San Antonio International Airport Strategic Development Plan

2021 AIRPORT MASTER PLAN

CHAPTER 5 – ALTERNATIVES DEVELOPMENT AND EVALUATION

MARCH 2022

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5 ALTERNATIVES DEVELOPMENT AND EVALUATION

This Chapter documents the identification and evaluation of alternatives for adequately meeting SAT's long-term aviation needs, based on the facility requirements defined in Chapter 4. With the involvement of SAAS, advisory and other committees, and members of the community, a broad range of development concepts were identified, evaluated, then reduced to a shortlist of alternatives, and lastly a final plan.

The alternatives analysis followed the FAA methodology for airport master planning (AC 150/5070-6B). The key elements of this process are:

- Identification of alternative ways to address previously identified facility requirements.
- Evaluation of the alternatives, individually and collectively, so that planners gain a thorough understanding of the strengths, weaknesses, and other implications of each.
- Selection of the recommended alternative.

5.1 APPROACH AND METHODOLOGY

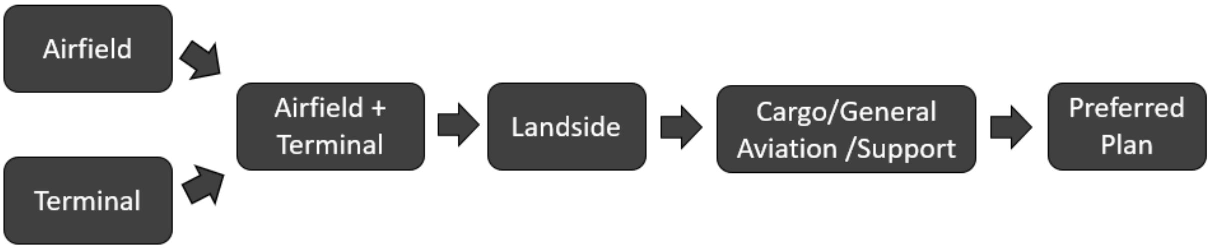
The alternatives analysis process is based on the facility requirements documented in Chapter 4 and summarized for ease of reference in Chapter 5. The alternatives will achieve the long-term (20-year) facility requirements, without precluding potential ultimate (50-year) development options.

Planning facilities priorities were identified, starting with airfield, given the land-intensive and inflexible nature of airfield development. The shortlisted airfield alternatives were then integrated with terminal alternatives, given the gate facilities' relationship to the airfield, the physical and operational limitations on gate placement, and the customer service aspects of passenger processing functions.

Once a preferred airfield/terminal combination was selected, multimodal access was considered, based on the need to link the terminal to the surrounding transportation network and region, and the need to accommodate various modes of travel to the Airport (encompassing both multimodal access and parking). Finally, cargo, corporate general aviation and support facilities were incorporated in the alternatives. The alternatives analysis process is depicted on **Figure 5.1-1**.

At SAAS's request, the 2040 high growth forecast was used for terminal facility planning. For consistency, the 2040 high growth forecast was also used for landside and support facilities planning.

Figure 5.1-1: Alternatives Analysis Process



Source: WSP USA, 2021.

5.2 AIRFIELD ALTERNATIVES

5.2.1 SUMMARY OF AIRFIELD FACILITY REQUIREMENTS

The following issues and requirements were identified for the SAT airfield through 2040 in the *Facility Requirements* chapter. Highlights are summarized below:

- Enhance safety at Hot Spot #1: safety is paramount in Aviation. The SAT airfield is safe, but the FAA periodically updates its guidance, and as a result, there are opportunities for improvement. The FAA identified the intersection of Runways 13R-31L and 4-22 as a safety hot spot. The location of the Runway 31L end is on Runway 4-22, causing aircraft departing Runway 31L to taxi on Runway 4-22. Several factors at this location contribute to runway incursions, hence the FAA designation of this area as Hot Spot #1.
- Enable air service to farther international destinations: as air service grows over the planning period, it is anticipated that Western European or deeper Latin American markets will be offered from SAT. In order to serve the demand for these markets, a runway length between 9,500 feet and 10,700 feet is necessary to accommodate the associated larger or heavier aircraft.
- Accommodate long-term projected traffic growth: the proposed airfield improvements need to be able to accommodate the forecast number and size of aircraft anticipated to operate at SAT through the planning horizon.
- Operate an FAA grant-eligible airfield: to maintain eligibility for FAA funding, the proposed airfield improvements need to meet FAA standards (e.g., runway/taxiway geometry and need for secondary and crosswind runways)

5.2.2 ALTERNATIVES DEVELOPMENT AND EVALUATION

This section summarizes the airfield alternatives development and evaluation. Many rounds of technical alternatives workshops took place, and more details are provided in **Appendix 5A**.

The airfield alternatives development process started with sketch planning sessions to get all ideas about development of SAT on the table; no idea was off-limits. Six technical sketch planning sessions took place, which included 107 participants, whom identified a total of 91 initial airfield concepts.

ROUND 1

In **Rounds 1A and 1B**, the SDP technical team screened the original 91 concepts to identify technically feasible concepts that would undergo further evaluation. In Round 1A and 1B, all screening factors are fatal flaws: a concept either meets the criteria or does not and is eliminated. Screening criteria included:

ROUND 1A:

- Airfield capacity: the proposed airfield needs to provide adequate capacity to accommodate the forecast number of aircraft operations in 2040.
- Runway length: the proposed airfield needs to provide a runway that is at least 10,700 feet long, to accommodate anticipated flights to European markets.
- Airspace conflicts: the proposed airfield cannot worsen existing airspace conflicts with Randolph Air Force Base (RND), which occur when aircraft depart SAT on Runway 4. Any concept that proposes a primary runway in the same alignment as Runway 4 would worsen these conflicts.
- Runway intersections: intersecting runways are suboptimal for traffic flow, capacity and safety. Parallel runways are optimal.
- Major airspace penetrations: the environment around the Airport may result in airspace penetrations, such as roads, railroads, buildings. Penetrations to the 20-year airfield's airspace surfaces by interchanges, parking garages, etc. are too costly to mitigate.
- Impacts to elevated roadways or requires railroad realignment: the proposed airfield and its safety surfaces cannot impact the footprint of major elevated roadways or railroads, as their realignment would be too costly.
- Not implementable in 20 years: the proposed airfield needs to be implementable within the 20-year planning horizon.

ROUND 1B:

- Other airspace impacts include a crosswind runway in the direction of RND or a 50-year runway with major airspace penetrations (U.S. 281 interchange, Wurzbach Parkway, …)
- 50-year airfield capacity: the proposed airfield should not preclude additional improvements to accommodate 50-year airfield capacity
- Proposed 20-year runway off airport property: the proposed airfield should not have the majority of its runway off the existing Airport property
- Excessive airfield capacity: the proposed airfield should not result in excessive airfield capacity (e.g., three primary runways)
- Impacts to public parks: the proposed airfield should preserve public parks (McAllister Park, Salado Creek Greenway Trail)

This two-step screening (Rounds 1A and 1B) resulted in 28 airfield concepts (Round 1A), then 13 airfield concepts (Round 1B) that moved ahead for further evaluation (Round 2), using objective and technical criteria.

ROUND 2

In Round 2A, a new airfield alternative was identified and added for evaluation, resulting in a total of 14 airfield alternatives evaluated in Round 2A, as depicted on **Figure 5.2-1**.

Round 2A evaluation criteria included:

- Sufficient 20-year airfield capacity: two commercial service parallel runways are needed to provide adequate airfield capacity through the planning horizon (these 20-year parallel runways may be dependent. Independent parallel runways would provide more capacity than needed).
- Implementability within 20 years: the proposed 20-year capacity improvements need be implementable in sequence in 20 years, and need to be built while operating the airfield.
- Allows for independent parallel runways in 50 years
- Precluded by policy alternative (e.g., change in RND mission)

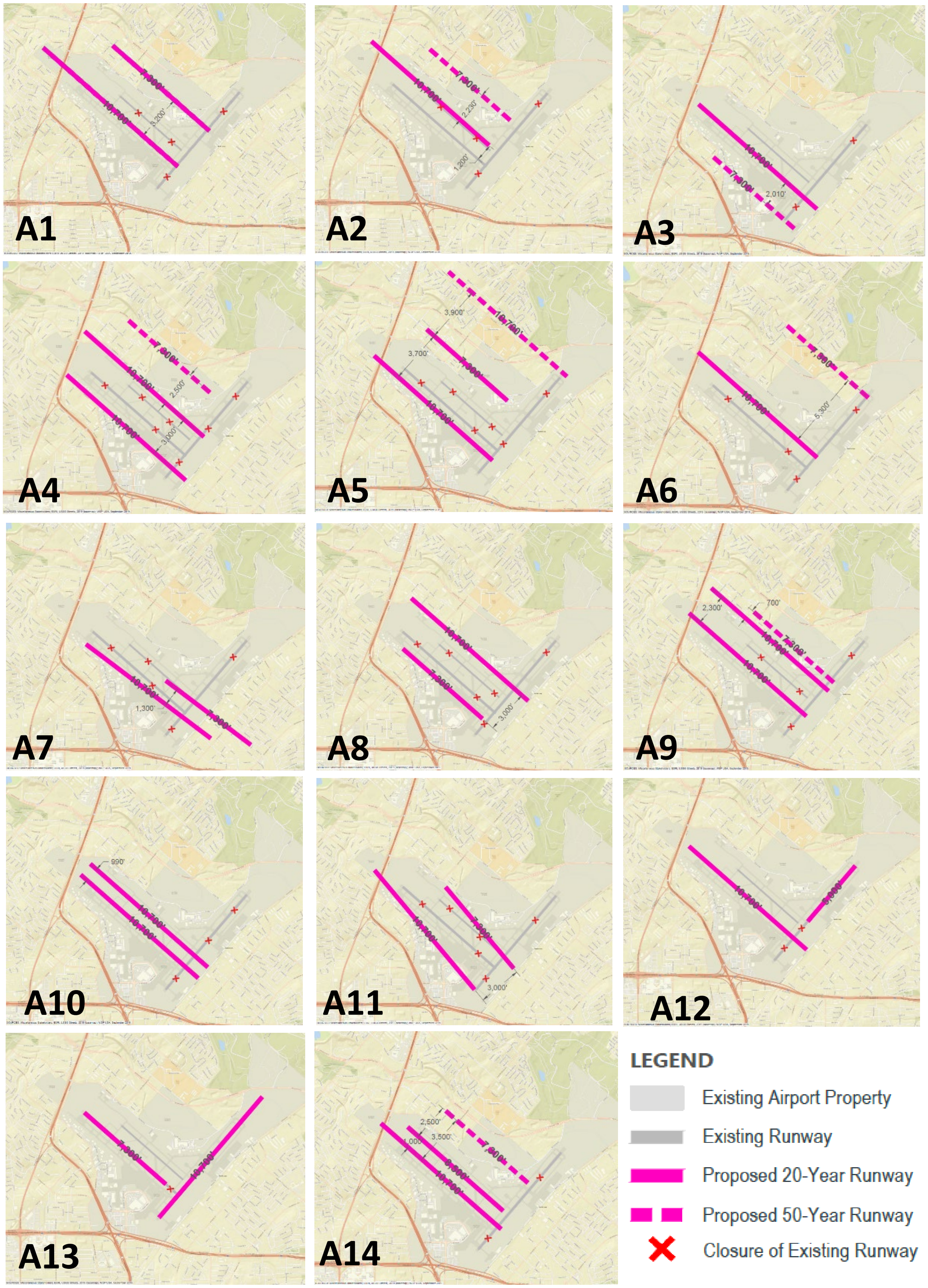
The Round 2A evaluation process and results are summarized in **Table 5.2-1.** In Round 1, airfield concepts were numbered based on broad categories (such as east-west parallel runways, north-south parallel runways, runways off-airport, …). When a modification was possible to avoid eliminating a concept, a "M" for "modified" was added at the end of the modified concept number (i.e., it is similar to the original idea, but slightly modified to meet requirements). "MM" means the concept was modified twice, both in Round 1A and Round 1B. For clarity, in Round 2, all 14 remaining airfield concepts were renamed A1 through A14.

Table 5.2-1: Round 2A Evaluation

Round 1 Concept Number	Round 2 Alternative Number	ROUND 2A EVALUATION CRITERIA				Moves to Round 2B?
		Sufficient 20-Year Airfield Capacity	Implementable in 20 Years	Independent Parallel Runways in 50 Years	Policy Alternative	
0-3MM	A1	✓	✓	✓	✓	Yes
0-5MM	A2	✓	✓	✓	✓	Yes
0-14MM	A3	✗	✓	✗	✓	No
1-1	A4	✓	✗	✓	✓	No
2-6	A5	✓	✗	✓	✓	No
3-1	A6	✓	✓	✓	✓	Yes
4-3M	A7	✓	✗	✓	✓	No
5-4MM	A8	✓	✗	✓	✓	No
6-2MM	A9	✓	✓	✓	✓	Yes
9-1	A10	✓	✓	✓	✓	No (duplicate)
12-1MM	A11	✓	✗	✓	✓	No
14-2	A12	✗	✓	✓	✓	No
14-7	A13	✓	✓	✓	✗	No
16-1MM	A14	✓	✓	✓	✓	Yes

Source: WSP USA, 2020.

Figure 5.2-1: Airfield Alternatives Evaluated in Round 2A



Source: WSP USA, 2019.

Alternative A10 is a duplicate of A14 and was subsequently eliminated. As a result, five airfield alternatives move to Round 2B.

In Round 2B, the five remaining airfield alternatives were paired with initial terminal concepts. The terminal concepts that would impact the proposed airfield or would not be feasible from a constructability and/or phasing perspective were eliminated. The remaining five airfield alternatives and feasible terminal concepts are depicted on **Figure 5.2-2**. The predominant departure/arrival flow arrows are shown to help assess runway crossing to/from the potential terminal concepts.

ROUND 3

Round 3 consisted of four steps. In **Round 3A**, the remaining five airfield alternatives were further refined (runway end locations adjusted, Runway 4-22 shortened rather than closed), and the airfield/terminal combinations were evaluated. Round 3A evaluation criteria included:

- Special purpose environmental laws:
  - 20-year horizon
  - Applied to airfield, then terminal. In NEPA, if impact to the following resources is **avoidable, it <u>MUST</u> be avoided**:
    - Wetlands
    - Section 4(f): public park, recreation area, wildlife and waterfowl refuge, historic site
    - Floodplains
  - Moved some terminal concepts to mitigate flaws
- 20-year implementability:
  - Cannot acquire land (no eminent domain) and build new terminal complex on that land in 20 years
  - Eliminated terminal concepts that required closure of Runway 4-22 in the short term

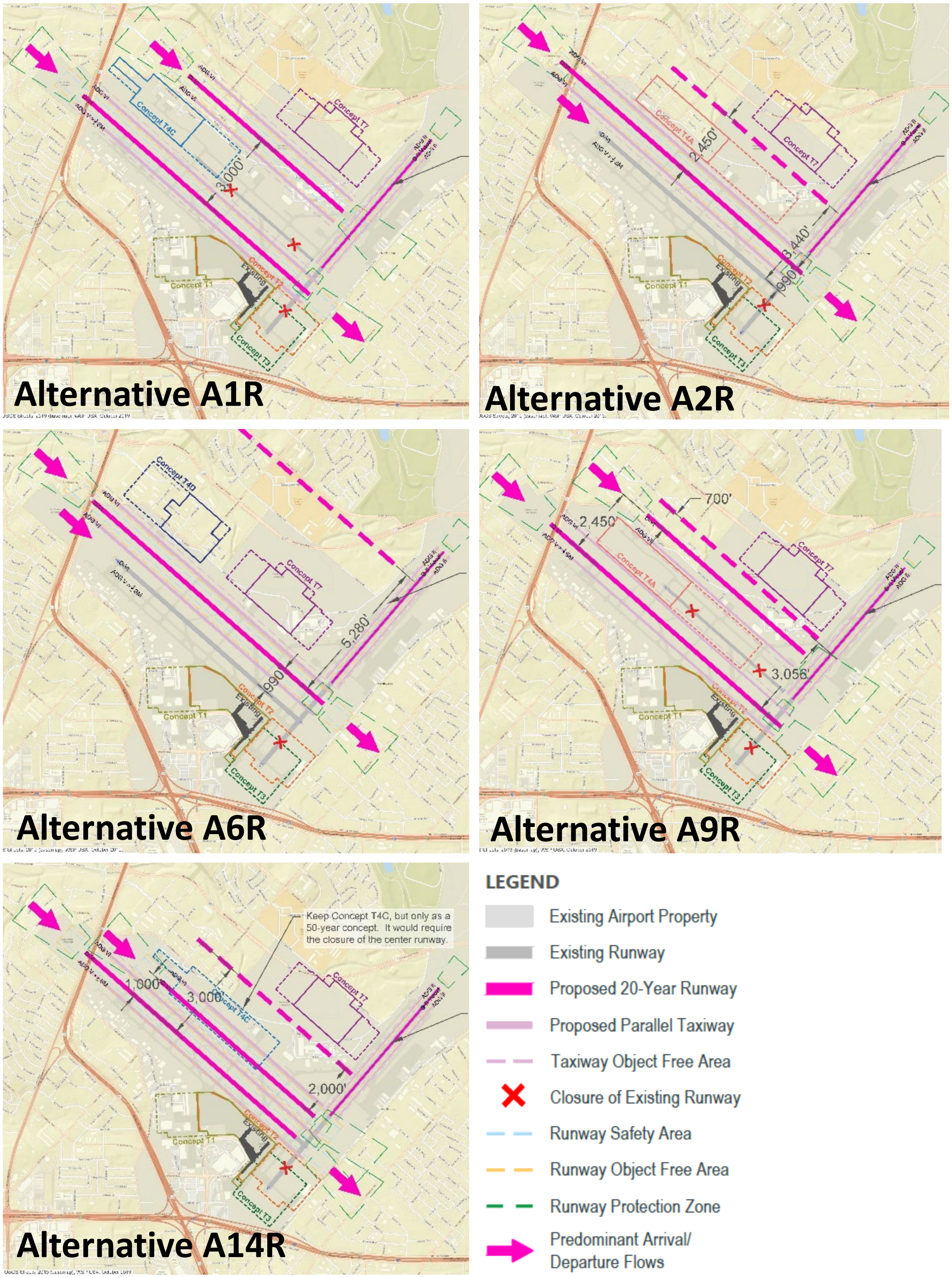
The Round 3A evaluation process is summarized in **Table 5.2-2.** A total of three airfield alternatives remained after Round 3A.

Table 5.2-2: Round 3A Evaluation

Round 2 Concept Number	Round 3 Alternative Number	ROUND 3A EVALUATION CRITERIA		Moves to Round 3B?
		Special Purpose Environmental Laws	20-Year Implementability	
A1	AF1	✗	✓	No
A2	AF2	✓	✓	Yes
A6	AF6	✓	✓	Yes
A9	AF9	✗	✓	No
A14	AF14	✓	✓	Yes

Source: WSP USA, 2020.

Figure 5.2-2: Round 2B Airfield Alternatives Moving to Round 3



Source: WSP USA, 2019.

Round 3B focused on evaluation of terminal concepts and will be discussed in more details in Section 5.3. During Round 3B however, it was established that Airfield Alternatives AF2 and AF6 differed in post-2040 facilities, but proposed the same airfield layout in the 20-year horizon, making them duplicates. As a result, Alternative AF6 was eliminated, and only two airfield alternatives moved to Round 3C, AF2 and AF14.

Round 3C consisted of preparing runway profiles for each remaining airfield alternative (each profile is referred to as a "variant"), to identify the optimal location of runway ends along the proposed runway centerline, as well as depicting runway protection zones. Scenarios included:

- Extend runway west over U.S. 281 (requires a bridge), with various runway slope and U.S. 281 elevation scenarios
- Extend runway east and install EMAS bed (an overrun area in the form of an aircraft arrestor bed made of crushable concrete)
- Extend runway east over Wetmore Road and railroad (analysis found the dual-track railroad could not be relocated by 2040 and therefore a bridge would be required. See **Appendix 5B**)

Round 3C evaluation factors included:

- Lack of flexibility in timing of runway length extension: during the Round 3C evaluation, it was established that with Airfield Alternative AF2:
  - SAT would only benefit from a maximum runway extension of 400 feet (on the Runway 31L end), until the parallel runway (upgraded Runway 13L-31R) would be built. Since the parallel runway would be built no sooner than Year 20, the inability to extend the runway to the full required length for Runway 13R-31L was considered a fatal flaw, and Alternative AF2 was eliminated.
  - The upgraded Runway 13L-31R, which would be the longest runway at SAT (10,700 feet), would have to be abandoned in the 50-year horizon to accommodate runway and terminal developments. Extending Runway 13R-31L to 10,700 feet would make more economical sense in the long run.
- Proposed pavement exceeds taxiway-runway slope standards
- Runway extension to the east is greater than 400 feet:
  - Engineering challenges (drainage, slopes, constructability)
  - Early closure of Runway 4-22
- Resulting runway length is less than 10,700 feet

As a result, all AF2 variants were eliminated, as well as three AF14 variants, as summarized in **Table 5.2-3**. The remaining three variants for Airfield Alternative AF14 are depicted on **Figures 5.2-3** through **5.2-5**.

Table 5.2-3: Round 3C Evaluation

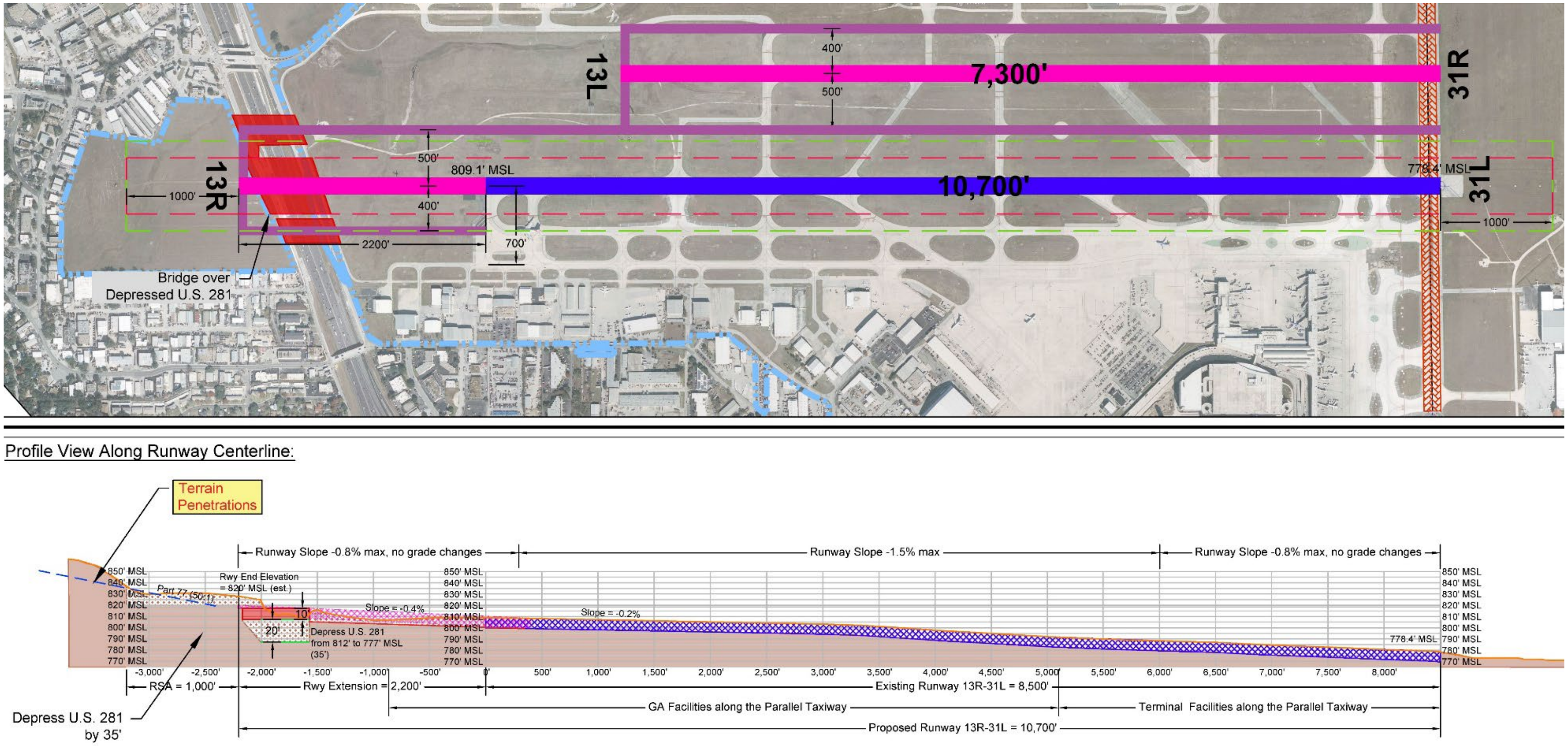
Round 3C Alternative Number	ROUND 3C EVALUATION CRITERIA				Moves to Round 3D?
	Timing Flexibility	Meets Taxiway-Runway Slope Standards	Runway Extension to the East is Less than 400 Feet	Resulting runway Length is at Least 10,700 Feet	
AF2-1	✗	✓	✓	✓	No
AF2-2A	✗	✓	✓	✓	No
AF2-2B	✗	✓	✓	✗	No
AF2-2C	✗	✓	✓	✗	No
AF2-3	✗	✓	✗	✓	No
AF14-1A	✓	✗	✓	✓	No
AF14-1B	✓	✓	✓	✓	Yes
AF14-1C	✓	✓	✓	✓	Yes
AF14-2A	✓	✗	✓	✓	No
AF14-2B	✓	✓	✓	✗	No
AF14-2C	✓	✓	✓	✗	No
AF14-2D	✓	✓	✓	✓	Yes
AF14-3	✓	✓	✗	✓	No

Source: WSP USA, 2020.

In **Round 3D**, further engineering analysis (drainage and costs) was conducted on the three remaining variants, with the following results, depicted in **Figure 5.2-6**:

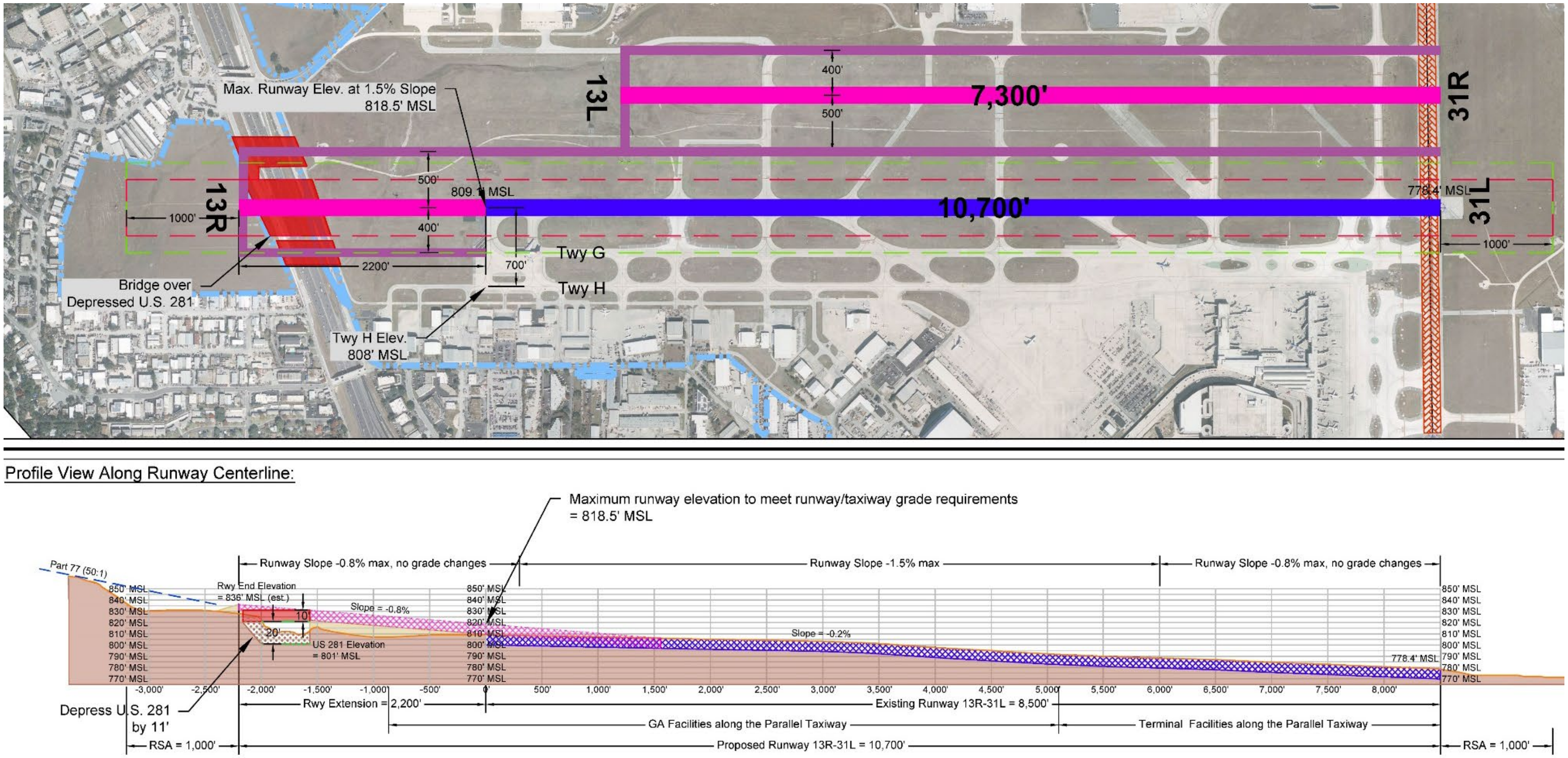
- Variant AF14-1B: runway extension to the west, with U.S. 281 depressed 35 feet
  - Depressing U.S. 281 by 35 feet prevents gravity drainage to Salado Creek, requiring pump stations to drain the area
  - Challenging grade transition to existing San Pedro Avenue
  - Eliminate due to engineering and drainage issues, and does not maximize east extension
- Variant AF14-1C: runway extension to the west, with U.S. 281 depressed 11 feet
  - 11-foot depression of U.S. 281 is optimal:
    - Reduces the “levee effect”
    - It is the minimum depression for runway and taxiway grades to meet requirements without closing connector access to Twy H (general aviation access)
    - Allows gravity drainage
    - Allows reasonable freeway grade transition
  - Eliminate because does not maximize east extension
- Variant AF14-2D: runway extension to the east with EMAS, and west with U.S. 281 depressed 11 feet
  - Preliminary preferred alternative

Figure 5.2-3: Round 3C – Airfield Alternative AF14-1B Runway Profile



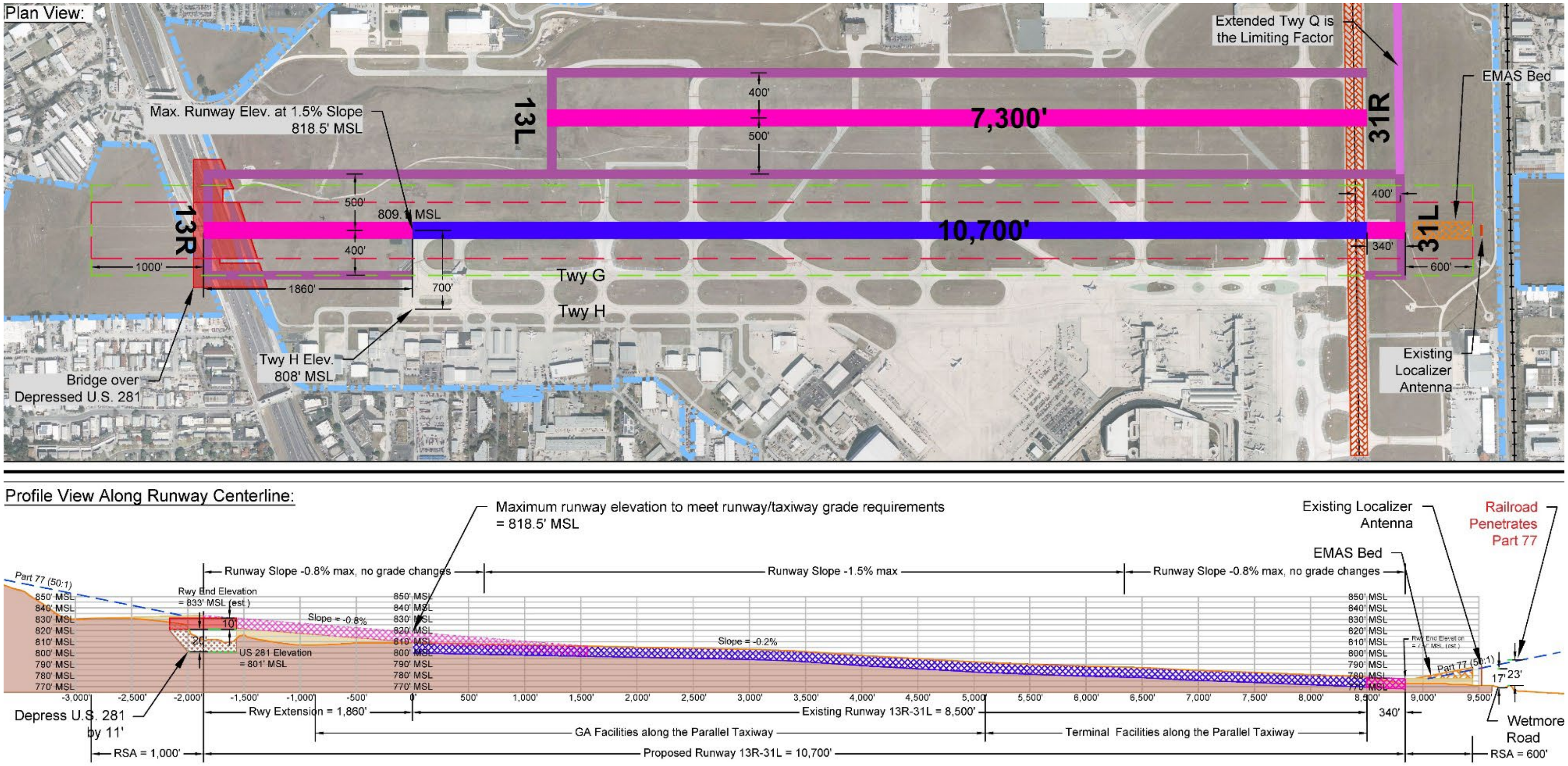
Source: WSP USA, 2020.

Figure 5.2-4: Round 3C – Airfield Alternative AF14-1C Runway Profile



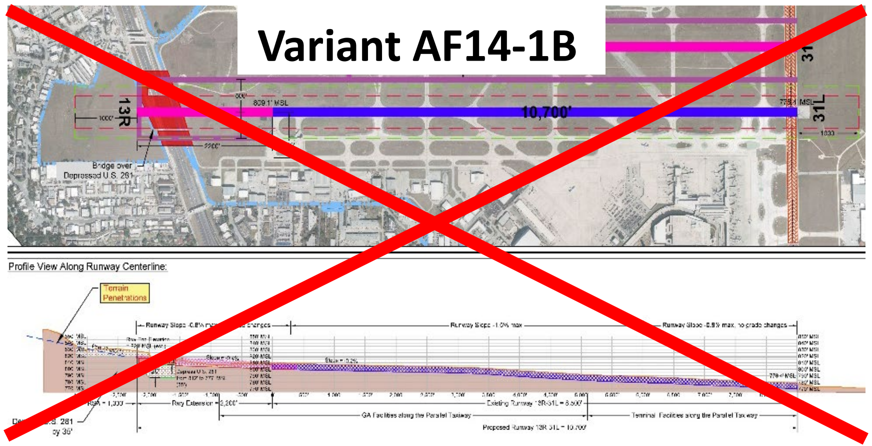
Sources: WSP USA, 2020.

Figure 5.2-5: Round 3C – Airfield Alternative AF14-2D Runway Profile

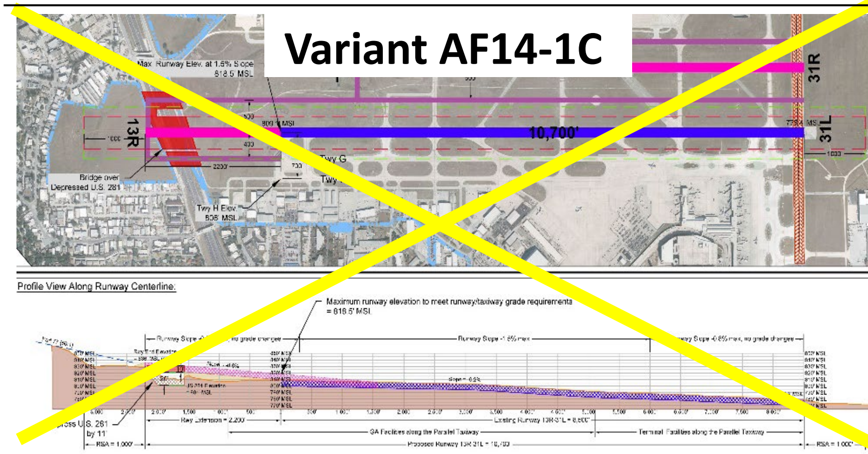


Sources: WSP USA, 2020.

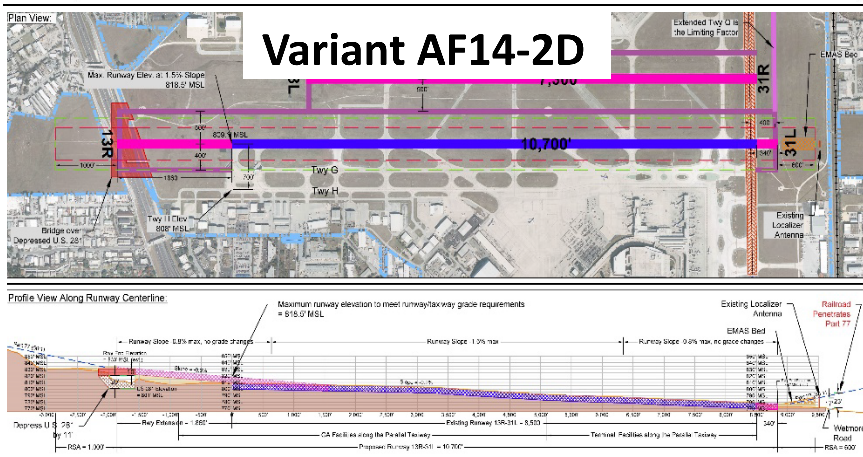
Figure 5.2-6: Round 3D Variants Analysis



- Extension west/bridge over 35-foot depressed U.S. 281
- Prevents gravity drainage to Salado Creek/requires pump stations
- Difficult grade transition to existing San Pedro Avenue
- Technically doable, but significant engineering challenges



- Extension west/bridge over 11-foot depressed U.S. 281
- Technically doable, but only extends to the west



- Extension to the east with EMAS
- Bridge over 11-foot depressed U.S. 281
- Preliminary preferred

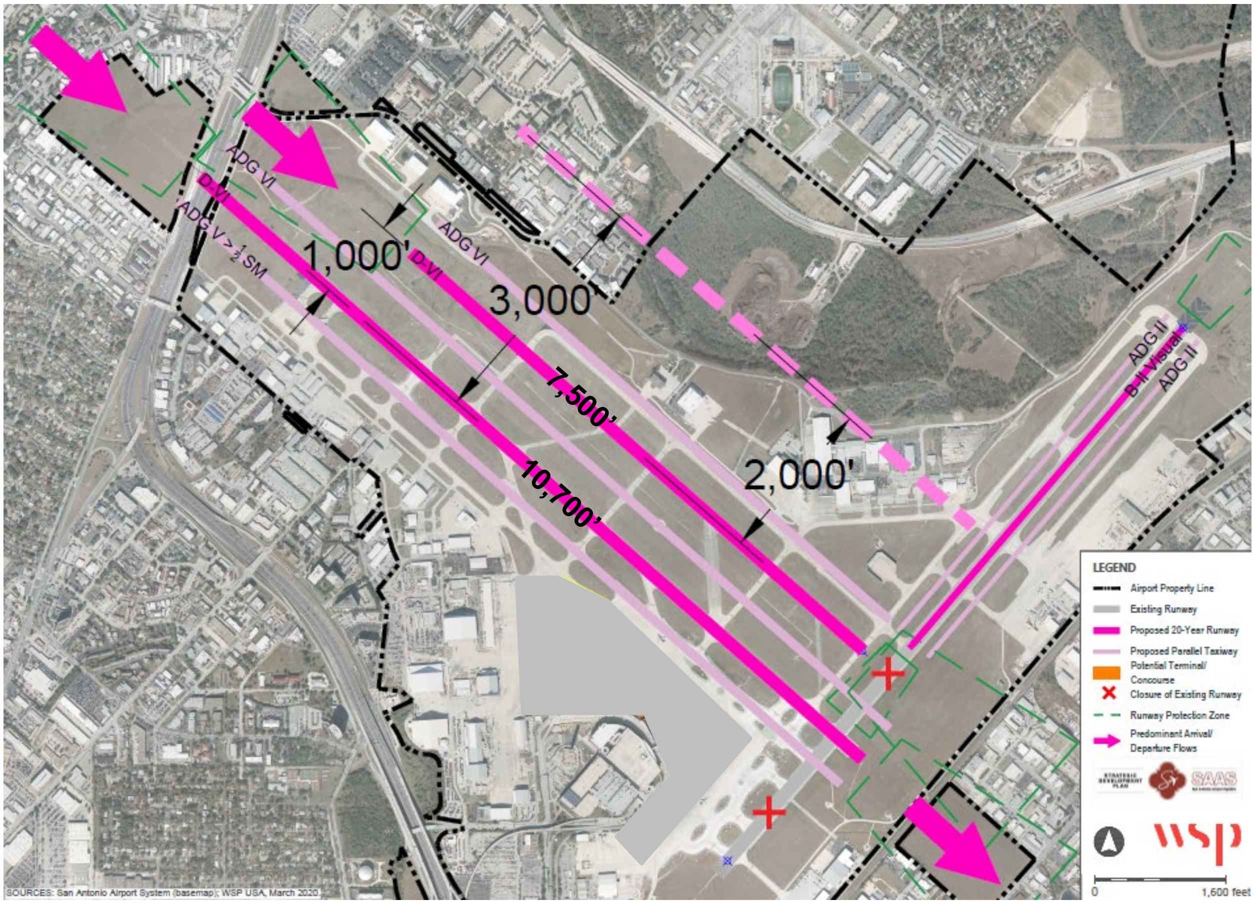
Source: WSP USA, 2020.

The final engineering variant remaining became the preferred airfield alternative, depicted on **Figure 5.2-7**. At this stage of the analysis, the preferred airfield alternative consisted of:

- An extended/upgraded Runway 13R-31L to 10,700 feet
- An upgraded Runway 13L-31R to 7,300 feet (1,000-foot separation from Runway 13R-31L)

- A shortened or closed Runway 4-22
- The potential for a 50-year runway with a 3,000-foot separation from Runway 13R-31L

Figure 5.2-7: Preferred Airfield Alternative after Round 3



Source: WSP USA, 2021.

5.2.3 PREFERRED AIRFIELD ALTERNATIVE REFINEMENT

PREFERRED 2040 AIRFIELD

Numerous airfield refinements were introduced after the initial airfield/terminal combination was selected. These consisted of:

- Runway 31L end 340-foot relocation to the southeast to mitigate Hot Spot #1 by moving the runway end off Runway 4-22.
    - The previous ALP Hot Spot #1 mitigation proposed to physically decouple Runways 13R-31L and 4-22 by shifting Runway 13R-31L 491 feet to the northwest. This mitigation has not proceeded due to high cost, construction spanning 6 to 8 years, complex phasing, and because the resulting runway length does not meet the 2040 requirements through the planning horizon.

  - This led the SDP team to assess other mitigations for Hot Spot #1 and propose an alternative that consists of relocating the Runway 31L end 340 feet to the southeast, moving the runway end off runway 4-22, eliminating aircraft taxiing on Runway 4-22 to depart on Runway 31L, and hence eliminating Hot Spot #1. A Comparative Safety Assessment was conducted on this preferred mitigation plan (**Appendix 5C**), which was found to be equivalent in safety to the prior decouple solution.
  - However, the FAA subsequently withdrew its support of this plan. The new FAA direction was based on EMAS not being desirable and a physical disconnect being preferred over a shift of the runway end. The SDP reflects this FAA preference.
- Runway 13R-31L to remain on existing airport property (up to 10,089 feet) to minimize impacts and costs associated with constructing a bridge over U.S. 281. A round number of 10,000 feet will be carried forward for future Runway 13R-31L.
- Runway 13R-31L to remain 150 feet wide (including proposed extensions). A Modification of Standards (MOS) would be required to accommodate ADG VI aircraft.
- Addition of a high-speed taxiway exit for Runway 13R arrivals (**Appendix 5D**), to reduce runway occupancy time and increase runway capacity.
- Taxiway geometry improvements (**Appendix 5E**, to mitigate non-standard geometry.

