGL	**$0**	**$0**	**$0**	**$0**
	Opt 10C: 129' - 240' AGL	**$0**	**$0**	**$0**	**$67,000**
	Opt 10D: 146' - 260' AGL	**$0**	**$0**	**$663,000**	**$2,308,000**
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	**$3,964,000**	**$5,615,000**	**$7,510,000**	**$10,164,000**

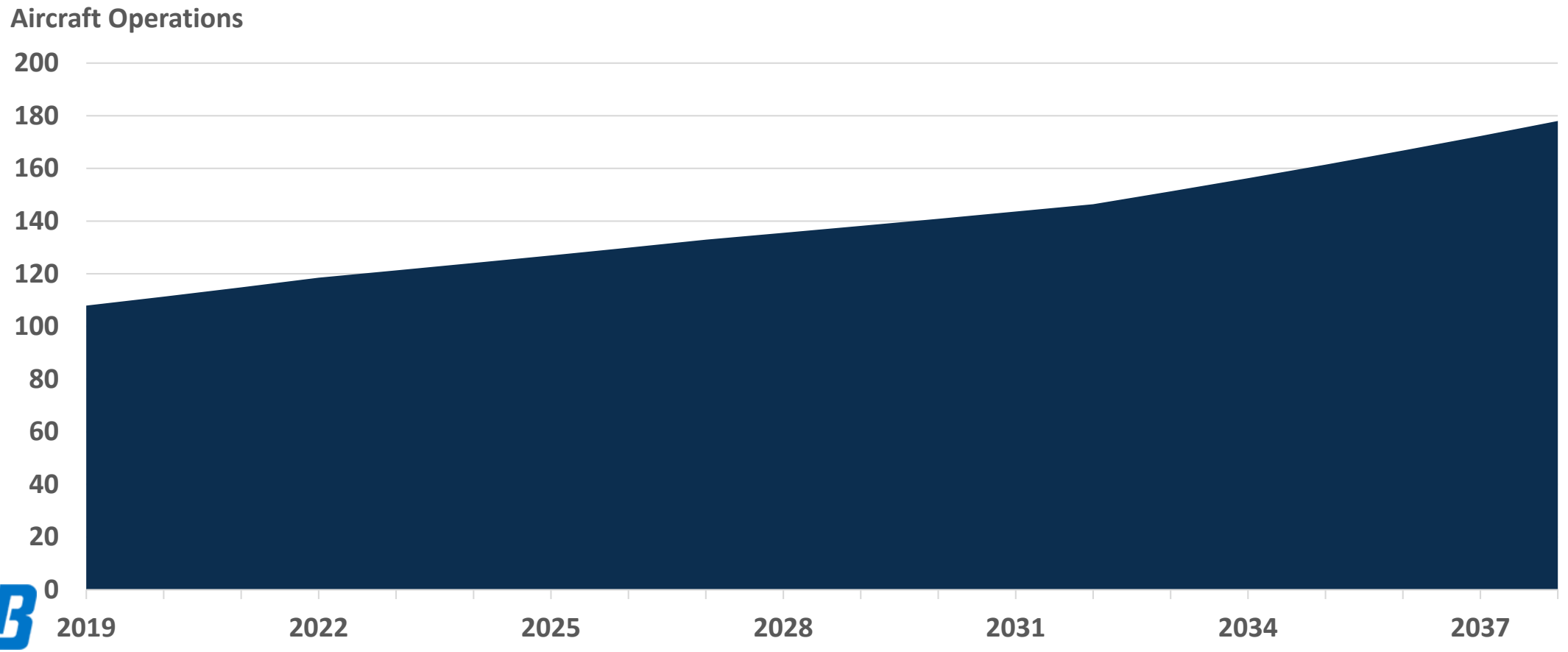
INTERNATIONAL DEPARTURE FORECAST

- 2019 through 2028 were obtained from the SJC unconstrained international forecast
- A trend analysis was performed for 2029 through 2038
- The year-over-year passenger growth multiplied by the load factors gathered from BTS T100 to determine future load factors

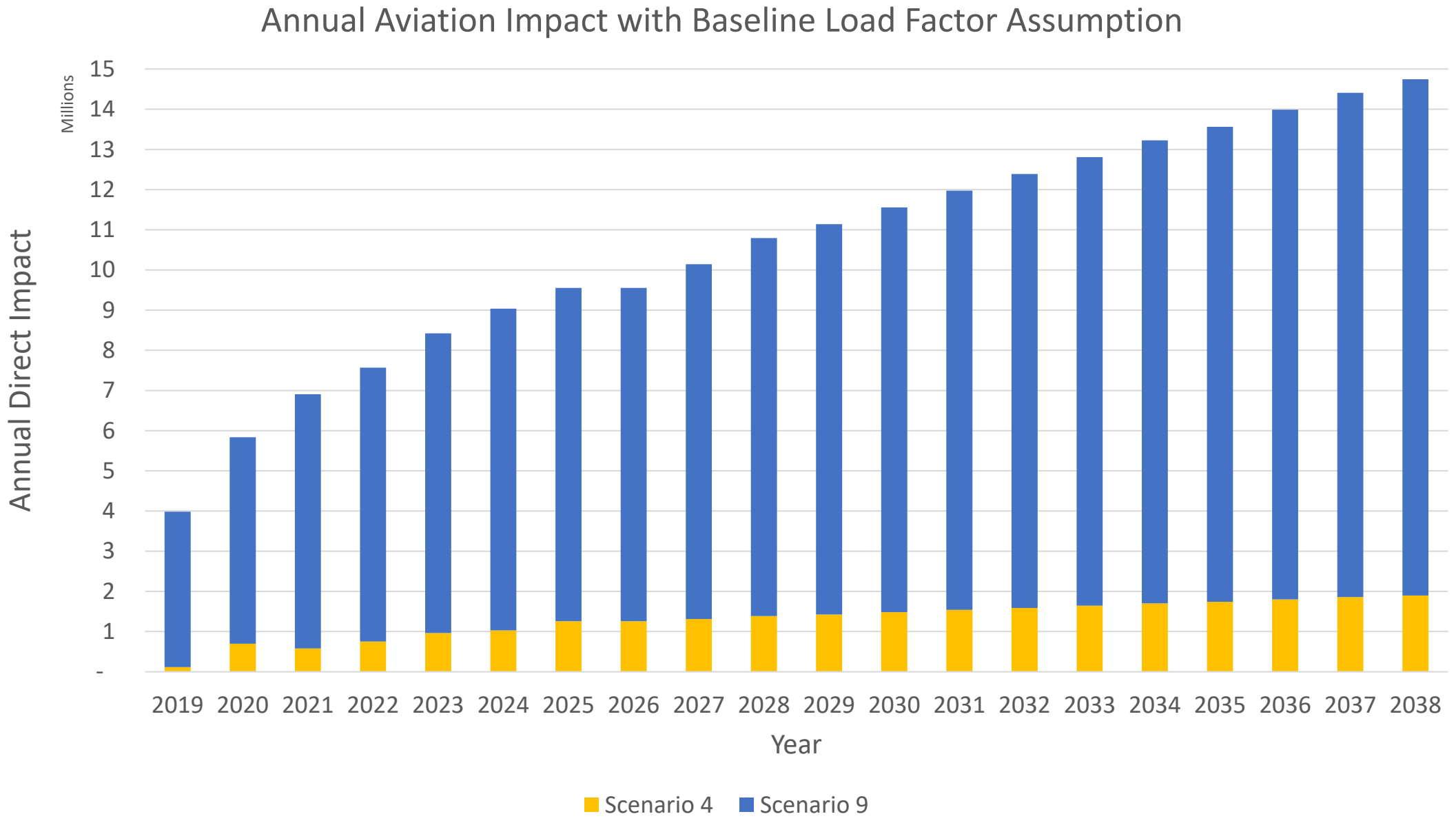


DOMESTIC OPERATIONS FORECAST

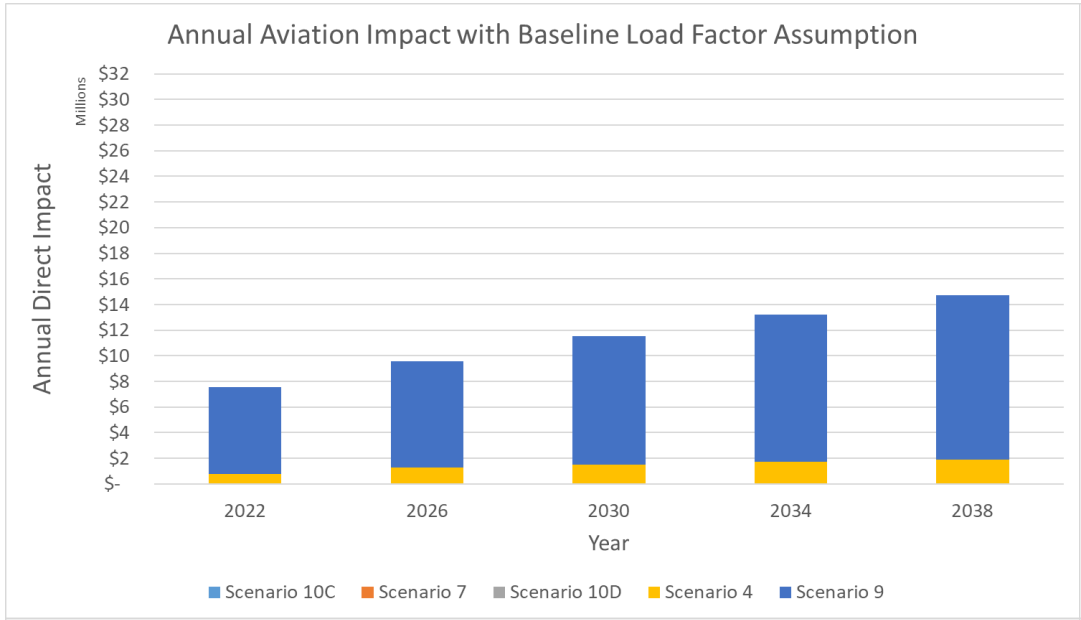
- 2019 through 2037 were obtained from the SJC domestic forecast. 2038 was estimated based on the previous year's growth.
- The year-over-year passenger growth multiplied by the load factors gathered from BTS T100 to determine future load factors

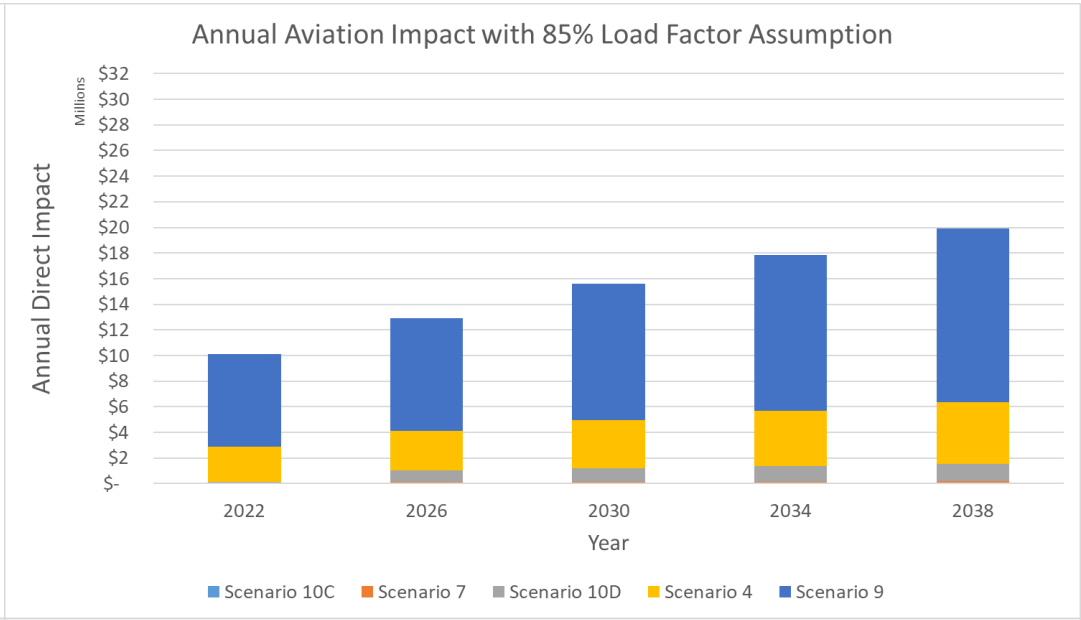


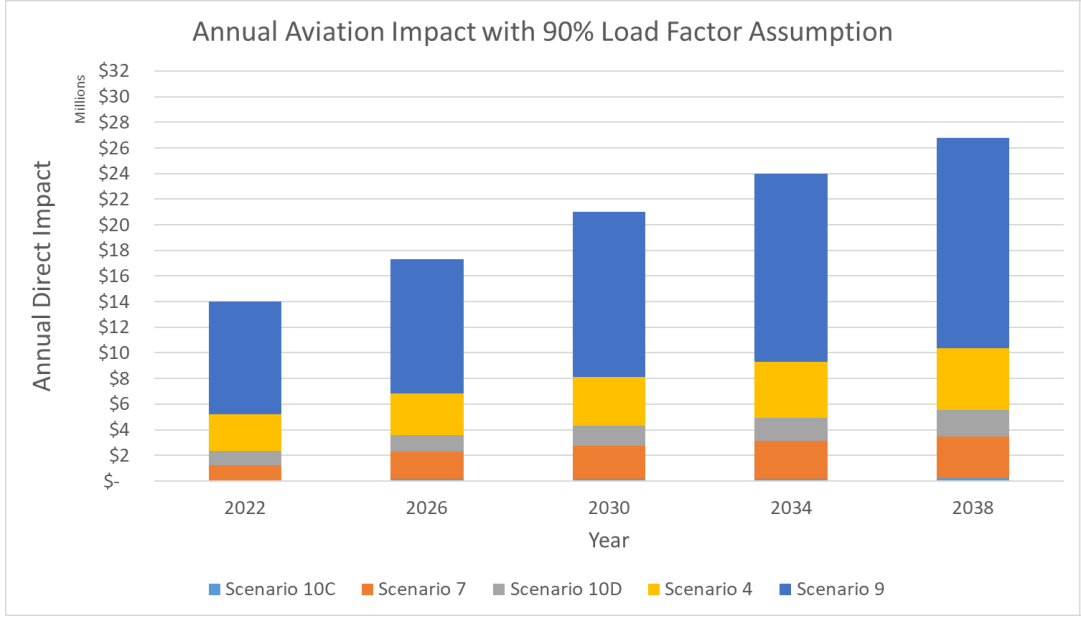
SUMMARY OF 20-YEAR DIRECT IMPACTS

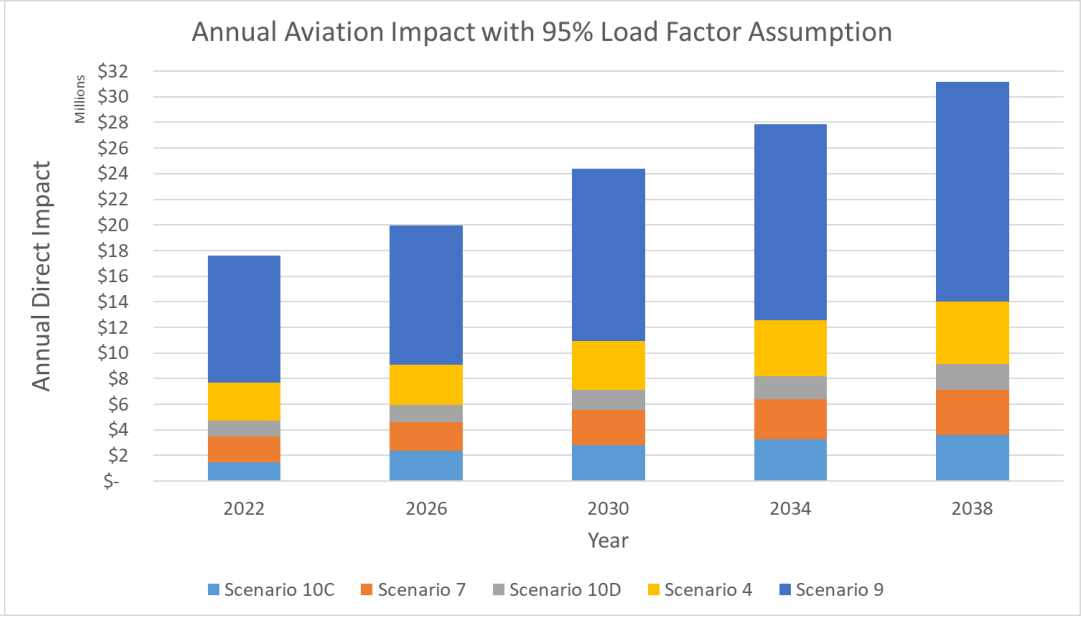


SUMMARY OF 20-YEAR DIRECT IMPACTS WITH LOAD FACTOR SENSITIVITY TEST









SUMMARY OF 20-YEAR CUMULATIVE DIRECT IMPACTS
LOAD FACTOR SENSITIVTY TEST

Cumulative Summary of Losses		Baseline Load Factor	85% Load Factor	90% Load Factor	95% Load Factor
Scenario 1	Existing airspace protection	**$0**	**$0**	**$0**	**$0**
Scenario 4	TERPS Only	**$26,034,000**	**$89,217,000**	**$148,827,000**	**$203,596,000**
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	**$0**	**$2,031,000**	**$47,238,000**	**$101,472,000**
Scenario 10	Existing Conditions: 85' - 166' AGL	**$0**	**$0**	**$0**	**$0**
	Opt 10A: 100' - 195' AGL	**$0**	**$0**	**$0**	**$0**
	Opt 10B: 115' - 224' AGL	**$0**	**$0**	**$0**	**$0**
	Opt 10C: 129' - 240' AGL	**$0**	**$0**	**$2,255,000**	**$49,906,000**
	Opt 10D: 146' - 260' AGL	**$0**	**$19,636,000**	**$76,975,000**	**$131,655,000**
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	**$211,596,000**	**$285,294,000**	**$385,051,000**	**$455,005,000**

NEXT FIVE MONTHS: NOVEMBER 2018 TO MARCH 2019

- Continue to meet with airline representatives
- Complete additional international aircraft payload/range analysis
- Complete economic impact analysis
- December 13, 2018: Project Steering Committee Meeting
- December 2018: Develop internal strategy recommendation
- January 2019: Stakeholder update meeting
- January 28, 2018: Present strategy recommendation to CEDC
- February/March 2019: Strategy recommendation to City Council

APPENDIX

KEY ECONOMIC OUTPUTS

Output	Value	Source
All-In Residential Construction Cost*	$534.51/sf	JLL
All-In Office Construction Cost†	$303.40/sf	JLL
Property Tax Millage Rate (City Only)	0.12660 per $100 in assessed value	Santa Clara County
Annual New Construction Residential Tax Revenue	$0.68/sf	JLL
Annual New Construction Office Tax Revenue	$0.38/sf	JLL
New Residents	Average of 1 new resident per 596 rentable square feet	JLL survey of new construction Downtown
New Employees	Average of 1 new employee per 185 rentable square feet	JLL survey of 90 JLL clients with 550+ million square feet under management

** Includes parking; excludes land; factors in 3% inflation per year*
† Includes parking @ $40,000/space, TI allowance, commission; excludes land; factors in 3% inflation per year

KEY ECONOMIC OUTPUTS (CONT'D)

Output	Value	Source
Plan Review Fee	Office: $172 per 1,000 sf above 40,000 sf Residential: $418 per 1,000 sf above 40,000 sf	City of San Jose
Inspection Fee	Office: $112 per 1,000 sf above 40,000 sf Residential: $502 per 1,000 sf above 40,000 sf	City of San Jose
CRMP	Office: 3.00% of valuation Residential: 2.42% of valuation	City of San Jose
Building and Structure Construction Tax	Office: 1.50% of valuation Residential: 1.54% of valuation	City of San Jose
Construction Tax	Office: $0.08 per sf Residential: $75 - $100 per unit	City of San Jose
Residential Construction Tax	$90 - $180 per unit	City of San Jose
New Construction Fee	Office/Residential: $0.56 per sf	San Jose Unified School District
Park Impact Fee (Residential Only)	$14,600 per unit	City of San Jose

Note: Does not include SMIPA or BSARSF.