The preferred 2040 airfield is depicted on **Figure 5.2-8**.

Figure 5.2-8: Preferred 2040 Airfield Layout

Source: WSP USA, 2021.

PREFERRED POST-2040 AIRFIELD (20-50 YEAR PLANNING HORIZON)

The preferred post-2040 airfield is depicted on **Figure 5.2-9**. This airfield layout will be depicted on the Future Airport Layout Plan (ALP) sheet to protect airspace for long-term airport development (20-50 year planning horizon) only. It reflects the following additional proposed improvements:

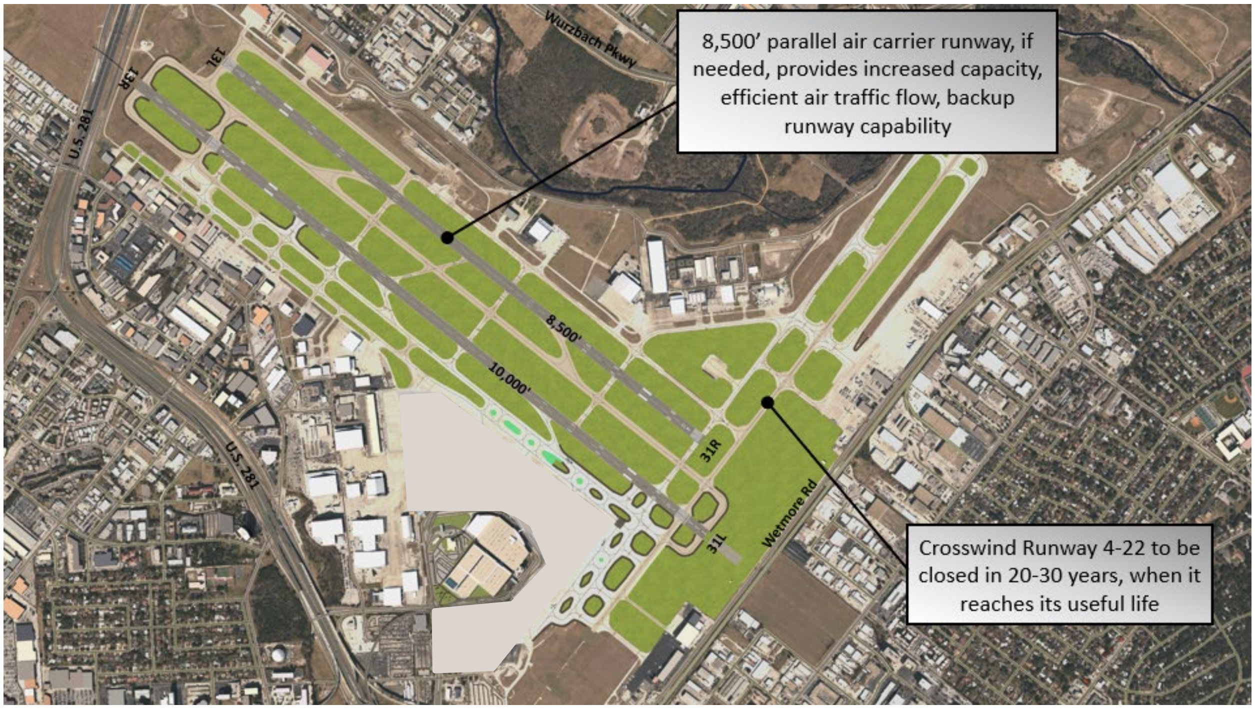
- Runway 13L-31R upgraded to an air carrier runway and parallel ADG VI midfield taxiway:
  - Although Runway 13L-31R would be an arrival runway upon being upgraded, its length would be increased (from a minimum required arrival length of 7,300 feet) to 8,500 feet, to provide back-up capability in case Runway 13R-31L is unusable.
  - As an arrival runway, high-speed exit taxiways are proposed in both directions; for planning purposes, these taxiways are shown starting 5,500 feet from the landing threshold. Evaluation of the exact location of the high-speed exit taxiways needs to be refined further based on the anticipated aircraft fleet mix expected at the time of design.
  - Runway to taxiway Separation:
    - Runway 13R to parallel ADG VI taxiway = 550 feet, to allow for CAT II approaches for ADG VI aircraft

- Parallel ADG VI taxiway to upgraded Runway 13L = 450 feet

- Runway 4-22 to be converted into a taxiway at the end of its useful life (approximately 30 years away) (**Appendix 5F**)

A Safety Review meeting was conducted on the post-2040 airfield layout (ALP) with SAAS, FAA ADO and ATC, and the airlines. The Safety Review findings are discussed in **Appendix 5G**.

Figure 5.2-9: Preferred Post-2040 Airfield Layout



Source: WSP USA, 2021.

5.2.4 PRELIMINARY PHASING OF RUNWAY 13R-31L EXTENSION

Mitigating Hot Spot #1 is a priority. Two options were provided to do so:

- Option 1: decouple the Runway 31L end from Runway 4-22, by shortening the Runway 31L end about 491 feet (to Taxiway N).
- Option 2: extend the Runway 31L end approximately 340 feet to eliminate use of Runway 4-22 as a taxiway. A Comparative Safety Risk Assessment was conducted to vet this mitigation.

After extensive coordination between SAAS and the FAA Texas ADO, the ADO requested that Option 1 be implemented, as avoidance of EMAS and a physical decouple solution are preferred. Upon closure of Runway 4-22, Runway 13R-31L would be extended to the southeast to achieve the required 2040 10,000-foot length.

5.2.5 SUMMARY OF PREFERRED AIRFIELD ALTERNATIVE

In summary, the preferred airfield alternative provides the following benefits:

- Enhanced safety with the mitigation of Hot Spot #1
- Airfield capacity through the 20-year planning horizon
- Possibility for further airfield improvements to meet 50-year capacity needs
- Maximizing current airfield and pavements, by retaining Runway 4-22 through the end of its useful life

5.3 TERMINAL ALTERNATIVES

The focus of the terminal alternatives analysis is to identify and evaluate long-term development options that meet the future terminal expansion needs for the 20-year planning horizon in a world-class manner. Consideration was given to the long-range capacity of the Airport, beyond 2040. Additionally, the capacity of major components of the Airport (airfield, terminal/aircraft gates and landside) needs to be kept in balance for efficient operation of the Airport.

5.3.1 SUMMARY OF TERMINAL FACILITY REQUIREMENTS

A major element of the Strategic Development Plan is the passenger terminal building. The Airport has a terminal complex consisting of two terminals/concourses that are connected on the landside, pre-security, at both departures and arrivals levels, and share a common curb. Terminal A was opened in 1984. Terminal B was opened in 2010. The latter was built to more current standards, but there are some elements that could be improved. The following issues and requirements were identified for the passenger terminal through 2040.

CURRENT ISSUES

In addition to projected growth needs, below are several key shortcomings of today's SAT terminals:

- Many of Terminal A's building systems are at or past the end of their useful lives. The roof is also in need of significant repairs/replacement. Terminals A and B electrical infrastructure is at capacity, limiting new types of concessions and vending concepts.
- The Terminal A concourse is functionally deficient in terms of passenger circulation and accommodations, due to insufficient concourse widths. The north end of the concourse is approximately 77 feet wide and the south end less than 60 feet. As a result:
  - The corridors are only 16 feet of clear width, compared to recommended widths of 20-25 feet for single-loaded concourses, and 30 feet for double-loaded concourses. The four international swing gates in Terminal A (Gates A6 - A9) have internal ramps to the passenger boarding bridge door, which force all boarding operations into the concourse corridor and can block passenger flows through the corridors when passengers are arriving.
  - The passenger holdrooms are too small
  - Insufficient space exists for needed restroom expansion
  - Concessions are inadequate to provide desired passenger services and for optimal revenue production.

- The SSCPs are undersized in both terminals. This relates to both the number of lanes, the available areas for SSCP equipment and passenger divest/composure, and passenger queuing. Additionally, once past security, passengers cannot access the concessions in the other terminal.
- Baggage handling space is insufficient for efficient operations.
- The USO is undersized especially for the large number of military personnel transiting SAT. There is only one airline club, United Airlines' in Terminal B, which is undersized.
- Terminal A international gates are at capacity; there is limited room for growth. FIS capacity is also insufficient for 2040 projections.

TERMINAL FACILITIES RECOMMENDATIONS SUMMARY

The terminal facilities needs are a function of the specific and unique characteristics of SAT. These include the design levels of passenger and aircraft activity, the number and type of airlines serving the airport, the operating requirements of the airlines, and local factors such as the proportions of leisure vs. business travelers, locally originating passengers, etc.

Table 5.3-1 summarizes gates and gross terminal areas recommended to support each level of design hour passengers and the associated annual passengers associated with the forecasts, expressed in Planning Activity Levels (PALs). Per SAAS staff, the proposed terminal facilities are planned for the 2040 high growth forecast (PAL17.3).

Table 5.3-1: Terminal Facility Requirements Summary

		FORECAST			
YEAR	**2018 (EXISTING)**	**2025**	**2030**	**2040**	**2040HG**
Million Annual Passengers (MAP)	9.7	PAL11.5	PAL12.6	PAL14.5	PAL17.3
Number of Gates	23	26 (24 NB + 2 WB)	27 (25 NB + 2 WB)	31 (29 NB + 2WB)	35 (32 NB + 3 WB)
Building Area (Square Feet)	650,600	921,000	964,000	1,100,000	1,226,000

Notes:
NB = narrowbody aircraft
WB = widebody aircraft
HG = high growth forecast scenario

Source: Hirsh Associates, Inc., 2020.

The forecasts (through 2040) are presented as PALs to reflect that economic and other conditions can change and that improvements would be tied to actual activity, not years. In this Study, PALs are the baseline demand levels at the increments of 2018/Existing, 2025, 2030 and 2040.

MAJOR TERMINAL AREA CONSTRAINTS

The existing terminal complex is relatively compact and bounded as follows:

- The airfield limits the terminal area on the north (Runway 13R-31L) and the east (Runway 4-22). Rwy 4-22 is expected to remain in operation at least through 2040. On the airside, the area to the west is relatively vacant and was previously designated for future terminal development.
- The landside of the complex is bounded by a westerly extended elevated curbside roadway built in anticipation of a future Terminal C (based on the previous Master Plan recommendations). Immediately to the south of the curb front is a recently completed ConRAC and short-term garage. This limits terminal expansion to the south. Farther to the west side of the terminal complex is a major MRO tenant, limiting expansion to the west beyond the preserved area.

5.3.2 GOALS/OBJECTIVES

The goal of the terminal portion of the SDP is to develop a plan that addresses the following:

CAPACITY

The terminal complex needs to meet the gate and facilities requirements for the forecast levels of activity. These would meet the high-level forecast for 2040, be implementable in a logical, incremental manner, and have expansion potential beyond 2040.

CUSTOMER EXPERIENCE

From a customer experience perspective, the terminal complex should provide:

- Facilities to maintain an “optimum” Level of Service (LOS) during the design hour levels of activity, as defined by the International Air Transport Association. Airport terminal facilities are sized to accommodate the peak hour passenger volumes of a design day - typically an average day of the peak month. Annual enplanements are an indicator of overall airport size, however, peak hour volumes more accurately determine the demand for airport facilities based upon the specific user patterns of a given airport.
- “World class” facilities. The term “world class” has been used to describe some airports around the world and by many other airports as an aspirational goal. What “world class” means is subjective. From a terminal planning perspective, it means providing sufficient space, dimensions and service points to achieve the “optimum” LOS during the design hour. The SDP terminal plan will provide flexibility to accommodate architectural treatments that could provide the aesthetic elements that many would call “world class”.
- A plan that allows efficient, logical movement of passengers through the terminal and landside.
- Opportunities for expanding the size and types of concessions in the locations where customers congregate and/or pass by.
- Post-security connectivity between gates where feasible.

OPERATIONAL EFFICIENCY AND FLEXIBILITY

The following considerations should be included in the terminal complex to provide operational efficiency and flexibility:

- Provide for efficient aircraft movement by having dual ADG III taxilanes where feasible. Add a ramp control tower to coordinate aircraft pushbacks (physical or virtual).
- Preserve ADG VI access to the MRO facilities west of the terminal complex.
- Provide flexibility for international gates, while maximizing domestic gate capacity (swing gates); and flexible aircraft parking positions/passenger boarding bridge configurations to accommodate a mix of narrowbody and widebody aircraft (5 narrowbody aircraft parking positions/gates can accommodate 3 widebody aircraft parking positions/gates).
- Consolidate passenger SSCP and CBIS where possible.
- Provide flexible spaces that can accommodate changes in airline operating practices.
- Increase the amount of space available for concessions
- Increase the amount of space for IT/communications and tech equipment.
- Consider sustainability and environmentally-friendly options, such as hydrant fueling, electrification of GSE, solar energy sources, ...

5.3.3 PLANNING ASSUMPTIONS

The following planning and programming assumptions are critical to the development of the geometry of the terminal concepts.

CONCOURSES

Concourse width is based on:

- The SAT concourses are planned for narrowbody aircraft (Airbus A321 and Boeing 737), with the ability to accommodate widebody aircraft (Airbus A350 and Boeing 787) at certain gates.
- The total concourse width would be 110 feet: 30-foot deep holdrooms, 45-foot wide corridor plus 5-foot allowance for external structure.
- The central circulation corridor would be 45-foot wide for double-loaded gates to accommodate moving walkways, or 30-foot for shorter piers without moving walkways.
- For single-loaded gates, the circulation corridor would be 20-25 feet wide, depending on whether there are significant uses across from the holdrooms and the number of gates. If moving walkways are needed due to length, the width would be 30 feet.
- For concourses with international gates, the width would be increased by 10 feet on the side(s) with the international gates for sterile arrivals circulation elements.
- A reconstructed single-loaded concourse for Terminal A (domestic gates only) would be 65 feet wide: 30-foot wide holdroom, 30-foot wide corridor plus 5-foot allowance for external structure.

TERMINAL PROCESSOR

- For initial concepts with a new unit terminal containing an expanded FIS, the processor depth needed is ±225 feet, which is adequate for a single level FIS using current processing flows. All terminal functions are included in this dimension. The refined terminal concepts with a central processor assume a processor depth of ±330 feet (holdroom at end of processor not included).

- Length of processor is based on the 2040 single level FIS requirements and four 150 LF domestic bag claims (±610 feet long).
- Processor would have up to a 25-foot deep sidewalk between the terminal roadway and the building.

TERMINAL APRON AND TAXILANES

- Narrowbody aircraft parking envelope depth was set at 208 feet, as requested by SAAS, to allow for future longer narrowbody aircraft. Aircraft parking area width is 143 feet for maximum ADG III wingspan + 25 feet. The critical narrowbody aircraft are the Boeing 737-900 and Airbus A321.
- Widebody parking envelope depth was set at 270 feet based on A350-900/B787-900 aircraft, which is considered the largest likely passenger aircraft for SAT. However, a B777-300 aircraft could be accommodated on some positions if needed, depending on final loading bridge configurations. Aircraft stand width is 239 feet for maximum ADG V wingspan + 25 feet.
- International gates would be swing for domestic use and loading bridges should be designed for dual use as domestic gates to accommodate the maximum number of narrowbody aircraft.
- Dual ADG III taxilanes can accommodate a single ADG V taxilane for international gate access.
- New vehicle service road (VSR) is assumed to be 26 feet wide, as requested by SAAS, and located at back of aircraft stand.

5.3.4 TERMINAL SITING ASSESSMENT

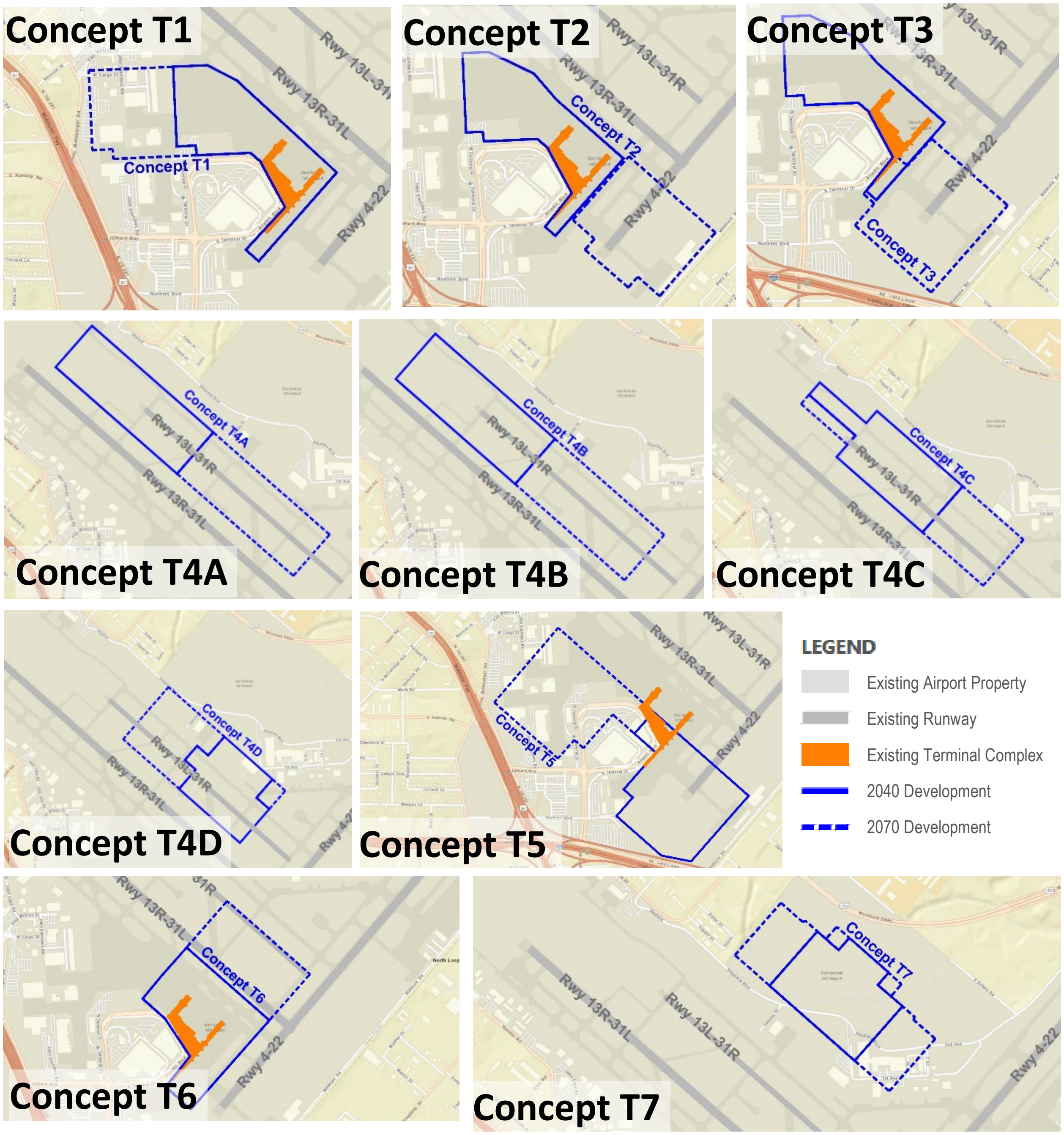
At the end of Round 2A, five airfield configurations remained from the initial 91 potential concepts, as shown on Figure 5.2-2.

In **Round 2B**, ten initial terminal concepts were developed, which could accommodate the 2040 gate demands and the longer term 50-year projected gates. These included concepts that expanded the current terminal complex, midfield locations for parallel runway configurations, and a terminal complex north of the airfield, as depicted on **Figure 5.3-1**. Each initial terminal concept was then combined with the remaining five airfield concepts (50 airfield/terminal combinations total). These terminal/airfield combinations were screened for fatal flaws related to:

- Airfield impacts (pavement, safety surfaces)
- Constructability/ease of phasing
- Ability to meet 2040 demand

In addition, only the best suited midfield terminal concept was retained, out of four midfield options for each airfield alternative. **Table 5.3-2** summarizes the evaluation, which resulted in 25 remaining terminal/airfield combinations.

Figure 5.3-1: Initial Terminal Concepts



Sources: Hirsh Associates, 2020; WSP USA, 2021.

Table 5.3-2: Round 2B Evaluation and Results

Airfield Alternative	Terminal Concept	EVALUATION CRITERIA			Retained?
		Airfield Impacts	Meets 2040 Demand	Best Midfield	
A1R	T1		✓		Yes
	T2		✓		Yes
	T3		✓		Yes
	T4A		✓	✗	No
	T4B		✓	✗	No
	T4C		✓	✓	Yes
	T4D	✗	✓	✗	No
	T5	✗	✓		No
	T6	✗	✓		No
	T7		✓		Yes
A2R	T1		✓		Yes
	T2		✓		Yes
	T3		✓		Yes
	T4A		✓	✓	Yes
	T4B	✗	✓	✗	No
	T4C	✗	✓	✗	No
	T4D	✗	✓	✗	No
	T5	✗	✓		No
	T6	✗	✓		No
	T7		✓		Yes
A6R	T1		✓		Yes
	T2		✓		Yes
	T3		✓		Yes
	T4A		✓	✗	No
	T4B		✓	✗	No
	T4C		✓	✗	No
	T4D		✓	✓	Yes
	T5	✗	✓		No
	T6	✗	✓		No
	T7		✓		Yes
A9R	T1		✓		Yes
	T2		✓		Yes
	T3		✓		Yes
	T4A		✓	✓	Yes
	T4B	✗	✓	✗	No
	T4C	✗	✓	✗	No
	T4D	✗	✓	✗	No
	T5	✗	✓		No
	T6	✗	✓		No
	T7		✓		Yes
A14R	T1		✓		Yes
	T2		✓		Yes
	T3		✓		Yes
	T4A	✗	✓	✗	No
	T4B	✗	✓	✗	No
	T4C		✓	✓	Yes
	T4D	✗	✓	✗	No
	T5	✗	✓		No
	T6	✗	✓		No
	T7		✓		Yes

Sources: Hirsh Associates, 2020; WSP USA, 2020.

In **Round 3A,** the refined airfield alternatives were renamed AF1, AF2, AF6, AF9 and AF14 for clarity.

The remaining 25 terminal/airfield combinations were next reduced based on airfield evaluation criteria (also discussed in Section 5.2.2):

- Environmental considerations: special purpose environmental laws
- 20-year implementability:
  - Cannot acquire land (no eminent domain) and build new terminal complex on that land in 20 years
  - Eliminated terminal concepts that required closure of Runway 4-22 in the short term

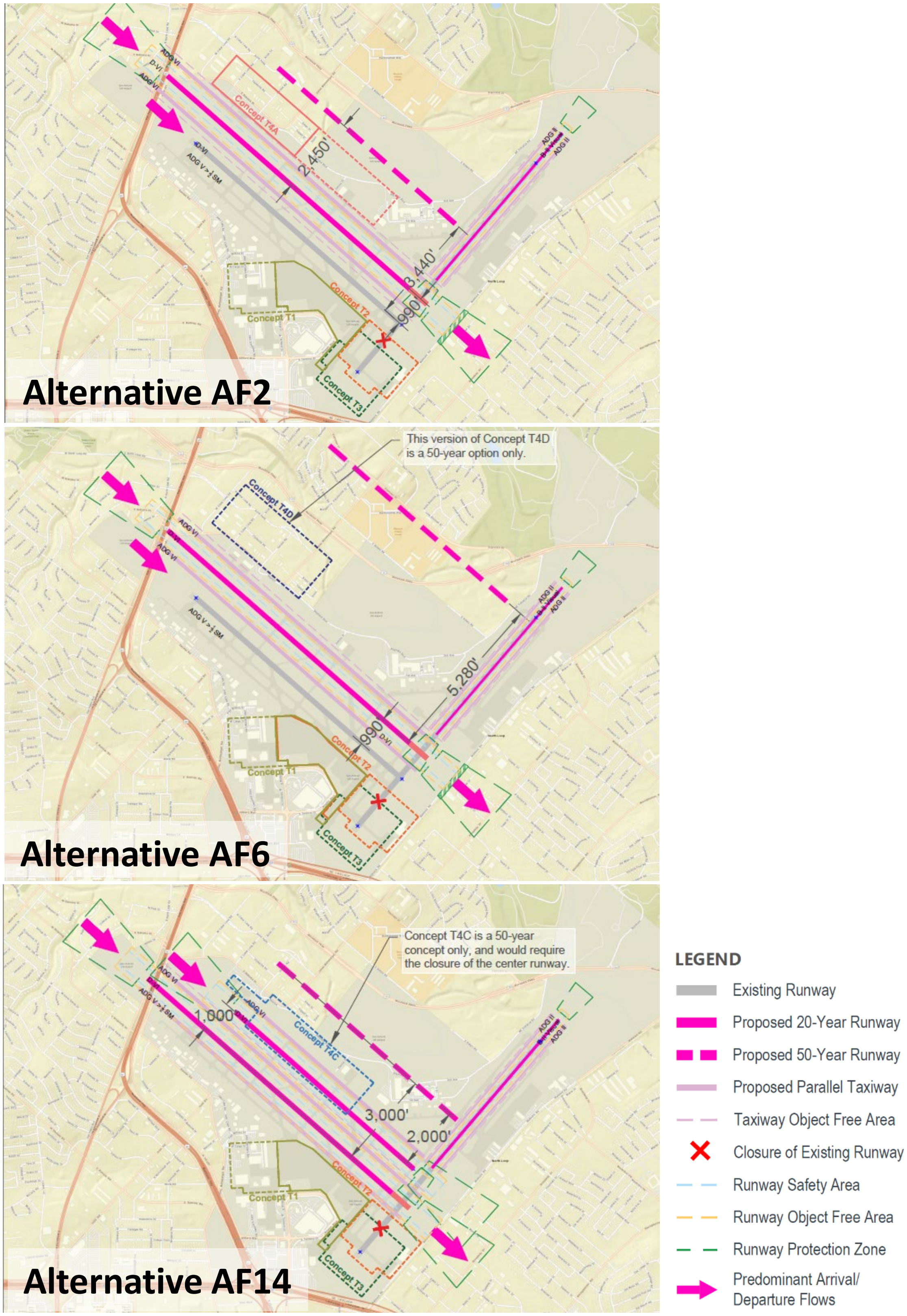
Table 5.3-3 summarizes the evaluation, which resulted in 12 remaining airfield/terminal combinations, depicted on **Figure 5.3-2**.

Table 5.3-3: Round 3A Evaluation and Results

Airfield Alternative	Terminal Concept	Special Purpose Environmental Laws	20-Year Implementability	Retained?
AF1	T1	✘	✓	No
	T2		✓	
	T3		✓	
	T4C		✓	
	T7		✓	
AF2	T1	✓	✓	Yes
	T2		✓	Yes
	T3		✓	Yes
	T4A		✓	Yes
	T7		✓	Yes
AF6	T1	✓	✓	Yes
	T2		✓	Yes
	T3		✓	Yes
	T4D		✓	Yes
	T7		✓	Yes
AF9	T1	✘	✓	No
	T2		✓	
	T3		✓	
	T4A		✓	
	T7		✓	
AF14	T1	✓	✓	Yes
	T2		✓	Yes
	T3		✓	Yes
	T4C		✓	Yes
	T7		✓	Yes

Sources: Hirsh Associates, 2020; WSP USA, 2020.

Figure 5.3-2: Remaining Airfield/Terminal Combinations (After Round 3A)



Sources: Hirsh Associates, 2020; WSP USA, 2021.

In **Round 3B**, the remaining 12 airfield/terminal combinations were further reduced based on screening criteria that included:

- Aircraft tail penetrations to Part 77 surfaces
- Ability to produce a "world class" terminal in terms of space and passenger comfort, based on a footprint that could provide the building and access requirements identified in the Facility Requirements chapter.
- Terminal operational efficiencies (walking distances, level changes, APM connections, etc.)
- Rough order of magnitude (ROM) costs

The following combinations were eliminated as a result of the Round 3B evaluation:

- AF2-T4A: this combination has low passenger convenience and high costs
  - Level changes, walking distances: not world class
  - Tunnel for train connector (headhouse in existing Terminal Complex)
  - AF6-T4D and AF14-T4C are not implementable within 20 years
- All T3 terminal concepts: this terminal concept results in impacts to Runway 4-22 within the 20-year horizon (Runway 4-22 is to remain until after 2040)
- All AF6 combinations: AF2 and AF6 propose the same airfield layout in the 20-year horizon

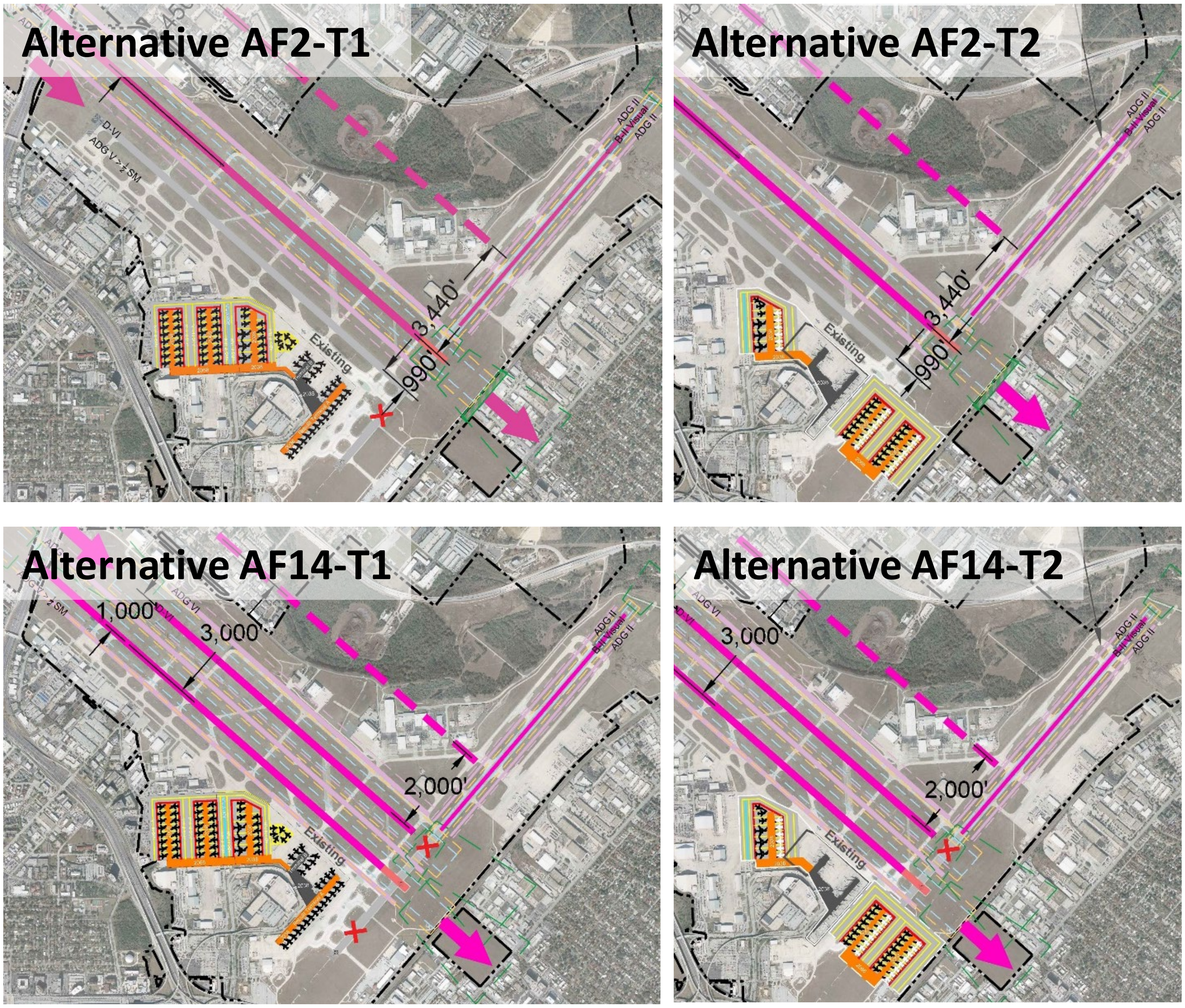
This left four terminal/airfield combinations, both with the terminal expanding from the existing terminal complex:

- AF2-T1
- AF2-T2
- AF14-T1
- AF14-T2

The remaining four airfield/terminal combinations are depicted on **Figure 5.3-3**. As shown on Figure 5.3-3, the proposed terminal envelopes T1 and T2 are the same for both airfield layouts (AF2 and AF14). As a result, two terminal concepts remain, T1 and T2, as depicted on **Figure 5.3-4.**

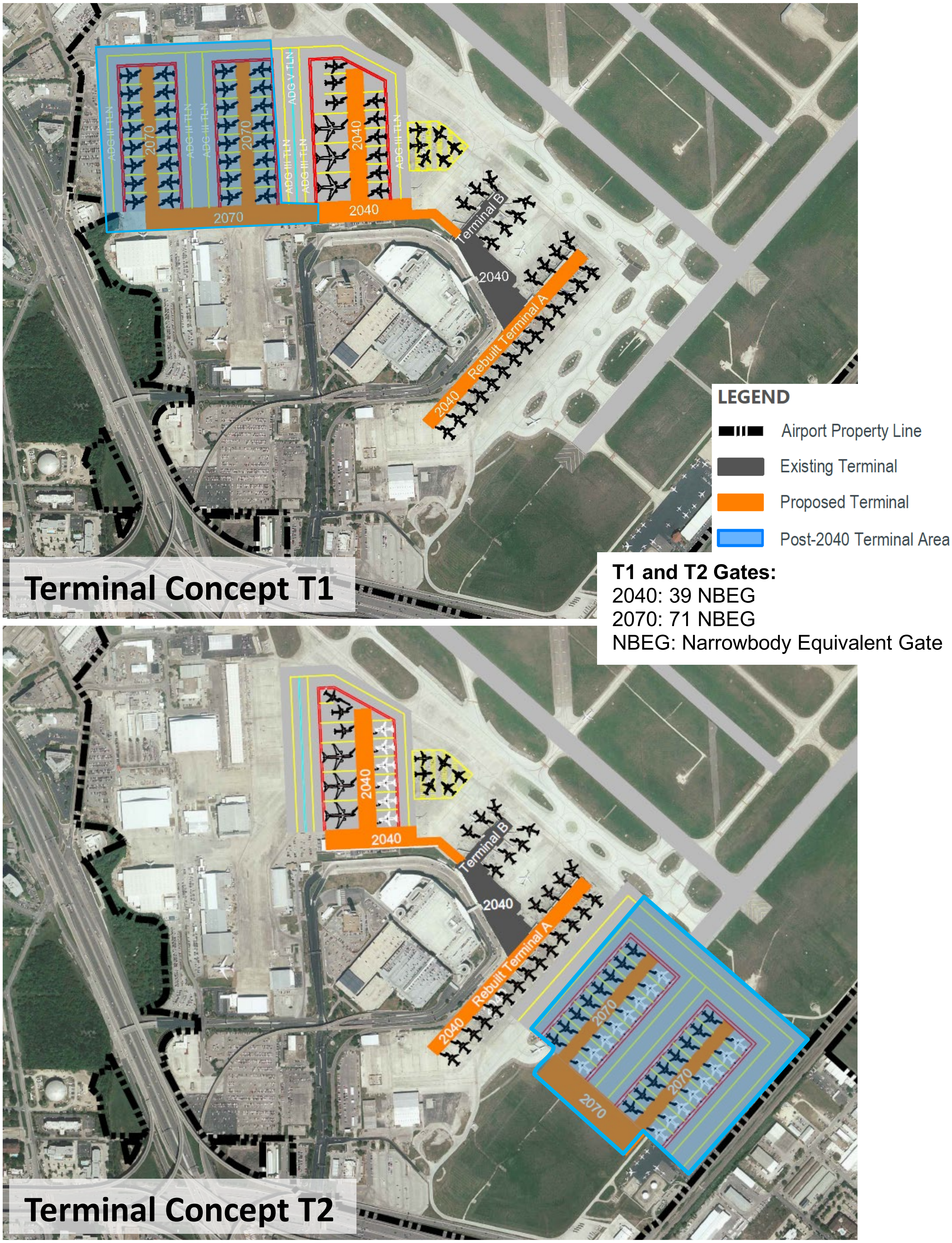
The proposed terminal complex expansion through 2040 would be the same for T1 and T2: add a new terminal and concourse to the west of existing Terminal B. The difference between Terminal Concepts T1 and T2 is the direction of growth post-2040, either to the east with Runway 4-22 closing, or the west, displacing the existing MRO facilities.

Figure 5.3-3: Remaining Airfield/Terminal Combinations (After Round 3B)



Sources: Hirsh Associates, 2020; WSP USA, 2021.

Figure 5.3-4: Remaining Terminal Concepts (After Round 3B)



Sources: Hirsh Associates, 2020; WSP USA, 2021.

5.3.5 TERMINAL CONCEPTS DEVELOPMENT

The siting assessment determined that the terminal expansion within the planning horizon would occur within the existing terminal complex, to the west of Terminal B. The next step was to develop alternative configurations, referred to as “variants”, to meet the program requirements and consider any limitations due to the selected airfield layout.

Workshops were held with SAAS staff and the ASDC to identify specific objectives as summarized in Section 5.3.2. Additional factors to be considered included:

- Provide for more than the 2040 high growth forecast gate count (35-37 gates).
- Allow for additional gate expansion within the basic terminal configuration.
- Reduce the number of single-loaded gates.
- Centralize SSCP and other facilities to the extent possible.
- Provide secure-side connections between all gates.
- Concourse B was assumed to have an additional gate for a total of 9 narrowbody gates (subsequent to this analysis, SAAS started design for up to 3 additional gates on Terminal B).
- High-level phasing to allow growth in gates as new and/or renovated terminals are constructed.

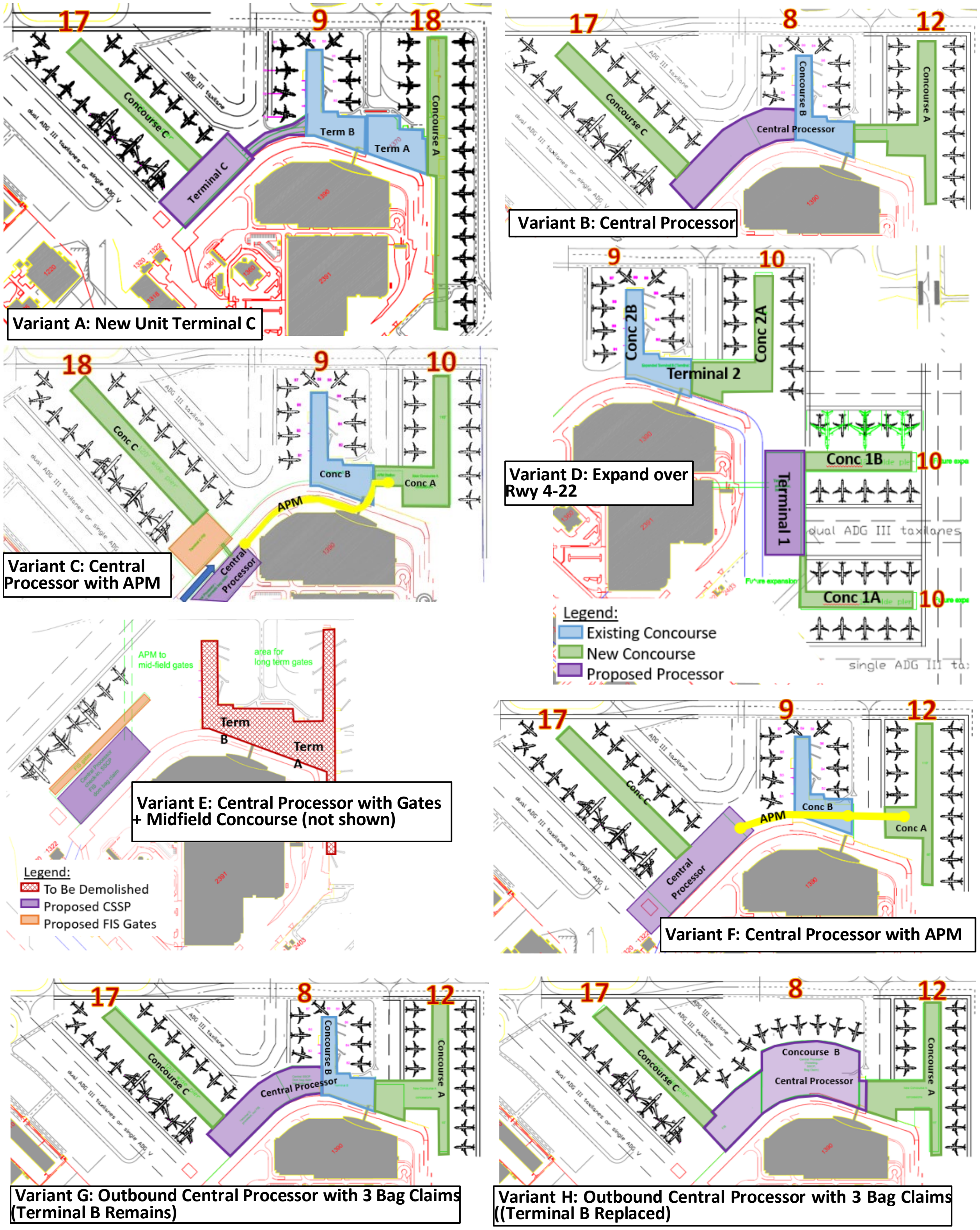
As workshops continued, some concepts were eliminated, but other ideas resulted in adding new variants for evaluation. These included some variants that were initially eliminated in the terminal siting assessment. These resulted in a series of variants described below and depicted on **Figure 5.3-5**. Each variant would provide at least 37 narrowbody gates, which is the high growth scenario 2040 gates projection, with additional expansion potential.

VARIANT A

Variant A adds a third unit terminal, Terminal C, west of Terminal B. Additional characteristics include:

- Terminal C would have 17 narrowbody gates (5 of these narrowbody gates could be converted into 3 international widebody gates) and the FIS.
- The Concourse C taxilane would connect to the Concourse B taxilane to provide an effective dual taxilane configuration.
- Connections between Terminals B and C would be provided for both secure and non-secure passengers.
- The Terminal A processor would be renovated. Concourse A would be replaced with a new wider concourse, which would also provide space for an expanded SSCP and secure concessions.

Figure 5.3-5: Preferred Terminal Concept Variants



VARIANT B

Variant B adds a third concourse, but the processor is expanded to become a central processor. Additional characteristics include:

- Modification of Taxiway H allows Concourse C to be shifted west and lengthened to 17 gates, including the 3 international widebody gates and the FIS.
- The Concourse C taxilane would connect to the Concourse B taxilane to provide an effective dual taxilane configuration.
- The Terminal C processor would be expanded and shifted closer to Terminal B. A central SSCP would be located between the check-in halls of the B and C processors. A continuous bag claim hall would utilize Terminal B as well as new facilities.
- Terminal A would be demolished. A new Concourse A would be built with a large concessions area and fewer single-loaded gates than in Variant A. Concourse A would be connected to the central processor via a secure-side connector.

VARIANT C

Variant C has a new central processor to serve three airside concourses via an automated people mover (APM). Additional characteristics include:

- A new central processor including ticketing, SSCP, bag screening, and domestic bag claim would be located on the south side of the existing curb/access roadway. This would require a change in the vehicle direction flow.
- New Concourse C would contain the FIS for arriving international passengers.
- Terminal B would be converted to gates and secure concessions.
- Terminal A would be demolished. A new Concourse A would be built with a large concessions area and fewer single-loaded gates than in Variant A.
- Passengers would access Concourse C via a secure bridge, while passengers for Concourses B and A would use the APM with a shared station.

VARIANT D

Variant D assumed that Runway 4-22 would be closed during the planning period. This would allow replacement of Terminal A with a new 18-gate terminal. Additional characteristics include:

- The replacement for Terminal A (referred to as Terminal 1) would initially have two double-loaded piers with a total of 18 gates, including 3 widebody international gates. This would be a unit terminal with FIS.
- Existing Concourse A would be rebuilt to modern standards. The processor portion of Terminals A and B would be reconfigured as a single terminal with one SSCP, referred to as Terminal 2.
- The two terminals could be connected on the secure side.

VARIANT E

Variant E is for a new midfield airside satellite served by a processor in the existing terminal area. Additional characteristics include:

- A central processor with FIS and attached international gates would be located west of Terminal B.
- A midfield satellite located north of Runway 13R-31L would contain all the domestic gates. This would be connected by an underground APM to the new central processor.
- Terminals A and B would be demolished. The site could be used for expansion of the central processor and/or attached gates, or other terminal related functions.

VARIANT F

Variant F has a new central processor to serve three airside concourses via an APM. Additional characteristics include:

- A new central processor including ticketing, SSCP, bag screening, domestic bag claim and FIS would be located in the Terminal C location, connected to a 17-gate concourse.
- Terminal B would be converted to gates and secure concessions.
- Terminal A would be demolished. A new Concourse A would be built with a large concessions area and fewer single-loaded gates than in Variant A.
- A secure APM would connect the central processor to Concourses A and B, each with its own station.

VARIANT G

Variant G is similar to Variant B with a central processor that incorporates Terminal B. Additional characteristics include:

- The Terminal C processor would be expanded and tie into Terminal B. A central SSCP would be located between the check-in halls of the B and C processors.
- Separate domestic bag claim halls would be located closer to gates to reduce walking distances. These would be close to Concourse C, the existing Terminal B bag claim, and a replacement bag claim in Concourse A.
- The FIS would be located at the west end of the processor closest to the international gates.
- Terminal A would be demolished. A new Concourse A would be built with a large concessions area and fewer single-loaded gates than in Variant A. Concourse A would be connected to the central processor via a secure-side connector.

VARIANT H

Variant H is centered around a new central processor that would be closer to the center of the terminal complex. Additional characteristics include:

- The new central processor would completely replace Terminal B. The central processor would contain all the ticketing, SSCP and baggage screening equipment. Eight frontal gates would replace the existing Concourse B gates.
- Separate domestic bag claim halls would be located closer to gates to reduce walking distances. These would be close to Concourse C, in the new CP building, and a replacement bag claim in Concourse A.
- The FIS would be located close to the international gates.
- Terminal A would be demolished. A new Concourse A would be built with a large concessions area and fewer single-loaded gates than in Variant A. Concourse A would be connected to the central processor via a secure-side connector.

5.3.6 SHORTLISTING OF VARIANTS

Workshops were held with SAAS staff to further review the above eight variants and reduce these to a shortlist for more detailed evaluation. The workshops focused on:

- Being phaseable (ease of phasing, customer experience during construction)
- Allow for efficient and logical movement of passengers and minimize walking distances.
- Estimate ROM costs with a focus on the cost of the "1st additional gate"
- Allow for efficient movement of aircraft
- Provide flexibility to respond to actual aviation demand
- Preserve growth options beyond 20 years
- Optimize use of existing landside facilities

Table 5.3-4 summarizes the evaluation results. The following variants were eliminated:

- Variant C (central processor south of frontage roadway): required reversing traffic flow, costly APM and BHS.
- Variant D (two-unit terminals) was dependent on closing Runway 4-22 early in the planning period. This was not considered likely and thus eliminated.
- Variant E (midfield satellite) was eliminated due to the high cost of an underground APM and BHS relative to other concepts, as well as the ability to be phased in gradually.
- Variant F (central processor at Concourse C) was eliminated due to construction and O&M costs of the APM, difficulty of integrating a third level track structure into Concourse C, and connection to the ConRAC.
- Variant G (central processor integrating Terminals B and C, with three bag claim areas) did not provide sufficient depth (±330 feet) for a true central processor with a direct flow from ticketing through security.

Table 5.3-4: Terminal Variants Evaluation and Results

Terminal Variant	EVALUATION CRITERIA								Retained?
	Phaseable	Passenger Movement	Cost of 1st Gate	Aircraft Movement	ATCT LOS	Flexibility to Respond to Aviation Demand	Growth Options Beyond 20 Years	Use Existing Landside Facilities	
A	✓	✓	✓	✓	✓	✓	✓	✓	Yes
B	✓	✓	✓	✓	✓	✓	✓	✓	Yes
C	✓	✗	✗	✓	✓	✓	✓	✓	No
D	✗	✓	✓	✓	✓	✓	✓	✓	No
E	✗	✓	✗	✓	✓	✓	✓	✓	No
F	✓	✓	✗	✓	✓	✓	✓	✓	No
G	✓	✗	✓	✓	✓	✓	✓	✓	No
H	✓	✓	✓	✓	✓	✓	✓	✓	Yes

Source: WSP USA, 2020.

Three variants of the preferred terminal concept remained, depicted on **Figure 5.3-6**:

- Variant A: Three-unit terminals with airside connections between concourses.
  - Variant A was renamed Terminal Alternative 1.
- Variant B: Central processor integrating Terminals B and C, with Terminal A rebuilt as an airside concourse.
  - Variant B was renamed Terminal Alternative 2.
- Variant H: Central processor for outbound functions replacing Terminal B, and three bag claim areas.
  - Variant H was renamed Terminal Alternative 3.

5.3.7 SELECTION OF PREFERRED ALTERNATIVE

The selection of the preferred terminal alternative took place during two workshops with SAAS staff. These workshops focused on the pros and cons of each alternative, as well as high-level phasing plans. The phasing plans also reviewed commonalities of the three alternatives that would allow a 'common first phase'. This could allow a decision point in the future where the final direction of the terminal alternative could be considered, should conditions change.

The evaluation of the shortlisted alternatives is summarized in **Table 5.3-5**.

Table 5.3-5: Shortlisted Terminal Alternatives Evaluation Matrix

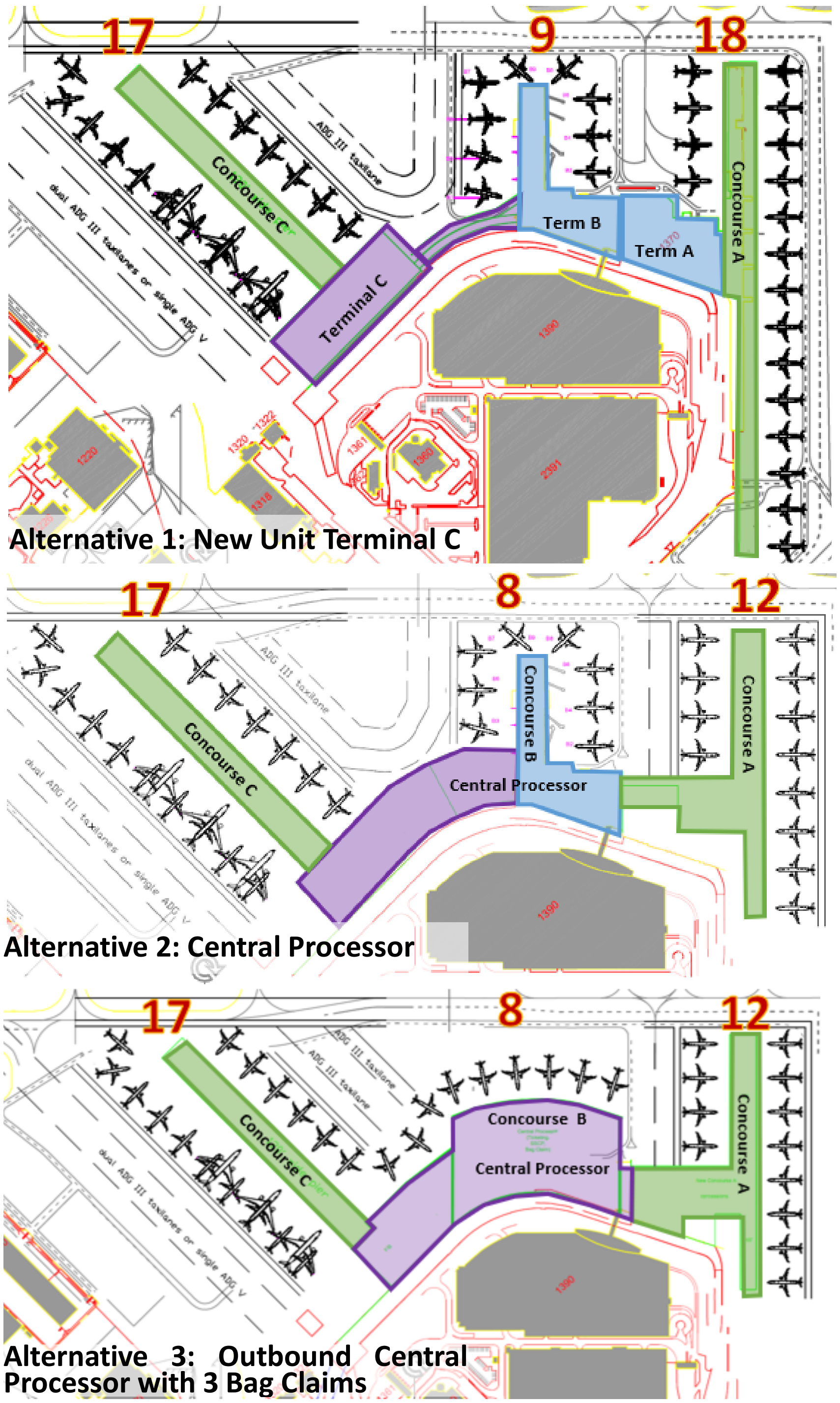
ALT	Overall passenger desirability/ experience	New vs. Renovated Space in Term A/B	Ease of Phasing & Cust. Exp. during Const.	Maximum Outbound Walking Distances	Maximum Inbound Walking Distances	Total ROM Cost (Terminal & Apron Only)	Aircraft Movement	Flexibility for Reacting to Actual Demand
1						$1.6B	Meets standards	
2						$1.7B	Meets standards	
3						$1.9B	Optimal	

Legend:
No or minimal impacts/Best
Moderate impacts/Better
Significant impacts/Good

Sources: Hirsh Associates, 2021; WSP USA, 2021.

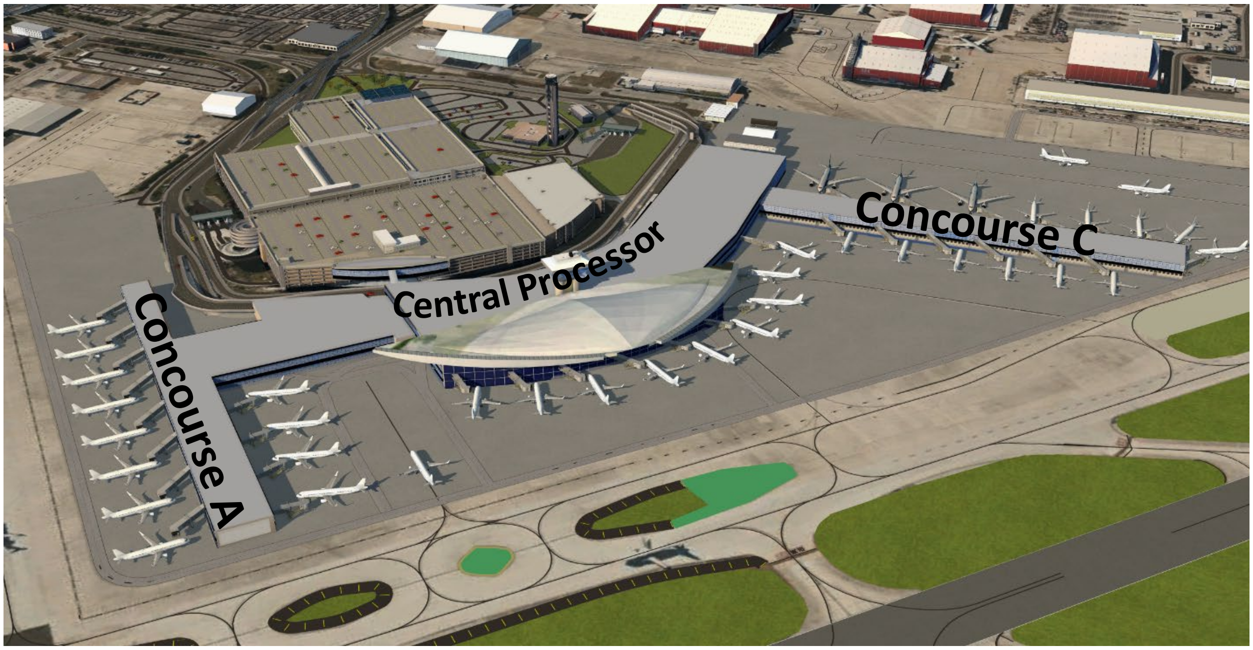
These factors are not all equivalent. Passenger experience and new space (lower operations and maintenance costs, more efficient, …) are more important. Alternative 2, although it has a central processor, it is not a true central processor. Alternative 3 is also a change from the existing terminal operation at SAT. As a result, Alternative 3 was selected as the preferred terminal alternative. A rendering of the preferred terminal alternative is depicted on **Figure 5.3-7**.

Figure 5.3-6: Preferred Terminal Alternative Variants



Source: WSP USA, 2021.

Figure 5.3-7: Preferred Terminal Alternative



Source: WSP USA, 2021.

5.3.8 REFINEMENT OF PREFERRED TERMINAL ALTERNATIVE

HIGH-LEVEL PHASING

The initial phase of development of the preferred alternative would be the construction of a 17 narrowbody-gate Concourse C and the necessary passenger processing to support this activity until a central processor is built, i.e. Terminal C. Terminal C would provide sufficient new space and gates to allow some airlines to relocate temporarily during reconstruction of Terminal A, as well as to accommodate growth.

There are two main phasing approaches to implement the preferred terminal alternative:

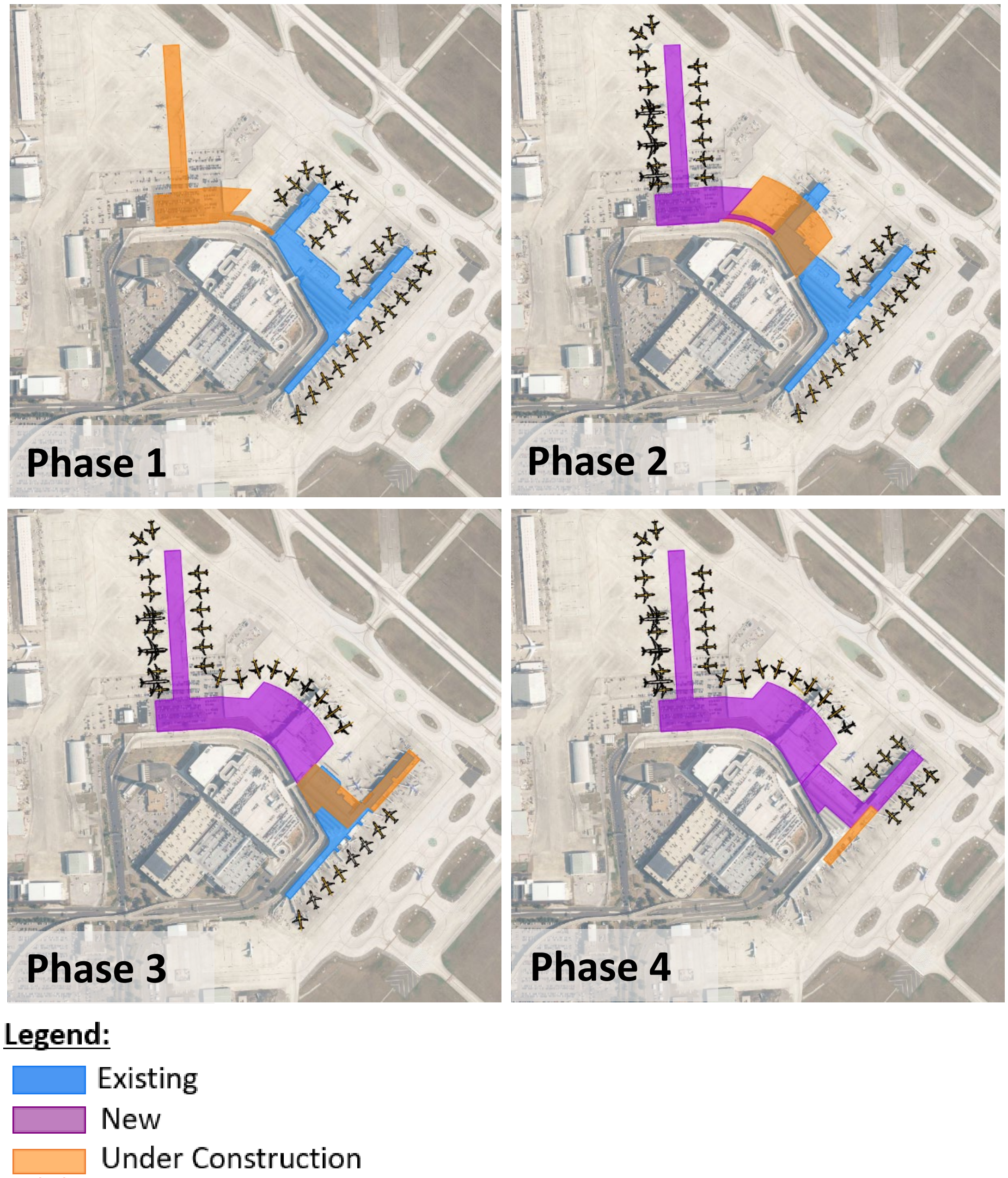
- Approach A: This would immediately begin the demolition of Terminal B and construction of the central processor. When the central processor is completed, the interior of Processor C would then be partially converted to other functions. Terminal A would be renovated/reconstructed as a primarily airside concourse. Approach A is depicted on **Figure 5.3-8**.
- Approach B: If conditions and/or demands are different than anticipated, Terminal A could be kept as a full terminal longer, and the new central processor deferred. After completion of Terminal C, Terminal A would be renovated and gates reconstructed. As conditions change, the demolition of Terminal B and construction of the central processor would proceed. After the central processor is completed, the interior of Processor C would then be partially converted to other functions. Terminal A would then be converted to a primarily airside concourse. Approach B is depicted on **Figure 5.3-9**.

The relocation of the FIS could also occur during different sub-phases depending on the timing of construction and the need to expand beyond the capacity of the existing Terminal A FIS.

Approach B was selected and will be discussed in more detail in the *Implementation* chapter.

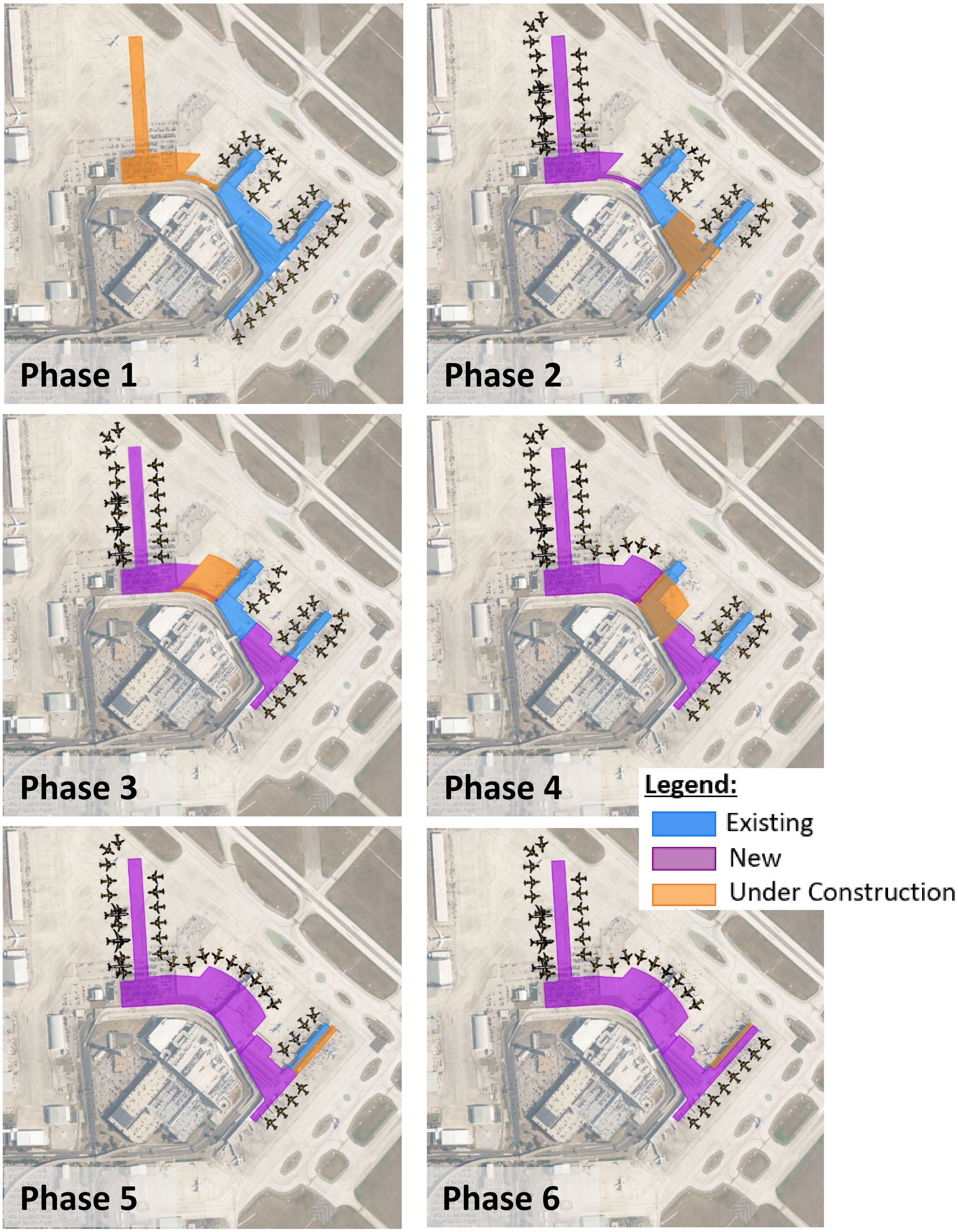
Roadway phasing alternatives are the same for both approaches and are discussed in Section 5.4.

Figure 5.3-8: Terminal Phasing Approach A



Sources: Hirsh Associates, 2020; WSP USA, 2020.

Figure 5.3-9: Terminal Phasing Approach B



Sources: Hirsh Associates, 2020; WSP USA, 2020.

TERMINAL FUNCTIONAL PLANS

Functional interior plans were developed to confirm that the preferred concept could accommodate the recommended facilities for the forecast levels of activity. As noted above, the processor of Terminal C would have an initial configuration as stand-alone terminal. Some of this space would be converted to other uses after the central processor is completed.

These are shown in the following four figures:

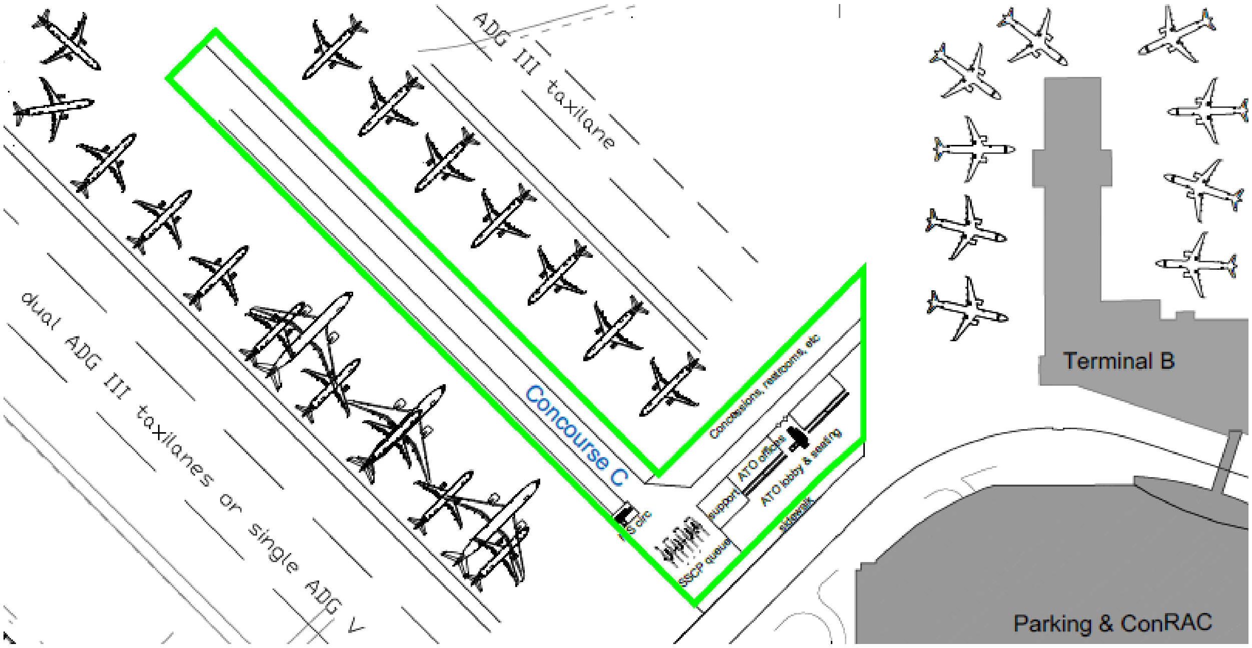
Figures 5.3-10 and **5.3-11** depict the initial interior layout configuration of Terminal C, which consists of:

- The departures level would contain a ticket lobby, airline offices, SSCP, concessions and restrooms.
- The arrivals level would contain four domestic bag claim units, bag service offices, restrooms and the FIS. Depending on the timing of Terminal C construction, the FIS may be "shelled" out while keeping the existing FIS in Terminal A active until a later phase.
- The apron level of Concourse C would contain the CBIS and bag make-up units.

Figures 5.3-12 and **5.3-13** depict the central processor and Terminal C final interior layout (after the central processor is built in the area of existing Terminal B). The layout would consist of:

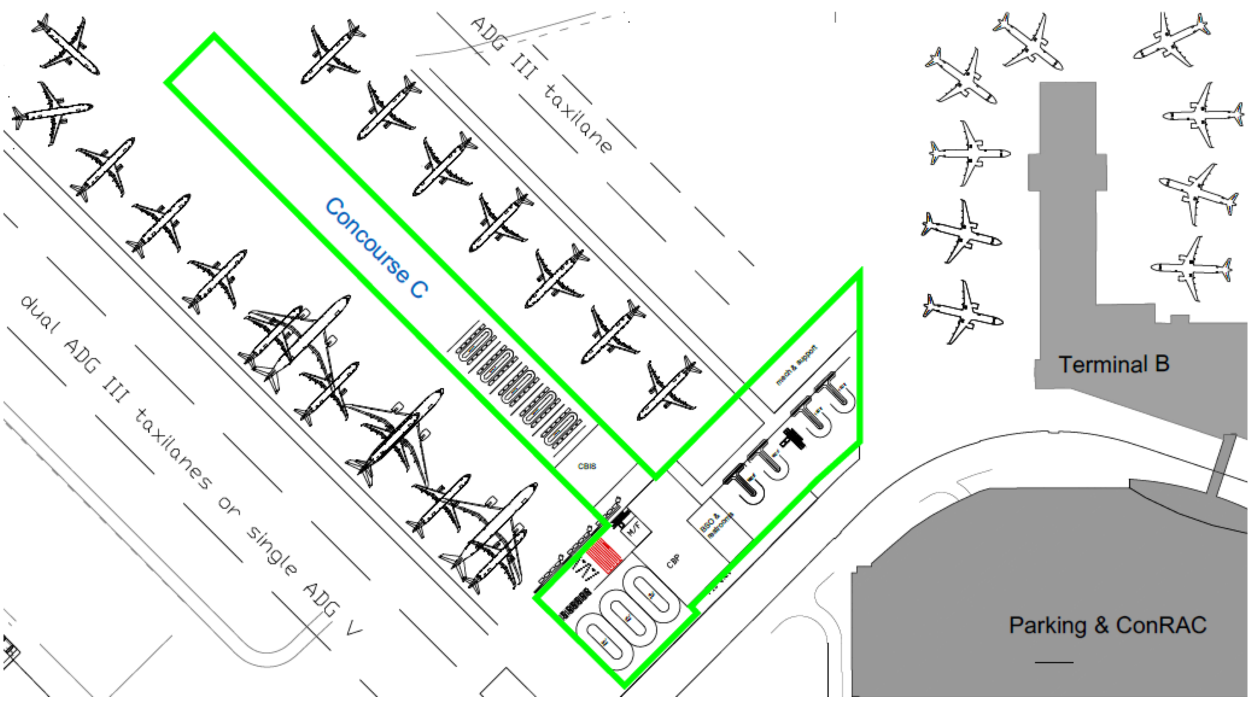
- The departures level of the central processor would contain all the ticketing lobby functions, airline offices, SSCP, secure and non-secure concessions, restrooms and holdrooms for 8 gates.
- The check-in and SSCP areas of Processor C would be converted to offices, concessions and other uses. Some of the secure concessions in the processor would be converted to holdrooms as gates are realigned.
- The departures level of Terminal A would be converted to concessions and related uses, and the concourse fully rebuilt.
- The arrivals level of the central processor would contain six domestic bag claim units, bag service offices, the CBIS for all check-in areas, bag make-up units, and airline operations offices for the 8 gates.
- The domestic bag claim of Processor C would be reduced to two claim units, which would connect to the central processor bag claim area. The reduced number of claim units would allow expansion of the international meeter/greeter lobby and arrivals concessions.
- The apron level of Concourse C would continue have bag make-up units, but the smaller CBIS would be replaced by the large, single CBIS in the central processor.
- The arrivals level of Terminal A would be renovated and contain two bag claim units, which would connect to the central processor bag claim area. Concessions support spaces would occupy other available spaces.

Figure 5.3-10: Initial Upper Departures Level (Ticketing)



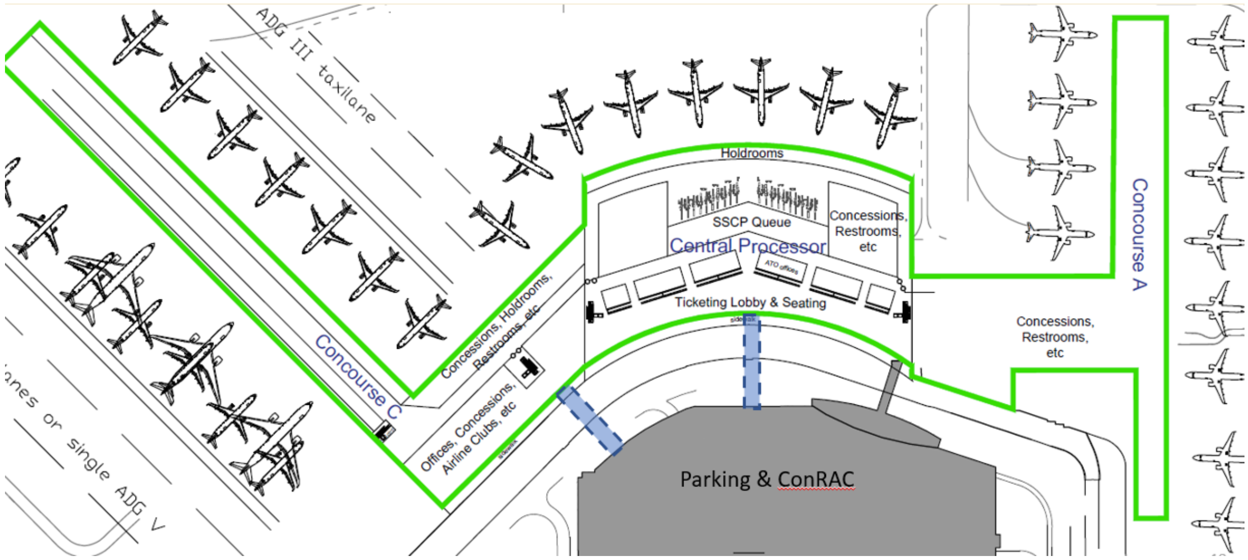
Sources: Hirsh Associates, 2021; WSP USA, 2021.

Figure 5.3-11: Initial Lower Arrivals Level (Baggage Claim)



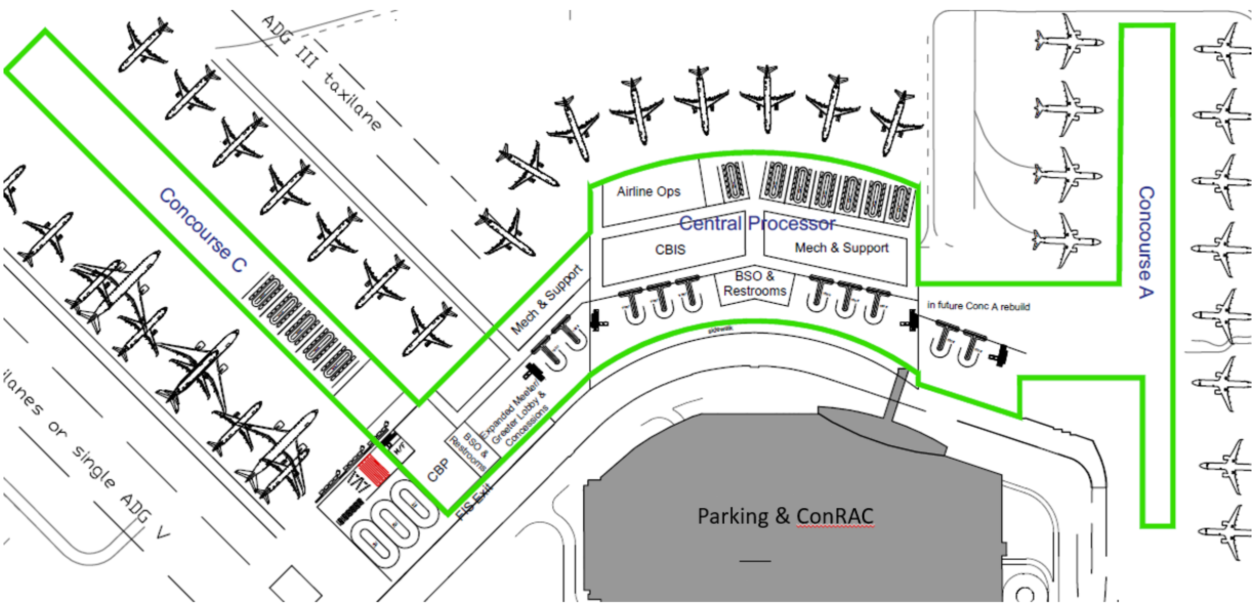
Sources: Hirsh Associates, 2021; WSP USA, 2021.

Figure 5.3-12: 2040 Upper Departures Level (Ticketing)



Sources: Hirsh Associates, 2021; WSP USA, 2021.

Figure 5.3-13: 2040 Lower Arrivals Level (Baggage Claim)



Sources: Hirsh Associates, 2021; WSP USA, 2021.

5.4 MULTIMODAL ACCESS ALTERNATIVES

The identification of multimodal alternatives focused on landside capacity enhancement, industry planning standards, integration of other modes of transportation, and consideration of emerging technologies. For SAT, the landside capacity enhancements that were considered encompassed curbside and terminal roadway improvements, integration of a Ground Transportation Center (GTC), public and employee parking expansion, taxicab/TNC staging areas and cell phone waiting lot expansion, as well as accommodating future Urban Air Mobility (UAM) facilities.

The goals used at the start of the analysis were revised to increase the focus on cost and implementation duration. Initial road layout goals emphasized increasing the central terminal area at the Airport, which was later removed as a goal. Use of and improvements to existing facilities became the emphasis over all new roadways in access infrastructure.

5.4.1 AIRPORT ACCESS ROADS

The focus of landside improvements was on roadways, such as U.S. 281, Loop 410, Dee Howard Way, and Airport Boulevard, which provide direct access to/from the Airport's passenger terminal building. In addition, improvements to address existing issues with the air cargo carriers access along Wetmore Road were also developed.

SUMMARY OF PASSENGER ROADWAY REQUIREMENTS

The following issues and requirements were identified for the SAT roadway facilities through 2040:

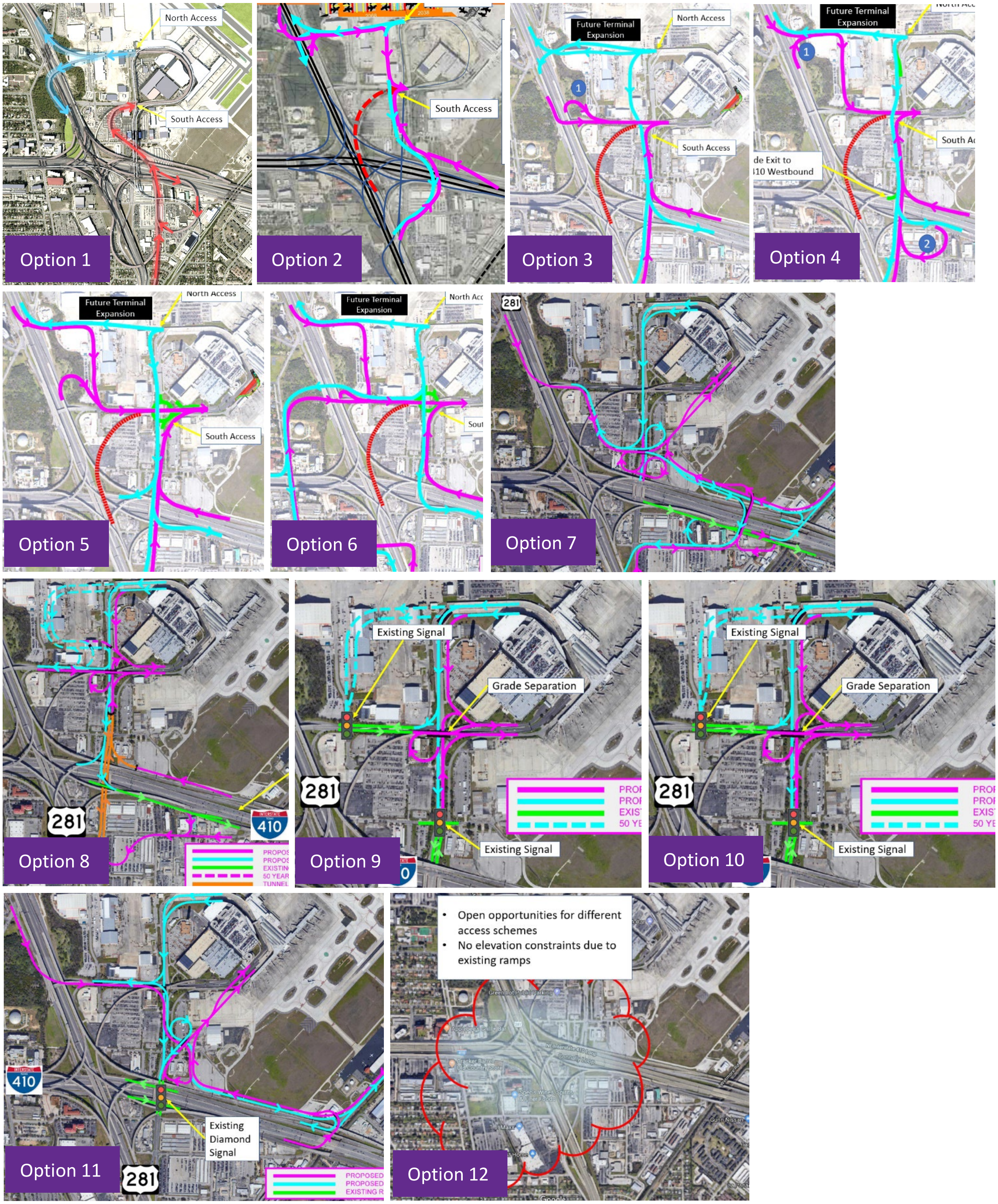
- Simplify I-410 and U.S. 281 access to/from Airport
- Provide a dedicated approach boulevard to the airport terminals and related facilities, in order to:
  - Provide a world-class driver experience
  - Allow increased decision distances
  - Minimize confusion and lead to more driver-intuitive roads
  - Reduce conflict points, congestion, and intersections

INITIAL OPTIONS

Twelve initial high-level landside planning options were developed, without cost being a key factor, and therefore consisted of several direct connectors to highways to provide for improved traffic flow, along with a world-class experience.

Figure 5.4-1 summarizes the 12 initial options. Each option dramatically improves access to/from SAT, but includes several major roadway reconstructions, elevated structures and potential right-of-way (ROW) requirements. Several of the options included new direct connectors from U.S. 281, new airport ring roads, and/or ramps to/from I-410.

Figure 5.4-1: Initial Roadway Options



Source: WSP USA, 2020.

The initial 12 roadway options were reduced to four. However, considering the significant construction costs and long estimated implementation durations (beyond 2040). Ultimately, none of these options was retained and a new set of airport roadway goals was developed to define new roadway options that were more fiscally achievable.

REVISED ROADWAY GOALS AND OPTIONS

GOALS

Following additional working sessions with SAAS staff, a revised set of goals was developed focusing on using the existing access points to SAT:

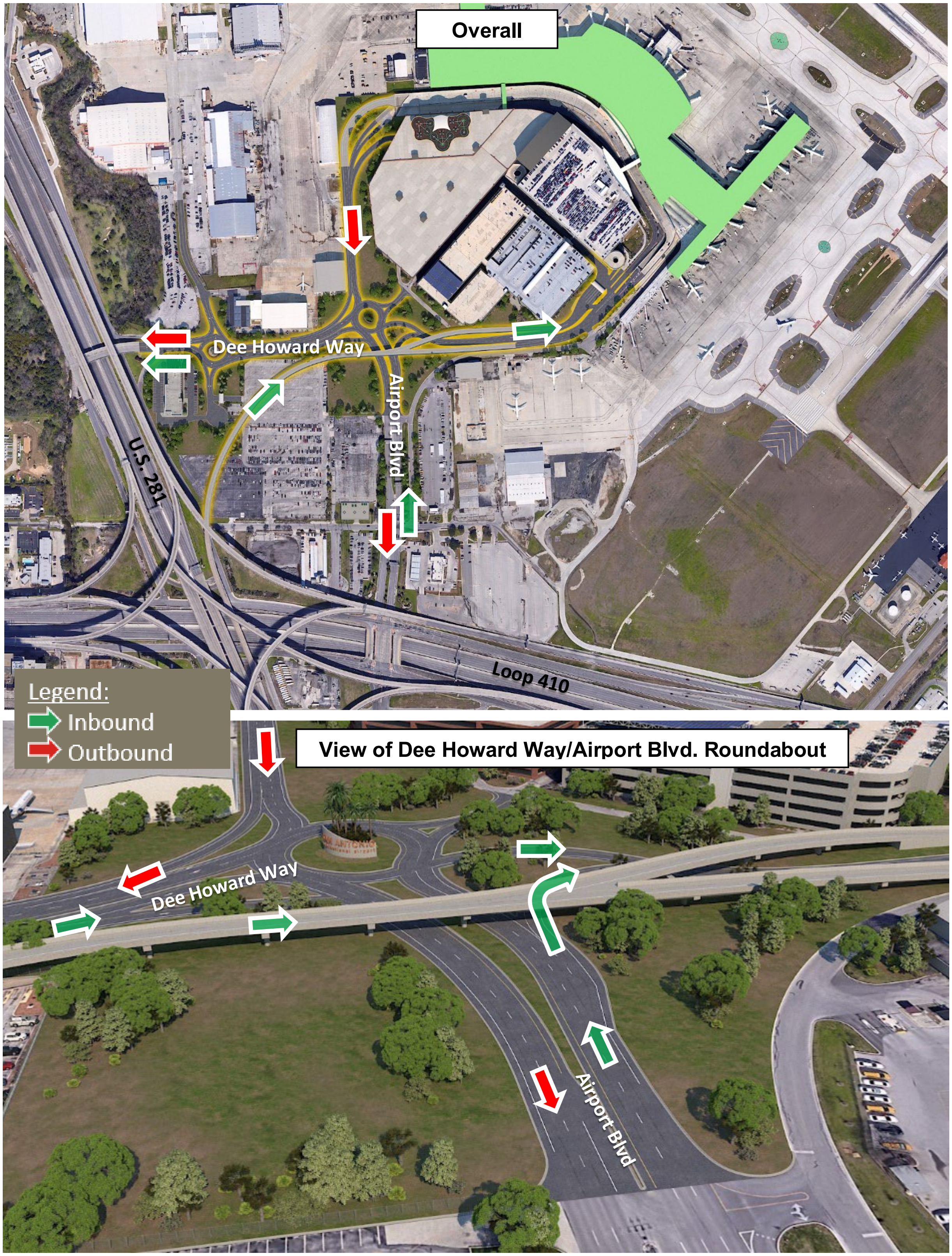
- Enhance driver experience and safety:
  - Decrease weaving and travel routes with traffic signals
  - Increase decision-making distances
- Reduce congestion and accommodate projected growth:
  - Reduce intersections and provide more continuous flow
  - Increase use of existing airport connector ramp from northbound U.S. 281
- Provide enhanced airport entrance gateway experience:
  - Consolidate inbound airport traffic earlier
  - Simplify on-airport road system
  - Facilitate multi-modal options

Many of the attributes included within the original 12 options were reviewed and revised to better align with the new goals. Two options were developed and then analyzed using traffic simulation modeling in VISSIM.