ANNUAL TAX REVENUE (ANNUALIZED) IN DIRIDON STATION

Scenario	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
4	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$450,600	$450,600	$450,600	$450,600	$450,600	$450,600
7	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$450,600	$450,600	$450,600	$450,600	$450,600	$450,600
9	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$450,600	$450,600	$450,600	$450,600	$450,600	$450,600
10A	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$450,600	$250,700	$6,200	$0	$0	$0
10B	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$450,600	$450,600	$450,600	$450,600	$181,600	$19,200
10C	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$450,600	$450,600	$450,600	$450,600	$450,600	$450,600
10D	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$450,600	$450,600	$450,600	$450,600	$450,600	$450,600

Note: assumes a straight-line increase in office and residential development based on historical absorption/delivery pace. Values are net new tax revenues each year and are not cumulative.

ONE-TIME FEES (ANNUALIZED) FOR DIRIDON STATION

($ millions)

Scenario	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
4	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$22.97	$22.97	$22.97	$22.97	$22.97	$22.97
7	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$22.97	$22.97	$22.97	$22.97	$22.97	$22.97
9	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$22.97	$22.97	$22.97	$22.97	$22.97	$22.97
10A	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$22.97	$13.18	$0.59	$0.00	$0.00	$0.00
10B	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$22.97	$22.97	$22.97	$22.97	$9.80	$1.85
10C	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$22.97	$22.97	$22.97	$22.97	$22.97	$22.97
10D	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$22.97	$22.97	$22.97	$22.97	$22.97	$22.97

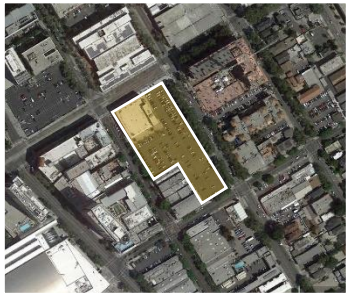
Note: assumes a straight-line increase in office and residential development based on historical absorption/delivery pace.

AERIALS OF SELECTED DOWNTOWN SITES



25934007-14, 25934020-31

66 N Market St (Approximate)



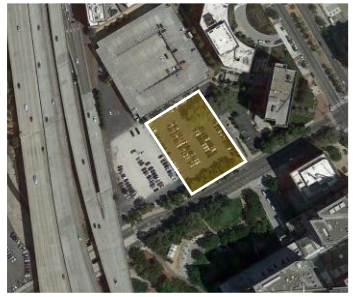
46746080-82

345 S 2nd Street & 300 S 1st Street



25942080

282 S Market St



25939116

333 W San Fernando St



25940012

60 S Almaden Ave



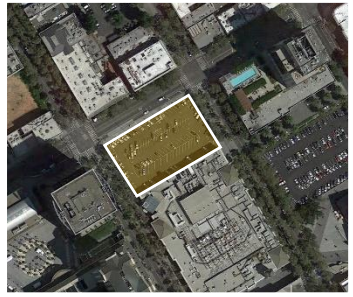
46722160

174 S 2nd St



25931072, 25931077-80

115 Terraine St



46722142

8 E San Fernando St

EXISTING DENSITY AND INCREASES FOR DOWNTOWN SITES

Address			Scenario 4		Scenario 9	
	Parcel Area	Max Existing Potential SF	Max SF Increase	% Max SF Increase	Max SF Increase	% Max SF Increase
66 N Market St (Approximate)	170,017	2,441,000	0	0%	300,000	12%
345 S 2nd Street & 300 S 1st Street	123,173	2,232,000	*Not Impacted*	*Not Impacted*	782,000	35%
282 S Market St	65,781	1,090,000	52,000	5%	363,000	33%
333 W San Fernando St	62,242	910,000	101,000	11%	202,000	22%
60 S Almaden Ave	61,874	966,000	107,000	11%	215,000	22%
174 S 2nd St	58,456	981,000	*Not Impacted*	*Not Impacted*	187,000	19%
115 Terraine St	55,200	653,000	44,000	7%	174,000	27%
8 E San Fernando St	43,513	754,000	36,000	5%	144,000	19%
Museum Place	107,815	988,203 (planned)	100,000	10%	250,000	25%



333 San Ferndando St
Adobe Tower 4
Planned SF: 750k
Site Capacity: 859k-909k



60 S Almaden Ave
Former Greyhound Site
Planned SF: 622k (JLL est.)
Site Capacity: 980k

ASSUMPTIONS – ADJUSTED SEATING CAPACITY

Winter					
Aircraft Data		Adjusted Seating Capacity Based on LFs			
Aircraft	Aircraft Seat Capacity (Max)	Hawaii (89.70% LF)	Transcontinental (84.90% LF)	Europe (73.00% LF)	Asia (78.10% LF)
A320-200	150		127		
A321 NEO	189	170			
B737-800 (Transcon)	175		149		
B737-800 (Hawaii)	173	155			
B787-9	290			212	226

Summer					
Aircraft Data		Adjusted Seating Capacity Based on LFs			
Aircraft	Aircraft Seat Capacity (Max)	Hawaii (90.50% LF)	Transcontinental (82.20% LF)	Europe (87.20% LF)	Asia (81.50% LF)
A320-200	150		123		
A321 NEO	189	171			
B737-800 (Hawaii & Transcon)	175	158	144		
B787-9	290			253	236

PASSENGER PENALTY VS EMPTY SEATS SUMMARY

Destination (Season)	Aircraft Type	Aircraft Seat Capacity	Load Factor	Load Factor Seat Count	Available Empty Seats Due to Load Factor	Additional PAX Lost In Excess of Load Factor	Scenarios Impacted
Hawaii (Winter)	A321 NEO	189	89.70%	170	19	0	Scenarios 1,4,7,9 & 10
	B737-800	173	89.70%	155	18	0	Scenarios 1,4,7,9 & 10
Hawaii (Summer)	A321 NEO	189	90.50%	171	18	0	Scenarios 1,4,7,9 & 10
	B737-800	175	90.50%	158	17	0	Scenarios 1,4,7,9 & 10
Transcon (Winter)	A320-200	150	84.90%	127	23	0	Scenarios 1,4,7,9 & 10
	B737-800	175	84.90%	149	26	0	Scenarios 1,4,7,9 & 10
Transcon (Summer)	A320-200	150	82.20%	123	27	0	Scenarios 1,4,7,9 & 10
	B737-800	175	82.20%	144	31	0	Scenarios 1,4,7,9 & 10
Asia (Winter)	B787-9	290	78.10%	226	64	0	Scenarios 1,4,7 & 10
Asia (Winter)	B787-9	290	78.10%	226	64	30	Scenario 9
Asia (Summer)	B787-9	290	81.50%	236	54	0	Scenarios 1,4,7 & 10
Asia (Summer)	B787-9	290	81.50%	236	54	41	Scenario 9
Europe (Winter)	B787-9	290	73.00%	212	78	0	Scenarios 1,4,7 & 10
Europe (Winter)	B787-9	290	73.00%	212	78	0	Scenario 9
Europe (Summer)	B787-9	290	87.20%	253	37	0	Scenarios 1,4,7 & 10
Europe (Summer)	B787-9	290	87.20%	253	37	4	Scenario 9

LOST PFC REVENUE

Total		Annual Flights Impacted	Anuual Lost Passengers	Lost Revenue Per Year
Scenario 1	Existing airspace protection	**583**	**-**	**$0**
Scenario 4	TERPS Only	**583**	**201**	**$884**
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	**583**	**-**	**$0**
Scenario 10	Existing Conditions: 85' - 166' AGL	**583**	**-**	**$0**
	Opt 10A: 100' - 195' AGL	**583**	**-**	**$0**
	Opt 10B: 115' - 224' AGL	**583**	**-**	**$0**
	Opt 10C: 129' - 240' AGL	**583**	**-**	**$0**
	Opt 10D: 146' - 260' AGL	**583**	**-**	**$0**
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	**583**	**5,794**	**$25,435**