OPTION 1

The focus of Option 1 was to minimize changes to existing travel patterns while improving traffic flow and safety. Option 1 proposes building two roundabouts along Dee Howard Way, thus removing intersections, minimizing conflict points and significantly improving safety. The proposed roundabout at Dee Howard Way/Airport Boulevard would also improve weaving distances and promotes slower on-airport vehicular speeds. Option 1 is depicted on **Figure 5.4-2.**

Figure 5.4-2: Proposed Airport Access Road - Option 1



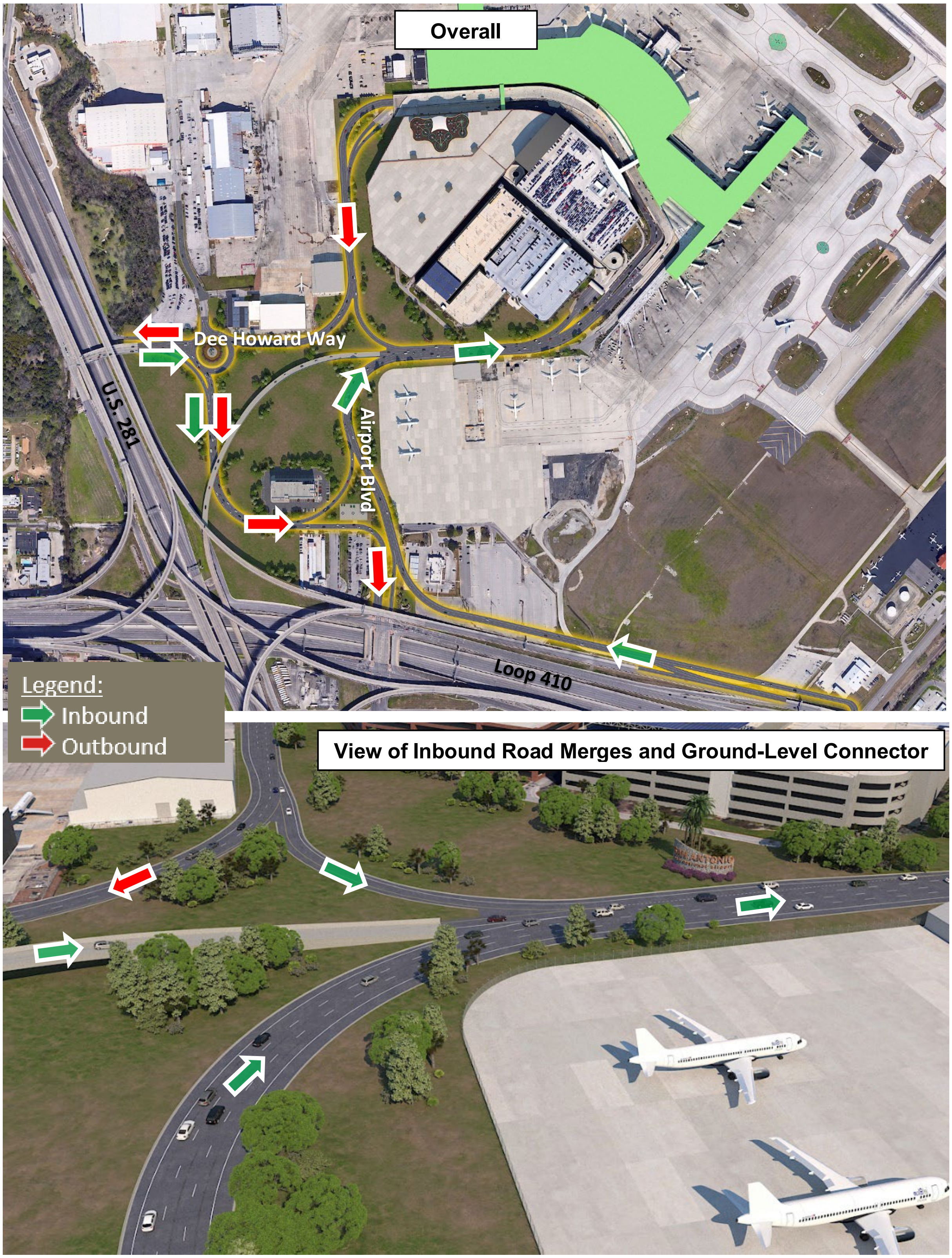
Source: WSP USA, 2021.

OPTION 2

Option 2 provides for one roundabout on Dee Howard Way but includes a circulatory roadway to the south that then ties into Airport Boulevard, with a roadway that loops northward towards the terminals. A key component of Option 2 includes the lowering of the northbound U.S. 281 direct connector as it approaches Airport Boulevard, thus creating a roadway concept with increased decision distances and reduced weaving. To further improve traffic flow, drivers traveling eastbound along I-410 would exit at Wetmore Rd along the eastbound frontage road, and traverse along a newly constructed U-turn ramp under I-410 that provides drivers with a free-flowing option that bypasses the traffic signals at Airport Boulevard. Option 2 is depicted on **Figure 5.4-3.**

Both options would also encourage drivers entering the Airport via northbound U.S. 281 to use the existing direct connector, the official Airport entrance, versus the Airport Boulevard. exit. New directional guide signs would be designed and installed to promote the use of the direct connector as the main entrance into the Airport from the south. It is recommended that a new street name be created, that does not include the word “Airport” to minimize use of the “Airport Boulevard” exit as an entrance to the airport.

Figure 5.4-3: Proposed Airport Access Road - Option 2



Source: WSP USA, 2021.

APPROACH ROADWAY GEOMETRY/TERMINAL A PINCH POINT

In addition to redesigning the Airport access road, mitigations for the Terminal A "pinch point" were assessed. The Terminals A and B curbside is comprised of four lanes; however, these four lanes only function as about 1.5 lanes due to several factors:

- A support column at the start of the Terminal A curbside, where drivers make a 90° turn, blocks the driver's view, thus slowing down traffic. The 2-lane approach road becomes a 4-lane road after this column.
- Although there are 2 "through" lanes to Terminal B, they are rarely used; additionally, the outer lane pavement is currently marked not to be used at this point (the markings only apply to the first section in front of Terminal A).
- The first door to access the Terminal A Baggage Claim area is near the 90° turn, causing drivers to slow down and start looking for their passenger(s), resulting in further back-ups and congestion (even though there is no pick-up allowed at this door).
- The area under the upper-level roadway is dark and not well lit, making it difficult to see passengers, signage, etc. further causing drivers to slow down.
- Signage identifying passenger pick-up locations is lacking or not easily visible, which also contributes to traffic backups. These traffic backups are daily occurrences, typically all the way back to the Airport gas station around 11 p.m.
- There is a crosswalk close to the "pinch point" contributing to the backups.

The goals of this analysis are to eliminate the "pinch point", identify enhancements to mitigate the daily traffic back-ups, improve safety, and use the 4 lanes of curb roadway to their full capacity. Two approach road variants were developed.

VARIANT 1

Variant 1 is depicted on **Figure 5.4-4**. It proposes realigning East Terminal Dr. (pick-up and drop-off approach lanes) starting approximately 350 feet from the Terminal A curb.

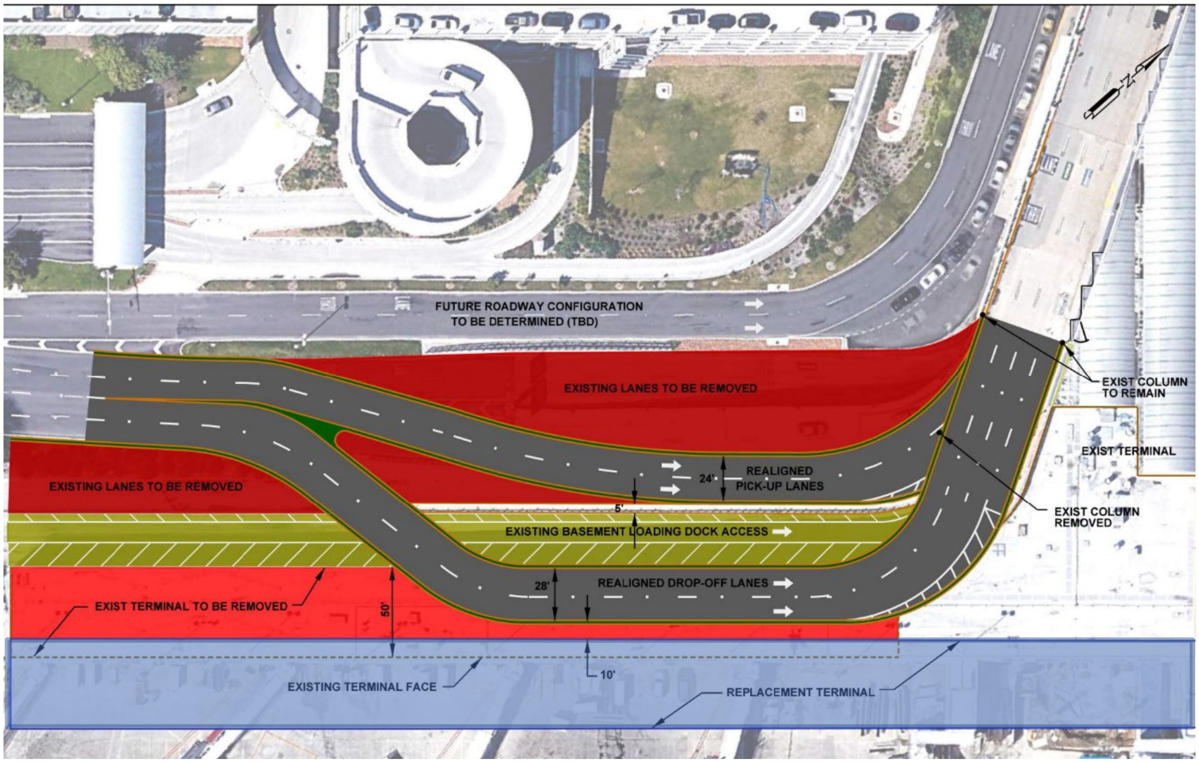
Benefits include:

- Relocates/removes existing columns to improve sight distance and view of curbside area
- Promotes use of all 4 curb lanes
- Keeps existing loading dock access

VARIANT 2

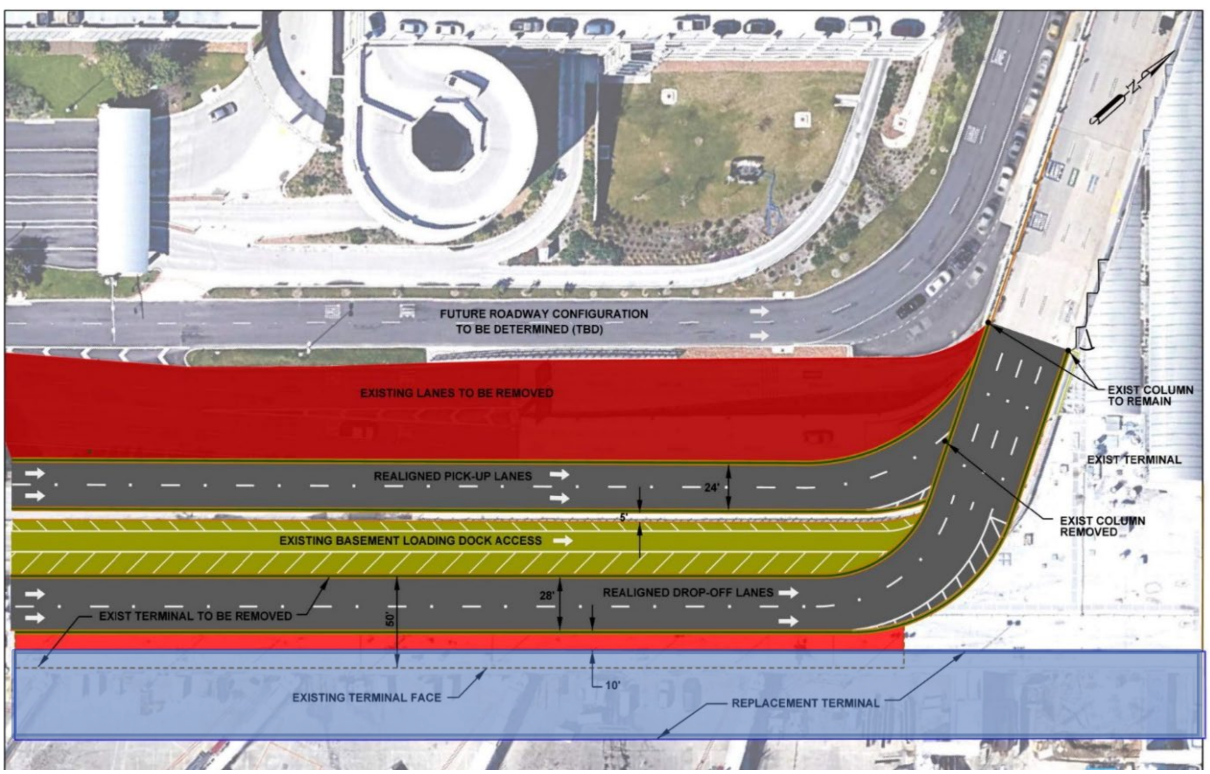
Variant 2 is depicted on **Figure 5.4-5**. It proposes realigning East Terminal Dr. (pick-up and drop-off approach lanes) starting at South Terminal Dr.

Figure 5.4-4: Terminal A Pinch Point Mitigation – Variant 1



Source: WSP USA, 2021.

Figure 5.4-5: Terminal A Pinch Point Mitigation – Variant 2



Source: WSP USA, 2021.

Benefits include:

- Increases spacing between major decision points for drivers between Arrivals and Departure Curbs (perception, reaction time)
- Relocates/removes existing columns to improve sight distance and view of curbside area (note that a structural assessment was completed to confirm that removal and relocation of the first column is feasible. The concern stemmed from it being part of the cantilevered structure of Terminal A).
- Promotes use of all 4 curb lanes
- Keeps existing loading dock access

Variant 2 was retained as the preferred alternative, as it increases spacing between major decision points for drivers between Arrivals and Departure Curbs, thus improving driver decision-making distance. Option 2 also does not add extra roadway curves just prior to the 4-lane curbfront, which may increase driver confusion.

One of the key improvements included in both options is the removal and replacement of the two columns supporting the Terminal A arrivals upper roadway; the reconstruction of the entryway would enhance capacity and improve wayfinding.

EVALUATION OF ACCESS ROAD OPTIONS (DEVELOPMENT OF VISSIM MODELS)

A valuable analytical tool for traffic engineering is microscopic simulation software. A transportation system analysis by means of a traffic simulation model allows the prediction of the effects of modified lane configurations, traffic control, and other key changes to the roadway network on the system's operational performance. Operational performance is measured in terms of measures of effectiveness (MOEs), which include average vehicle speed, vehicle stops, delays, vehicle hours of travel, vehicle miles of travel, fuel consumption/emissions, and several other measures. The MOEs provide useful input in the selection of future improvements to decrease congestion, delay, queues, etc.

VISSIM is classified as a microscopic simulation model because it models vehicles and other components as individual units and updates them every second. After defining the street geometry, traffic control and vehicular volumes, *VISSIM* can provide MOE results that can then be used as a basis for comparison between different simulation models. *VISSIM* also has the capability of modeling various modes of transit, such as buses, taxis, TNCs and rail.

CALIBRATION

One of the key reasons for using VISSIM was the ability to simulate vehicles along the arrival and departure curbs as observed during "Freak Week" in June 2018. During peak conditions, queuing along the curbs extends west to Airport Boulevard, and sometimes back to the Airport gas station, thus leading to excessive delays for drivers traveling to/from the Airport. In addition, VISSIM was used to assess the relative effectiveness of the overall roadway alternatives in accommodating traffic growth. Using the field traffic data obtained throughout this project, an existing conditions model was developed for each of the three peak hours analyzed (Morning peak, Afternoon Peak, and Evening Peak). Each model went through an extensive calibration effort with SAAS to confirm the simulated conditions matched closely with actual field conditions. **Figure 5.4-6** depicts a screen shot of VISSIM showing the backups during the Evening Peak.

Figure 5.4-6: 2018 Evening Peak 2018 VISSIM Simulation

Source: WSP USA, 2021.

Appendix 5H includes a detailed discussion of the calibration for the VISSIM models.

YEAR 2040 NO-BUILD MODELS

Once the existing peak hour models were developed and calibrated, Year 2040 No-Build models were developed to better understand the impact of the future increase in passengers would have along the existing curbs, as well as along the Airport access roadways. Extensive congestion occurred as expected from the curb areas to both interchanges along I-410 and U.S. 281, as shown on **Figure 5.4-7**.

Table 5.4-1 shows that three intersections are expected to operate at LOS F during the Afternoon peak hour, with two of these intersections also operating at LOS F during the Evening PM peak hour. Thus, improvements are required to accommodate the forecast 2040 passenger and associated vehicle movements.

Figure 5.4-7: 2040 No-Build Evening Peak VISSIM Simulation

Source: WSP USA, 2021.

Table 5.4-1: 2040 Intersection Delay Results (No Build, Options 1 and 2)

Intersection	OVERALL INTERSECTION DELAY (SECONDS)								
	Morning Peak Hour			Afternoon Peak Hour			Evening Peak Hour		
	No-Build	Option 1	Option 2	No-Build	Option 1	Option 2	No-Build	Option 1	Option 2
Dee Howard Way/US 281 SB FR (McAllister Fwy)	9 (A)	9 (A)	8 (A)	9 (A)	10 (A)	11 (B)	10 (A)	11 (B)	11 (B)
Dee Howard Way/John Saunders Rd	7 (A)	1 (A)	2 (A)	138 (F)	12 (B)	4 (A)	47 (D)	1 (A)	4 (A)
Dee Howard Way/Airport Boulevard	19 (B)	8 (A)	-	244 (F)	31 (C)	-	182 (F)	-	-
Airport Boulevard/NE Loop 410 FR (WB)	17 (B)	15 (B)	13 (B)	120 (F)	15 (B)	19 (B)	88 (F)	15 (B)	16 (B)
Airport Boulevard/NE Loop 410 FR (EB)	24 (C)	25 (C)	22(C)	44 (D)	20 (B)	22(C)	43 (D)	24 (C)	21 (C)

Source: WSP USA, 2021.

YEAR 2040 VISSIM RESULTS OPTIONS 1 AND 2

Both 2040 Options 1 and 2 were developed to maximize traffic flow capacity along the Airport roadways, as well as along the terminal curbs. These 2040 options are depicted on **Figures 5.4-8** and **5.4-9**. Table 5.4-1 summarizes the results of both options, as well as a comparison with Year 2040 No-Build. Option 1 includes two roundabouts, which are expected to operate at LOS B or better. Option 2 includes only one roundabout, which is expected to operate at LOS A. The lowering of the northbound U.S. 281 direct connector significantly improves weaving issues and provides for a simpler, more straightforward roadway environment. Estimated use of the direct connector by U.S. 281 northbound traffic is anticipated to increase from approximately 11 percent to approximately 56 percent.

Figure 5.4-8: 2040 Option 1 Evening Peak VISSIM Simulation

Source: WSP USA, 2021.

Figure 5.4-9: 2040 Option 2 Evening Peak VISSIM Simulation

Source: WSP USA, 2021.

PREFERRED ACCESS ROAD OPTION

Option 2, depicted on **Figure 5.4-10**, was selected as the preferred Airport access road option for the following reasons:

- Drivers are provided improved traffic flow with a free-flowing travel experience to/from SAT with only one roundabout, which was noted as a potential issue by SAAS.
- The redesigned northbound U.S. 281 direct connector (lowering of the ramp) would become the main entrance from downtown San Antonio. Renaming "Airport Boulevard" to a name without the word "Airport" would reduce use of this exit to access the Airport.
- The lowering of this direct connector ramp would also lead to an increase in decision-making distances, improving safety and enhancing the "sense of place" for SAT drivers, providing the feeling of having arrived at the Airport earlier along the roadway network.

As an additional positive feature, the southern on-airport loop roadway would also open existing airport property for additional parking and commercial development opportunities, such as hotels, office space, etc.

Figure 5.4-10: 2040 Preferred Airport Roadway Alternative

Source: WSP USA, 2021.

The implications of proceeding with the preferred roadway alternative are summarized below:

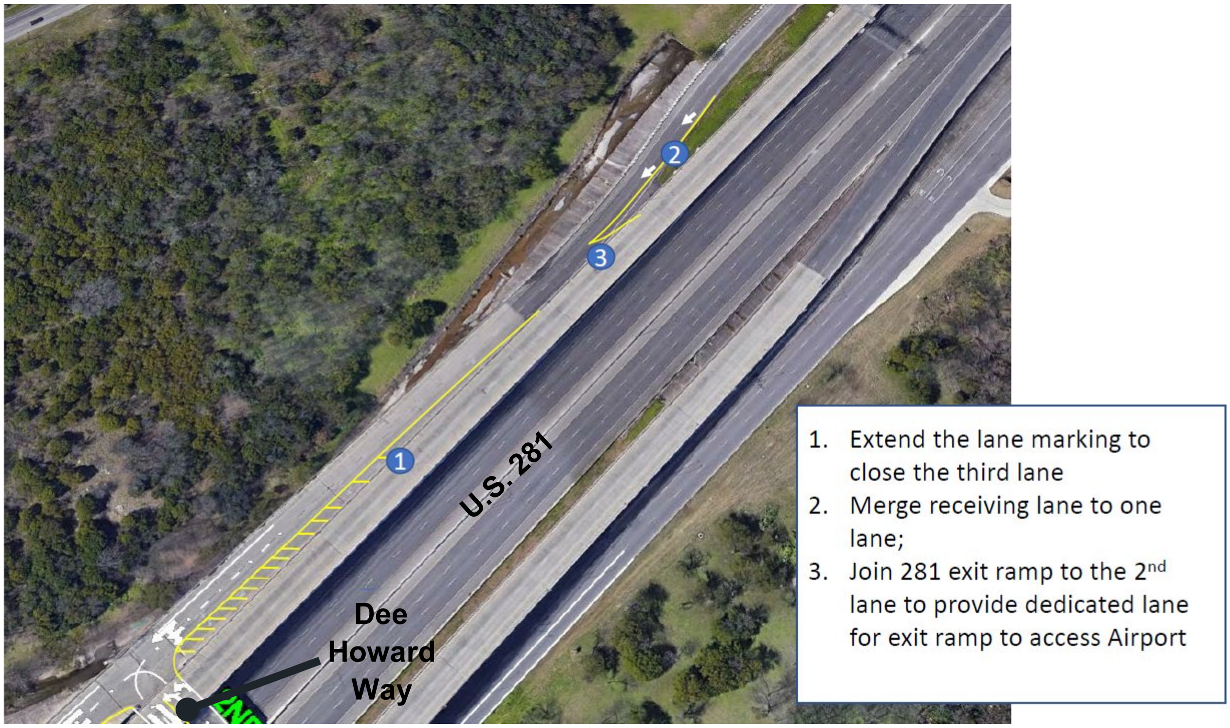
- Hangar 4, which was previously identified for demolition, needs to be removed to accommodate the shifted exit roadway from proposed Terminal C. This space is used by Airport Maintenance and the K9 squad and will be accommodated in new space proposed for both these units.
- The existing police building and badging office need to be demolished and/or relocated to make room for Option 2 roadway. Both these facilities will be accommodated in the proposed replacement facilities planned for these functions.
- The existing Flight Safety Textron Aviation Training center located on the southwest corner of Dee Howard Way and Airport Boulevard will need to be relocated.
- Coordination and permitting with other agencies, such as TxDOT, will be addressed during design.
- Drainage and utilities will be addressed during design.

NEAR-TERM IMPROVEMENTS

Additional Airport access road improvements were identified that could be implemented in the near term:

- Redesign the intersection at U.S. 281 & Dee Howard Way: restriping of southbound inner lane to shift traffic over and provide for better turn radius onto Dee Howard Way (see **Figure 5.4-11**)
- Create dedicated acceleration/deceleration lanes for traffic entering and exiting Dee Howard Way via Northbound U.S. 281 (by striping off the curb lane between Dee Howard Way entrance and exit)
- SAAS to encourage airport employees to enter/exit via Wetmore Road

Figure 5.4-11: U.S. 281 and Dee Howard Way– Proposed Improvements of Southbound Lanes



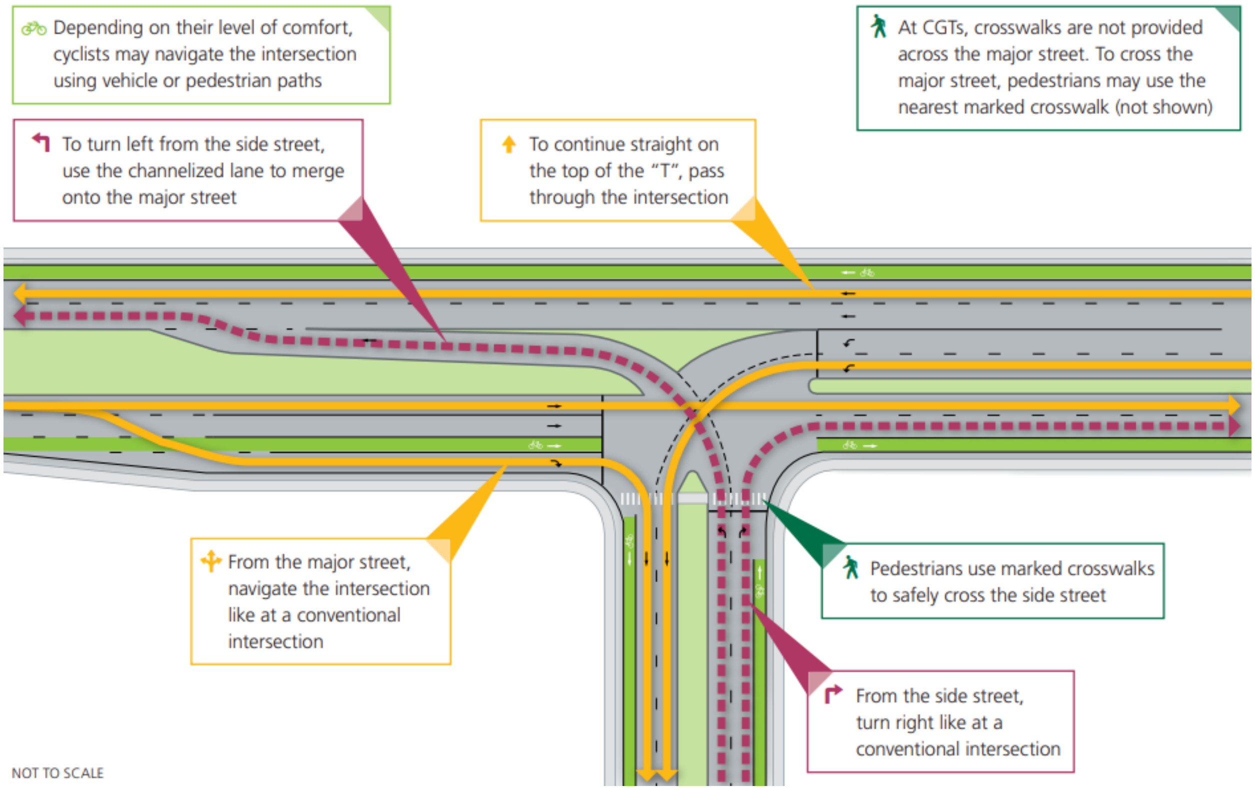
Source: WSP USA, 2021.

5.4.2 AIR CARGO ACCESS ROADS

The existing cargo tenants located along Wetmore Road, including operators such as FedEx and UPS, stated that exiting their facilities, specifically making a left turn, is difficult, particularly during morning and evening rush hours. The narrow sites with limited ROW were evaluated and proposed solutions for improving access were identified.

Green-T intersections are proposed for both the FedEx and WFS access driveways. A Green-T intersection is an intersection design where one major street direction of travel (the top side of the "T") can pass through the intersection without stopping, and the opposite major street direction of travel is typically controlled by a traffic signal. Left-turn vehicles from the side street use a channelized receiving lane on the major street to merge onto the major street. The intersection is typically signalized but can also be designed without a traffic signal. A typical Green-T intersection is depicted on **Figure 5.4-12**. Due to insufficient traffic volumes, traffic signals are not warranted; a Green-T intersection without a signal is proposed for both the FedEx and WFS access driveways.

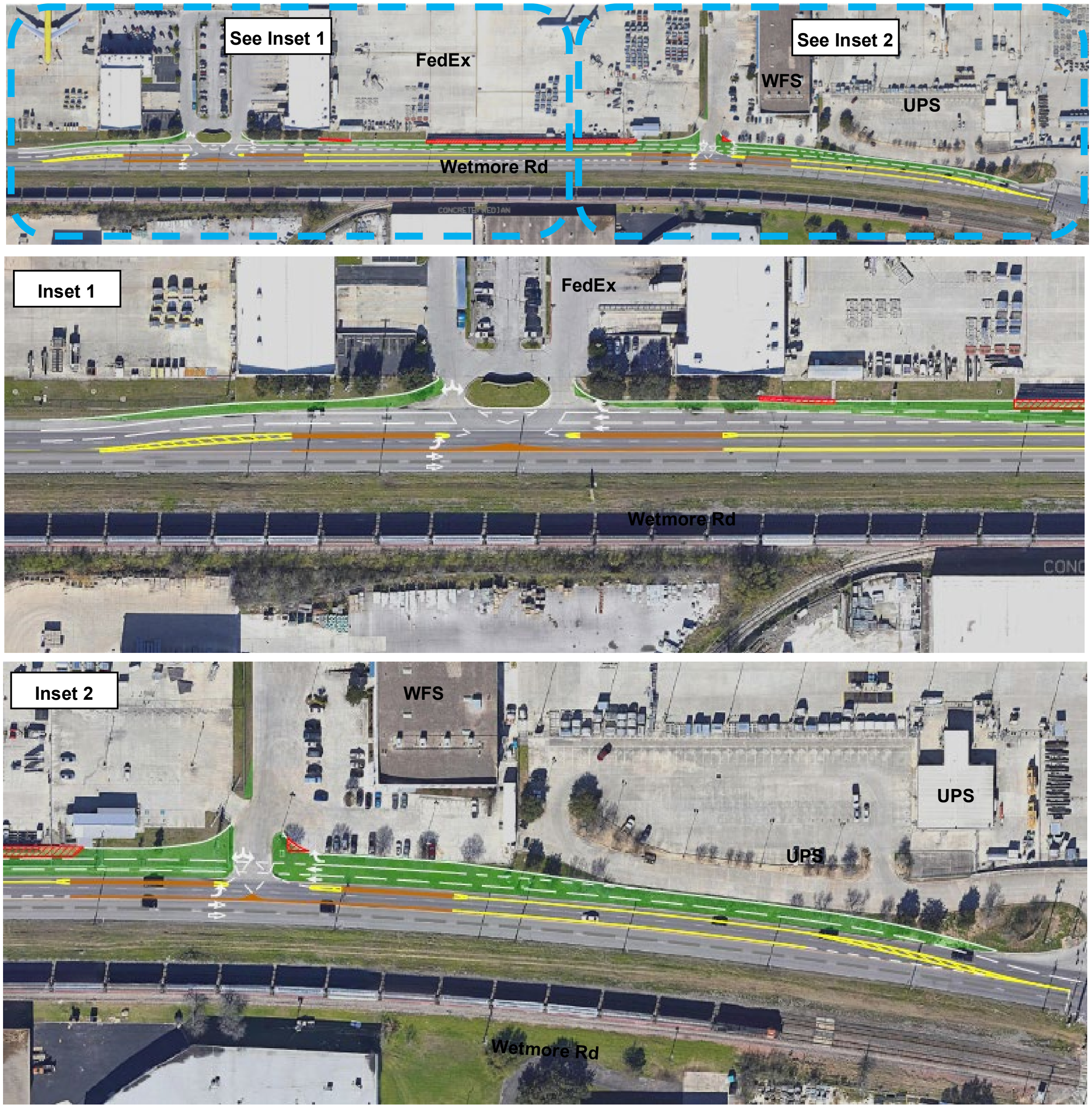
Figure 5.4-12: Typical Green-T Intersection Configuration



Source: Virginia Department of Transportation, *Innovative Intersections - Continuous Green-T*. Accessed June 2021. https://www.virginiadot.org/images/innovate/CGT_Final_082417.pdf

Figure 5.4-13 depicts the proposed lane improvements along the East Cargo area at SAT.

Figure 5.4-13: Proposed Air Cargo Access Improvements



Source: WSP USA, 2021.

5.4.3 GROUND TRANSPORTATION CENTER

The Transportation Research Board's Airport Cooperative Research Program (ACRP) Report 146: *Commercial Ground Transportation at Airports: Best Practices* defines GTC for airports as a consolidated area for passenger arriving and departing the airport to have multi-modal options. GTC services typically include taxicabs, limousines, TNC, courtesy vehicles, buses, and vans. In addition, some airports offer rail access and in the future UAM will also be offered at GTCs. This report and peer airport benchmark information was used by the SDP team to develop a high-level site plan to provide a safe, comfortable, easy-to-use, and efficient ground transportation facility for SAT to accommodate 2040 passenger demand.

GTC SITE PLANNING CONSIDERATIONS

The first step of GTC site planning is to identify the general area to accommodate the Multimodal Center/GTC in airport terminal area. Typically, airports locate the GTC to be conveniently located for passengers arriving and departing the airport terminals, so short walking distances and "intuitive" locations were evaluated. Since the SAT CONRAC was opened in December 2017 and is convenient for passengers, the proposed GTC was evaluated in this general area of the CONRAC and the existing parking garages. SAAS also stressed that a GTC location requiring an Automated People Mover (APM) should only be a last resort. In addition, the GTC is to include:

- Service from VIA Metropolitan Transit's Advanced Rapid Transit (ART) Plan and future rail, if ever implemented by VIA.
- Station and service via potential Personal Rapid Transit (PRT) system, a lightweight, automated people mover system or light rail system that loops around Airport, connects to North Star TC, hotel, terminals & CONRAC. PRTs can be fitted above existing roadways with limited infrastructure requirements.

COORDINATION WITH AGENCIES

Coordination with the following agencies was conducted during planning and is recommended during the design phase:

- VIA: as of January 2021, VIA's official SAT access plan is to drive ART/Bus Rapid Transit (BRT) buses on airport access road to transit curb or GTC.
- City of San Antonio
- Planning: SA Tomorrow Regional Centers
- TxDOT (Texas Department of Transportation)

SUMMARY OF FACILITY REQUIREMENTS

- Accommodate public transit on-site today
- Accommodate public transit on-site in the future and at the new GTC
- Provide connectivity between:
  - Airport & Downtown Station & Stone Oak P&R

  - Airport & North Star Transit Center
- Accommodate the following modes: Bus, bike, pedestrian, TNC, UAM/eVTOL, and others such as future rail.
- To accommodate the 2040 passenger high-forecast of 8.6 million enplanements, SAT needs 4 acres of GTC floor space to accommodate the modes listed above.
- Identifying the need for a hotel is not part of the SDP; however, SAAS has in the past researched market interest in hotels (high-end hotel close-in to the terminal or other hotel on Airport property). Therefore, sites available for a hotel were noted in the alternatives development.

ALTERNATIVES

Three GTC options were developed, and approximate areas for each option are depicted on **Figure 5.4-14:**

- GTC Option 1 – In new garage, ground floor:
  - Challenge: Relocate ATCT/TRACON facilities
  - The feasibility of relocating the rental car companies' Quick-Turn Around facility (QTA) was assessed. The constructability and phasing assessment concluded that the QTA relocation would occur after the new Terminal C garage would be constructed. At that time, relocation of the QTA would be challenging once a new garage is built next to it. As such, the QTA will remain in its existing location.
    - Pros of QTA remaining in existing location:
      - Lower project costs
      - Simpler implementation of Terminal C garage/GTC
      - No close-by QTA relocation site required on scarce airport property
      - More SAAS control over schedule (avoids NEPA and RAC agency negotiation)
    - Cons of QTA remaining in existing location:
      - Suboptimal use of valuable terminal-facing property—higher and better use could include a hotel
- GTC Option 2 – Convert first floor of CONRAC:
  - Challenge: Elevator bank and ramps in center of GTC
- GTC Option 3 – Convert ground floor of long-term parking garage:
  - Challenge: Longest walk, passenger crossing traffic, and level change

Figure 5.4-14: Ground Transportation Center Options

Source: WSP USA, 2021.

PREFERRED ALTERNATIVE

GTC Option 1, depicted on **Figure 5.4-15**, is the preferred GTC option. It provides:

- Shortest walking distance
- Logical vehicle ingress and egress
- Can be designed to proper GTC requirements vs. converting garages into less optimal GTC.
- Preserves ROW for future VIA Advanced Rapid Transit busses

Additionally, the preferred GTC alternative:

- Considers future road alignment and preferred 2040 terminal concept

- Can allow the existing QTA in its current location and sufficient space exists for the 2040 GTC.
- Requires the relocation of the ATCT/TRACON facilities

Figure 5.4-15: Preferred Ground Transportation Center Option

Source: WSP USA, 2021.

5.4.4 TERMINAL CURBSIDES

Improving curb operations is also a critical component of enhancing the experience and safety for SAT patrons. The curb length for Terminals A, B and future C on two levels provides sufficient capacity for passengers to flow into and out of the terminals efficiently.

SUMMARY OF FACILITY REQUIREMENTS (2040 HIGH FORECAST)

- Provide vehicle capacity of four lanes for arrivals and departures.

VISSIM confirmed that the current 4-lane departure curb roadway on the lower level adjacent to the terminals is effectively only operating at about 1.5 lanes of its capacity. This is due to the column issue at the pinch point and almost 90° turn, Terminal A doors and a crosswalk located in the same area, limited use of the outer lane due to lane markings, suboptimal signage, and finally the relatively low lighting under the upper roadway.

ALTERNATIVES

CURB AREA RECOMMENDATIONS

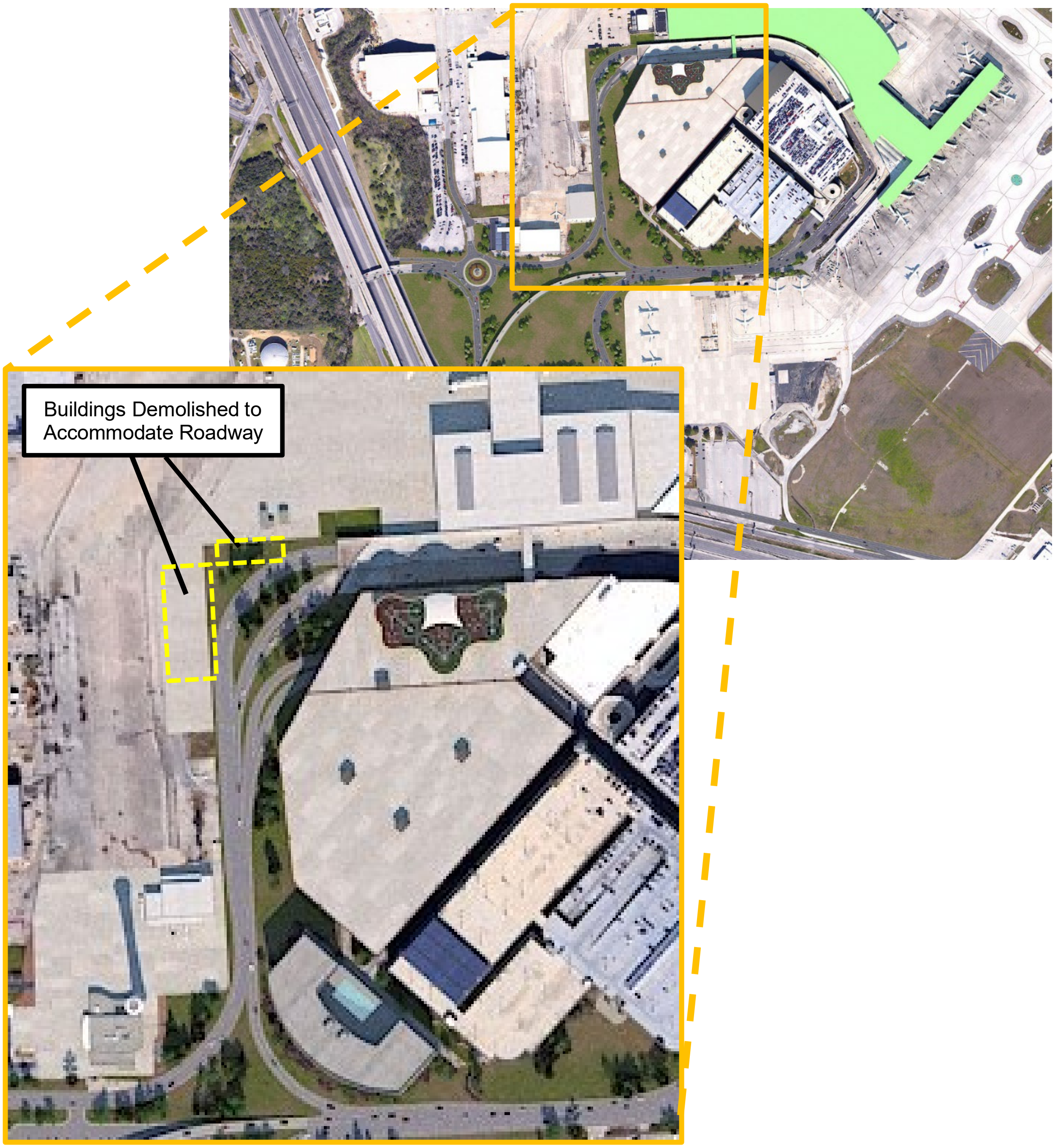
Based upon the VISSIM analysis results, it is recommended that the following curb area features be implemented to improve safety and vehicle flow, reducing congestion and eliminating the existing "pinch point":

- Close Door 1 of Terminal A Bag Claim. It is recommended that this become an "emergency exit only" from the terminal and hidden or deemphasized from view of vehicles, so passenger pick-up is shifted further west, to Door 2.
- Remove Crosswalk 1, near Door 2 of Terminal A, to prevent passengers from crossing the road in this area and extend the fence on the outer curb to further discourage jaywalking. Signage in the terminal should be updated to direct passengers for taxis and TNCs to Crosswalk 2.
- Add lane markings and overhead signs to define that the outer 2 lanes are for Terminal B and add large lit signs along the wall of Terminal A identifying that this area is Terminal A. Do the same for Terminal B and future Terminal C.
- Add significantly more lighting in the lower-level inner curb area to help drivers see more clearly and understand quicker that Terminal A is on the right and Terminals B and C through traffic should use the 2 left lanes.
- Potentially shift TNC pick-ups to the upper departure curb, which is used less during peak arrival traffic.
- Install a new overhead sign for Arrivals and Departures at the roadway split for Commercial curb and Arrivals/Departures curb. This will reduce observed driver confusion, last second swerving and weaving issues.

DEPARTURE ROADWAY GEOMETRY/TERMINAL C EXIT ROAD

Due to extenuating circumstances, the Terminal C exit road was not built as planned during the most recent expansion program; Thus, the upper level roadway deck stops, and temporary connector roads connected back to the existing road. The proposed exit roadway is redesigned to meet roadway geometry standards and maximize space available for parking facilities across the terminal. Existing Police and Badging Offices, and Hangar 4 would need to be demolished to accommodate this shift in the exit roadway, as originally planned at the time of roadway construction. The proposed revised Terminal C loop exit road is depicted on **Figure 5.4-16**.

Figure 5.4-16: Proposed Terminal C Roadway Exit Loop



Source: WSP USA, 2021.

5.4.5 PUBLIC PARKING

SUMMARY OF FACILITY REQUIREMENTS (2040 HIGH FORECAST)

- Short/long term (parking garage): need 82.6 acres/≈10,000 spaces total (additional 28 acres)
- Economy (surface parking): need 18.2 acres/≈2,200 spaces total (additional 3 acres)
- Private parking (off-airport): need approximately 22 acres/≈2,600 spaces total
- Provide convenient parking with bridge access to Terminal C and central processor

ALTERNATIVES

Alternatives for public parking were developed to accommodate the additional 31 acres of parking forecast to be needed by 2040 for short- and long-term parking, as well as economy parking, in addition to the existing public parking facilities (parking garages, economy lots).