Note: Airport gets **$4.39** per outbound passenger for PFCs

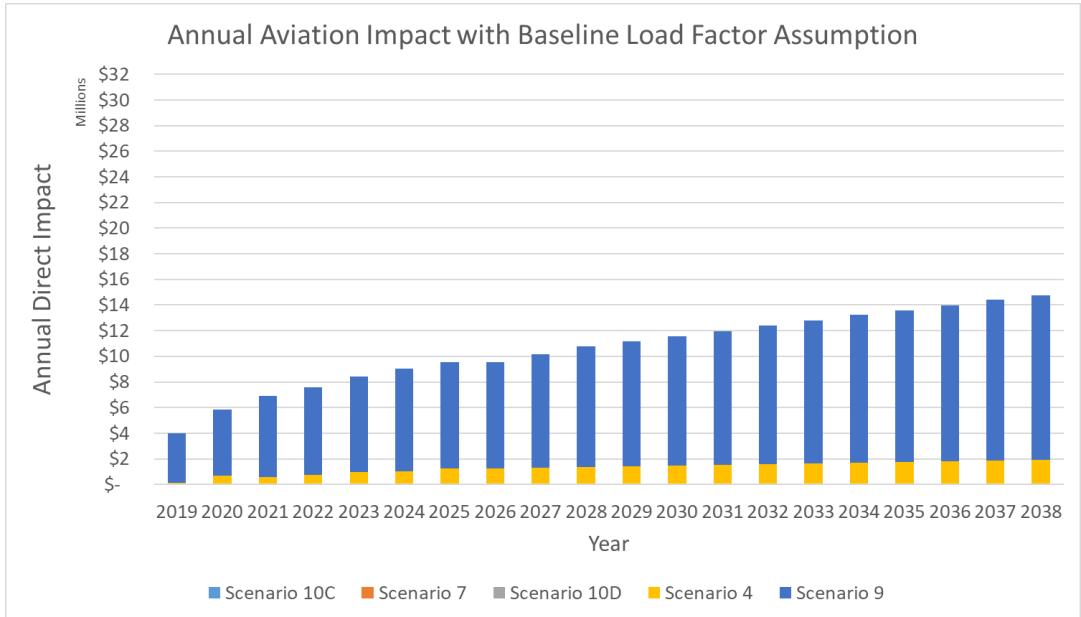
REVENUE LOSS SUMMARY

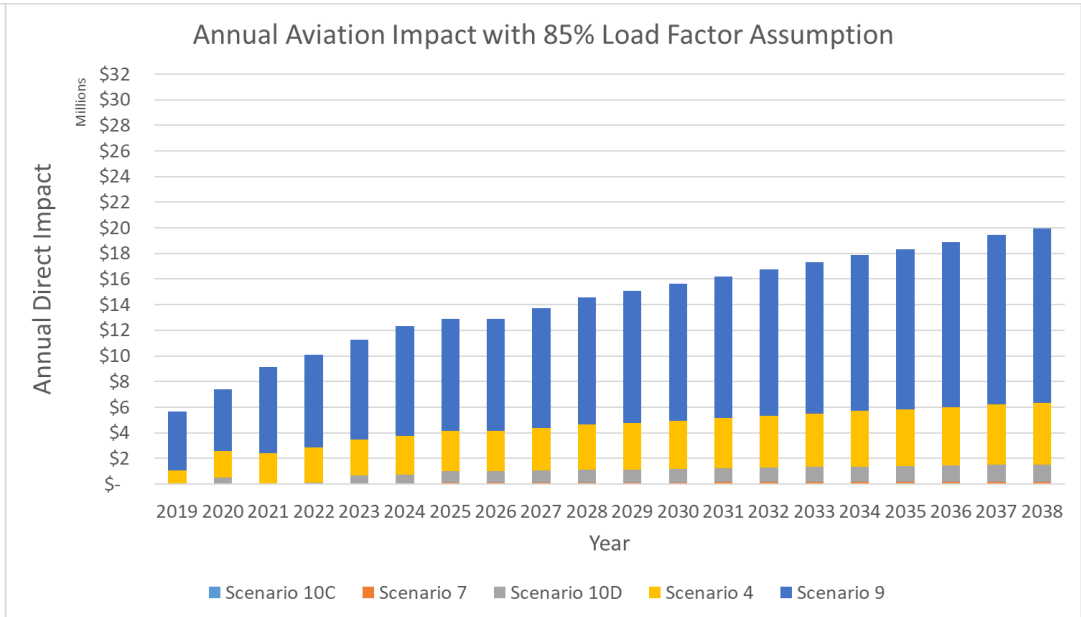
- No lost revenue per year for Hawaii and Transcontinental departures under any airspace scenario

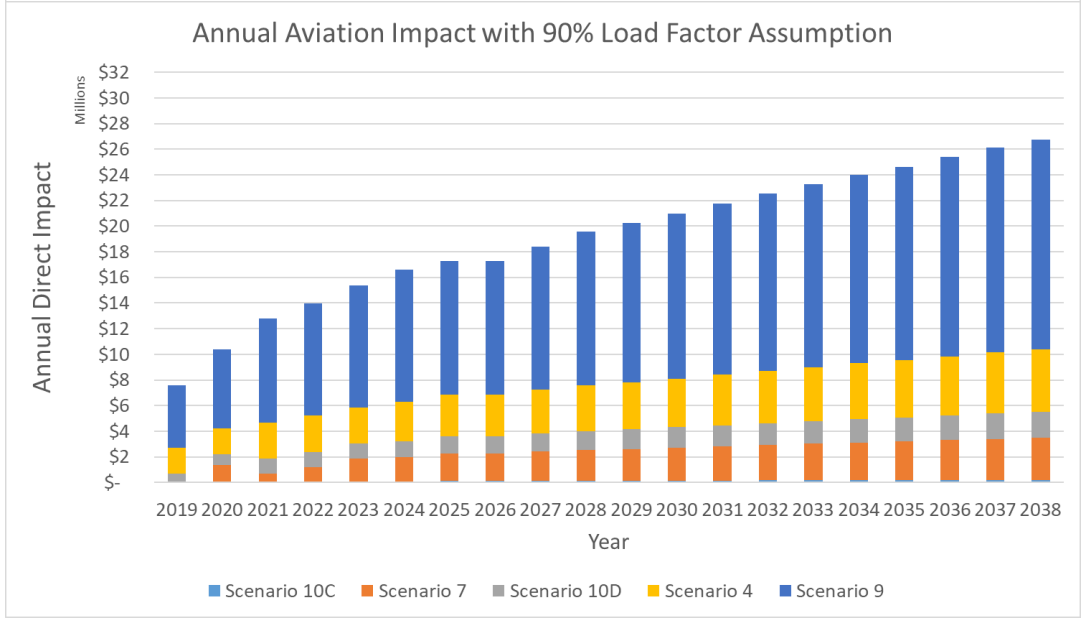
Market	Airspace Scenario	Lost Passengers Per Flight	Annual Departures	Flights Impacted	Airline Lost Revenue Per Year	Airport Concessions Lost Revenue Per Year	Terminal Concessions Lost Revenue Per Year	Lost Visitors Per Flight	Local Visitor Spending Lost Revenue Per Year
Europe	Scenario 1, 4, 7 & 10	0	359	47	$0	$0	$0	0	$0
	Scenario 9	4	359	47	**$38,000**	**$400**	**$2,000**	2	**$70,000**
Asia	Scenario 1, 7 & 10	0	582	74	$0	$0	$0	0	$0
	Scenario 4	2	582	74	**$43,000**	**$400**	**$2,000**	1	**$55,000**
	Scenario 9	71	582	74	**$1,699,000**	**$12,000**	**$72,000**	28	**$1,548,000**

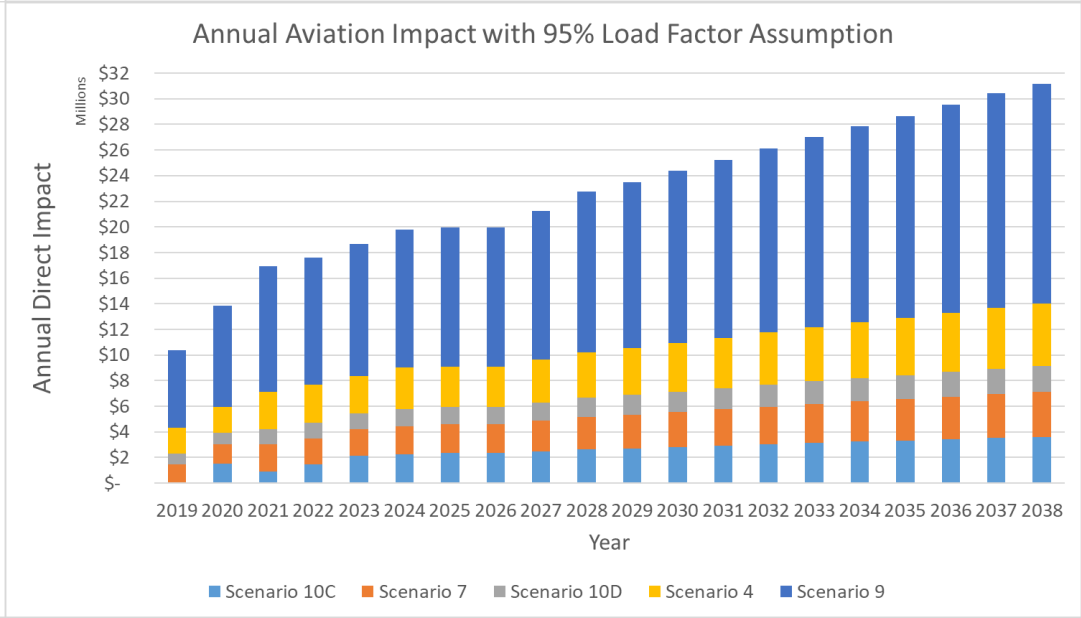
Note: Visitors are 28.9% for Europe and 39.1% for Asia