The following objectives were considered when developing parking garage options:

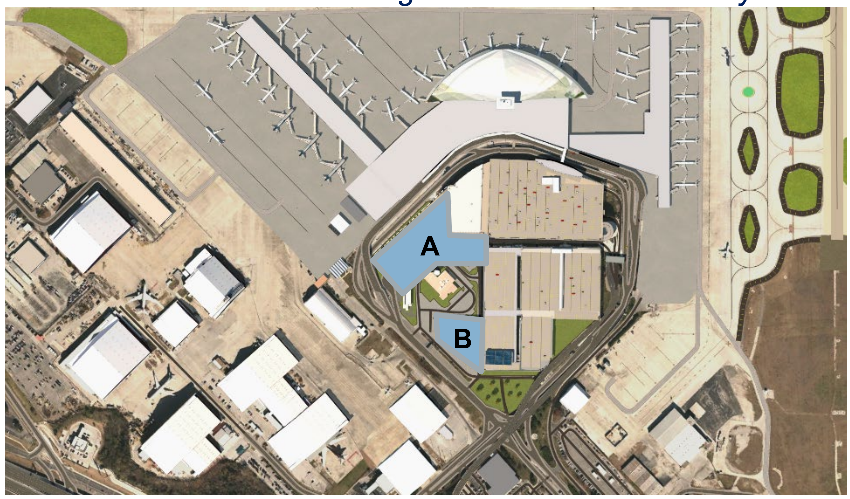
- Fewer levels and larger footprints are preferable
- Provide high customer experience = minimize level changes and walking distances
- Maintain proximity to terminals and connectivity to existing garages
- Maintain consolidated revenue control/exit plaza
- Plan for an option to provide more parking spaces than projected, if SAAS decides to capture off-site parking revenue

Three parking garage options were developed to provide hourly and daily parking and are depicted on **Figure 5.4-17**. All three options accommodate growth in parking demand for all terminal passengers without additional surface parking. However, additional floors could be added as an SAAS strategy decision to attract economy parking patrons into the garage, or off-site parking patrons onto on-airport facilities.

Figure 5.4-17: Terminal Parking Garage Options

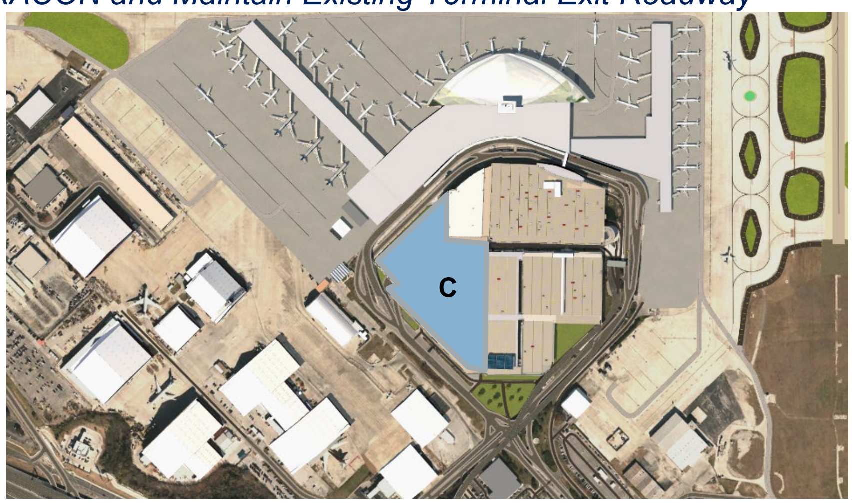
Option 1: Preserve ATCT/TRACON and Maintain Existing Terminal Exit Roadway

- Parcels A and B combined = 5.2 acres
- Need 6 levels (results in additional ≈31+ acres/3,700 spaces)



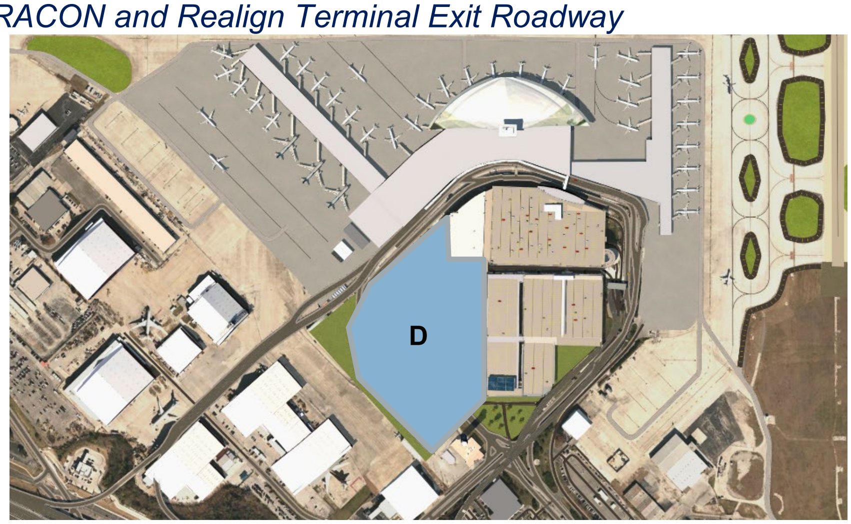
Option 2: Relocate ATCT/TRACON and Maintain Existing Terminal Exit Roadway

- Parcel C = 8.7 acres
- Need 4 levels (results in additional ≈34+ acres/4,000 spaces)



Option 3: Relocate ATCT/TRACON and Realign Terminal Exit Roadway

- Parcel D = 16 acres
- Need 2 levels (results in additional ≈32 acres/3,800spaces)
- Relocate ATCT/TRACON
- Allows for larger garage, along with other developments



Source: WSP USA, 2021.

The three parking garage options are:

- Option 1:
  - Preserve ATCT/TRACON (Parcels A & B)
  - Parcels A & B combined = 5.2 acres; need 6 levels to meet 31-acre requirement
- Option 2:
  - Relocate ATCT/TRACON
  - Maintain Existing Terminal Exit Roadway (Parcel C)
  - Parcel C: 8.7 acres; need 4 levels to meet 31-acre requirement
- Option 3:
  - Relocate ATCT/TRACON
  - Realign Terminal Exit Roadway (Parcel D)
  - Parcel D: 16.0 acres; need 2 levels to meet 31-acre requirement
  - Allows for a lower garage along with other development opportunities (hotel, etc.)

PREFERRED ALTERNATIVE

Option 2 was selected as the preferred public parking option, because:

- Passenger convenience and shorter walking distances
- Logical expansion of the parking garage once the ATCT and TRACON are relocated
- Location is intuitive to passengers
- Can accommodate a standard Ground Transportation Center on the ground floor

REFINED PREFERRED ALTERNATIVE

Option 2 was refined to reflect the terminal exit roadway shifted west. The terminal exit road was shifted west to enhance the terminal core area, which is the most valuable area on airport. The refined preferred parking garage option is depicted on **Figure 5.4-18**. Proposed roadway improvements are highlighted in yellow. Option 1A may be a potential first phase, as it avoids the ATCT/TRACON facilities.

Figure 5.4-18: Preferred Parking Garage Option

Source: WSP USA, 2021.

5.4.6 EMPLOYEE PARKING

SUMMARY OF FACILITY REQUIREMENTS (2040 HIGH FORECAST)

- Interim (Terminal C opening): need 7.2 acres total
- 2040: need 13.9 acres total

ALTERNATIVES

INTERIM

Employees park in the Purple Lot west of Terminal B. However, relocation of this lot is an enabling project for the construction of proposed Terminal C. An area approximately 7 acres is anticipated to be needed to accommodate relocated employee parking (approximately 940 spaces) upon the opening of Terminal C, and before a permanent employee parking site is provided. As shown on **Figure 5.4-19**, the Purple Lot is recommended to be temporarily relocated to Site 1, which is comprised of the Red Lot (approximately 3.6 acres), as well as a portion of the vacant land north of the Red Lot (3.6 acres). The Red Lot is used for overflow parking during peak travel periods, and therefore cannot also accommodate employee parking. Relocation will require busing of employees from the Red Lot location to the terminal. Currently employees can walk to the terminal from the Purple Lot.

LONG TERM

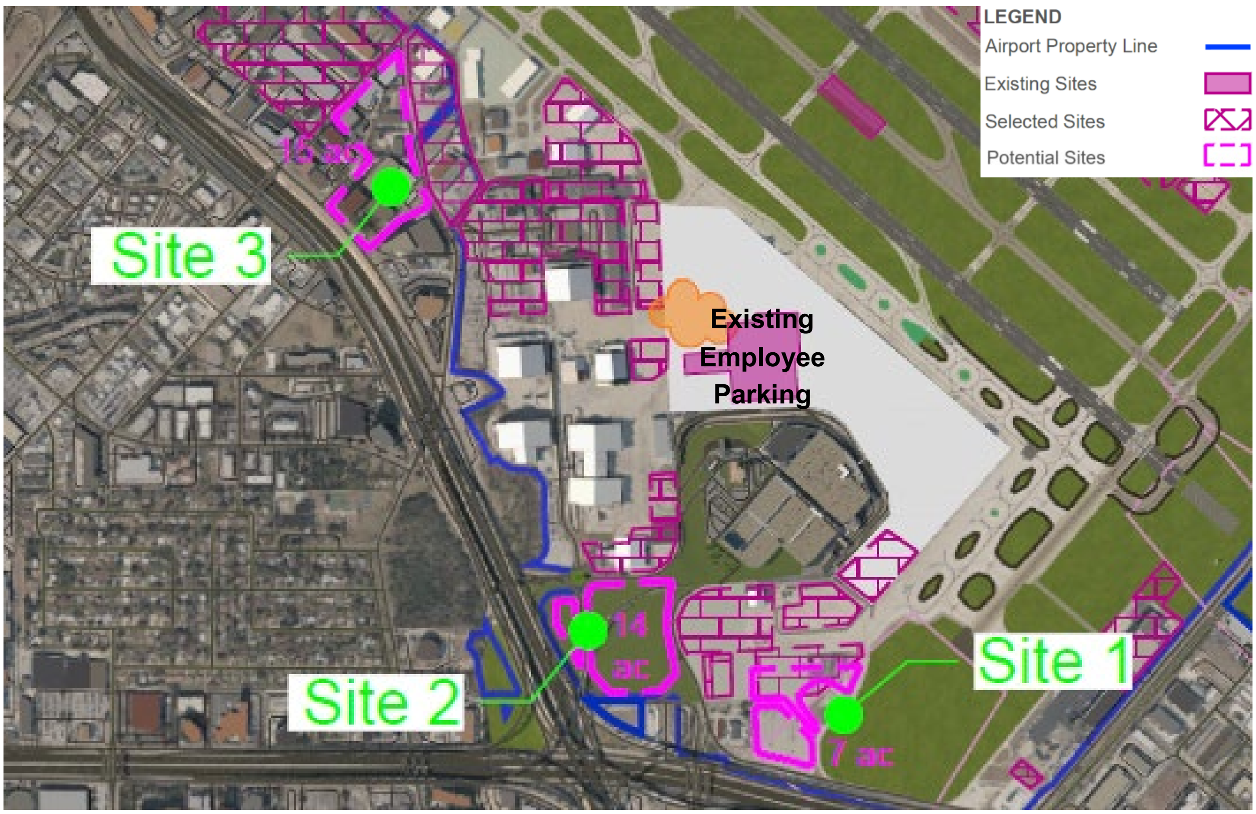
Two sites were identified for long-term employee parking (2040), as depicted on Figure 5.4-19.

- Site 2: South of Dee Howard Rd and west of Airport Boulevard (general area of existing Economy Lot)
- Site 3: Acquire land west of Jones Maltsberger Rd.

PREFERRED ALTERNATIVE

Each potential site was evaluated for factors such as proximity to terminal area (need for employee busing), landside access and site configuration. Site 3 was selected as the preferred site for the future long-term employee parking, as Site 2 would be better suited for higher and better uses.

Figure 5.4-19: Potential Employee Parking Relocation Sites



Source: WSP USA, 2021.

5.4.7 RENTAL CAR

SUMMARY OF FACILITY REQUIREMENTS (2040 HIGH FORECAST)

- Existing: 1,960 ready/return spaces
- Need 1,630 ready/return spaces

Rental car companies indicated that their facilities were built with growth in mind and that no additional space is needed.

5.4.8 TAXICAB AND TRANSPORTATIN NETWORK COMPANIES STAGING AREAS AND CELL PHONE WAITING LOT

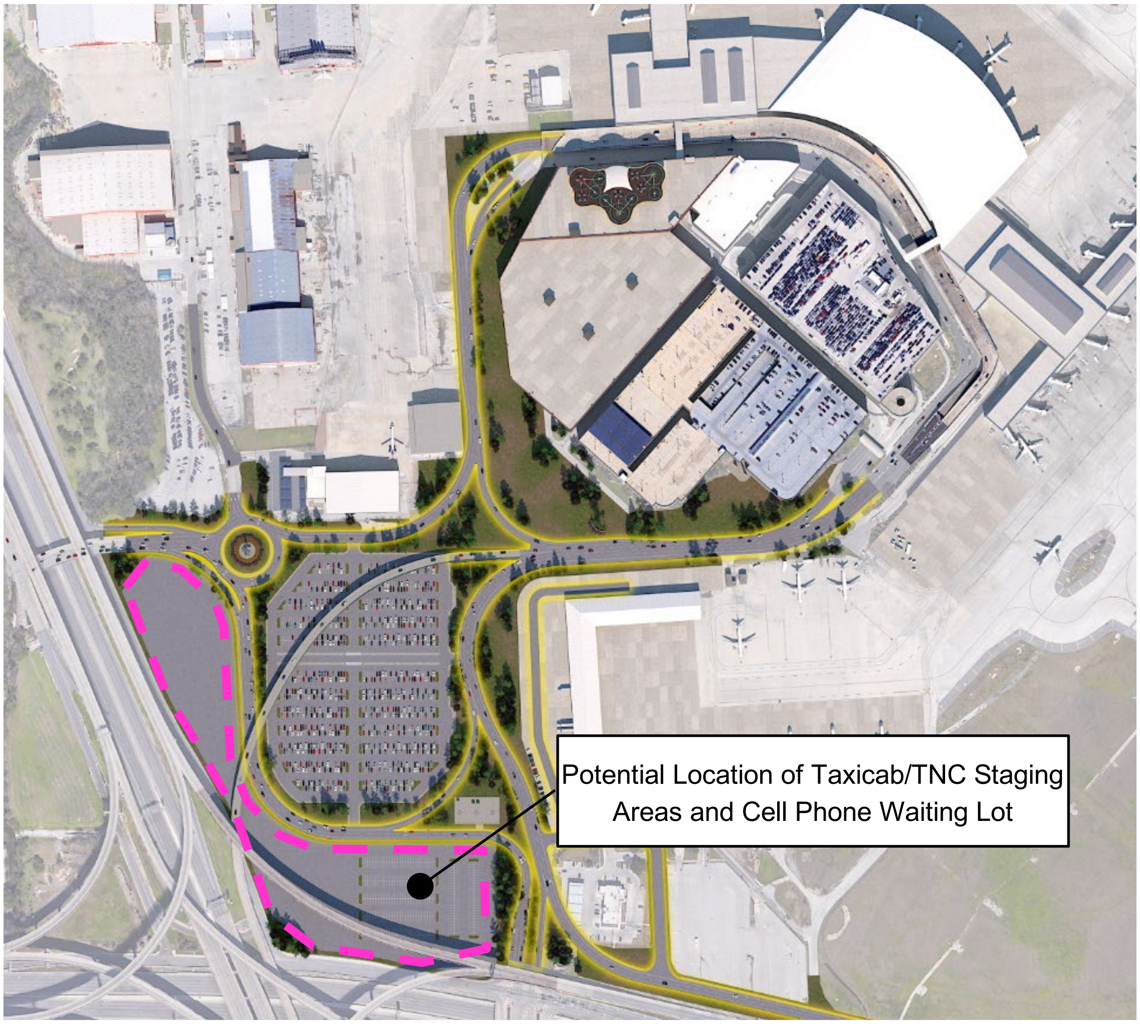
SUMMARY OF FACILITY REQUIREMENTS (2040 HIGH FORECAST)

- Taxicab staging: need 1.7 acres total
- Transportation network companies staging: need 3.7 acres total
- Cell phone waiting lot: need 0.8 acre total

ALTERNATIVES

The location of these lots/staging areas are not critical to the overall airport development plan. Individual areas are small, and may be in flexible locations. Based on the preferred roadway option, up to 10 acres are available along the west and south of the proposed Airport access, as depicted on **Figure 5.4-20**. Some land acquisition may be required for parcels located south of these roadways.

Figure 5.4-20: Potential Sites for Taxicab/Transportatoin Network Companies Staging Areas and Cell Phone Waiting Lot



Source: WSP USA, 2021.

5.4.9 AIRSIDE ACCESS GATE

Currently, the vehicle queue at the airside access gate occasionally backs up onto East Terminal Dr. The gate is anticipated to remain in its existing location with the proposed terminal expansion. Back-ups are anticipated to alleviate with the opening of the CRDF, as all concessions deliveries will go through the CRDF. Some non-concessions airside deliveries will still use the Access gate.

5.5 CARGO AND SUPPORT FACILITIES ALTERNATIVES

Cargo and support facilities alternatives are defined to identify and evaluate long-term development options that are complementary to the development of airfield and terminal area facilities.

The development of support facilities alternatives was based on tenant input, aviation activity forecasts and industry planning standards, and was sensitive to operational efficiency, aircraft fleet diversity, and flexibility to implement facilities in an incremental manner. Consideration was also given to expansion opportunities beyond the planning horizon. Multiple workshops were held with SAAS during the process.

While future support facility needs are quantitatively established in the master plan, it is important to note that there is a discretionary nature to some elements. Oftentimes, the decision to provide additional cargo, general aviation, or airline support facilities reflects tenant interests and business models.

5.5.1 PRIORITY LIST

Remaining developable land on SAT property is either airfield-facing or adjacent to the terminal, which are both considered prime real estate (i.e., there are no back lots or areas suitable for land uses that do not need airfield access). With such a constrained site, airport functions were prioritized and the best site for each function was selected in that order, rather than using the "highest and best use" approach. The priority order for the scarce SAT property is as follows:

1. Airfield (completed)
2. Terminal (completed)
3. Landside (completed)
4. Cargo
5. MRO
6. ARFF
7. General aviation (FBO, corporate)
8. All other support facilities:
    - ATCT (needed to support parking garage expansion)
    - RON (including deicing, wash rack)
    - Belly cargo
    - GSE/line maintenance
    - Airport maintenance and operations
    - Airport administration
    - Fuel storage
    - Central receiving and distribution facility (concessions logistics)

- Ground runup enclosure
- Isolation pad
- Waste disposal
- Compass rose

9. General aviation (single-engine piston <5,000 lbs.)

5.5.2 INTEGRATOR CARGO

SUMMARY OF REQUIREMENTS

Existing integrator cargo areas cover approximately 47 acres:

- 31 acres occupied by FedEx, UPS and WFS
- 16 acres available in East Cargo

The 2040 needs are as follows:

- Total of 76 acres for existing users
- Additional 10 acres for a new cargo entrant
- Additional 3 acres for multi-tenant cargo facility (50,000-square foot building)
- This results in a total of 89 acres for integrator cargo operations (or an additional 42 acres)

ALTERNATIVES

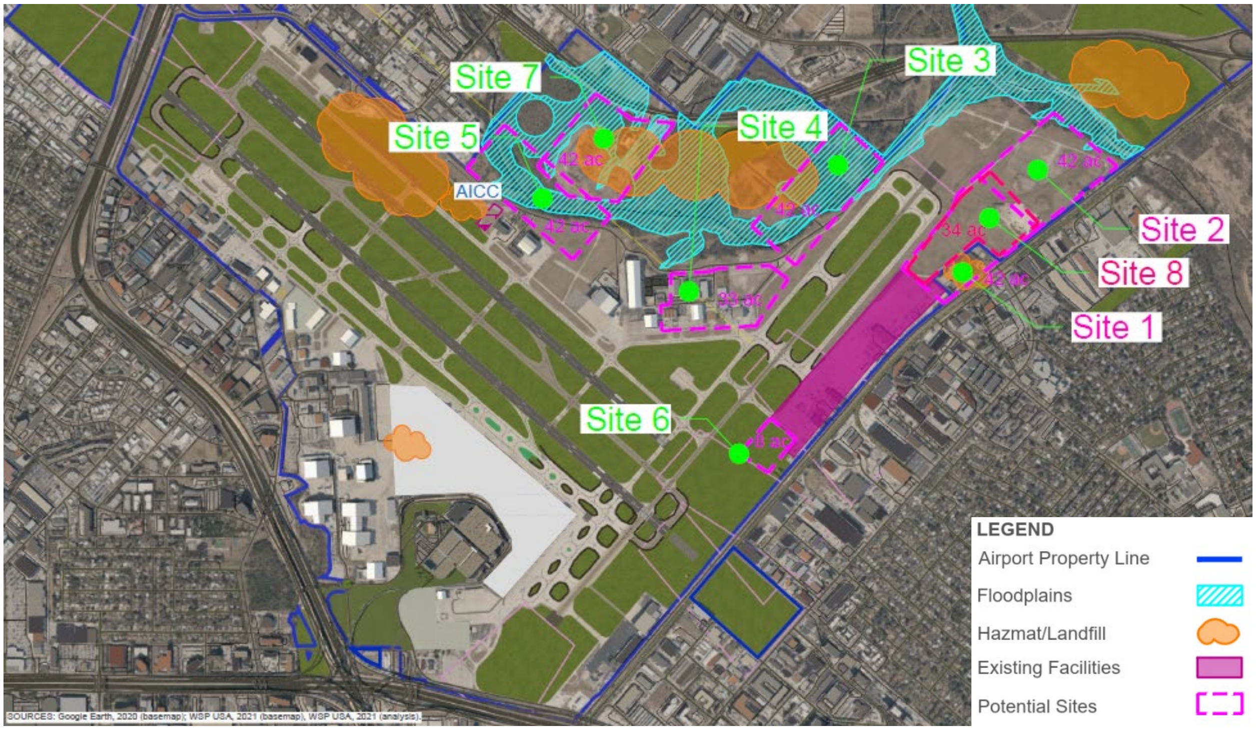
Eight sites were identified as potential integrator cargo expansion sites, as depicted on **Figure 5.5-1**.

PREFERRED ALTERNATIVE

Each potential site was evaluated for factors such as proximity to airfield, landside access, taxi times, terrain slopes, land acquisition, location on top of a landfill, location in a floodplain, planned developments, and aircraft tail penetration of existing and proposed airspace surfaces. Multiple workshops were held with SAAS during the process.

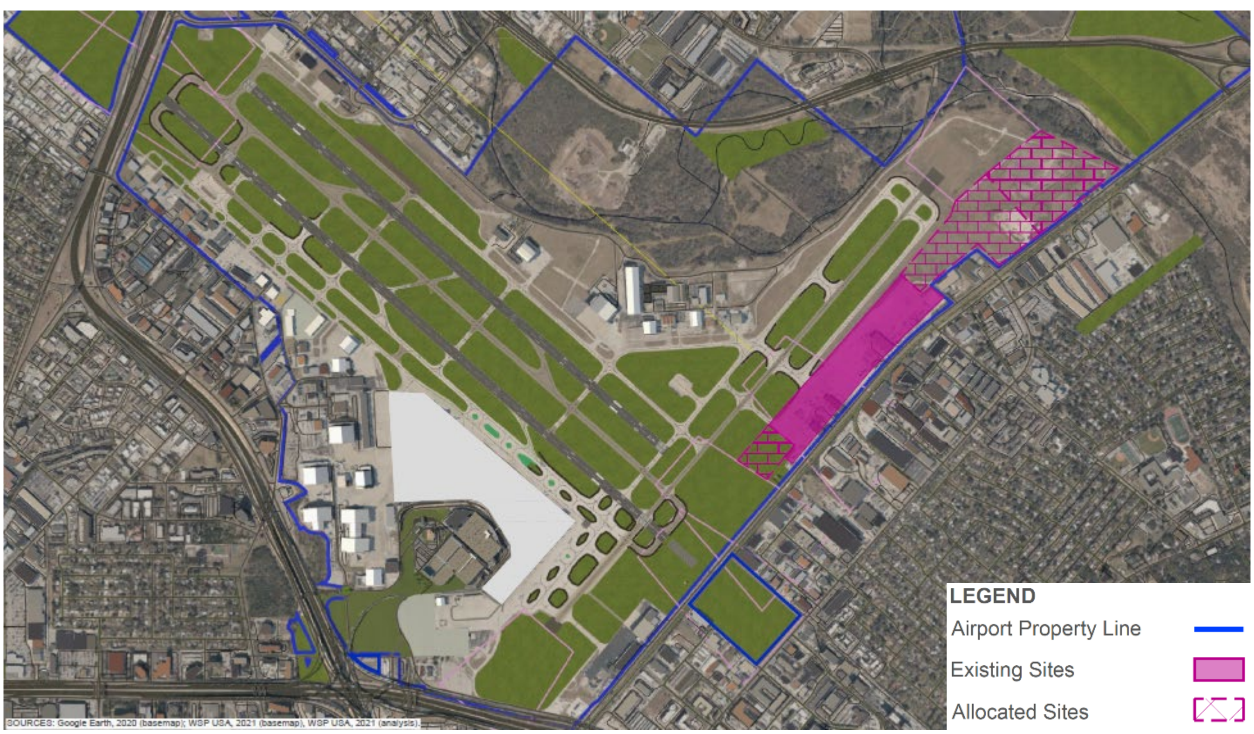
Sites 6 and 8 were selected as the preferred integrator cargo sites. Site 6 can meet an immediate need for additional cargo apron with minimal development. Site 8 is conveniently located adjacent to existing cargo facilities, has good landside access, and does not require land acquisition. Site 2, north of Site 8, was also identified as a strategic development area for integrator cargo (above and beyond the needs projected for SAT cargo), and as such, will be reserved and not be considered for other support facility needs. The preferred integrator cargo sites are depicted on **Figure 5.5-2**.

Figure 5.5-1: Potential Integrator Cargo Expansion Sites



Source: WSP USA, 2021.

Figure 5.5-2: Preferred Integrator Cargo Expansion Sites



Source: WSP USA, 2021.

5.5.3 AIRCRAFT MAINTENANCE, REPAIR AND OVERHAUL

SUMMARY OF REQUIREMENTS

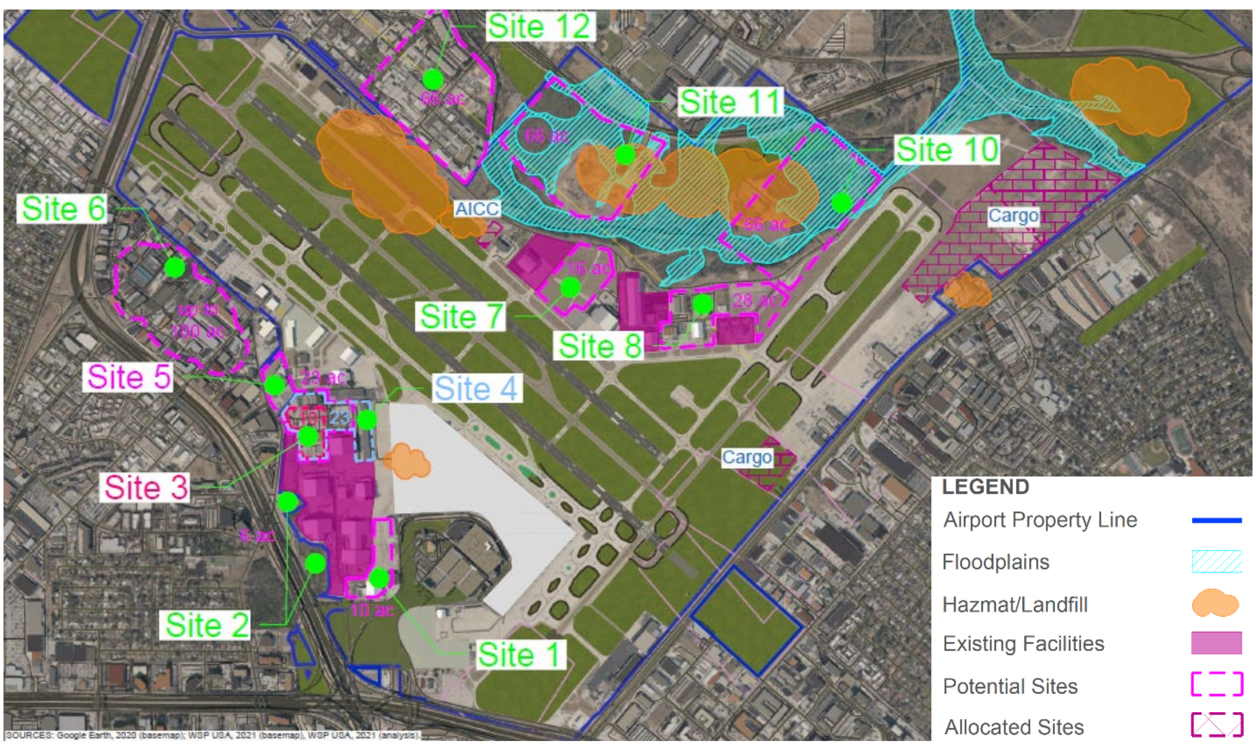
Existing aircraft MRO areas cover approximately 69 acres. Existing facilities are undersized. The 2040 needs are as follows:

- Existing tenants: 112 acres
  - VTSAA: need additional 20 acres
  - Other current MRO tenants: need additional 23 acres
- New entrant: 15 acres
- This results in a total of 127 acres for aircraft MRO operations (or an additional 58 acres)

ALTERNATIVES

Eleven sites were identified as potential MRO relocation/expansion sites, as depicted on **Figure 5.5-3**. Multiple workshops were held with SAAS during the process.

Figure 5.5-3: Potential MRO Expansion Sites



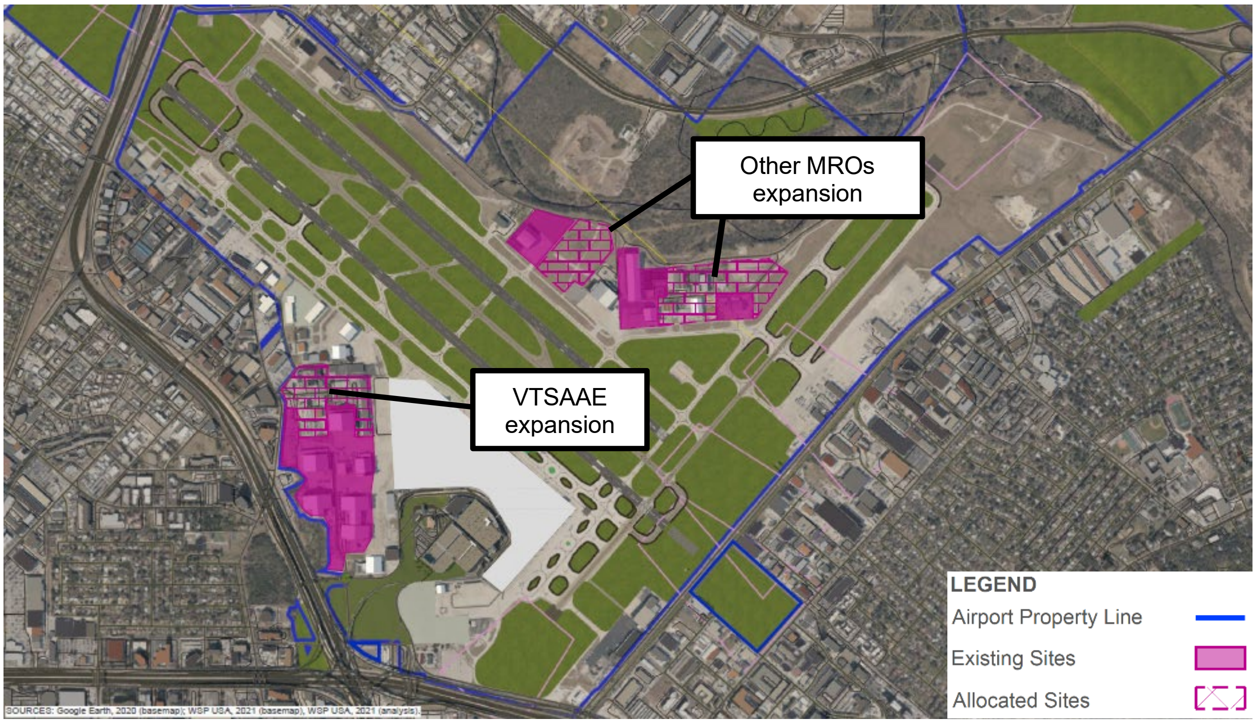
Source: WSP USA, 2021.

PREFERRED ALTERNATIVE

Each potential site was evaluated for factors such as proximity to existing MRO facilities, airfield access, expansion potential beyond the 20-year horizon, need for land acquisition, site configuration and terrain.

Site 4 was selected as the preferred expansion site for VTSAA, west of the terminal, as this site is contiguous to their existing facilities. Sites 7 and 8 were selected as the preferred expansion sites for other and potential new MRO tenants, as these sites are adjacent to existing MRO facilities. **Figure 5.5-4** depicts selected MRO expansion sites.

Figure 5.5-4: Preferred MRO Expansion Sites



Source: WSP USA, 2021.

5.5.4 *AIRCRAFT RESCUE AND FIRE FIGHTING*

SUMMARY OF REQUIREMENTS

Although the existing ARFF station meets requirements, its condition may require significant investment or replacement within the planning horizon. SAAS decided that replacement was preferred as it made the current ARFF site available for other uses.

PROPOSED RELOCATION SITE

To avoid challenges associated with construction of a new ARFF station on the existing site, a site slightly west of the existing ARFF station will be reserved for a new ARFF station, as depicted on **Figure 5.5-5**.

Figure 5.5-5: Preferred ARFF Relocation Site

Source: WSP USA, 2021.

5.5.5 FIXED BASE OPERATORS

SUMMARY OF REQUIREMENTS

Based on FBO input, approximately 22 more acres are required to accommodate FBO needs through 2040, for a total of 56 acres.

ALTERNATIVES

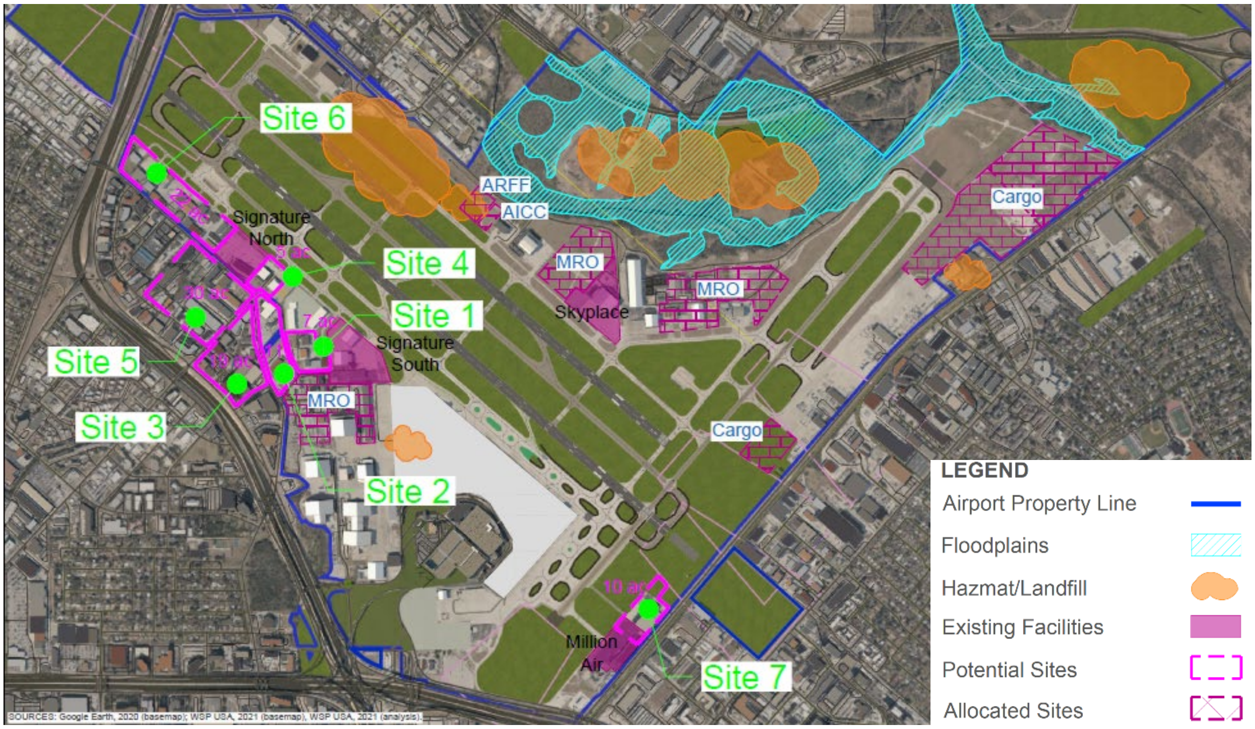
Seven sites were identified as potential FBO expansion sites, as depicted on **Figure 5.5-6**. The proposed expansion sites are adjacent to existing facilities, to promote consolidation. Some sites may require relocation of existing tenants or land acquisition.

PREFERRED ALTERNATIVES

Each potential site was evaluated for factors such as proximity to existing FBO facilities, need to relocate existing tenants, land acquisition, and site size.

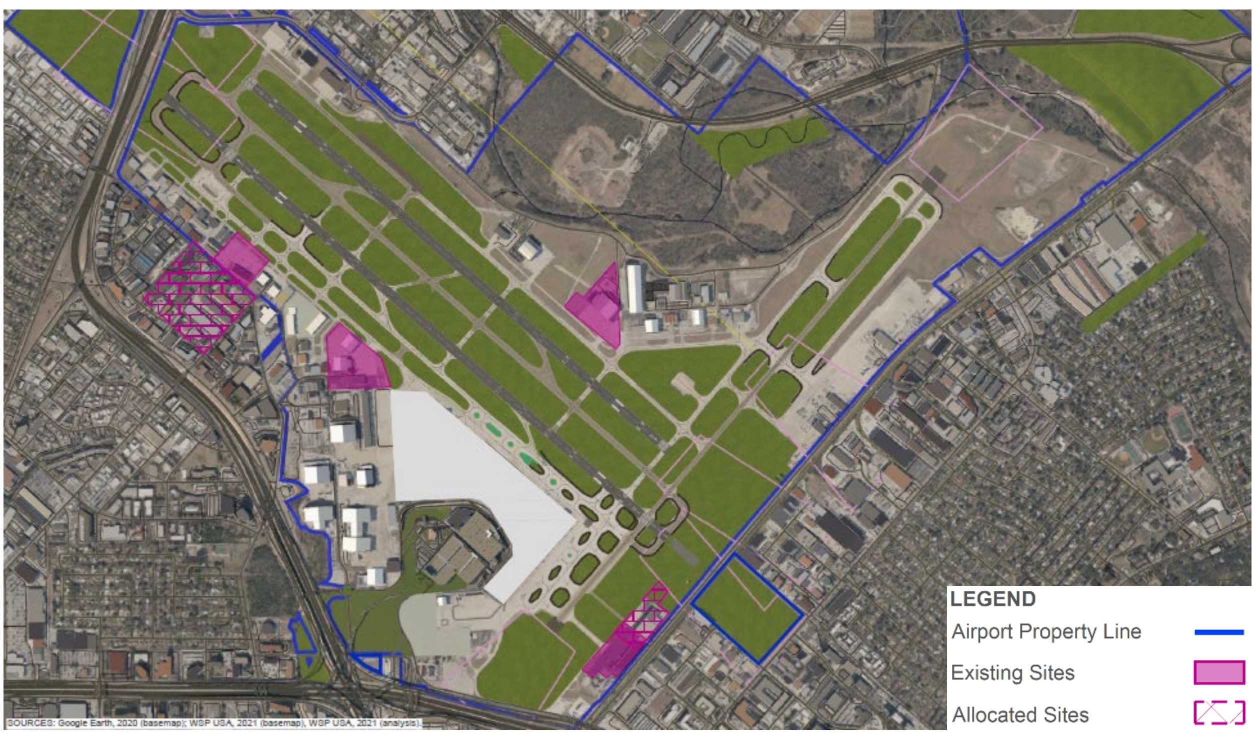
Sites 5 and 7 were selected as the preferred FBO expansion sites. Although Site 5 requires land acquisition, demolition of existing facilities and closure of a public road, it would allow consolidating the Signature North and South campuses into one, with enough room to grow through 2040. Site 7 would require relocating existing tenants but is adjacent to existing FBO facilities. The preferred FBO expansion sites are depicted on **Figure 5.5-7**. The existing Signature South campus would become available for other corporate hangar users.

Figure 5.5-6: Potential FBO Expansion Sites



Source: WSP USA, 2021.

Figure 5.5-7: Preferred FBO Expansion Sites



Source: WSP USA, 2021.

5.5.6 GENERAL AVIATION

SUMMARY OF REQUIREMENTS

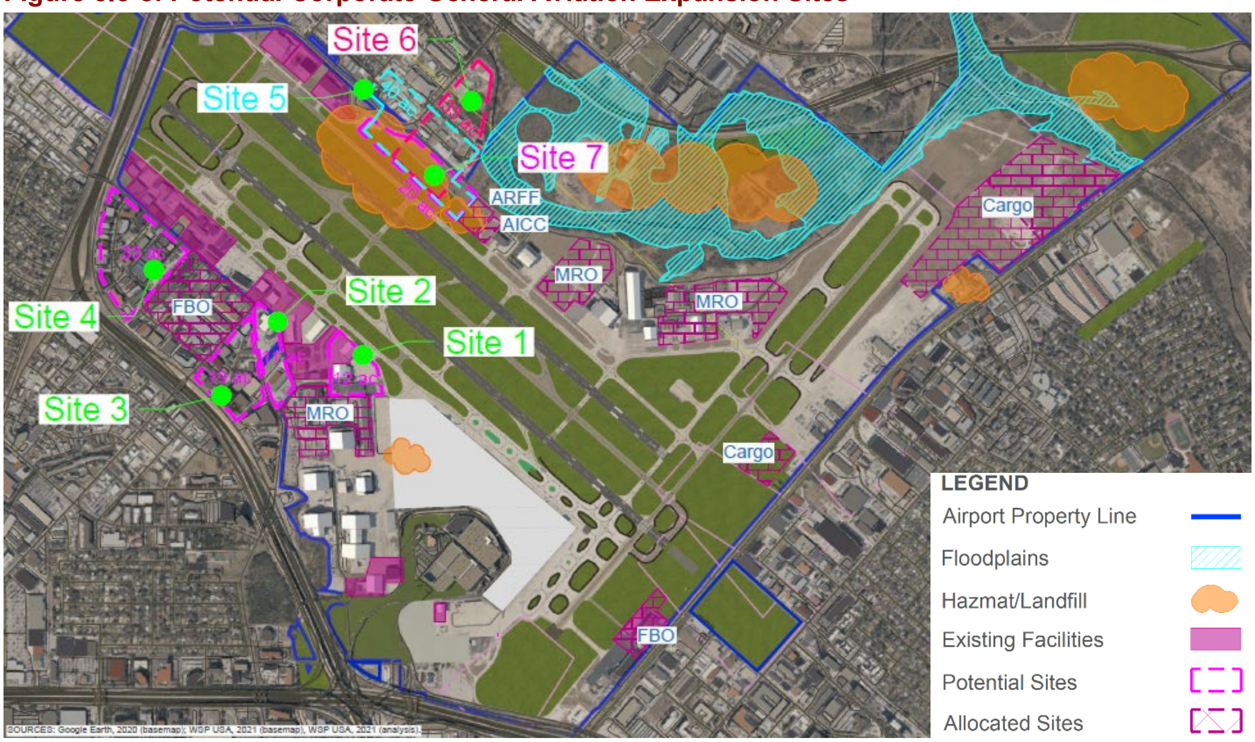
Based on tenant input, an additional 16 acres is required to accommodate corporate general aviation tenants through 2040, for a total of 71 acres:

- Existing Tenants: 62 acres
  - Existing tenants growth: +2 acres
  - Prospects/new entrants: +5 acres (up to five corporate hangars)
- Existing tenants relocation: +1 acre
- Existing tenant relocation to accommodate FBO expansion: +3 acres
- Existing tenant relocation to accommodate ATCT relocation: +5 acres

ALTERNATIVES

Seven sites were identified as potential corporate general aviation expansion sites, as depicted on **Figure 5.5-8**. Some sites may require land acquisition.

Figure 5.5-8: Potential Corporate General Aviation Expansion Sites



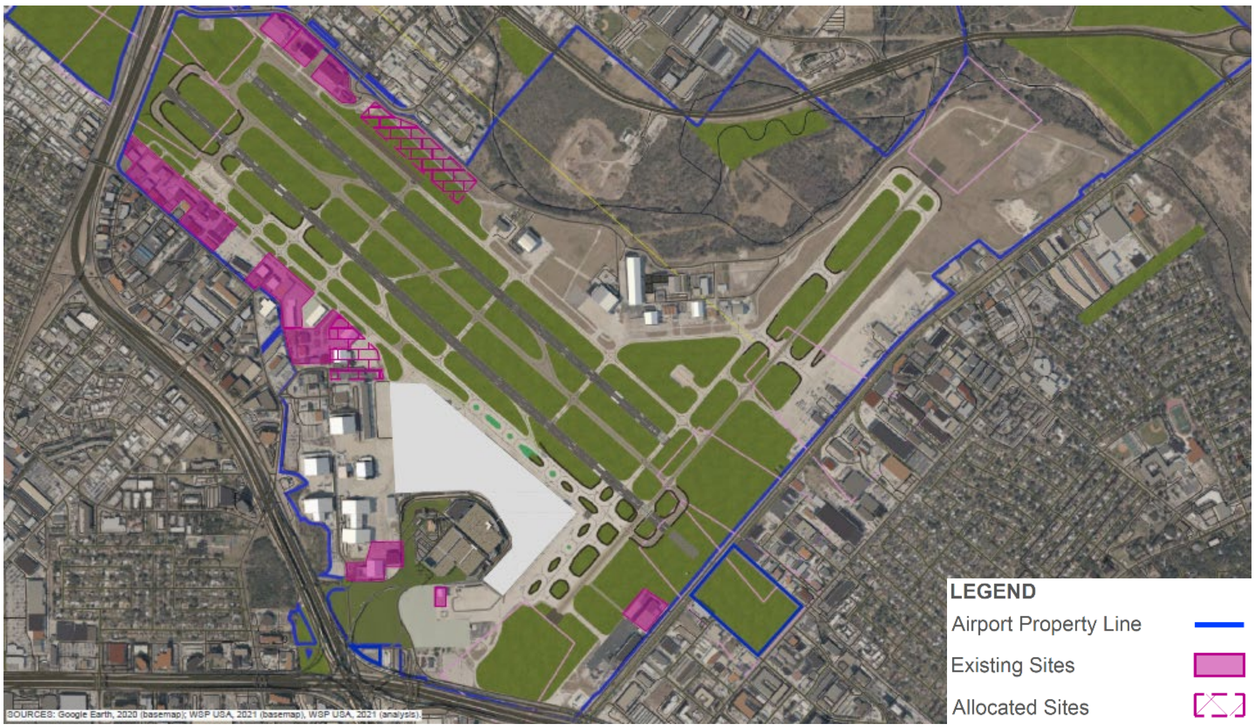
Source: WSP USA, 2021.

PREFERRED ALTERNATIVE

Each potential site was evaluated for factors such as proximity to airfield, proximity to other corporate hangars, land accessibility, land acquisition, landfill concerns, drainage concerns, potential for additional growth and need for internal taxilanes.

Sites 1 (12 acres) and 7 (20 acres) were selected as the preferred corporate general aviation expansion sites. Site 1 is currently occupied by an FBO, and the facilities may become available upon the FBO's consolidation in another location. Site 7 would be a greenfield site located on airport property. The preferred corporate general aviation expansion sites are depicted on **Figure 5.5-9**.

Figure 5.5-9: Preferred Corporate General Aviation Expansion Sites



Source: WSP USA, 2021.

5.5.7 AIR TRAFFIC CONTROL TOWER

SUMMARY OF REQUIREMENTS

Based on input from SAT ATCT staff, the existing ATCT/TRACON facility meets needs through 2040. However, the prior master plan recommended its relocation. SAAS conducted AFTIL assessment of several relocation sites and the preferred site is on the 2017 ALP. The current ATCT/TRACON location is across from the future passenger Terminal C, in the center of the otherwise-available area for expanding parking. It is recommended to relocate the ATCT/TRACON facilities to allow for the construction of additional parking garages by 2040 (note that the first phase of the garage does not require ATCT/TRACON relocation).

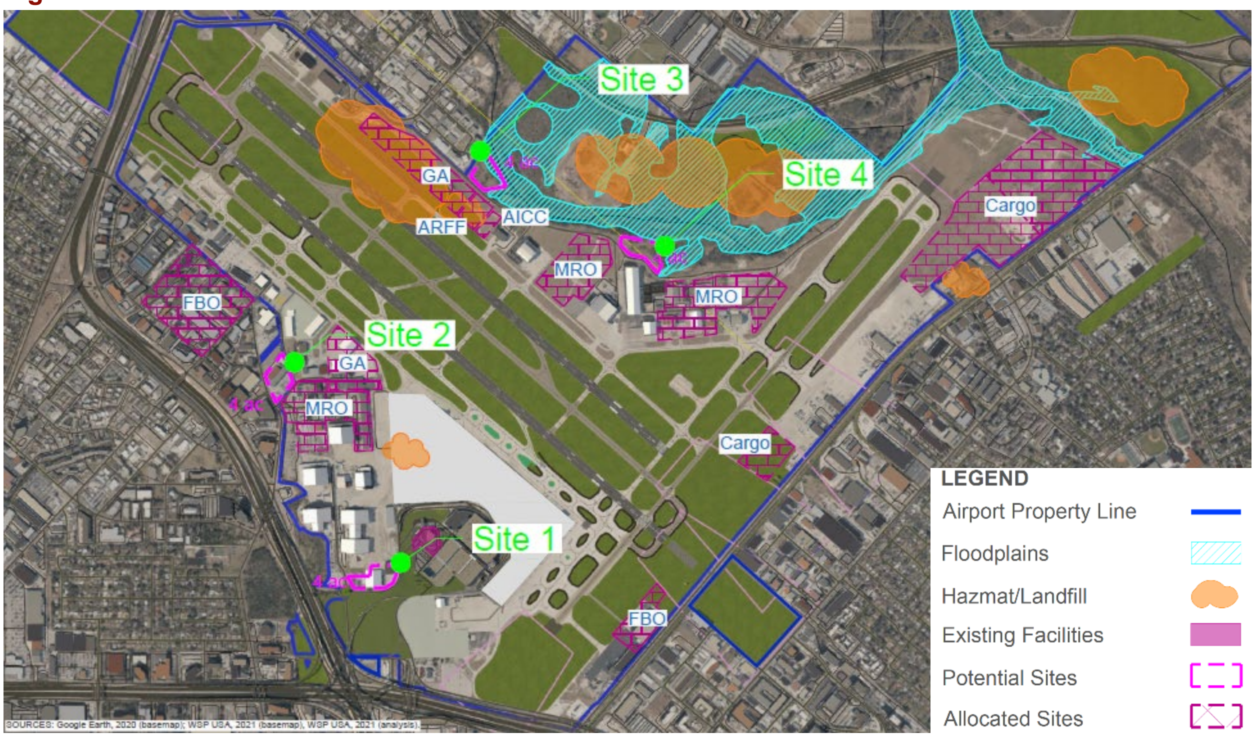
ALTERNATIVES

Four sites were identified as potential ATCT/TRACON relocation sites, as depicted on **Figure 5.5-10**. Some sites may require land acquisition.

Another alternative would be to install a remote control tower. Benefits of a remote control tower would be lower construction cost and space savings. Remote control towers consist of a multitude of cameras installed throughout the airport property. Remote control towers are not quite yet a feasible option in the United States (several pilot locations under testing) and should be considered at the time of the relocation of the ATCT. TRACON facilities would still need to be relocated, although an off-airport location would also be suitable.

For the purposes of long-term planning, the more site-restrictive version of an ATCT (physical building with controllers on site) was assumed.

Figure 5.5-10: Potential ATCT/TRACON Relocation Sites



Source: WSP USA, 2021.

PREFERRED ALTERNATIVE

Each potential site was evaluated for factors such as anticipated line of sight concerns, sun impacts, proximity to the terminal area, relocation of existing facilities and land acquisition. Site 1 was selected as the preferred ATCT/TRACON relocation site, as depicted on **Figure 5.5-11**. It is close to the terminal area, on a site previously identified as suitable (per study mentioned in 2017 SAT Master Plan), and would not require controllers to look into the sun.

Figure 5.5-11: Preferred ATCT/TRACON Relocation Site

Source: WSP USA, 2021.

5.5.8 REMAIN OVERNIGHT/HARDSTAND PARKING POSITIONS

SUMMARY OF REQUIREMENTS

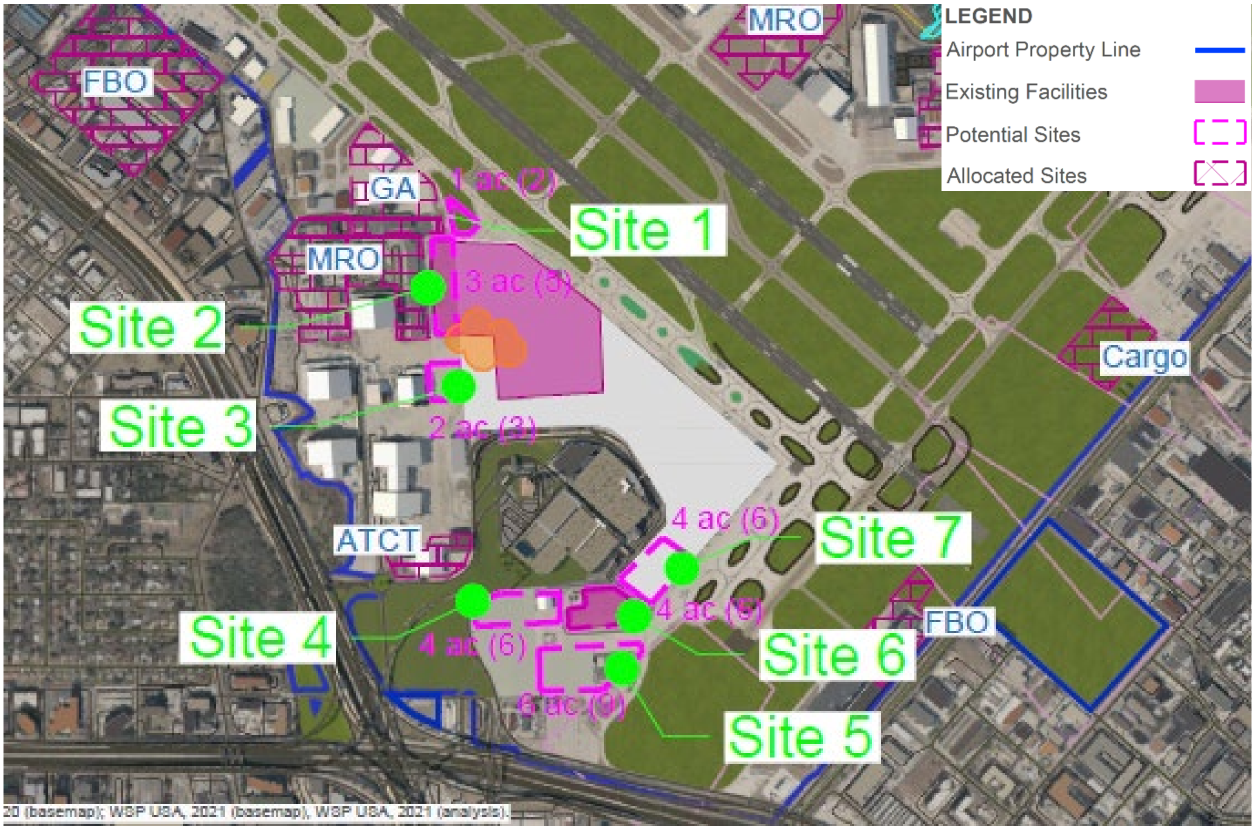
The facility requirements project a need for 12 RON positions. Based on subsequent SAAS input, 18 RON/hardstand parking positions are required in 2040, in addition to the 37 planned at-gate positions. This corresponds to approximately 12 acres for RON/hardstand parking.

ALTERNATIVES

Seven sites in the vicinity of the terminal complex were identified for future RON/hardstand parking, as depicted on **Figure 5.5-12**. The existing 22 RON/hardstand parking positions west of Terminal B are in the footprint of the proposed Terminal C and need to be replaced. Some RON/hardstand positions will be unusable during the Terminal C construction, and can be relocated to the southwest of Terminal A, on the site of the former Nayak building. A combination of sites is required to meet the required acreage. Multiple workshops were held with SAAS during the process.

Sites around the terminal complex are preferred as they are close to airline gates. These positions are expected to serve primarily passenger airlines with a small number needed by VT SAA (MRO tenant).

Figure 5.5-12: Potential RON/Hardstand Parking Relocation Sites



Source: WSP USA, 2021.

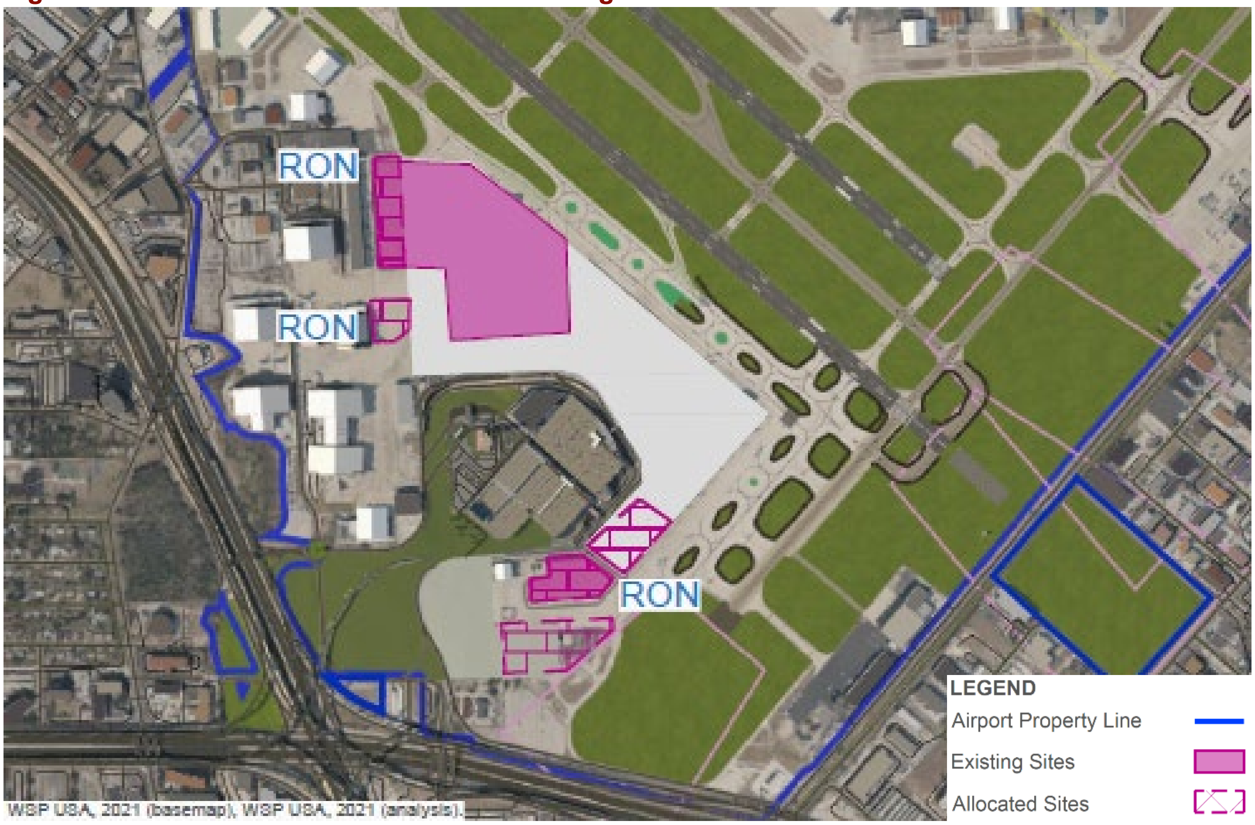
PREFERRED ALTERNATIVE

Each potential site was evaluated for factors such as distance to the terminal and size/parking flexibility.

To meet the SAAS-projected requirements, Sites 3, 5 and 7 were retained for RON/hardstand parking, in addition to existing Sites 2 and 6, as depicted on **Figure 5.5-13**. A portion of Site 7 would not be available until the south end of the new Concourse A is built.

Additionally, deicing and airline wash rack facilities are recommended to be designed into the RON/hardstand parking positions located southwest of Terminal A.

Figure 5.5-13: Preferred RON/Hardstand Parking Sites



Source: WSP USA, 2021.

5.5.9 BELLY CARGO

SUMMARY OF REQUIREMENTS

The existing belly cargo facilities are comprised of approximately 0.8 acres in the West Cargo Building (which also houses other uses). The 2040 projected needs are approximately 1.3 acres.

ALTERNATIVES

Two sites for future belly cargo facilities were identified, one on the site of Hangar 4 (west of the ATCT), and one northwest of the existing Red Lot (auto parking), along Northern Boulevard, as depicted on **Figure 5.5-14**.

PREFERRED ALTERNATIVE

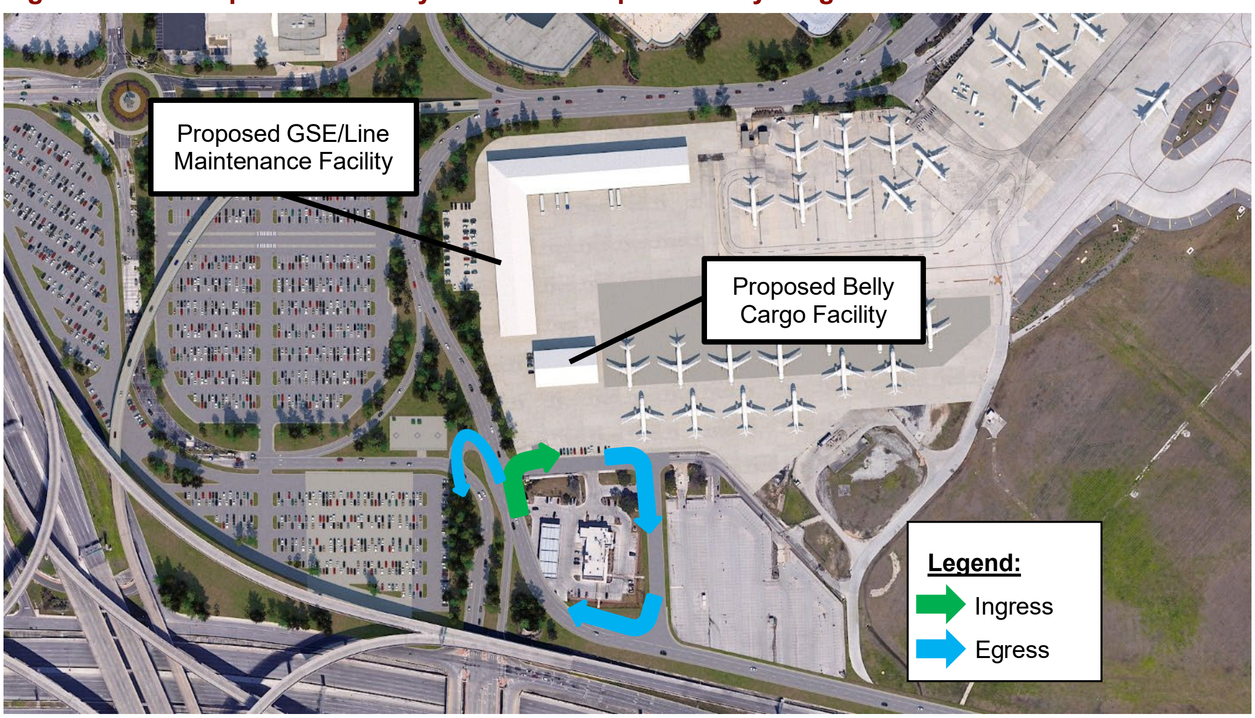
Each potential site was evaluated for factors such as proximity to terminal area, landside access and site configuration. Site 2 was selected as the preferred site for the future belly cargo facility. Site 2 has greater expansion potential and site layout flexibility.

Figure 5.5-14: Potential Belly Cargo Relocation Sites

Source: WSP USA, 2021.

Figure 5.5-15 illustrates the proposed access road to/from the proposed belly cargo facilities.

Figure 5.5-15: Proposed Roadway Access to Proposed Belly Cargo Facilities



Source: WSP USA, 2021.

Trucks departing the Belly Cargo facility would head south on a new road (over the existing cell phone lot), enter the new Loop 410 entrance road, merge across two lanes of traffic (low volume road), and turn left onto the old Airport Boulevard southbound, and exit the Airport area. This access road would also accommodate traffic to/from the proposed GSE and line maintenance facilities discussed in Section 5.5.10.

5.5.10 GROUND SUPPORT EQUIPMENT AND LINE MAINTENANCE

SUMMARY OF REQUIREMENTS

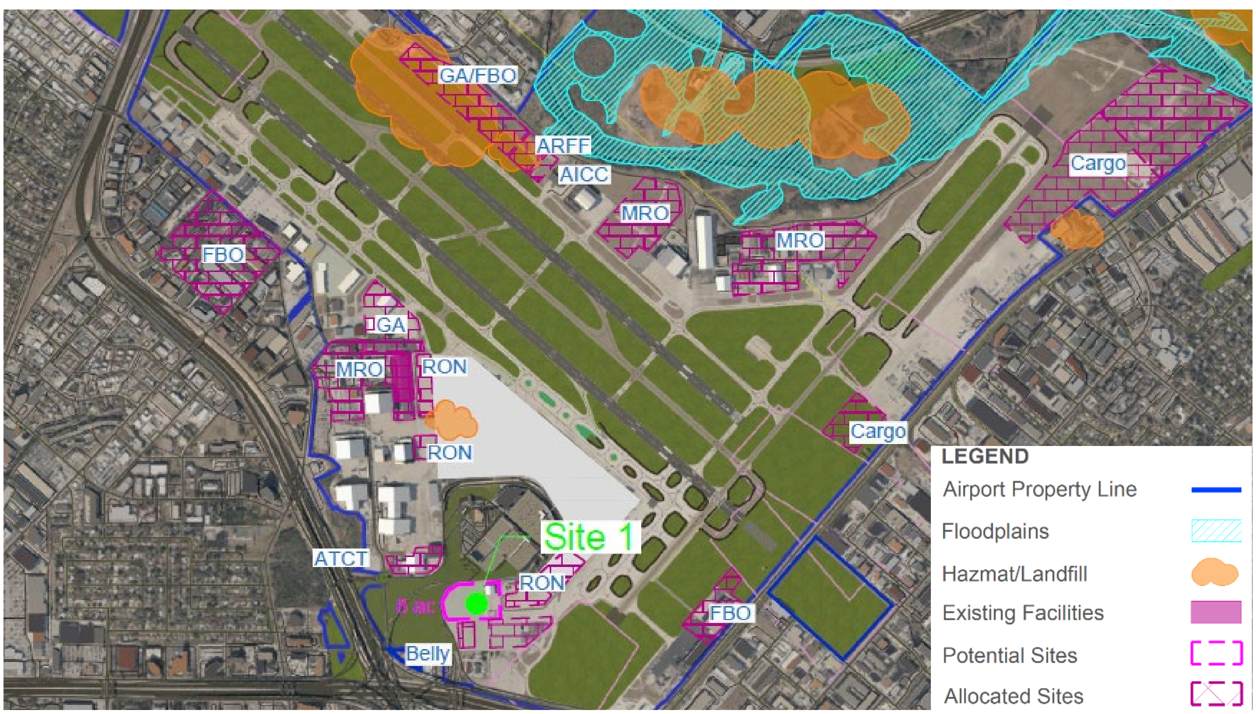
The existing GSE and line maintenance facilities are comprised of approximately 3 acres in the West Cargo Building. Existing facilities are undersized. The 2040 calculated needs are approximately 8 acres.

ALTERNATIVES

One site was identified for the GSE and line maintenance facility that meets siting criteria (proximity to terminal area, landside access, site size and configuration). The site is located southwest of Terminal A, as depicted on **Figure 5.5-16**. This site would allow a combination of belly cargo and GSE maintenance to occupy the same building complex, similar to the current situation in the West Cargo area. Note that SAAS is concerned about the aesthetics of the entrance road and design of the buildings and landscaping will need to consider making the complex as attractive as feasible.

Proposed landside access is depicted on Figure 5.5-15.

Figure 5.5-16: Preferred Ground Support Equipment and Line Maintenance Relocation Site



Source: WSP USA, 2021.

5.5.11 AIRPORT MAINTENANCE AND OPERATIONS

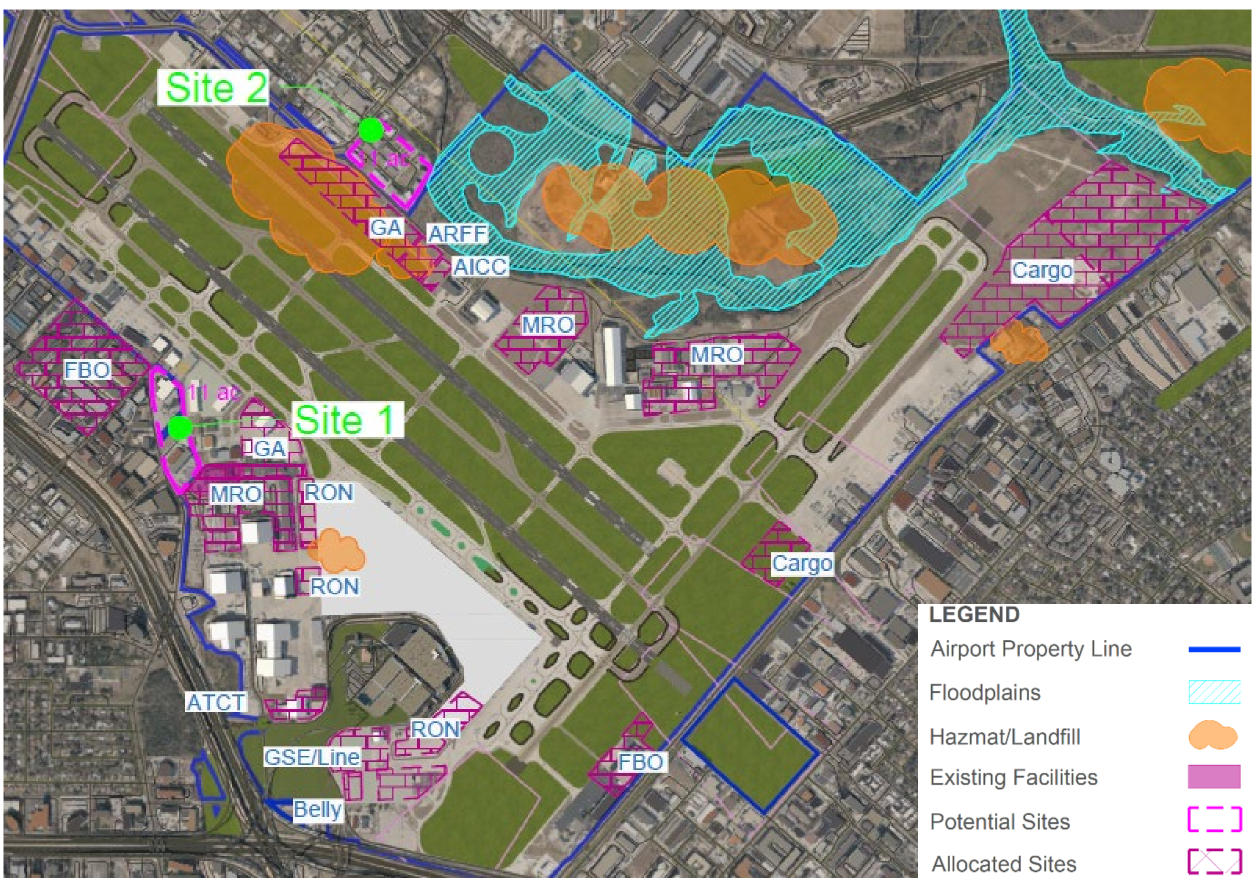
SUMMARY OF REQUIREMENTS

Airport maintenance (both airfield and facilities) and operations facilities are spread out across the airport. There would be benefit in consolidating into one or two locations. Before the VTSAA MRO can expand onto the existing Airport Maintenance Yard, a consolidated Airport Maintenance facility would need to be built. Calculated facility requirements based on industry standards and activity projections called for 10 acres for Airfield Maintenance/Operations in 2040, and 6 acres for Facilities Maintenance in 2040. During several support facilities workshops, SAAS staff indicated that calculated facility requirements were overstated, and that a site approximately 8 acres, with a two-story building for office and auto shop, was deemed adequate to house all Airfield and Facilities Maintenance functions, as well as Airfield Operations. Covered outdoor equipment storage would also be provided on the new site. A satellite location inside the terminal would also accommodate some Facilities Maintenance functions.

ALTERNATIVES

Two sites were identified as potential Airport Maintenance and Operations relocation/expansion sites, as depicted on **Figure 5.5-17**.

Figure 5.5-17: Potential Airport Maintenance and Operations Relocation Sites



Source: WSP USA, 2021.

PREFERRED ALTERNATIVE

Each potential site was evaluated for factors such as proximity to terminal area, airfield access and site configuration. Site 2 (11 acres) is located north of the Airport, off-Airport, and across a public road. Site 1 (11 acres) is also off-airport and in an area previously considered for acquisition. Site 1 was selected as the preferred site for the future Airport Maintenance and Operations facility.

5.5.12 AIRPORT ADMINISTRATION

Airport Administration office space needs will be met through leasing office space in the vicinity of the Airport. A nearby location is to be determined based on available space. Airport Badging and Police/Security functions would also be housed in the Airport Administration Building, with a satellite location for Airport Police/Security in the terminal.

5.5.13 AIRPORT POLICE AND SECURITY

Airport Badging and Police/Security functions would be housed in the Airport Administration Building, with a satellite location for Airport Police/Security in the terminal.

TSA and CBP requirements are included in the terminal program requirements.

5.5.14 CENTRAL RECEIVING AND DISTRIBUTION FACILITY

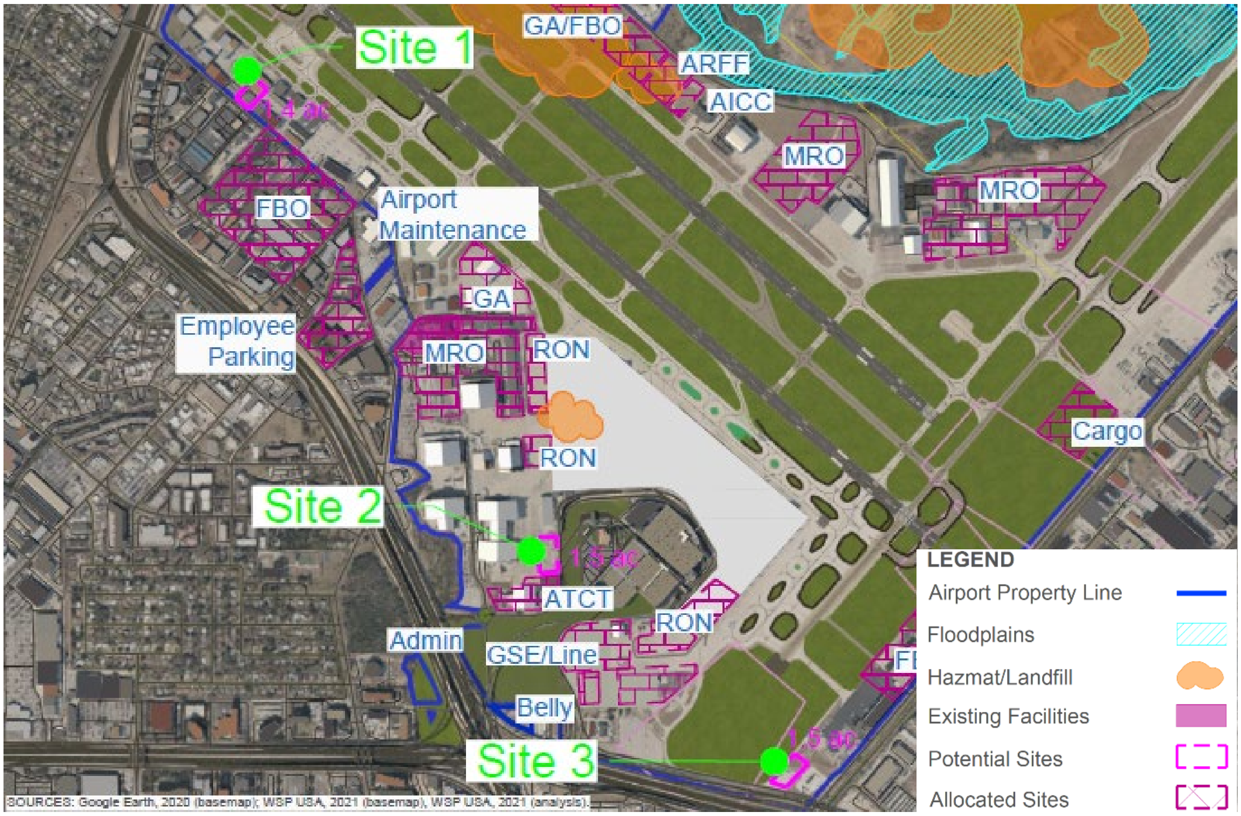
SUMMARY OF REQUIREMENTS

A site approximately 1.5 acres in size would be adequate to accommodate a 25,000-square foot Central Receiving and Distribution Facility.

ALTERNATIVES

Three sites were identified as potential Central Receiving and Distribution Facility sites, as depicted on **Figure 5.5-18**.

Figure 5.5-18: Potential Central Receiving and Distribution Facility Sites



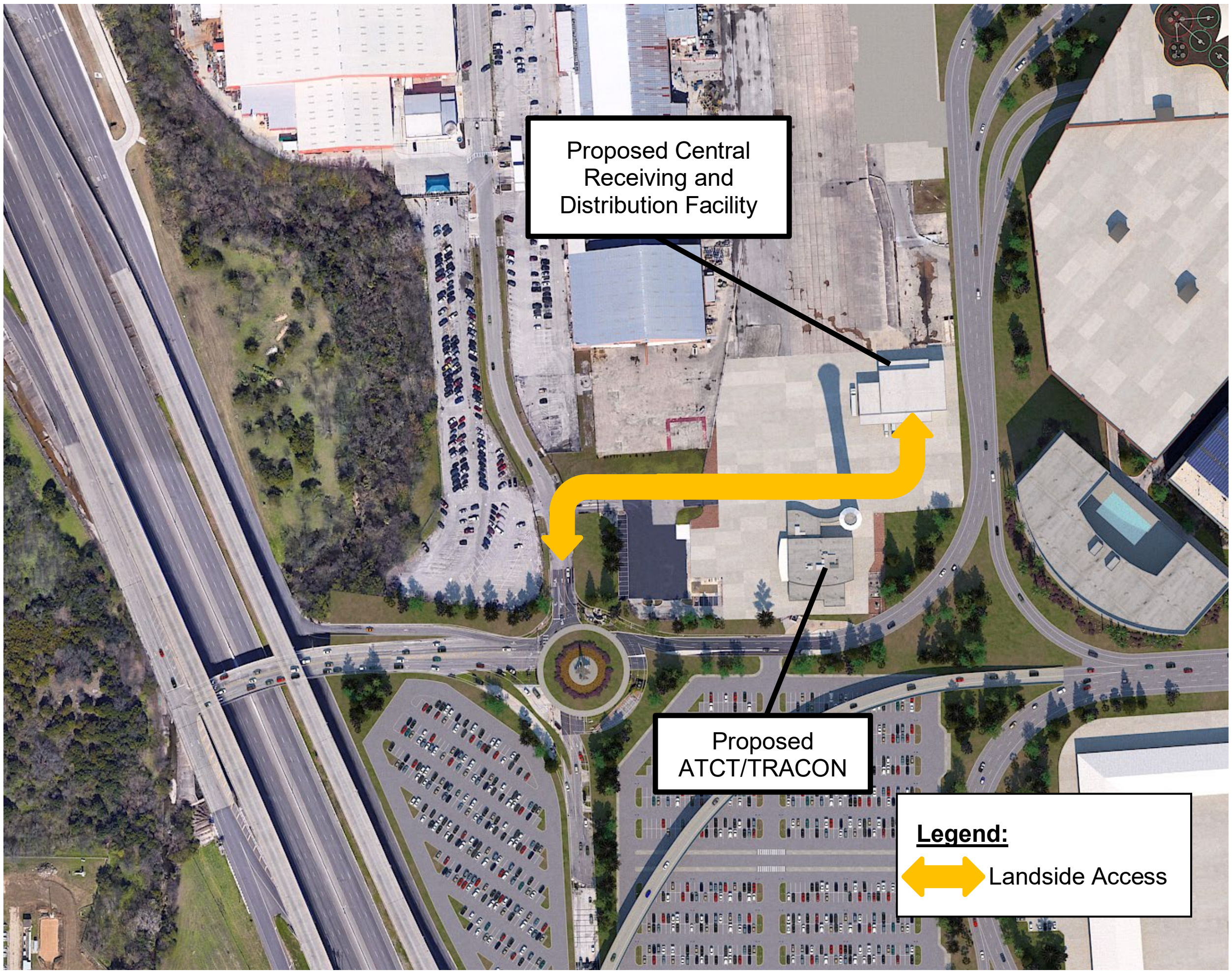
Source: WSP USA, 2021.

PREFERRED ALTERNATIVE

Each potential site was evaluated for factors such as proximity to terminal area, landside access suitable for large truck deliveries, airside access for deliveries to the terminal, and site configuration. Site 2 was selected as the preferred site for the future Central Receiving and Distribution Facility.

Figure 5.5-19 depicts the preferred site and highlights the proposed landside access from John Saunders Road.

Figure 5.5-19: Preferred Central Receiving and Distribution Facility



Source: WSP USA, 2021.

5.5.15 GROUND RUNUP ENCLOSURE

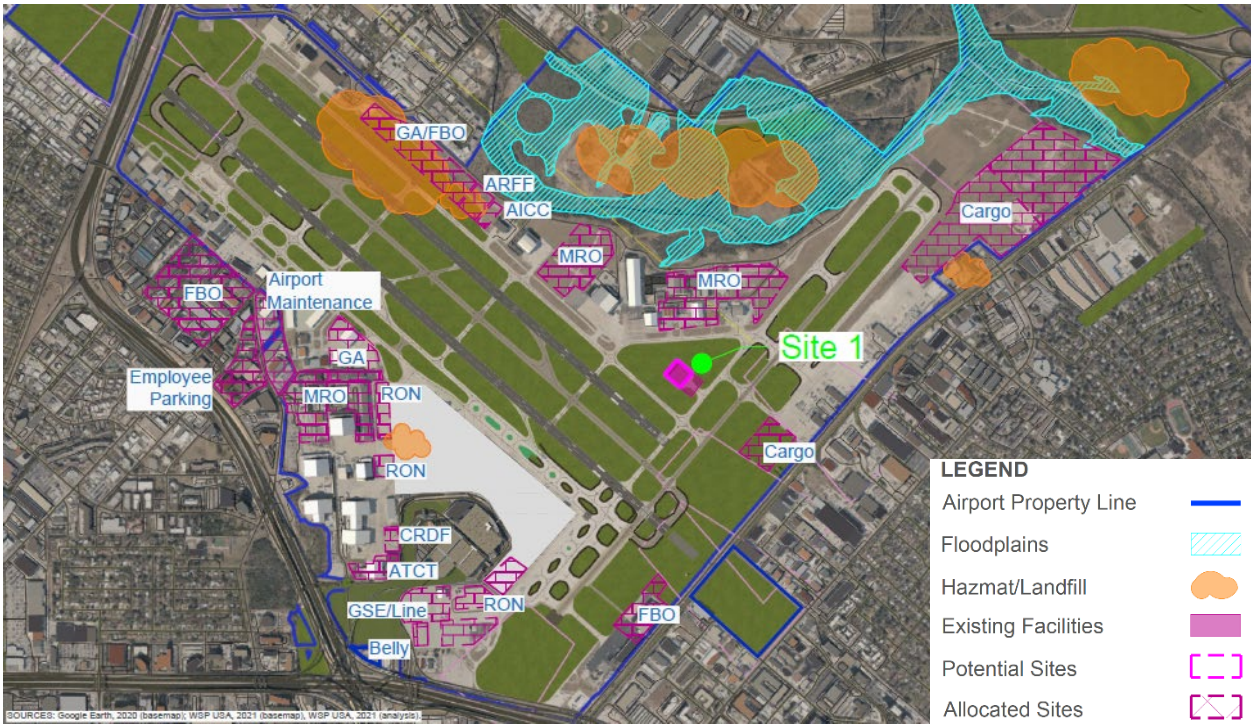
SUMMARY OF REQUIREMENTS

The Ground Runup Enclosure may need to be expanded to accommodate the Boeing 747-8 aircraft (enclosure size would be a minimum of 290 feet by 310 feet).

ALTERNATIVES

The existing location of the GRE was identified as the most suitable location for an expanded facility, as depicted on **Figure 5.5-20**. To avoid impacts to the existing RTR antenna located northeast of the GRE, the GRE expansion is proposed to be toward the southwest.

Figure 5.5-20: Potential Ground Runup Enclosure Expansion Sites



Source: WSP USA, 2021.

5.5.16 ISOLATION PAD

SUMMARY OF REQUIREMENTS

The isolation pad should be located at least 330 feet from structures, and there should not be any utilities under the pad.

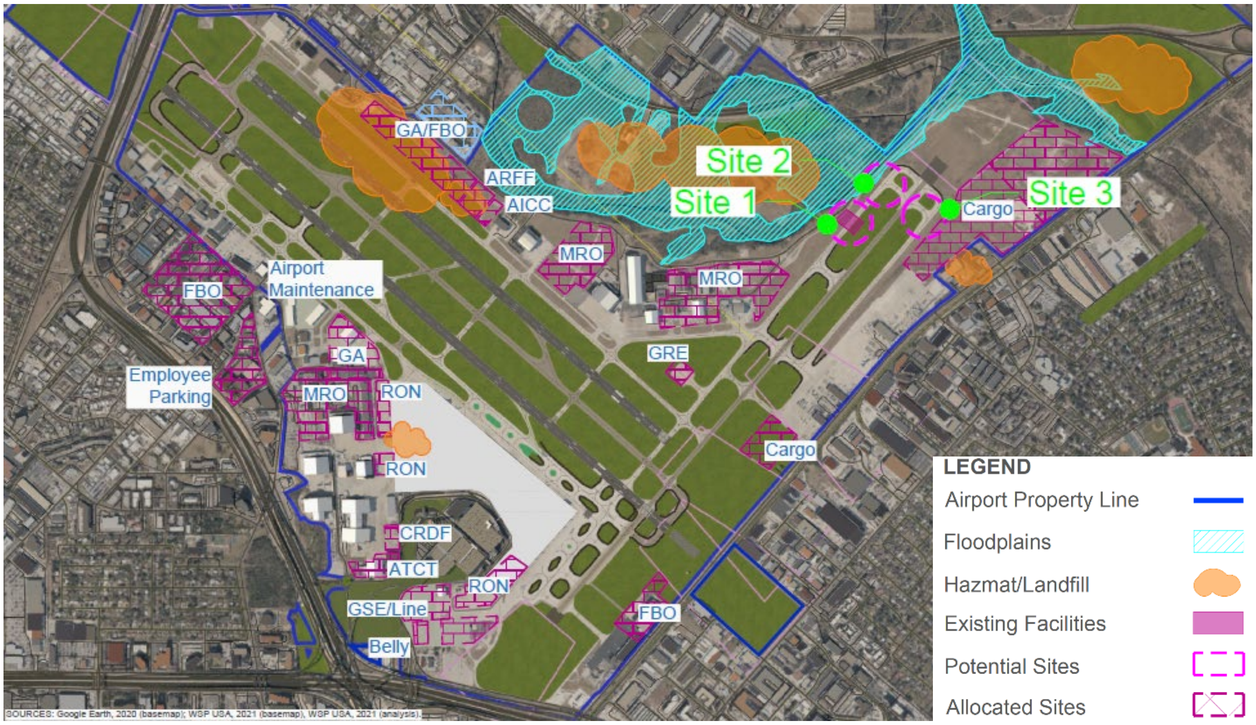
ALTERNATIVES

Three sites were identified that met the siting criteria, as depicted on **Figure 5.5-21**.

PREFERRED ALTERNATIVE

The existing location, Site 1, was deemed to remain the preferred site for the isolation pad.

Figure 5.5-21: Potential Isolation Pad Relocation Sites



Source: WSP USA, 2021.

5.5.17 TERMINAL WASTE DISPOSAL

SUMMARY OF REQUIREMENTS

Existing triturator and trash compactor facilities can remain in their existing location. However, additional triturator and trash compactor facilities will be required upon the completion of the new Terminal C.