SUMMARY OF 20-YEAR DIRECT IMPACTS WITH LOAD FACTOR SENSITIVITY TEST



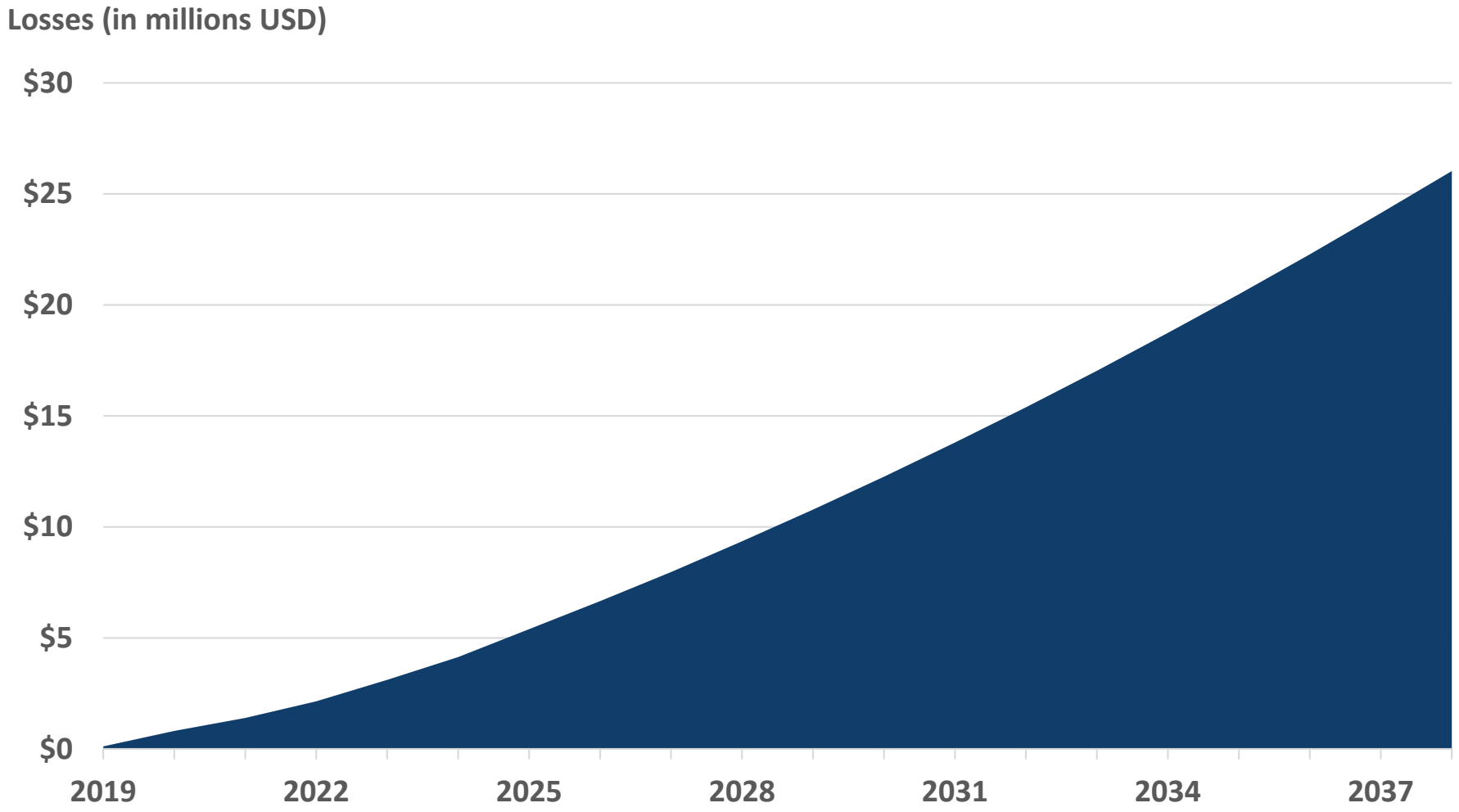






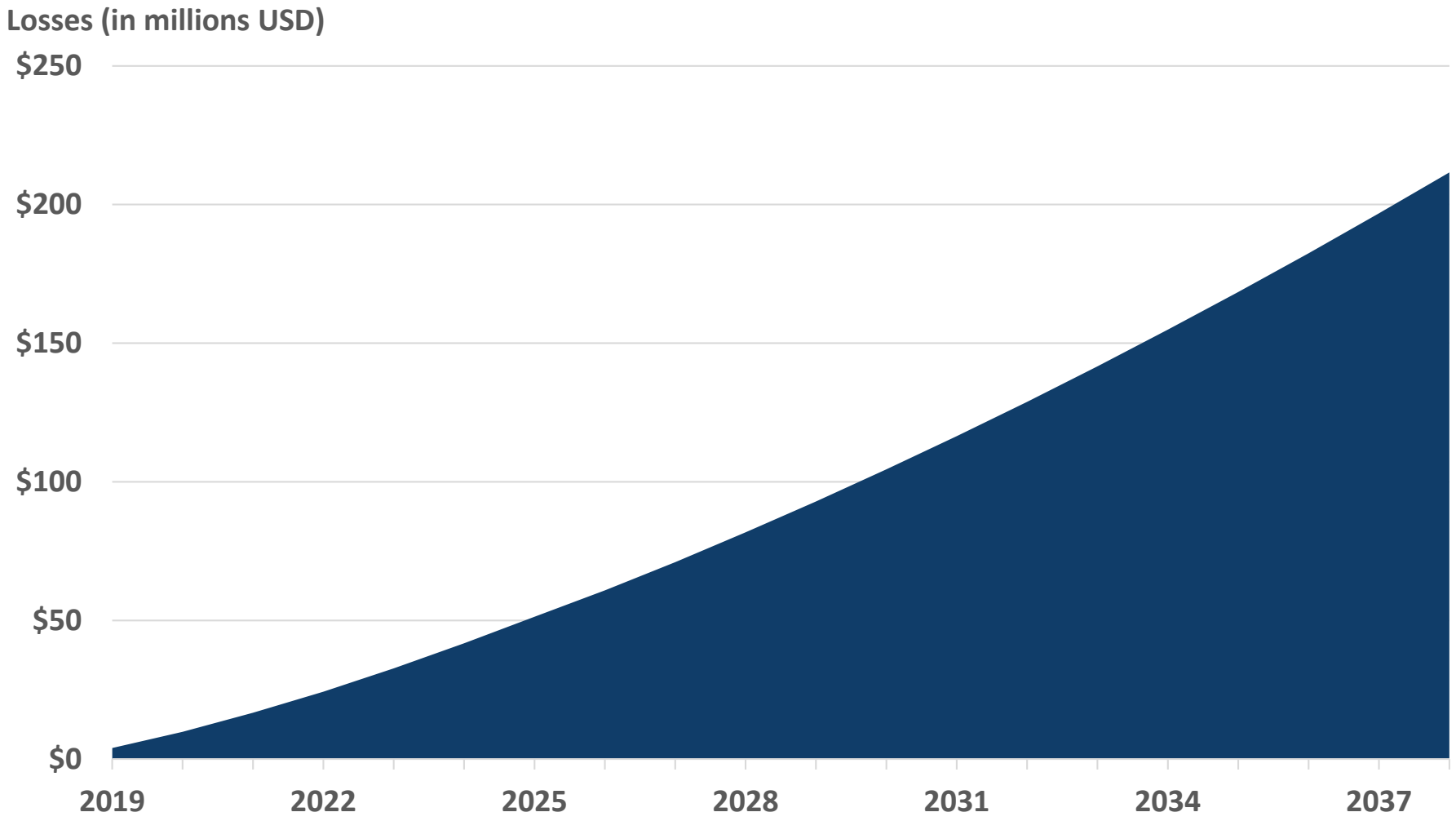
SCENARIO 4 CUMULATIVE SUMMARY OF LOSSES

- Scenario 4 is forecast to result in approximately $26.0 million over the next 20 years.



SCENARIO 9 CUMULATIVE SUMMARY OF LOSSES

- Scenario 9 is forecast to result in approximately $211.6 million over the next 20 years.

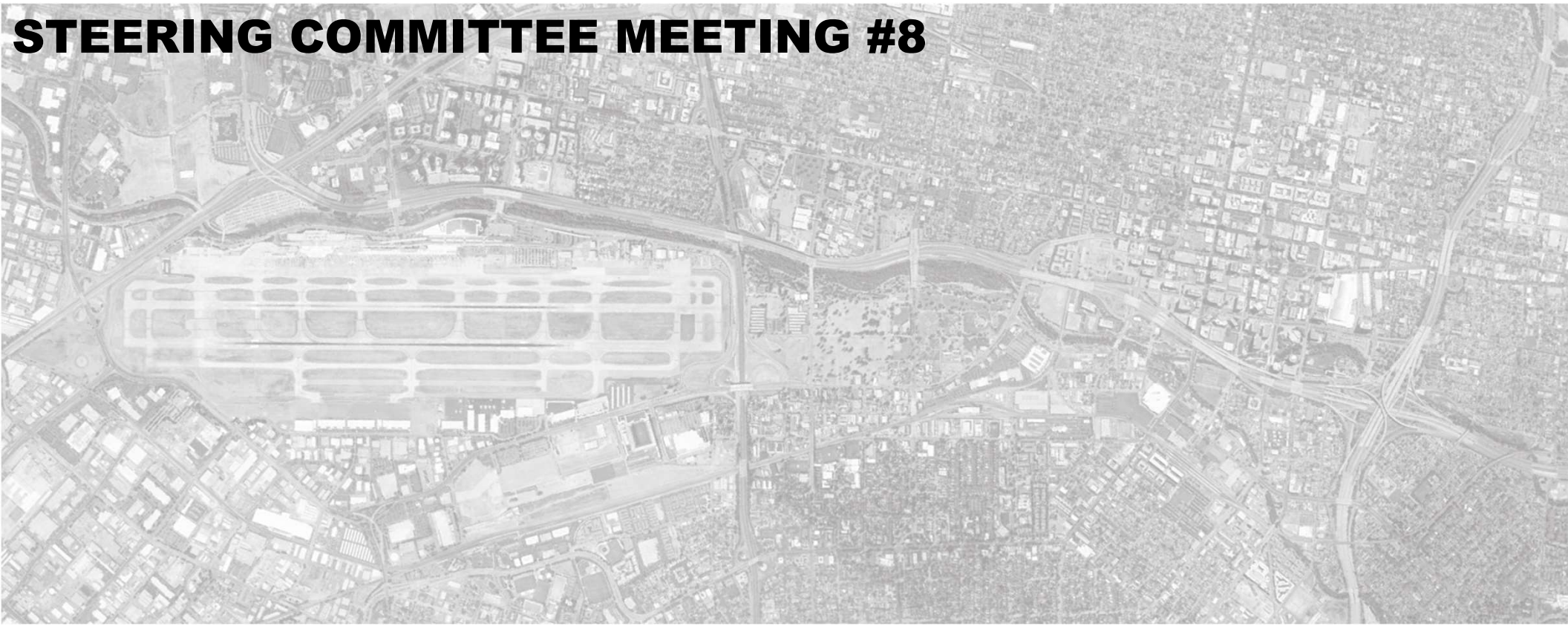


SUMMARY OF 20-YEAR CUMULATIVE DIRECT IMPACTS

Cumulative Summary of Loses		Airline Revenue	PFC Revenue	Terminal Concession Spending	Local Visitor Spending	Total
Scenario 1	Existing airspace protection	**$0**	**$0**	**$0**	**$0**	**$0**
Scenario 4	TERPS Only	**$12,762,000**	**$192,000**	**$637,000**	**$12,443,000**	**$26,034,000**
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	**$0**	**$0**	**$0**	**$0**	**$0**
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	**$119,389,000**	**$1,231,000**	**$4,791,000**	**$86,185,000**	**$211,596,000**
Scenario 10	Existing Conditions: 85' - 166' AGL	**$0**	**$0**	**$0**	**$0**	**$0**
	Opt 10A: 100' - 195' AGL	**$0**	**$0**	**$0**	**$0**	**$0**
	Opt 10B: 115' - 224' AGL	**$0**	**$0**	**$0**	**$0**	**$0**
	Opt 10C: 129' - 240' AGL	**$0**	**$0**	**$0**	**$0**	**$0**
	Opt 10D: 146' - 260' AGL	**$0**	**$0**	**$0**	**$0**	**$0**