ALTERNATIVES

A location west of the proposed Terminal C (Site 1, as depicted on **Figure 5.5-22**) was selected as the preferred site of future triturator and trash compactor facilities, due its proximity to the proposed terminal.

5.5.18 FUEL STORAGE

SUMMARY OF REQUIREMENTS

In additional to installing a hydrant fueling system under the terminal apron, an additional fuel storage tank (420,000 gallons) is anticipated to be required by 2040. With a hydrant system, there is no longer the need to park fuel delivery trucks, but an adequately-sized fuel controls building is required.

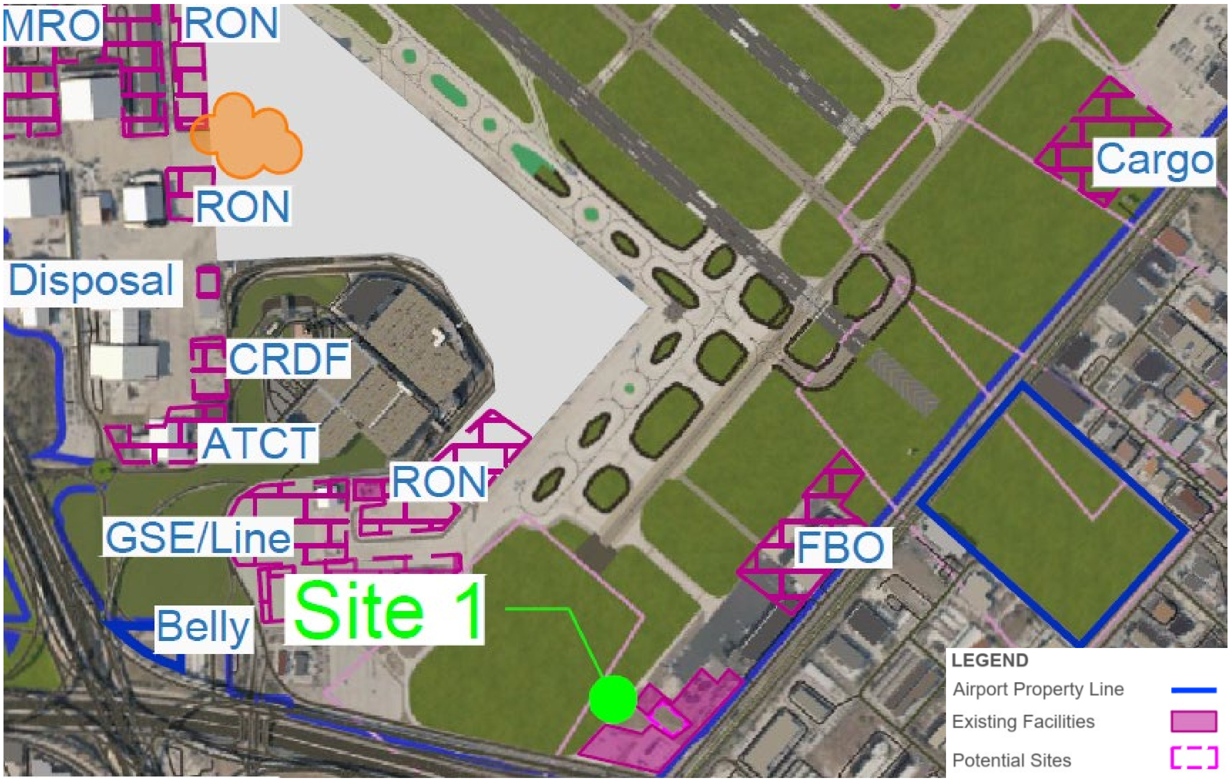
Figure 5.5-22: Potential Additional Terminal Waste Disposal Facilities Sites

Source: WSP USA, 2021.

ALTERNATIVES

The existing fuel farm site has adequate room for expansion. A third fuel storage tank could be installed southwest of the existing two tanks, as shown on **Figure 5.5-23**. The hydrant system fuel controls building would be in the vicinity of the fuel storage tanks.

Figure 5.5-23: Potential Fuel Storage Expansion Site



Source: WSP USA, 2021.

5.5.19 COMPASS ROSE

SUMMARY OF REQUIREMENTS

The compass rose (also referred to as compass calibration pad) will be relocated as part of the *Taxiway A Closure* project, which will mitigate runway crossings in the high-energy areas of Runway 13R-31L and 13L-31R.

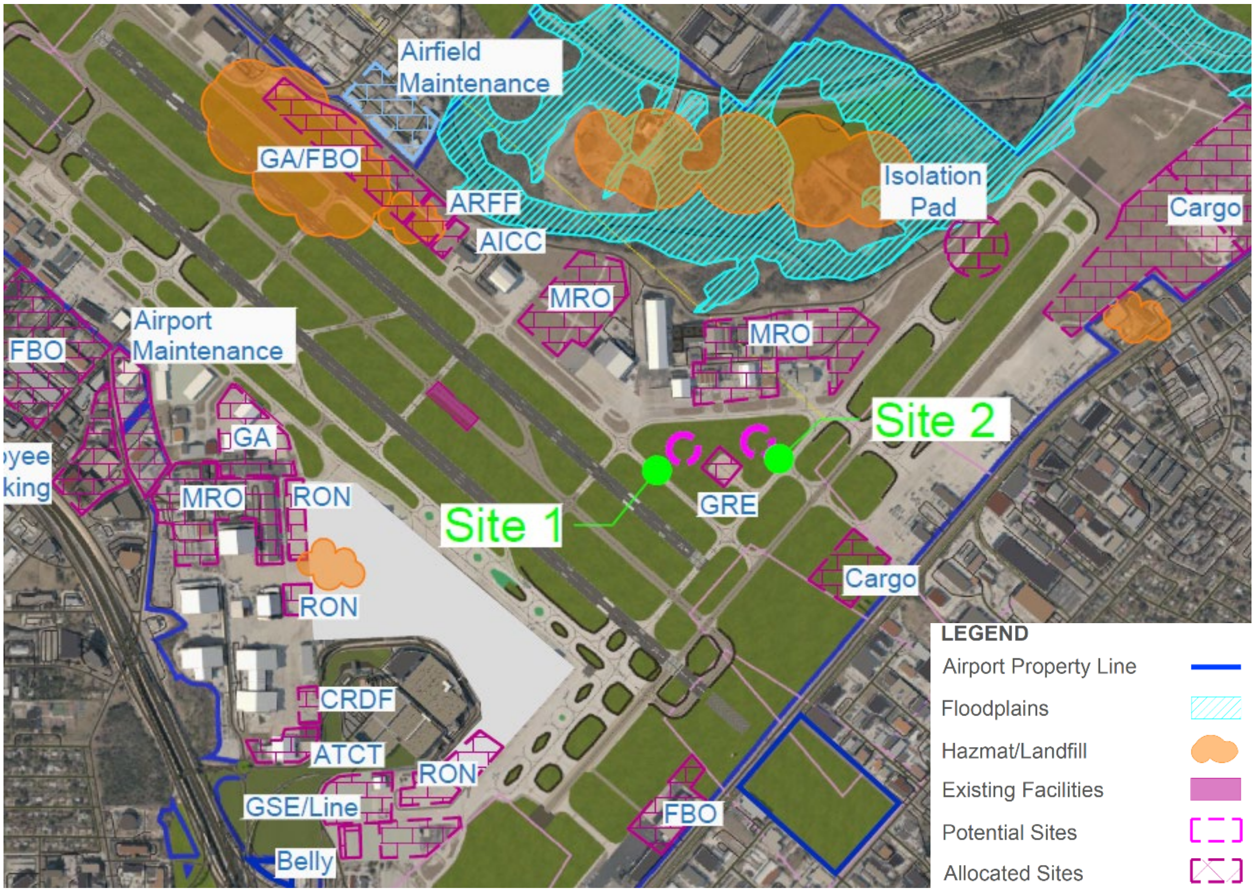
ALTERNATIVES

Two sites were identified as potential relocation sites for the compass rose, as shown on **Figure 5.5-24**.

PREFERRED ALTERNATIVE

Site 1 was selected as the preferred relocation site for the compass rose, as it is closest to the Cessna Aircraft MRO, which is its largest user. A magnetic survey would need to be conducted to verify the suitability of the final location.

Figure 5.5-24: Potential Compass Rose Relocation Sites



Source: WSP USA, 2021.

5.6 TECHNOLOGY INNOVATIONS

5.6.1 *ELECTRIC AIRCRAFT*

The electrification of larger commercial service aircraft is anticipated to be beyond the planning horizon of the SAT SDP. However, e-aircraft (new models or variants and retrofits of existing types) might be available in the short-term in the general aviation and commuter market segments. From an airline perspective, enough airports need to be equipped to accommodate e-aircraft for airlines to invest in them.

No specific infrastructure improvements are recommended for SAT at this time to accommodate e-aircraft. Factors to consider incude:

- Would there be enough e-aircraft operations at SAT to make the investment in e-aircraft infrastructure worthwhile?
- Electric aircraft will most likely require high-power charging stations to recharge their batteries, similar to a 400Hz Ground Power Unit (GPU), which could be made available at the gate or on RON/hardstand parking positions. The challenges with recharging batteries are the need for a

quick charge during an aircraft turn (sometimes as little as 30 minutes), as well as the enormous power drain on the electric grid during peak periods (daytime).

- Electric charging provided by the airport would be a new source of revenues.
- Ground handling infrastructure and apron layouts may have to be adapted to manage aircraft with unconventional shapes (such as longer/thinner wings for a given passenger capacity).
- Air traffic control procedures would need to be modified to handle slower e-aircraft, potentially affecting capacity.
- Airport emergency services would need to train on how to handle an emergency involving a battery-powered aircraft.
- Electric aircraft would be both non-polluting and quieter, meaning that community noise exposure could decrease.

5.6.2 VERTICAL TAKE-OFF AND LANDING VEHICLES/ UNMANNED AERIAL SYSTEMS

Vertical take-off and landing (VTOL) aircraft are aircraft that can take off, hover, and land vertically without relying on a runway. It is assumed that potential future operations by VTOL aircraft and unmanned aerial systems (UAS or drone) would operate from both existing/future terminals and/or FBOs, or the top of the existing/proposed parking garages.

5.6.3 AUTONOMOUS VEHICLES

Autonomous vehicles operating in the airport environment may include personal vehicles dropping-off/picking-up passengers, shuttles taking passengers to/from parking facilities, electric aircraft or baggage tugs, snow removal equipment. Integration of autonomous technology into existing systems is being tested in various locations around the world, and autonomous vehicles are expected to be a common sight at airports in the near to mid term.

The technology for autonomous personal vehicles is evolving rapidly. Currently, autonomous vehicles typically don’t operate well in congested environments, such as an airport’s drop-off/pick-up curbside. As such, a lane dedicated to autonomous vehicle within the existing roadway system is recommended; autonomous vehicle lanes are narrower than regular traffic lanes, and as such can be accommodated in existing traffic lanes with curbs to segregate autonomous vehicles from other vehicles. Autonomous vehicle lanes would not be located in dense pedestrian environments, and would originally be recommended for shuttles only.

Autonomous TNC/For Hire Fleet Vehicles may require staging lots, which the existing conventional TNC/Taxi lots or parking facilities could be used for. Staging areas, parking lots and garages should be provided with chargers, both for the benefit of customers and generating revenues for the airport.

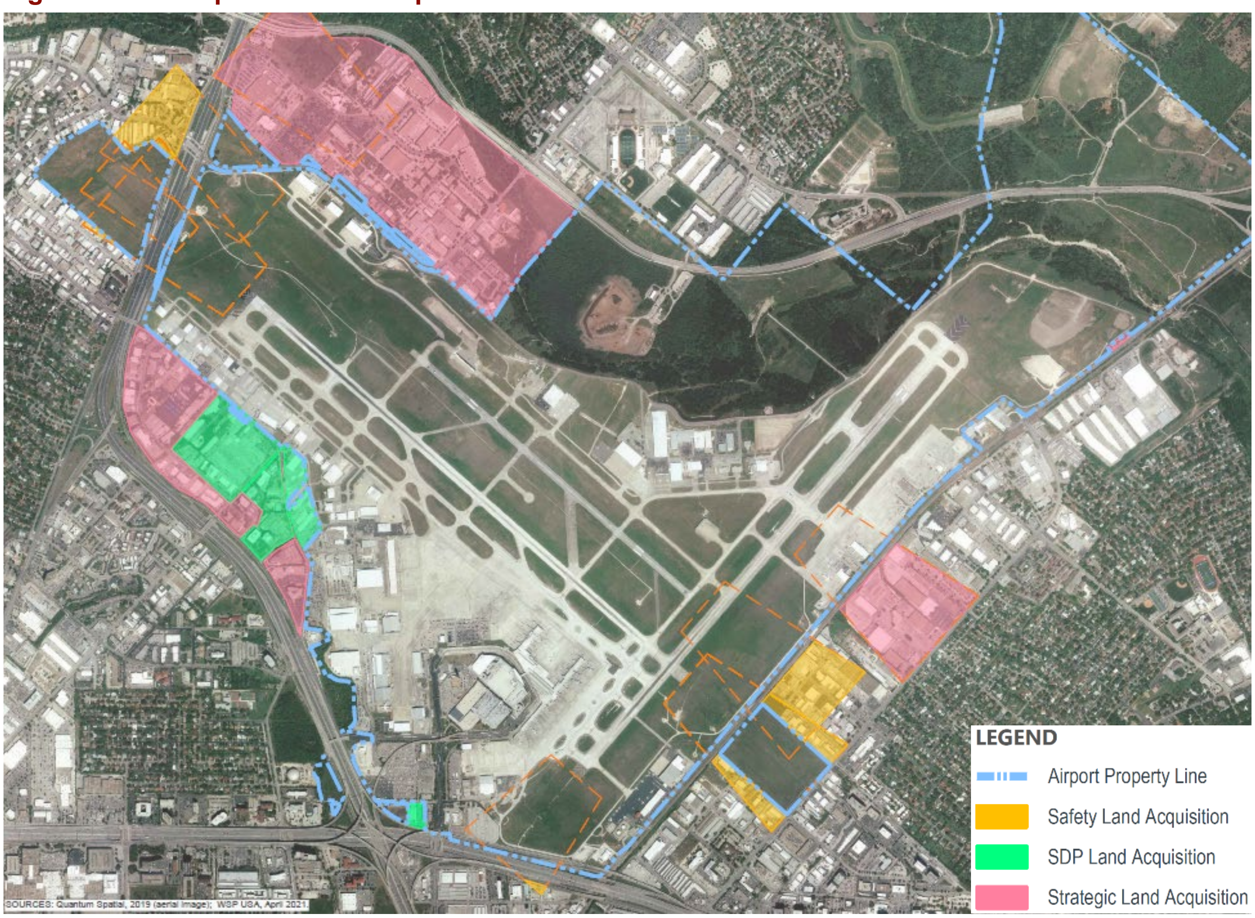
5.7 LAND ACQUISITION

A recommendation of the SDP is for SAAS to develop a land acquisition program to support Airport development, both in the near term and long terms. The program would consist of a spreadsheet tracking land acquisition parcels by purpose (required for FAA standards, required for airport development, strategic purchase), timeframe parcel is needed, as well as estimated funds required. SAAS would monitor parcel availability and would purchase the parcel on the open market (due to the lengthy City process for acquiring property, SAAS may consider using purchase options to prevent parcels from being purchased by others during City processes).

Proposed land acquisition parcels are depicted on **Figure 5.7-1.** They are grouped by purpose:

- FAA standards: parcels inside existing and potential future Runway Protection Zones
- Proposed airport development: parcels adjacent to the existing airport property required to support SAT's expansion plans
- Strategic development: parcels adjacent to the Airport property that may be used for airport development beyond the SDP planning horizon; these parcels may also be acquired to provide a compatibility buffer between airport operations and neighboring communities.

Figure 5.7-1: Proposed Land Acquisition



Source: WSP USA, 2021.

5.8 PREFERRED AIRPORT DEVELOPMENT PLAN

The preferred Airport development plan is depicted on **Figure 5.8-1**.

Figure 5.8-1: Preferred Airport Development Plan

Source: WSP USA, 2021.

San Antonio Airport System
Strategic Development Plan

2021 AIRPORT MASTER PLAN

MASTER PLAN UPDATE
CHAPTER 5 – ALTERNATIVES DEVELOPMENT AND EVALUATION
APPENDIX 5A – AIRFIELD AND TERMINAL ALTERNATIVES DEVELOPMENT

STRATEGIC
DEVELOPMENT
PLAN

SAAS
San Antonio Airport System

San Antonio International Airport
Strategic Development Plan

Airfield Concepts Development and Evaluation

October 2019

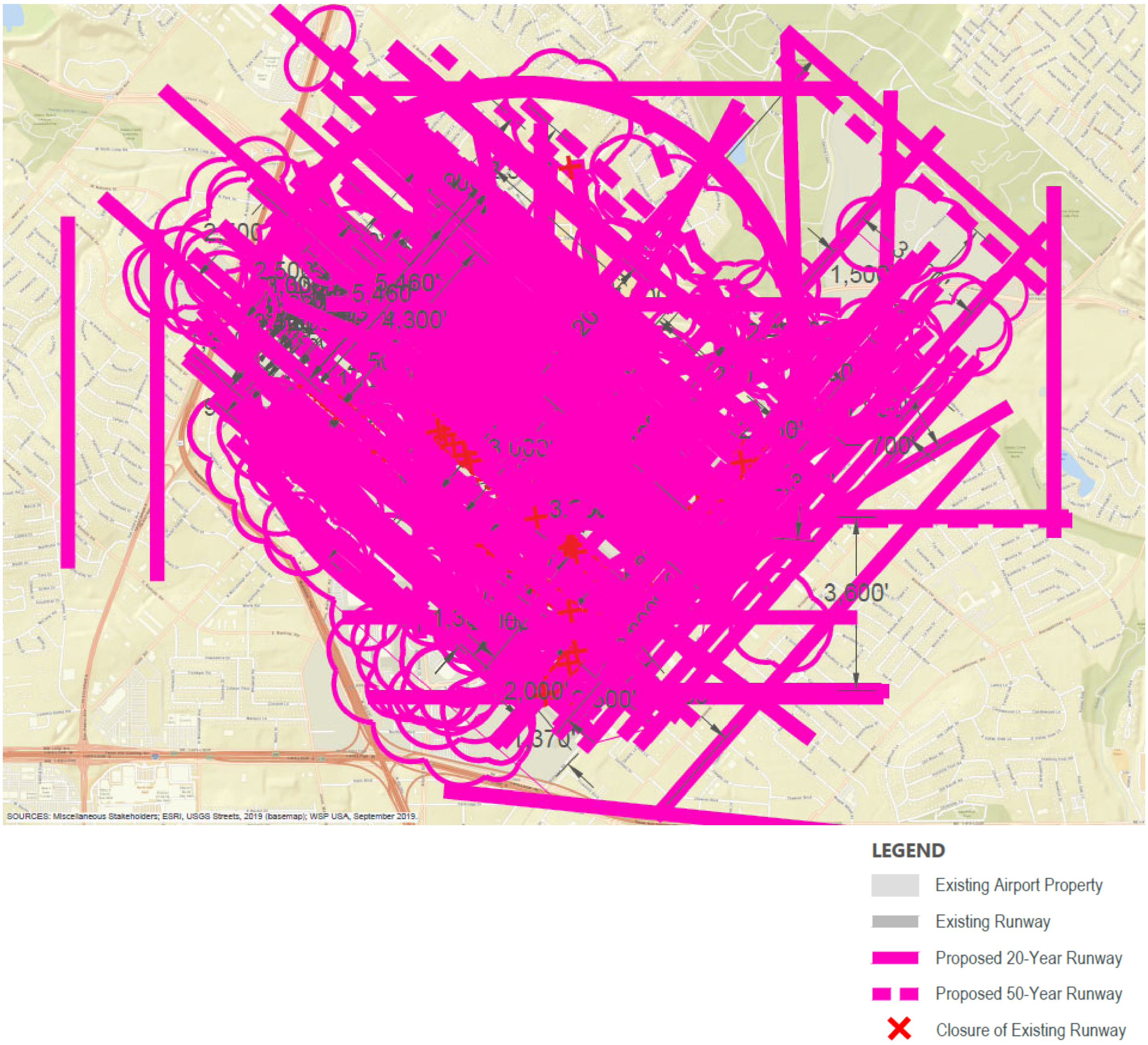
Concept Development
Sketch Planning Recap

- Goal: “to get all ideas about airport development on the table”

- Sketch planning in August and September
  - Conducted five sessions with 107 participants
  - Collected 91 initial airfield concepts
  - Concept numbering based on “table”/group

- We remain open to new concepts

Concept Development
Combined Input



Concept Evaluation
Considering All Ideas

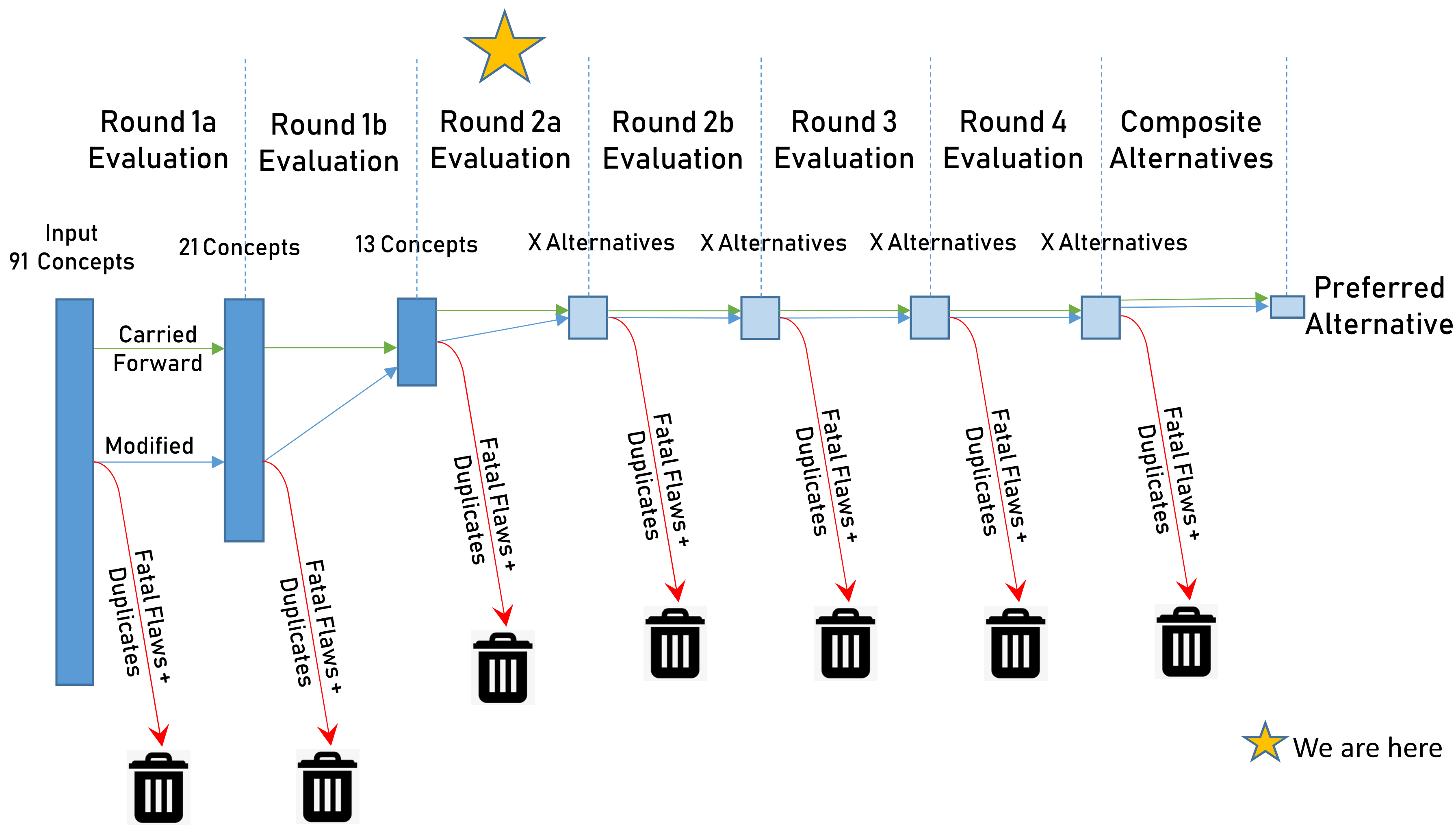
Round 1a Evaluation:

- Evaluated 91 concepts for fatal flaws
- Modified flawed concepts to eliminate flaws
- Eliminated any resulting duplicate concepts
- Resulted in 29 remaining airfield concepts

Round 1b Evaluation:

- Evaluated remaining 29 concepts for fatal flaws
- Modified flawed concepts to eliminate flaws
- Eliminated any resulting duplicate concepts
- Resulted in 13 remaining airfield concepts moving to Round 2

Concept Evaluation
Considering All Ideas



STRATEGIC DEVELOPMENT PLAN

SAAS

San Antonio Airport System

Airfield Concepts Evaluation

Round 1a

Round 1a Evaluation
Fatal Flaw Criteria

- Criteria are objective
- Criteria:
  - Airfield capacity
  - Runway length
  - Airspace conflicts with Randolph Air Force Base (RND)
  - Runway layout
  - Major airspace penetrations
  - Impacts to railroads, elevated roadways and interchanges
  - Implementable within the 20-year planning horizon

➢ Modified 15 initial concepts to eliminate fatal flaws

Note: one concept may have multiple fatal flaws

Round 1a Fatal Flaws Review
Airfield Capacity

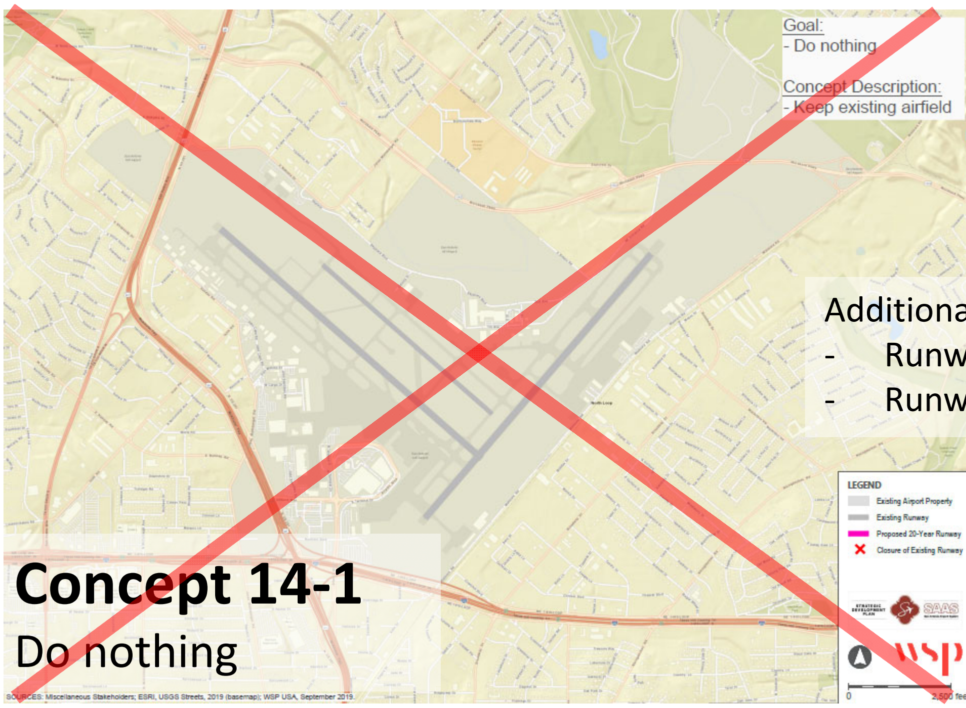
- Does the concept add airfield capacity?

- Adding airfield capacity:
  - Runway optimization – exit improvements to reduce runway occupancy times:
    - Exit taxiway geometry and location
  - Additional runway – even though not necessarily needed by 2038

➢ 1 concept does not add airfield capacity

Round 1a Eliminated Concept (Page 1 of 1)

Airfield Capacity



Additional Fatal Flaws:
- Runway length
- Runway layout

Round 1a Fatal Flaws Review
Runway Length

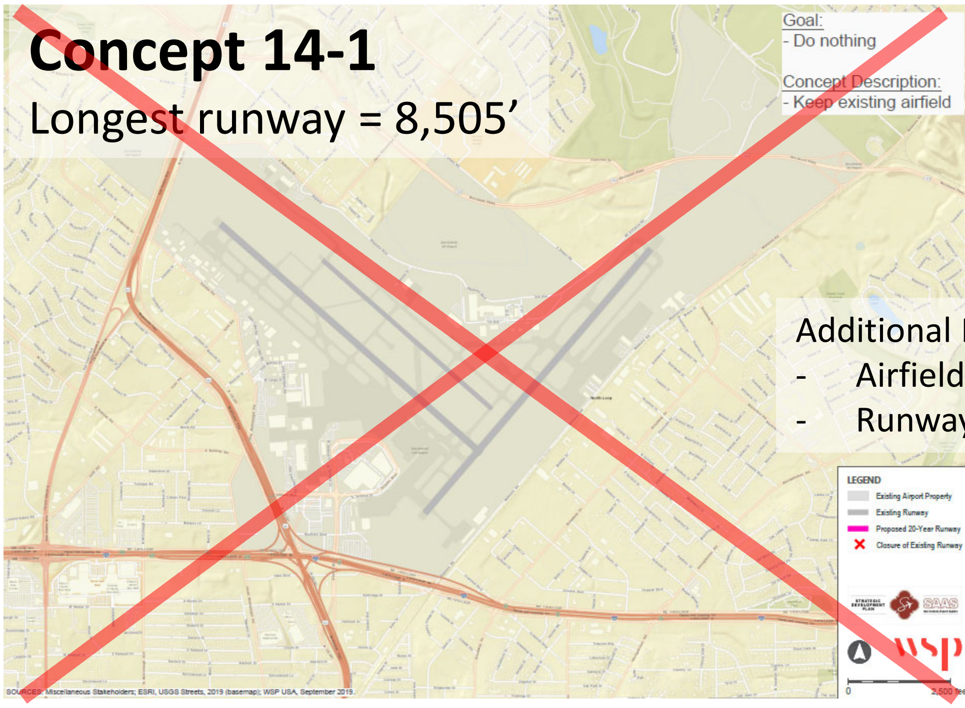
- Does the concept provide a 10,700 foot runway?
  - Optional: provide arrival-only runway 7,300 feet

- Includes:
  - Extension of existing runway(s)
  - Construction of new 10,700’ runway

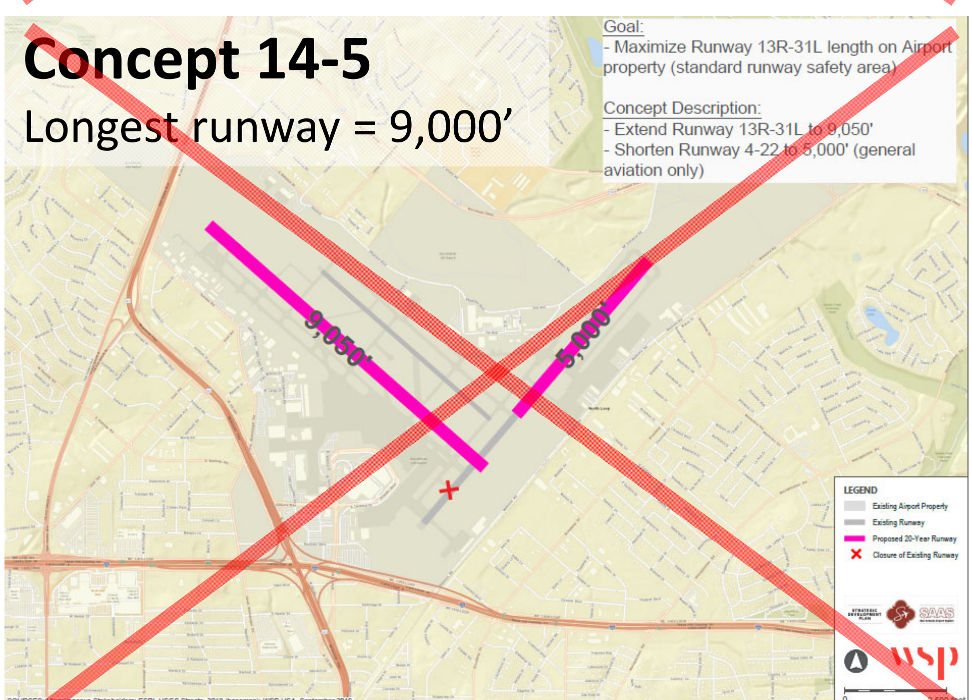
➢ 3 concepts do not provide a 10,700’ long runway

Round 1a Eliminated Concepts (Page 1 of 2)

Runway Length

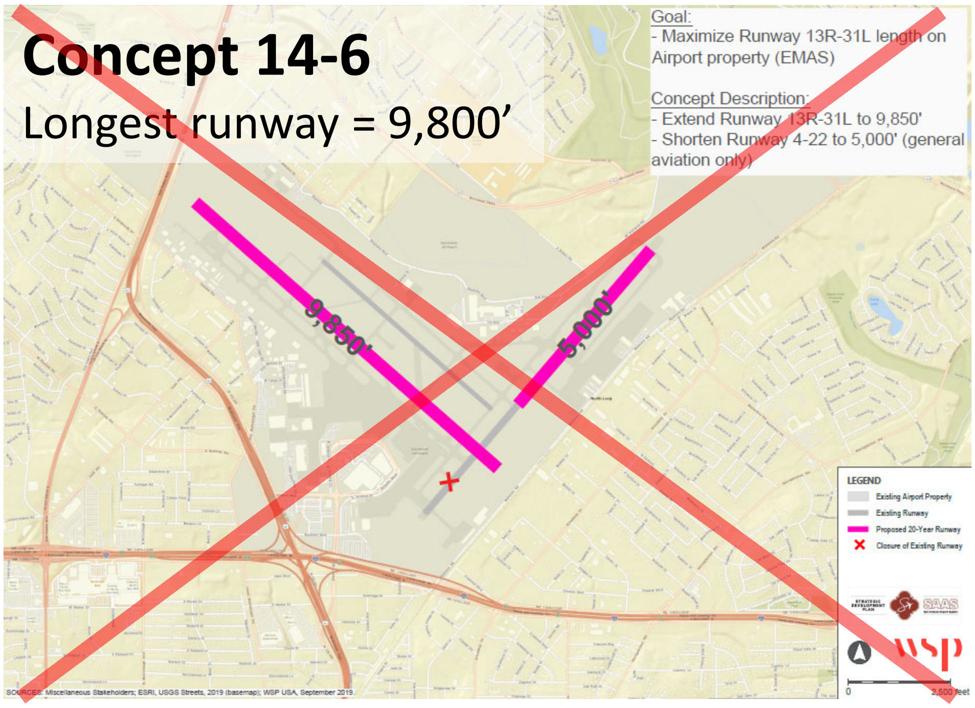


Additional Fatal Flaws:
- Airfield capacity
- Runway layout



Round 1a Eliminated Concepts (Page 2 of 2)

Runway Length



Round 1a Fatal Flaws Review
Airspace Conflicts with RND

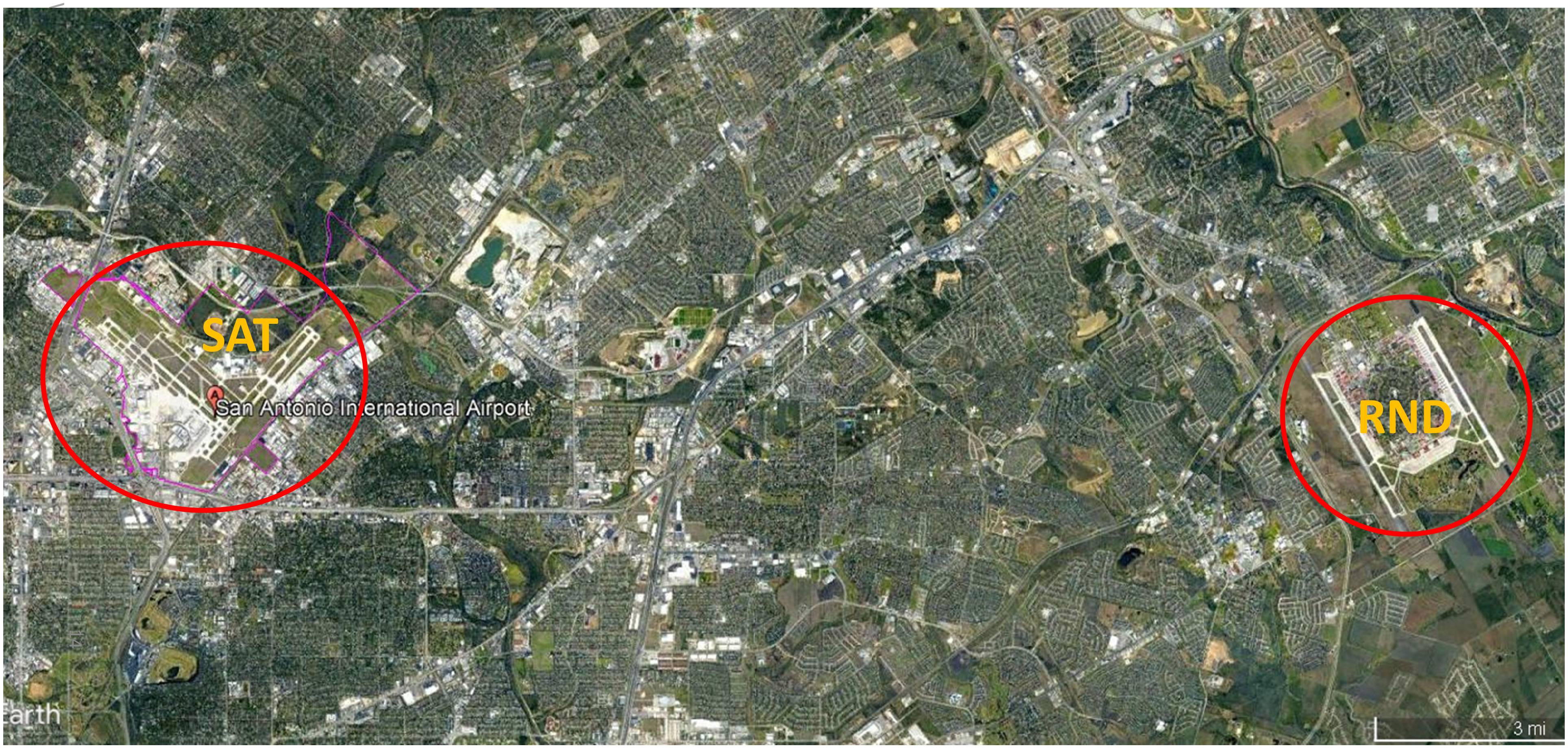
- Do the <u>primary runways</u> (departure/arrival) interfere with aircraft operations at Randolph Air Force Base (RND), 11 miles east of SAT?