DOWNTOWN SAN JOSÉ AIRSPACE & DEVELOPMENT CAPACITY STUDY (PROJECT CAKE)

STEERING COMMITTEE MEETING #8



December 13, 2018

AGENDA

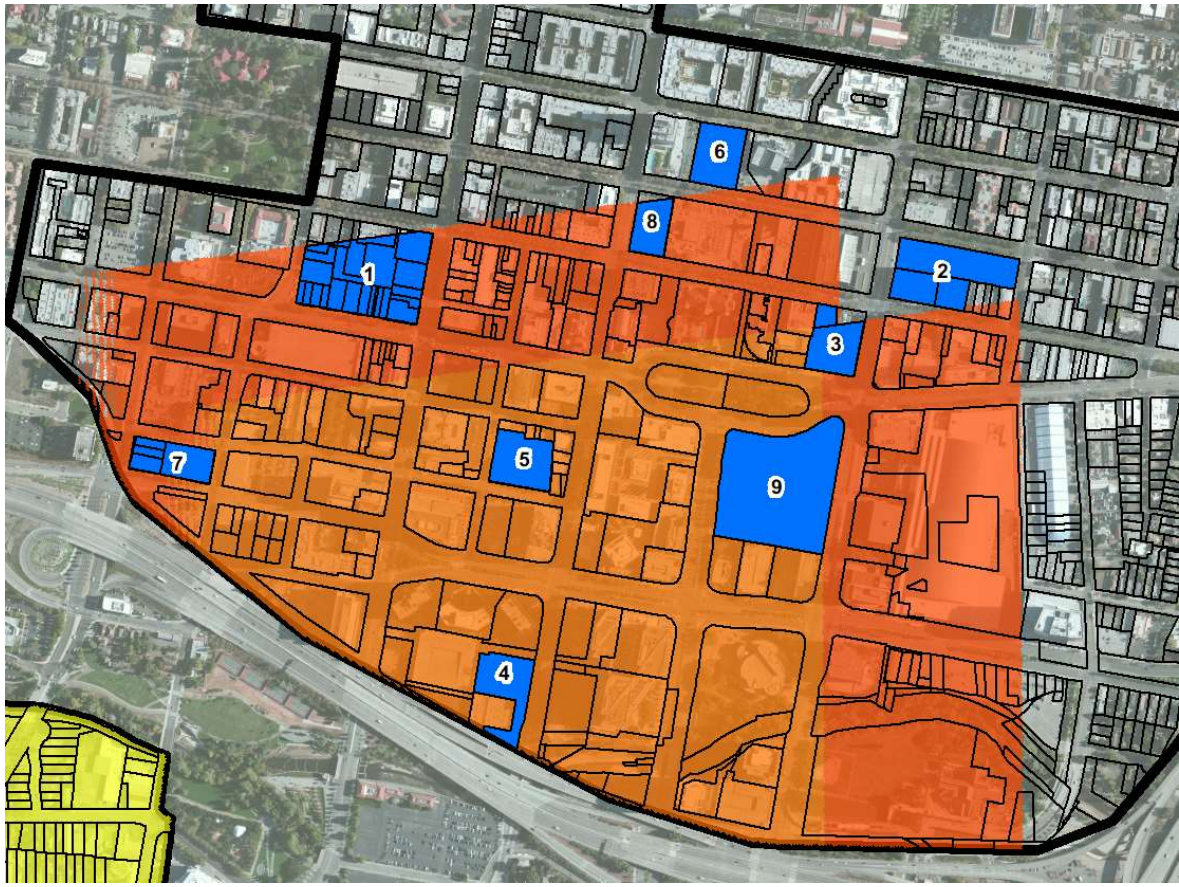
- Introduction
- Real Estate Economic Impact Assessment Update
- International Aircraft Performance Assessment
- Airline Aircraft Performance Assessment
- Aviation Direct Economic Impacts Update
- Induced Economic Impacts Assessment
- Strategy Recommendation Discussion
- Next Steps

REAL ESTATE
ECONOMIC IMPACT ASSESSMENT UPDATE

(JLL)

IMPACT ON INDIVIDUAL DOWNTOWN SITES

	APN(s)	ADDRESS	CURRENT	NOTES	AREA
1	25934007-14, 25934020-31	66 N Market St (Approximate)	Surface Parking + Low-Rise Commercial		170,017 sf
2	46746080-82	345 S 2nd Street, 300 S 1st Street	Surface Parking + Low-Rise Commercial		123,173 sf
3	25942080	282 S Market St	Surface Parking		65,781 sf
4	25939116	333 W San Fernando St	Surface Parking	Planned site of Adobe Tower 4 (750,000sf)	62,242 sf
5	25940012	60 S Almaden Ave	Former Greyhound Terminal	Planned site of 708 residential units and 20,000 SF retail	61,874 sf
6	46722160	174 S 2nd St	Surface Parking	Site of planned Sobrato parking structure	58,456 sf
7	25931072, 25931077-80	115 Terraine St	One-Story industrial, Surface Parking		55,200 sf
8	46722142	8 E San Fernando St	Surface parking		43,513 sf
9	25942023	201 Market Street	Museum	Museum Place Development	107,815 sf



Note: Graphic depicts the area of increased height differentials for Scenario 4 in relation to the nine test sites depicted in blue. Please note that portions of test sites 1, 2, 3 and 8 are outside of the area of increased heights. Test site 6 is completely outside the area of increased heights.

UPDATES TO PREVIOUS ASSESSMENT

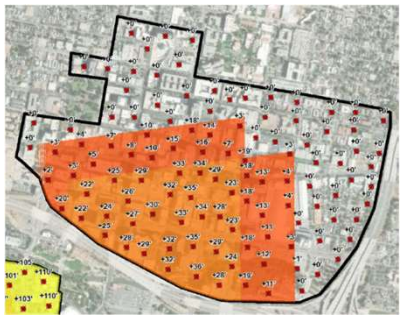
- Per the discussion at the November 13 meeting, JLL reviewed development test sites #3 and #8.
- There is a slight (though not significant compared to other sites) increase in density for these two future development sites.
- JLL adjusted the model and findings to reflect this, including all outputs.
- Development site #6 is outside of the area where additional height can be gained under Scenario 4. This area is governed by TERPS in both Scenarios 1 and 4 so no additional height would be gained over this parcel.

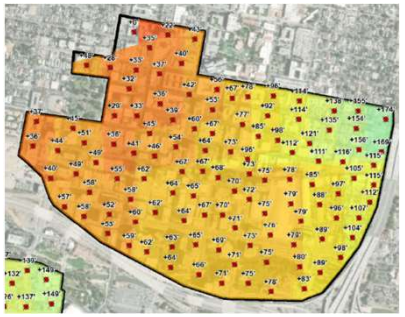
EXISTING DENSITY AND INCREASES FOR DOWNTOWN SITES

Address			Scenario 4		Scenario 9	
	Parcel Area	Existing Potential Density (SF)	Net New SF	% Increase	Net New SF	% Increase
66 N Market St (Approximate)	170,017	2,441,000	0*	0%	300,000	12%
345 S 2nd Street & 300 S 1st Street†	123,173	2,232,000	*Not Impacted*	*Not Impacted*	782,000	35%
282 S Market St	65,781	1,090,000	52,000	5%	363,000	33%
333 W San Fernando St	62,242	910,000	101,000	11%	202,000	22%
60 S Almaden Ave	61,874	966,000	107,000	11%	215,000	22%
174 S 2nd St	58,456	981,000	*Not Impacted*	*Not Impacted*	187,000	19%
115 Terraine St	55,200	653,000	44,000	7%	174,000	27%
8 E San Fernando St	43,513	754,000	36,000	5%	144,000	19%
Museum Place	107,815	988,203 (planned)	100,000	10%	250,000	25%

** An increase of zero square feet means either 1) the height limits imposed by the San Jose General Plan are below either the existing or the altered airspace protection scenarios or 2) an average of at least 14 feet must be achieved for each new floor, and the height increase afforded by a scenario does not meet this minimum.*

† Some parcels included in this test case site do fall under Scenario 4; however the majority do not, and therefore the development site as configured/tested assumes no height gain realized from Scenario 4.

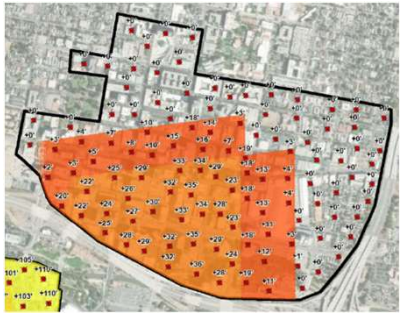


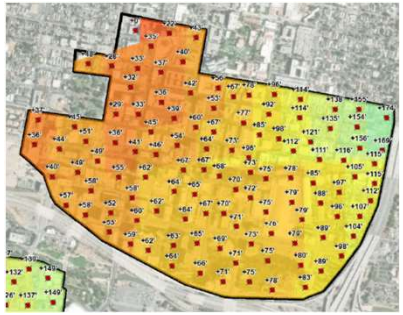


CONSTR. VALUE AND TAXES FOR DOWNTOWN SITES

Address	Scenario 4		Scenario 9	
	Net New Construction Value	Net New Annual Tax Revenue	Net New Construction Value	Net New Annual Tax Revenue
66 N Market St (Approximate)	*Not Impacted*	*Not Impacted*	$91,100,000	$115,000
345 S 2nd Street & 300 S 1st Street	*Not Impacted*	*Not Impacted*	$237,400,000	$301,000
282 S Market St	$15,800,000	$100,000	$110,300,000	$140,000
333 W San Fernando St	$30,700,000	$39,000	$61,300,000	$78,000
60 S Almaden Ave	$32,600,000	$41,000	$65,100,000	$82,000
174 S 2nd St	*Not Impacted*	*Not Impacted*	$56,700,000	$72,000
115 Terraine St	$13,200,000	$17,000	$52,900,000	$67,000
8 E San Fernando St	$10,900,000	$41,000	$43,600,000	$55,000
Museum Place	$30,300,000	$38,000	$75,800,000	$96,000

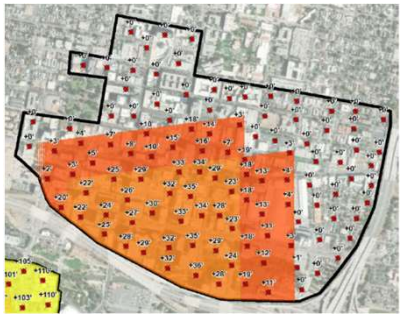
Note: Values represent both office development, are aggregate, and represent the total potential increase without regard to a specific timeframe.

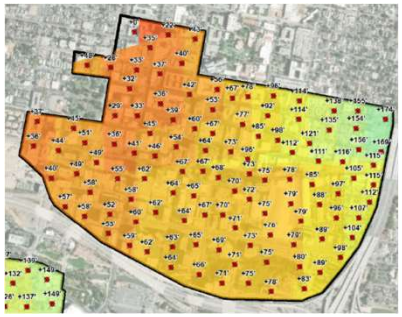




EMPLOYMENT IN DOWNTOWN SITES

Address	Scenario 4	Scenario 9
	Net New Employees	Net New Employees
66 N Market St (Approximate)	*Not Impacted*	1,400
345 S 2nd Street & 300 S 1st Street	*Not Impacted*	3,700
282 S Market St	200	1,700
333 W San Fernando St	500	900
60 S Almaden Ave	500	1,000
174 S 2nd St	*Not Impacted*	900
115 Terraine St	200	800
8 E San Fernando St	200	700
Musem Place	500	1,200

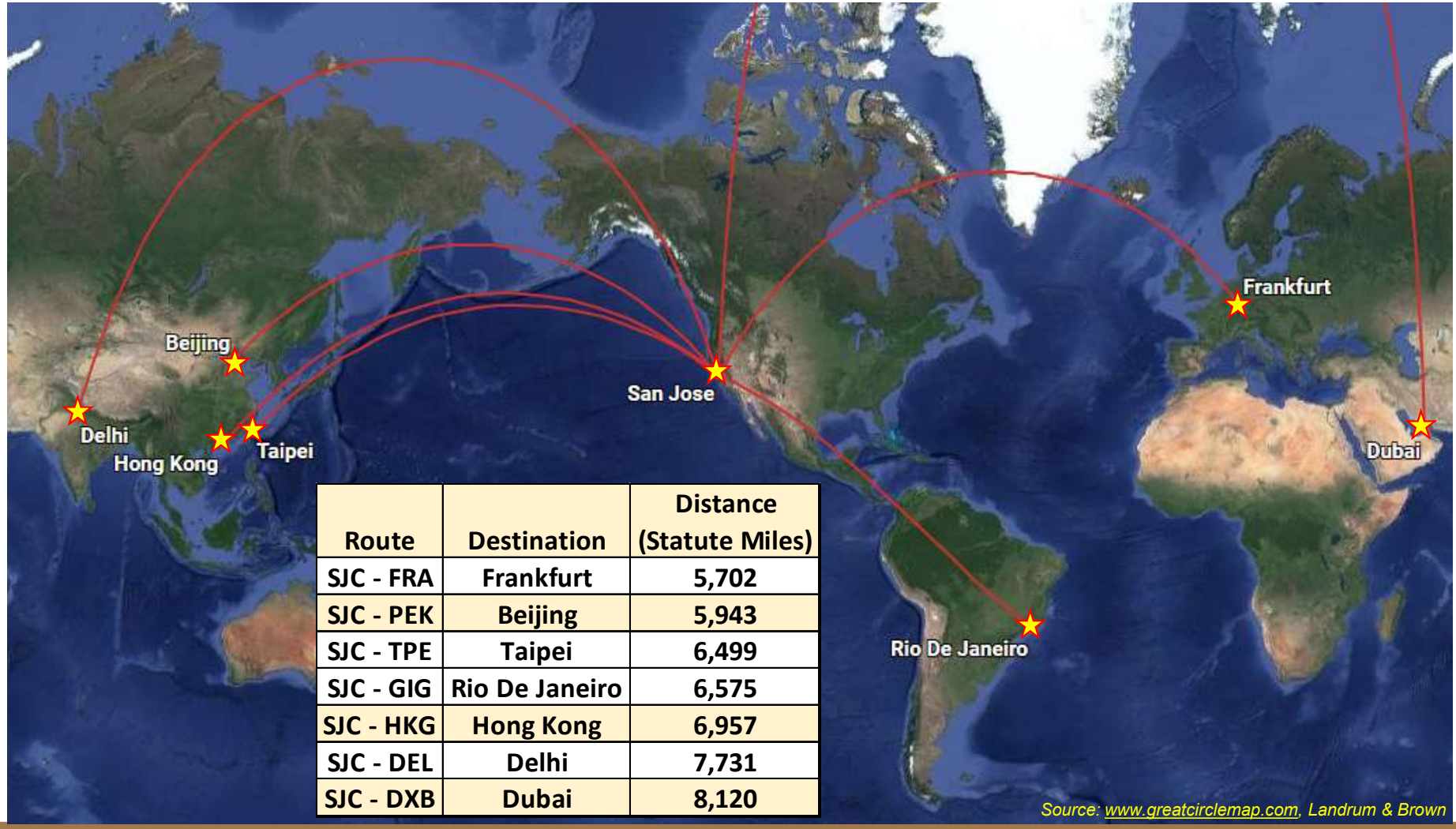




INTERNATIONAL AIRCRAFT PERFORMANCE ASSESSMENT

ASSESSMENT OF EXISTING STRAIGHT-OUT OEI VS TERPS ONLY FOR ADDITIONAL MARKETS

Aircraft Evaluated:
A330-200
A350-900
B777-300
B787-9



Route	Destination	Distance (Statute Miles)
SJC - FRA	Frankfurt	5,702
SJC - PEK	Beijing	5,943
SJC - TPE	Taipei	6,499
SJC - GIG	Rio De Janeiro	6,575
SJC - HKG	Hong Kong	6,957
SJC - DEL	Delhi	7,731
SJC - DXB	Dubai	8,120

Source: www.greatcirclemap.com, Landrum & Brown

WEIGHT PENALTY ASSESSMENT – GIG, TPE, HKG, DEL & DXB

Rio de Janeiro - GIG Summer (81.3° F)	A330-200 (284 seats/21,199 lbs. cargo)		A350-900 (325 seats/16,520 lbs. cargo)		B777-300ER (370 seats/32,012 lbs. cargo)		B787-9 (290 seats/0 lbs. cargo)	
	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Existing Straight Out OEI	-	-	-	-	-	-	51	-
TERPS Only	-	1,927	-	2,085	-	2,776	60	-

Taipei - TPE Summer (81.3° F)	A330-200 (284 seats/10,635 lbs. cargo)		A350-900 (325 seats/6,439 lbs. cargo)		B777-300ER (370 seats/19,465 lbs. cargo)		B787-9 (290 seats/0 lbs. cargo)	
	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Existing Straight Out OEI	-	-	-	-	-	-	89	-
TERPS Only	-	1,976	-	2,052	-	2,638	96	-

Hong Kong - HKG Summer (81.3° F)	A330-200 (284 seats/743 lbs. cargo)		A350-900 (325 seats/0 lbs. cargo)		B777-300ER (370 seats/5,348 lbs. cargo)		B787-9 (290 seats/0 lbs. cargo)	
	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Existing Straight Out OEI	-	-	15	-	-	-	128	-
TERPS Only	5	743	23	-	-	2,543	134	-

Delhi - DEL Summer (81.3° F)	A330-200 (284 seats/0 lbs. cargo)		A350-900 (325 seats/0 lbs. cargo)		B777-300ER (370 seats/0 lbs. cargo)		B787-9 (290 seats/0 lbs. cargo)	
	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Existing Straight Out OEI	48	-	69	-	62	-	178	-
TERPS Only	55	-	77	-	72	-	184	-

Dubai - DXB Summer (81.3° F)	A330-200 (284 seats/0 lbs. cargo)		A350-900 (325 seats/0 lbs. cargo)		B777-300ER (370 seats/0 lbs. cargo)		B787-9 (290 seats/0 lbs. cargo)	
	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)	PAX Penalty	Cargo Penalty (lbs.)
Existing Straight Out OEI	57	-	71	-	62	-	184	-
TERPS Only	65	-	79	-	72	-	191	-

AIRLINE AIRCRAFT PERFORMANCE ASSESSMENT

AIRLINES RESPONSES

- The following airlines participated in the aircraft performance assessment for the various airspace scenarios presented:

Responded	No Response
AeroMexico	Air Canda/Jazz
Air China	California Pacific
Alaska	Frontier
American	Lufthansa
ANA	UPS
British Airways	
Delta	
FedEx	
Hainan Airways	
Hawaiian	
Southwest	
United	
Volaris	

AIRLINE AIRCRAFT PERFORMANCE ANALYSIS RESULTS (1 OF 3)

- ANA
  - Evaluated B787-8 (max 169 PAX configuration)
  - No PAX penalty impacts in Scenarios 1,4,7 and 10, however cargo impact.
  - Scenario 9 results in PAX penalties between 30-37 PAX in Summer temperatures (92º F), including additional cargo penalties
- Hainan Airways
  - For B787-8/9, Scenario 4 obstacles results in significant reduction in cargo and PAX payload (50+ PAX for B787-9) due to loss of the West Corridor

AIRLINE AIRCRAFT PERFORMANCE ANALYSIS RESULTS (2 OF 3)

- British Airways
  - Scenarios 4 and 7 have no impact at all to current operations
  - Scenario 9 results in greatest impact when operating on Runways 12L/12R
  - Scenario 10 has no impact on 12L when departing straight-out, however a payload and engine impact for 12R when making a right course correction
- Alaska, American, Aeromexico, Delta, and Southwest, Volaris
  - No penalties for operations below 92º F.
- United
  - Significant PAX and cargo penalties for B737-900ER operation in Scenarios 1, 4, 7 and 9
  - Minor PAX and cargo penalties in Scenario 4 for B737-800; moderate PAX and cargo penalties in Scenario 9 for B737-800

AIRLINE AIRCRAFT PERFORMANCE ANALYSIS RESULTS (3 OF 3)

- Hawaiian (Aircraft - A321 NEO)
  - HNL, OGG, or KOA has no passenger penalties, some cargo penalties.
  - LIH has minimal passenger penalties and some cargo penalties.
- Federal Express
  - Cargo Penalties in most scenarios; however, will cube out before weight out.

AVIATION DIRECT ECONOMIC IMPACT ASSESSMENT UPDATE

REVISED LOAD FACTORS

- Account for airline load factors (average occupied seats)
- Europe and Asia load factors update to reflect anticipated load factors in 2024

Airline Load Factor by Market		
Region	**Winter**	**Summer**
Hawaii – SJC	89.7%	90.5%
Transcontinental – SJC	84.9%	82.2%
Europe – Bay Average	77.0%	86.0%
Asia – Bay Average	81.0%	85.0%

- Aviation/airline impacts assumed to begin in 2024 with either new high-rise development or associated construction cranes

Notes:
- Historic load factor data including winter and summer data from BTS T100 = Bureau of Transportation Statistics Air Carrier Statistics Database, U.S. Departure of Transportation, 2015 - 2017
- International general load factor data from "International Arriving Passengers 2018-2028 Estimate," the City of San Jose - SJC International Airport

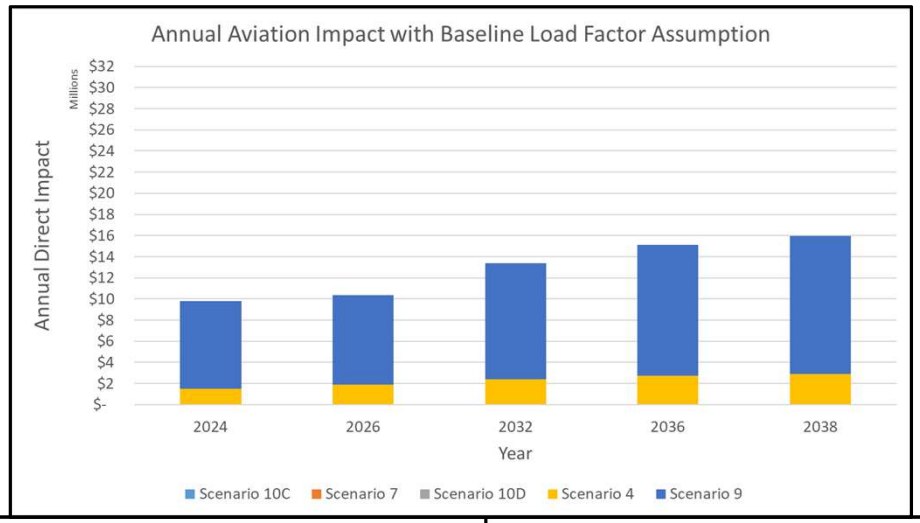
SUMMARY OF 2024 ANNUAL DIRECT IMPACTS BY SCENARIO HISTORICAL LOAD FACTORS

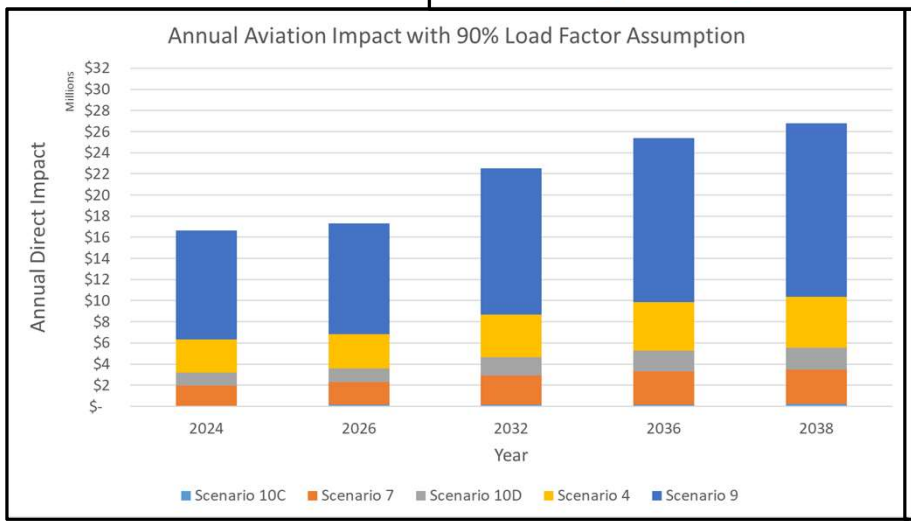
Summary of Loses		Airline Revenue	PFC Revenue	Terminal Concession Spending (Airport Share)	Terminal Concession Spending (Concession Share)	Local Visitor Spending	Total
Scenario 1	Existing airspace protection	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Scenario 4	TERPS Only	**$802,000**	**$10,000**	**$5,000**	**$31,000**	**$669,000**	**$1,517,000**
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Scenario 10	Existing Conditions: 85' - 166' AGL	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
	Opt 10A: 100' - 195' AGL	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
	Opt 10B: 115' - 224' AGL	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
	Opt 10C: 129' - 240' AGL	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
	Opt 10D: 146' - 260' AGL	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	**$5,566,000**	**$57,000**	**$32,000**	**$191,000**	**$3,966,000**	**$9,812,000**

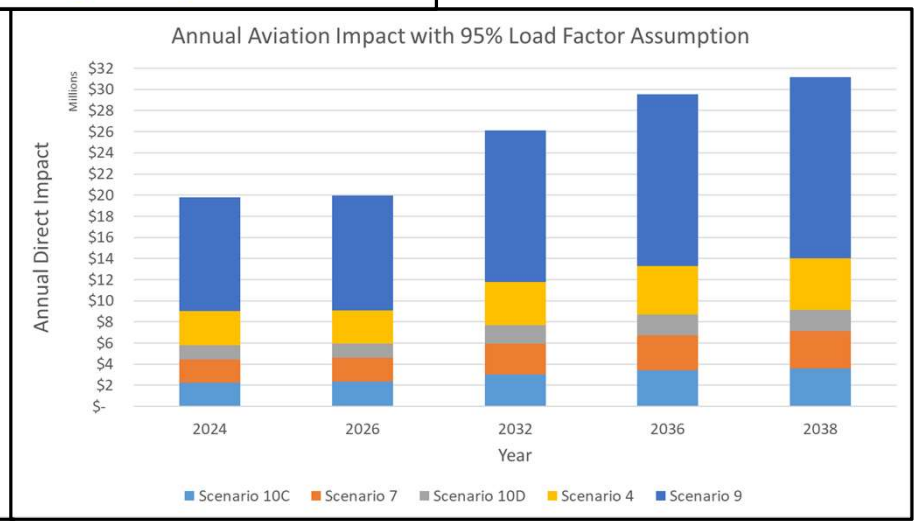
SUMMARY OF 2024 ANNUAL DIRECT IMPACTS
LOAD FACTOR SENSITIVTY TEST

Summary of Losses		Baseline Load Factor	90% Load Factor	95% Load Factor
Scenario 1	Existing airspace protection	**$0**	**$0**	**$0**
Scenario 4	TERPS Only	**$1,517,000**	**$2,716,000**	**$4,306,000**
Scenario 7	Straight-Out ICAO OEI surface protection without West OEI Corridor	**$0**	**$79,000**	**$1,439,000**
Scenario 10	Existing Conditions: 85' - 166' AGL	**$0**	**$0**	**$0**
	Opt 10A: 100' - 195' AGL	**$0**	**$0**	**$0**
	Opt 10B: 115' - 224' AGL	**$0**	**$0**	**$0**
	Opt 10C: 129' - 240' AGL	**$0**	**$0**	**$67,000**
	Opt 10D: 146' - 260' AGL	**$0**	**$663,000**	**$2,308,000**
Scenario 9	TERPS only with increased TERPS departure climb gradients and approach procedure minima	**$9,812,000**	**$7,510,000**	**$10,164,000**

SUMMARY OF 20-YEAR DIRECT IMPACTS WITH LOAD FACTOR SENSITIVITY TEST







INDUCED ECONOMIC IMPACT ASSESSMENT

INDUCED ECONOMIC IMPACT ASSESSMENT ASSUMPTIONS

- Assume Asia and Europe service remains and airlines accept weight penalties for passengers and cargo
- JLL's assessment for Diridon Station Area used as basis for real estate impacts
- Used IMPLAN to assess indirect and induced economic impact
  - Aviation impact: weight penalty related losses, airline revenue, lost airport passenger and visitor expenditures
  - Real estate impact: net new construction expenditures, engineering, office jobs
- Potential losses of airport service markets are not modeled

INDUCED ECONOMIC IMPACT ASSESSMENT SUMMARY

Total Economic Impact Summary (2038)

Airspace Scenario	Aviation Impact		Real Estate Impact	
	Employment	GDP Gain/Loss	Employment	GDP Gain/Loss
10A	-	-	1,000	$184,000,000
10B	-	-	2,400	$438,000,000
10C	-	-	4,300	$700,000,000
4, 7, 10D	-27	-$2,000,000	4,900	$747,000,000

Estimated City of San Jose Local Sales Tax

Airspace	2024		2026		2032		2036		2038	
Scenario	Airline/Airport	Real Estate	Airline/Airport	Real Estate	Airline/Airport	Real Estate	Airline/Airport	Real Estate	Airline/Airport	Real Estate
4	-$2,100	-	-$2,600	-	-$3,200	$110,000	-$3,500	$206,800	-$3,700	$253,400
7	-	-	-	-	-	$110,000	-	$206,800	-	$253,400
9	-$13,700	-	-$14,200	-	-$17,800	$110,000	-$19,600	$206,800	-$20,500	$253,400
10A	-	-	-	-	-	$110,000	-	$57,700	-	$57,700
10B	-	-	-	-	-	$110,000	-	$141,100	-	$137,400
10C	-	-	-	-	-	$110,000	-	$206,800	-	$226,800
10D	-	-	-	-	-	$110,000	-	$206,800	-	$253,400

STRATEGY RECOMMENDATION DISCUSSION

NEXT STEPS

- December 2018: Develop internal strategy recommendation
- Week of January 14, 2019: Stakeholder update meeting
- January 28, 2019: Present strategy recommendation to CEDC
- February 2019: Strategy recommendation to City Council