- Includes:
  - Arrivals on existing Runway 22
  - Departures on existing Runway 4
  - Proposed runways aimed at RND approach/departure paths

➢ 33 concepts interfere with RND aircraft operations

Round 1a Fatal Flaws Review

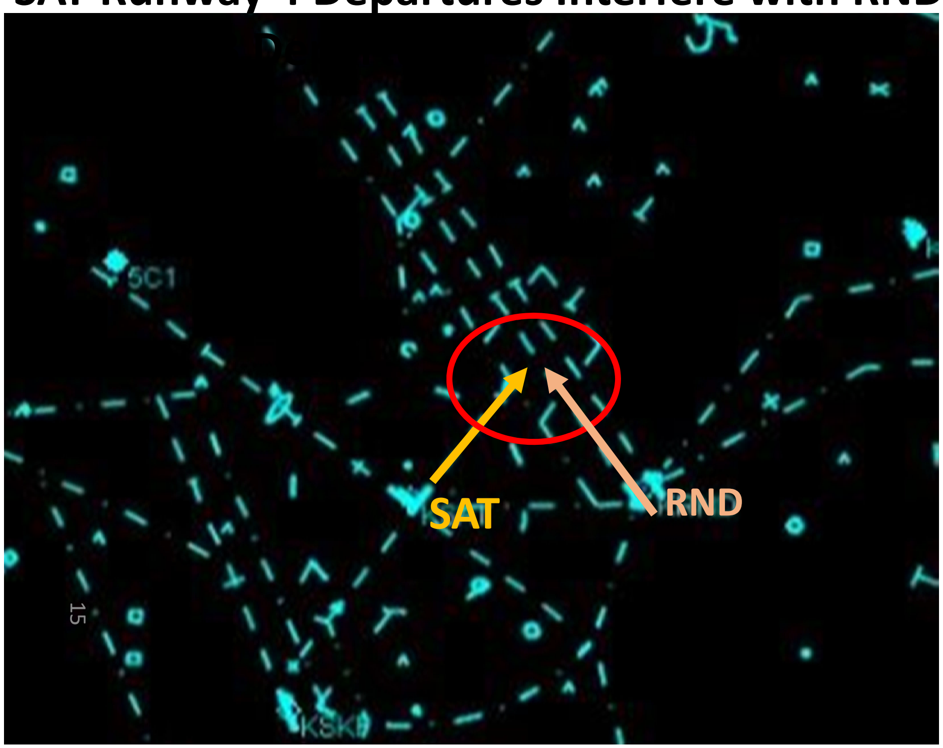
Airspace Conflicts with RND



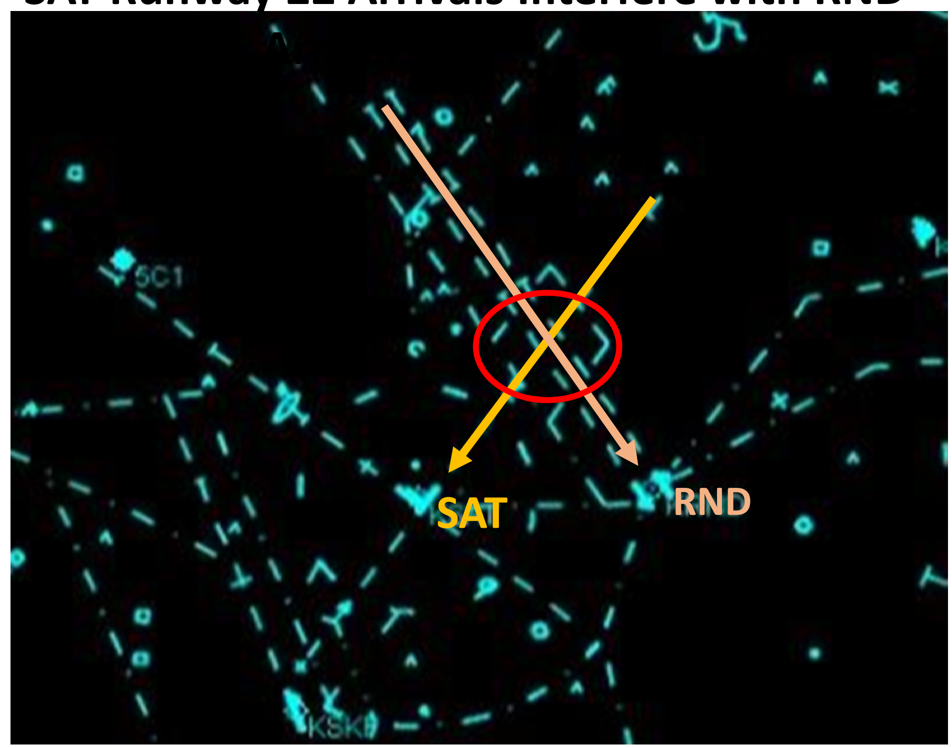
Round 1 a Fatal Flaws Review

Airspace Conflicts with RND

SAT Runway 4 Departures Interfere with RND

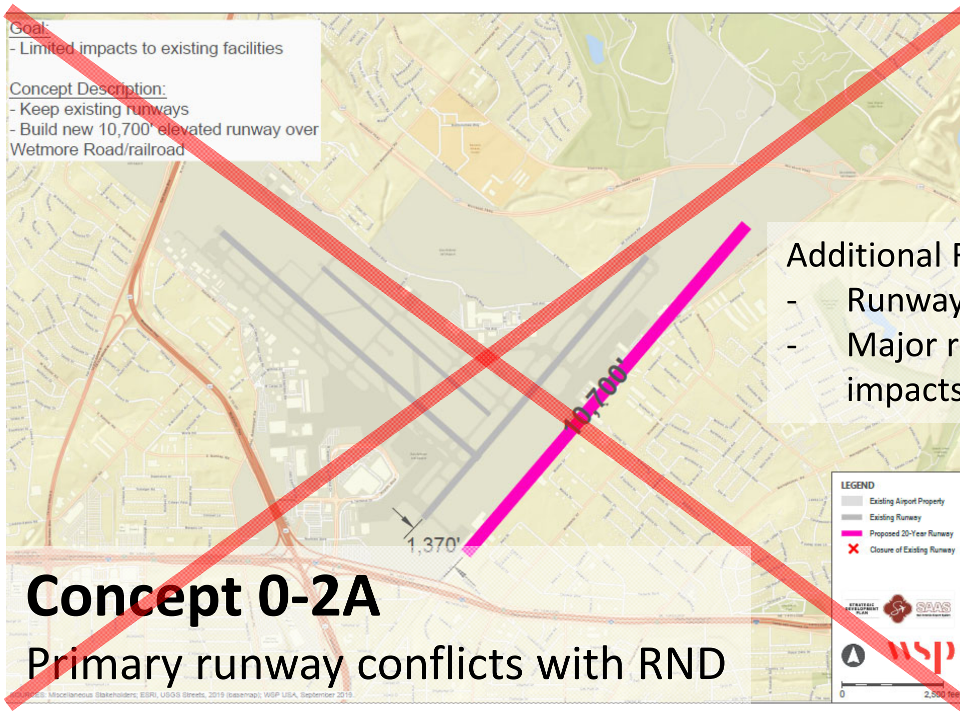


SAT Runway 22 Arrivals Interfere with RND

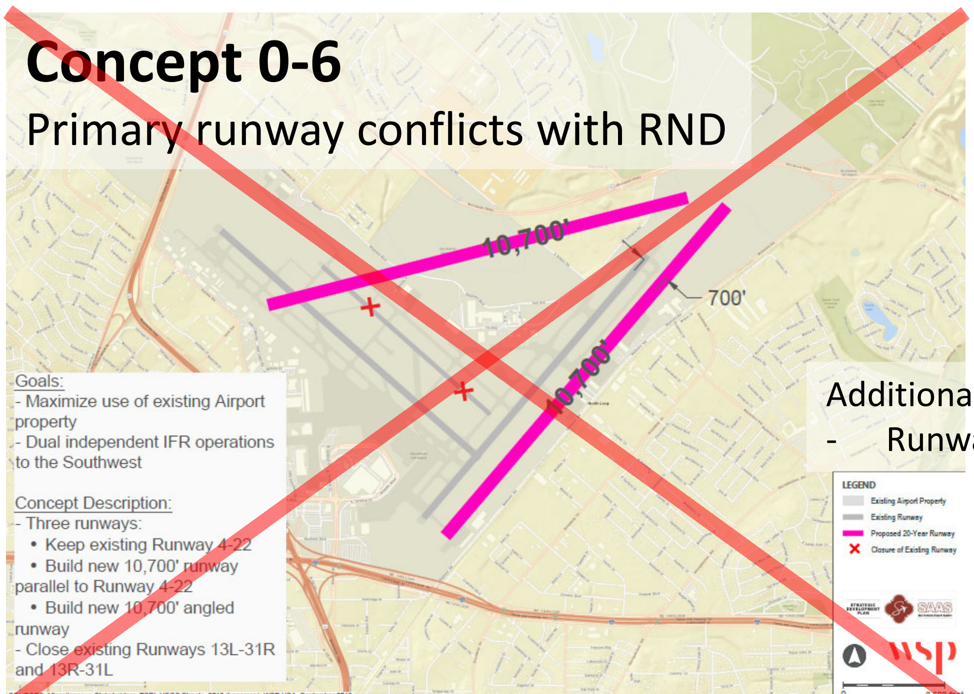


Round 1a Eliminated Concepts (Page 1 of 17)

Airspace Conflicts with RND



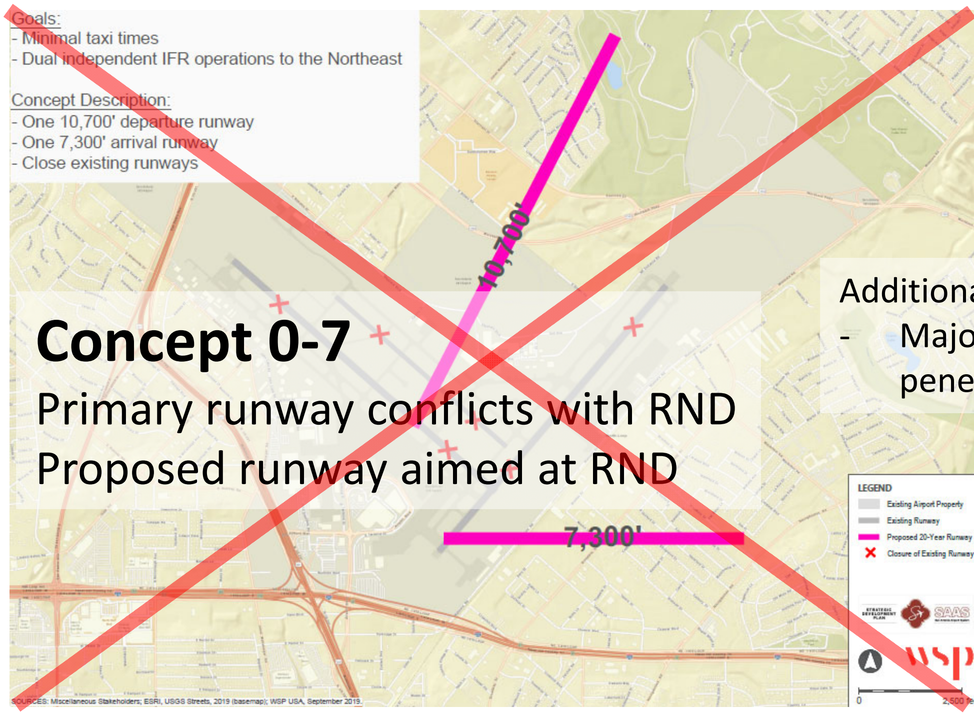
Additional Fatal Flaw:
- Runway layout
- Major road/railroad impacts



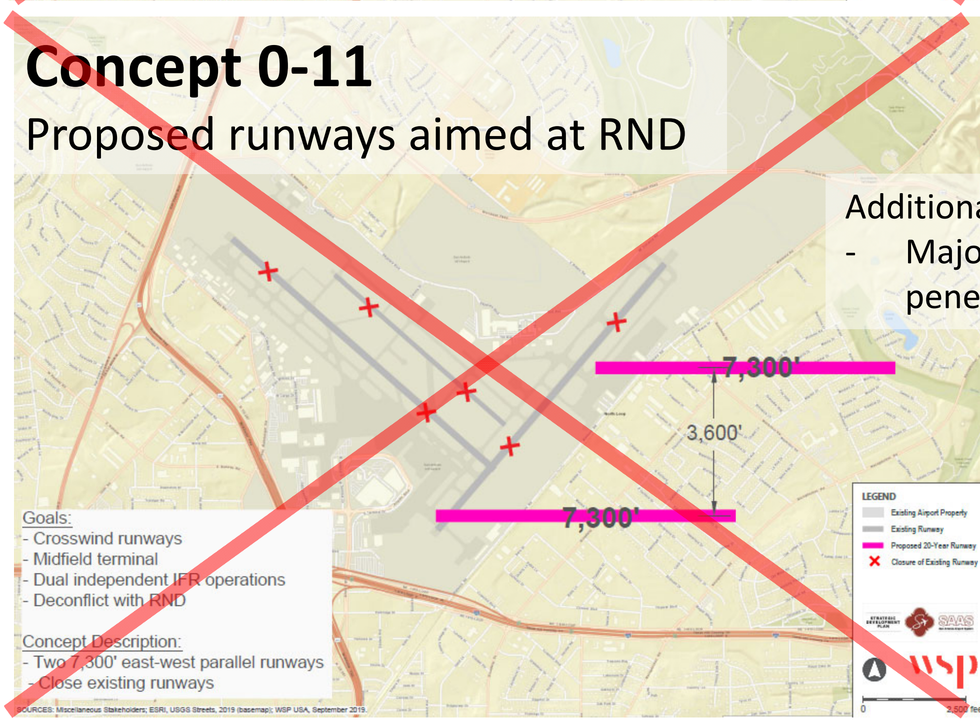
Additional Fatal Flaw:
- Runway layout

Round 1a Eliminated Concepts (Page 2 of 17)

Airspace Conflicts with RND



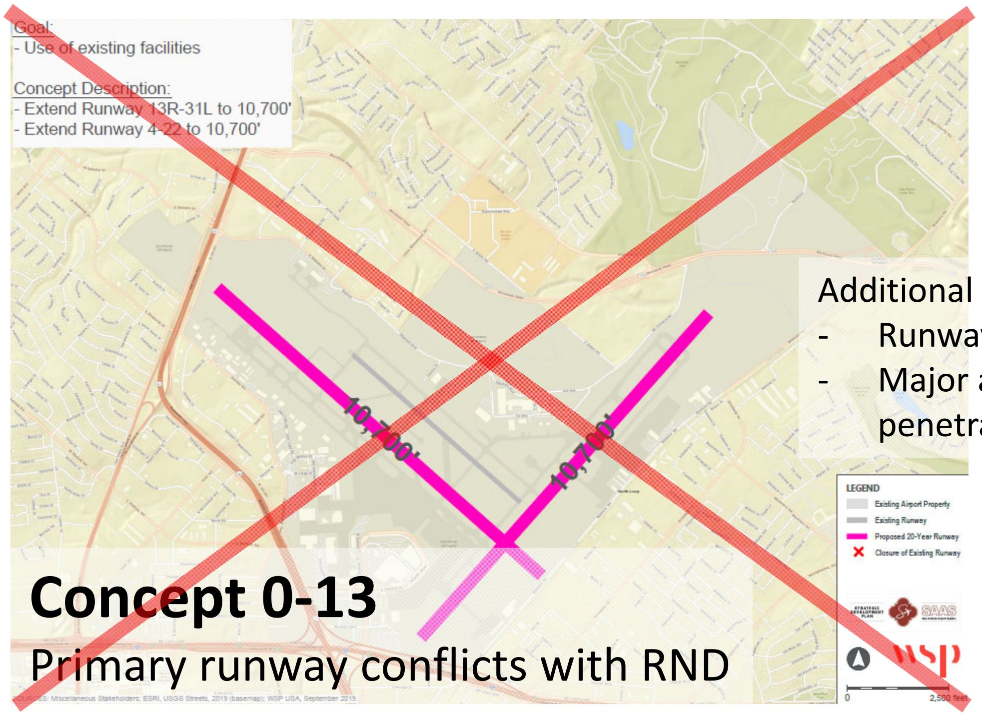
Additional Fatal Flaw:
- Major airspace penetrations



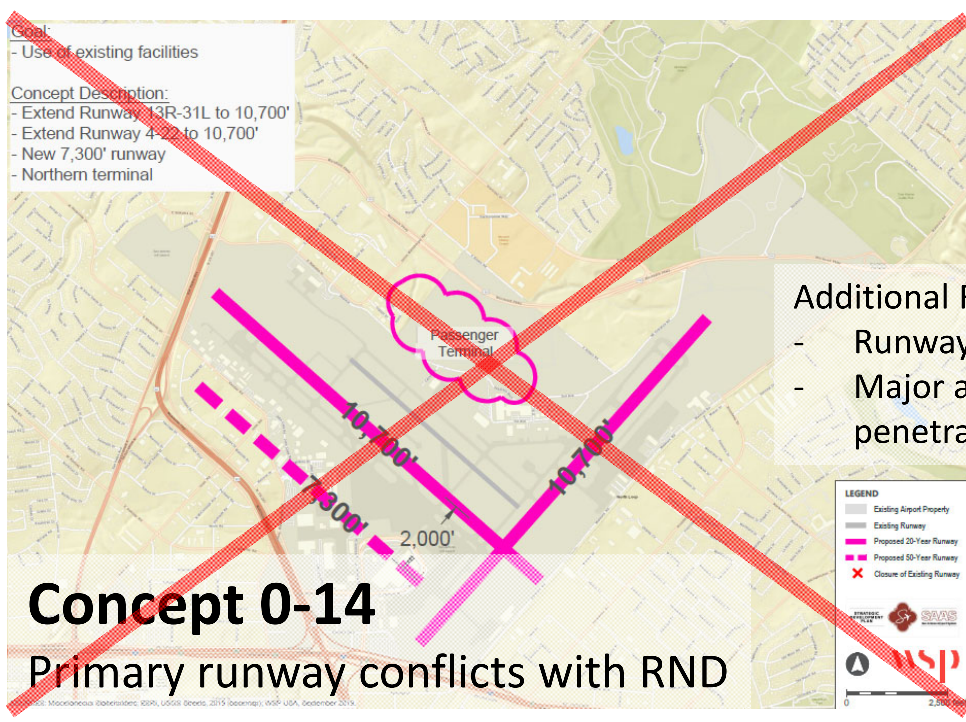
Additional Fatal Flaw:
- Major airspace penetrations

Round 1a Eliminated Concepts (Page 3 of 17)

Airspace Conflicts with RND



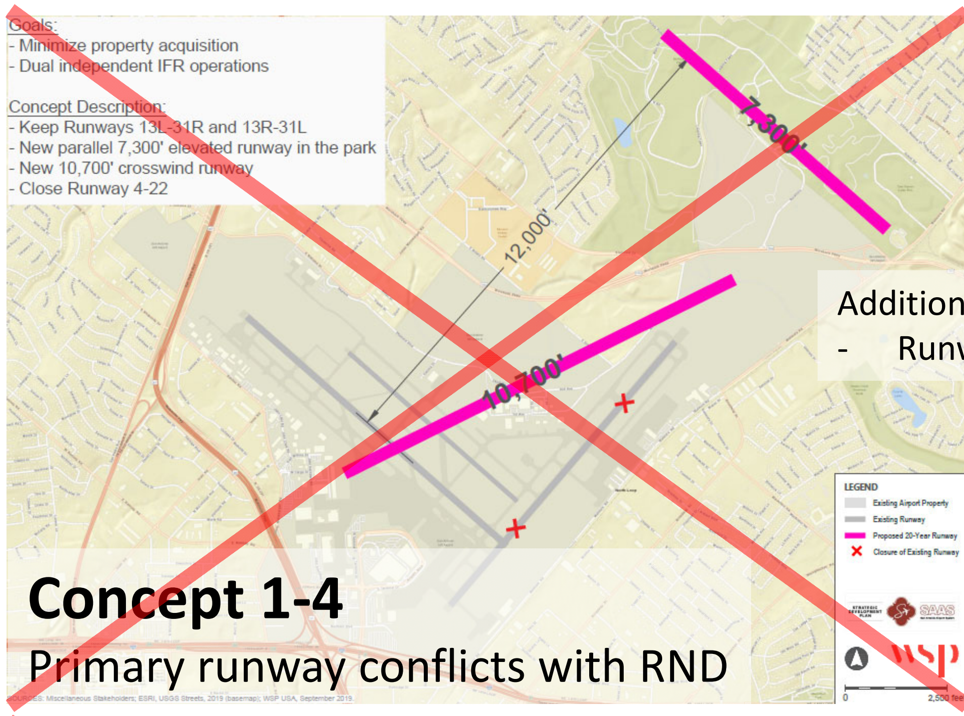
Additional Fatal Flaws:
- Runway layout
- Major airspace penetrations



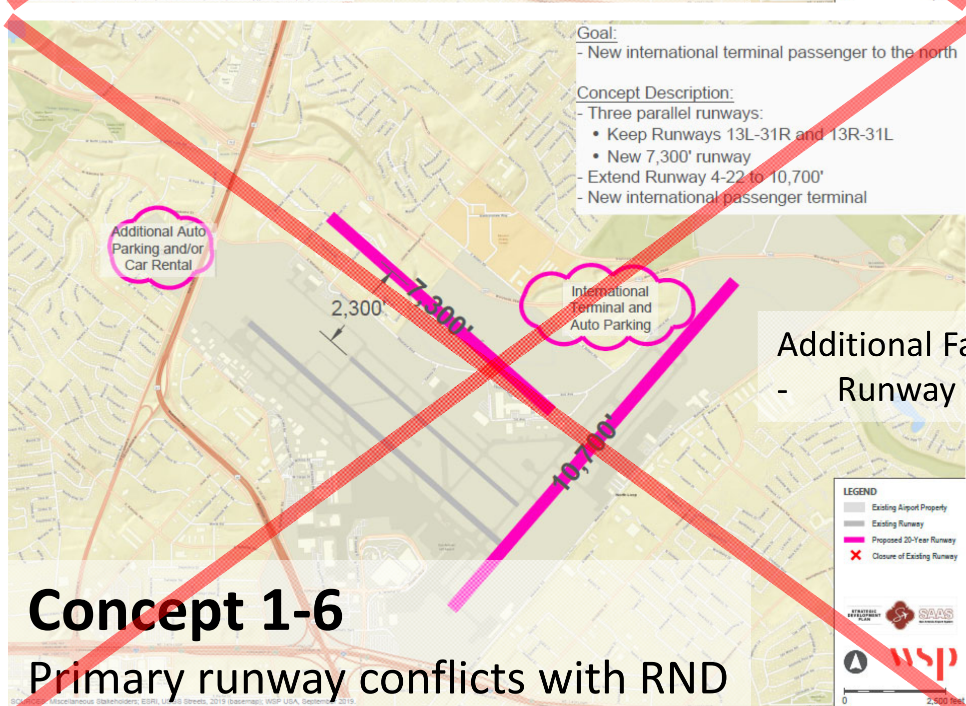
Additional Fatal Flaws:
- Runway layout
- Major airspace penetrations

Round 1a Eliminated Concepts (Page 4 of 17)

Airspace Conflicts with RND



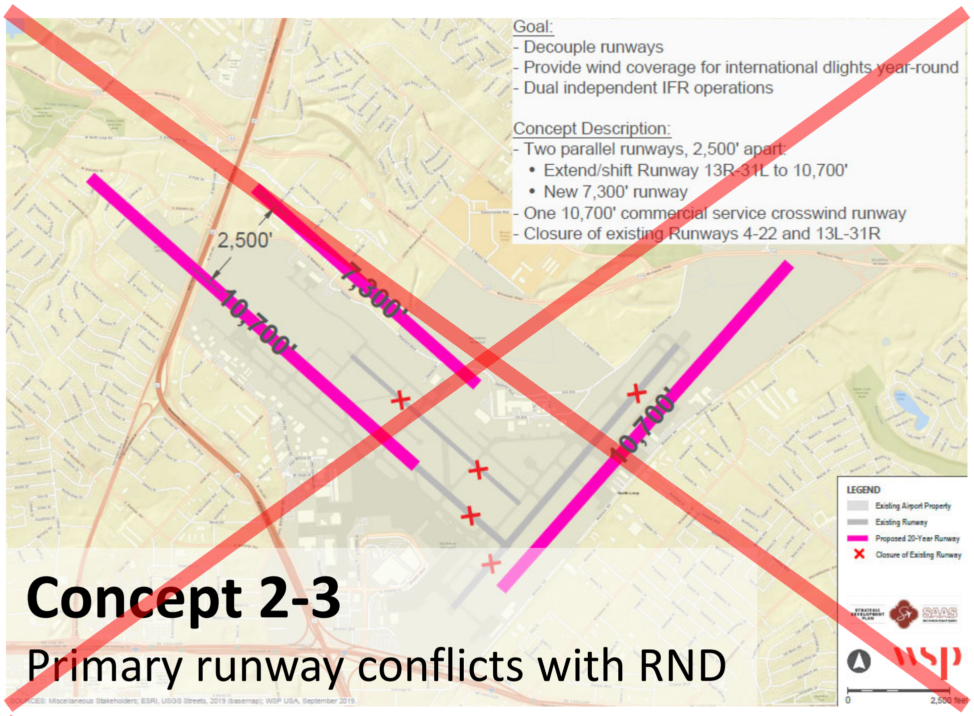
Additional Fatal Flaw:
- Runway layout

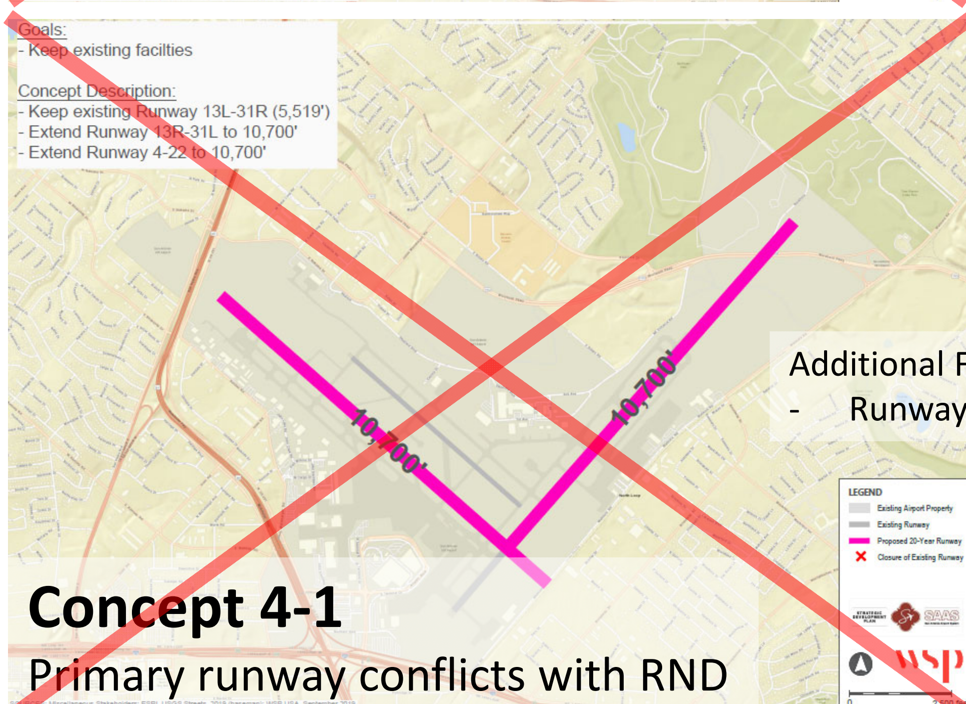


Additional Fatal Flaw:
- Runway layout

Round 1a Eliminated Concepts (Page 5 of 17)

Airspace Conflicts with RND

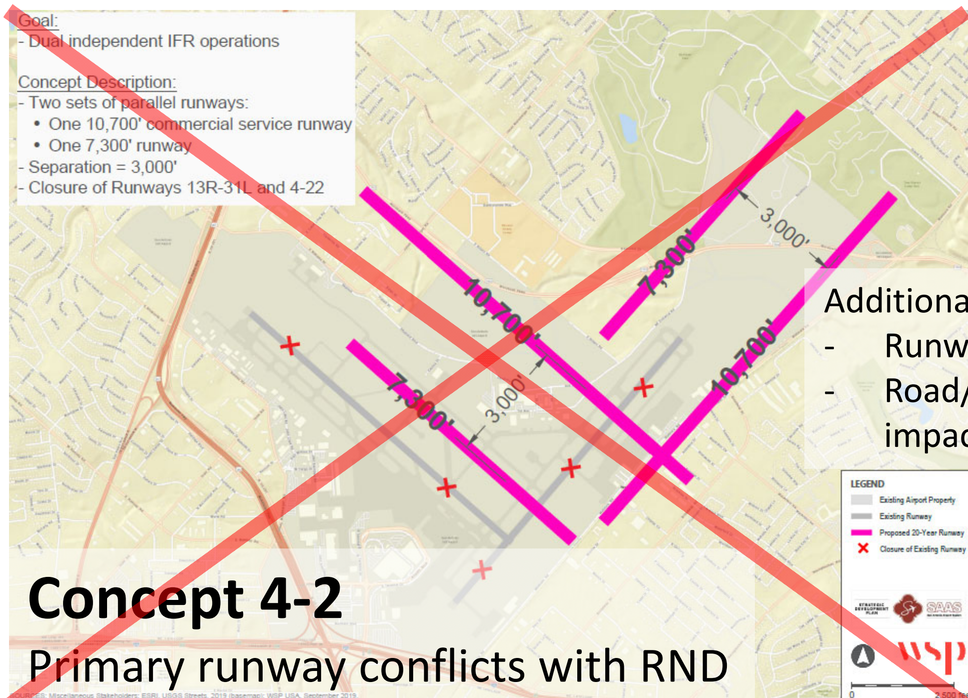




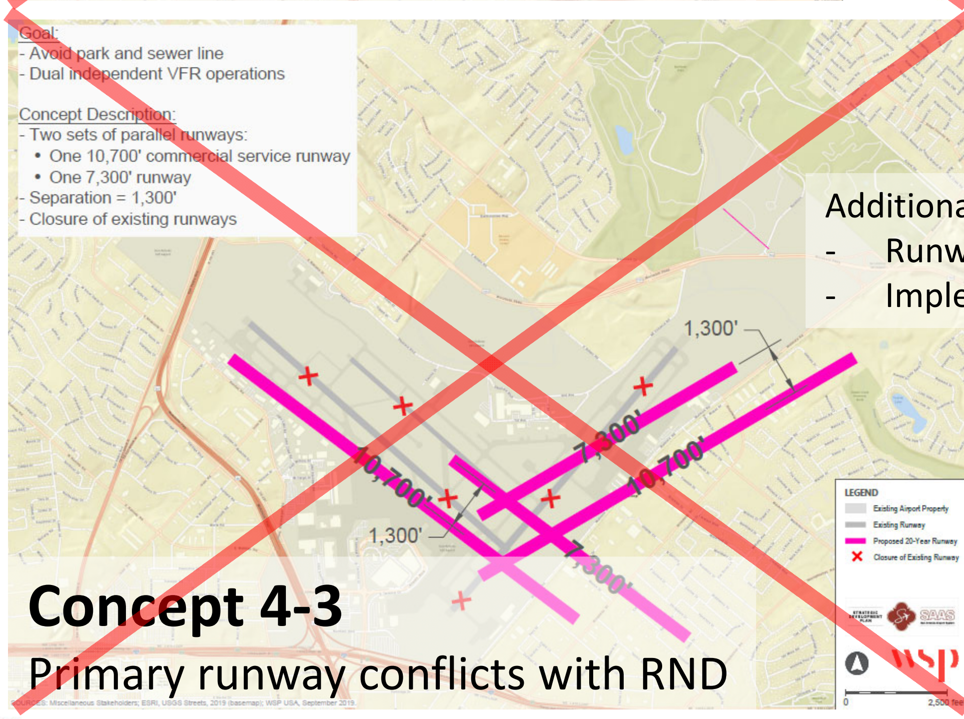
Additional Fatal Flaw:
- Runway layout

Round 1a Eliminated Concepts (Page 6 of 17)

Airspace Conflicts with RND



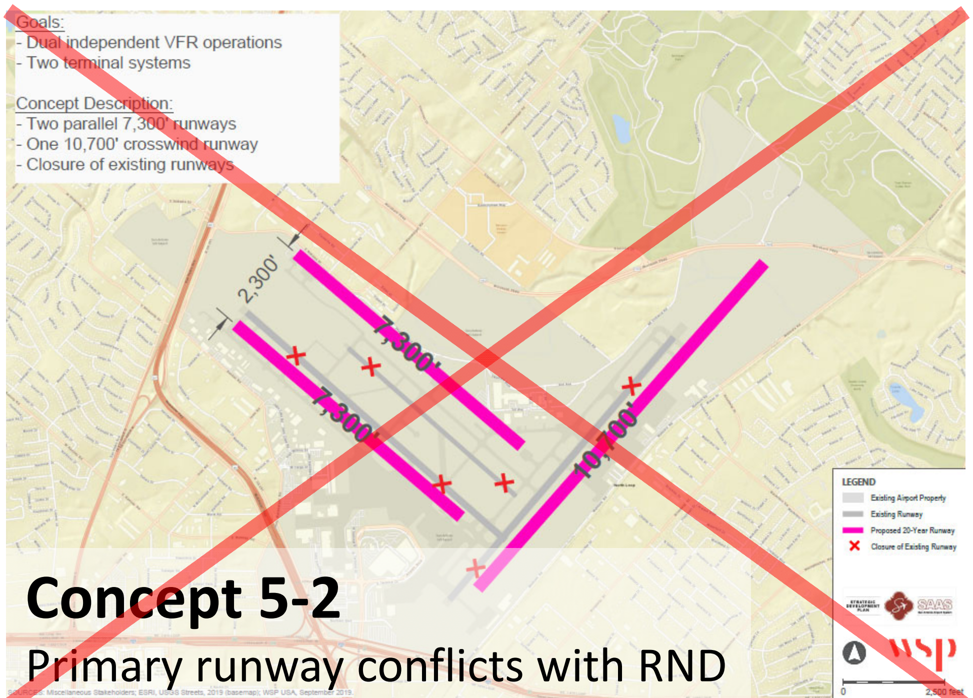
Additional Fatal Flaws:
- Runway layout
- Road/railroad impacts

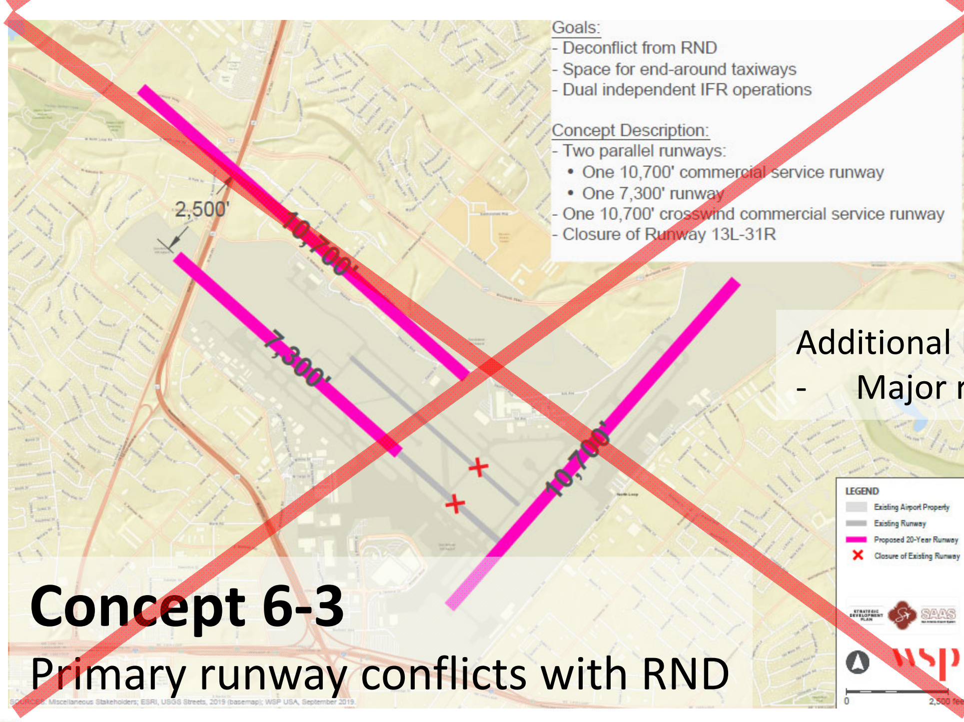


Additional Fatal Flaws:
- Runway layout
- Implementability

Round 1a Eliminated Concepts (Page 7 of 17)

Airspace Conflicts with RND

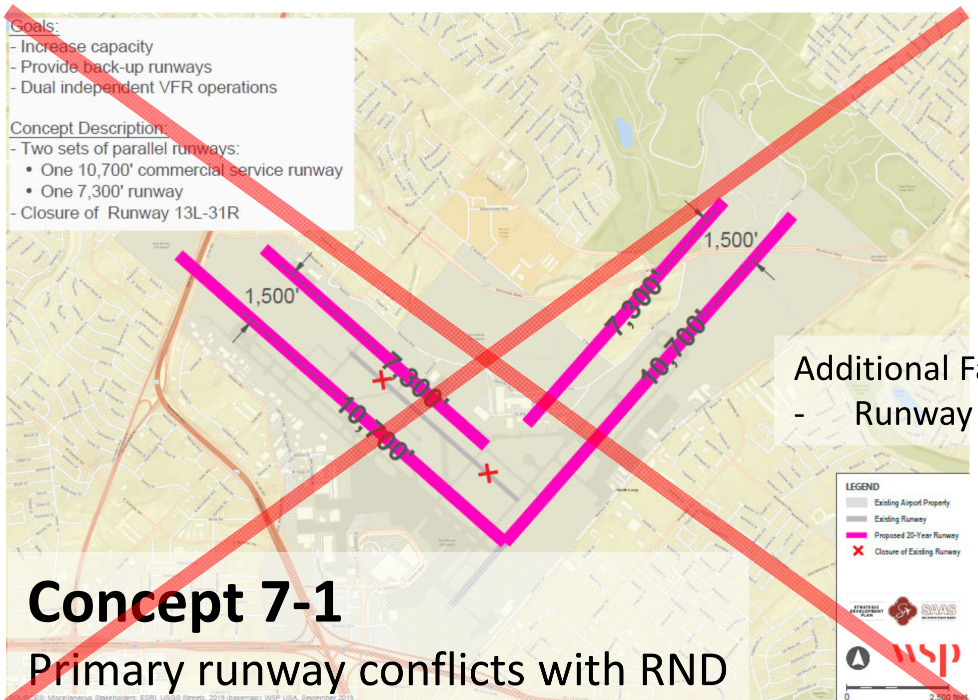


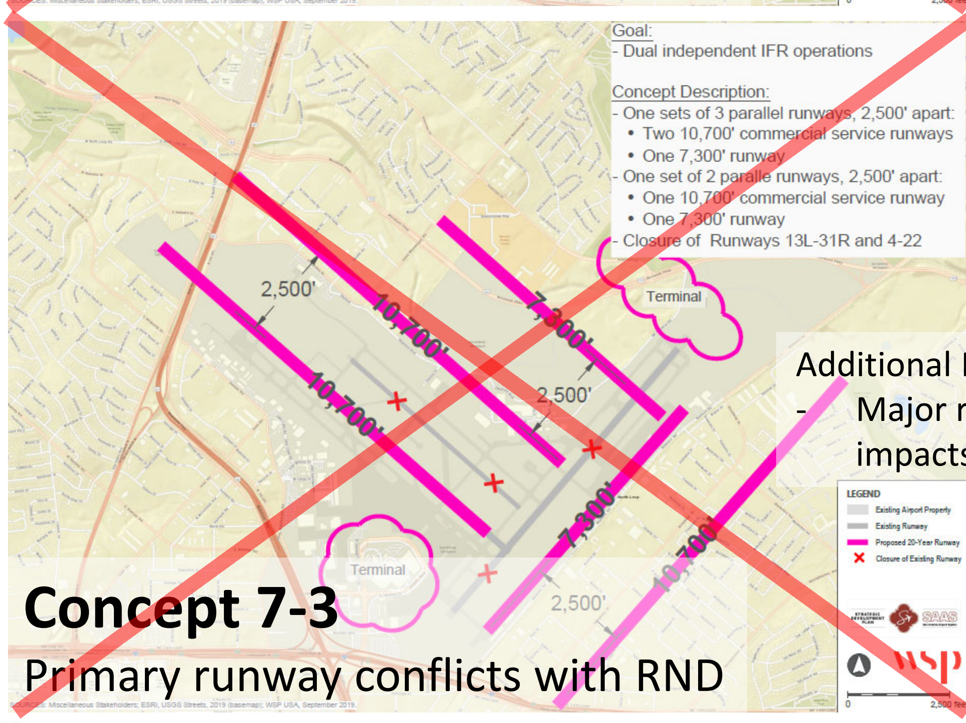


Additional Fatal Flaw:
- Major road impacts

Round 1a Eliminated Concepts (Page 8 of 17)

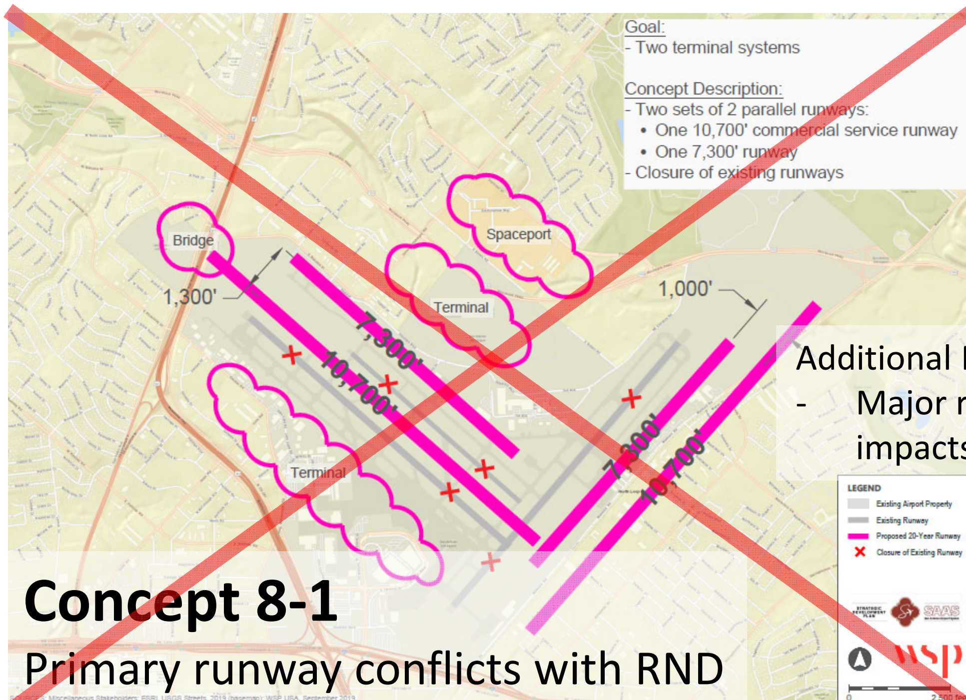
Airspace Conflicts with RND

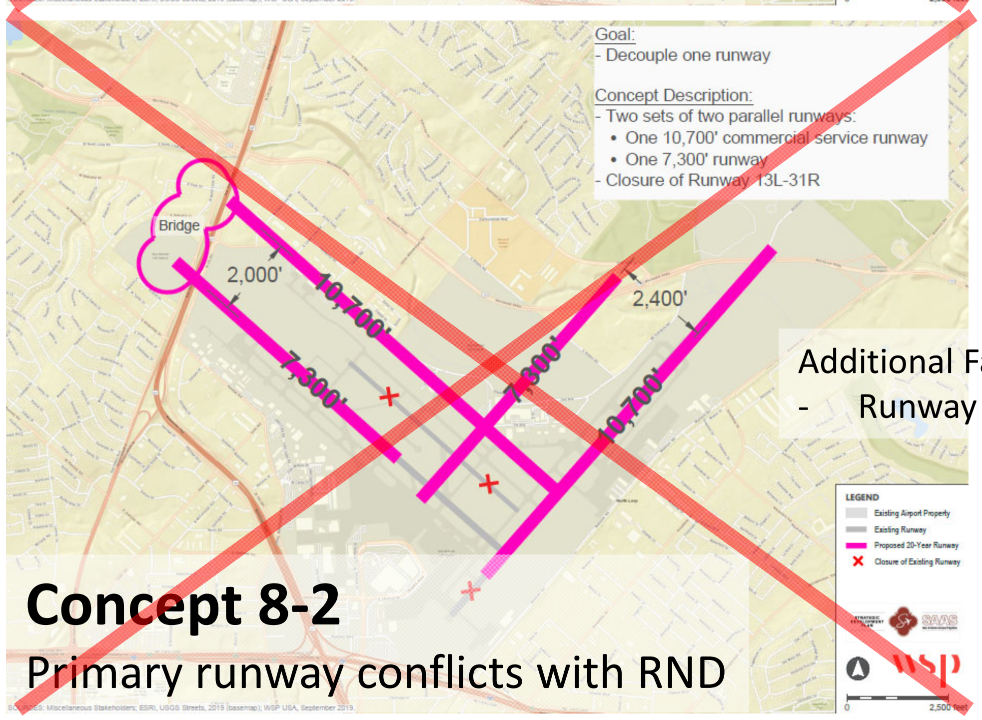




Round 1a Eliminated Concepts (Page 9 of 17)

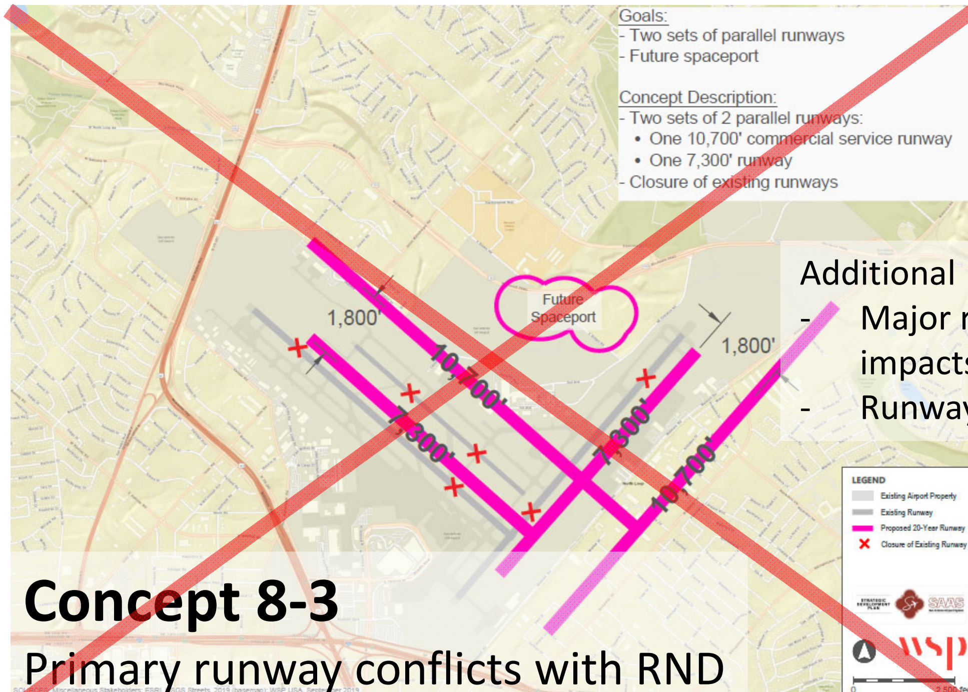
Airspace Conflicts with RND



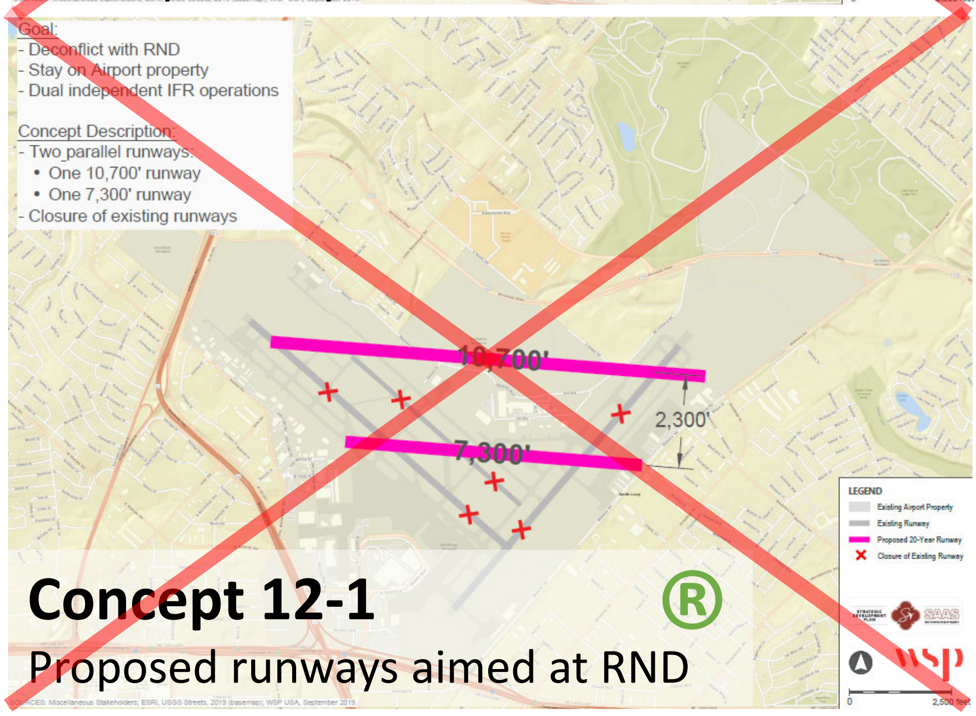


Round 1a Eliminated Concepts (Page 10 of 17)

Airspace Conflicts with RND

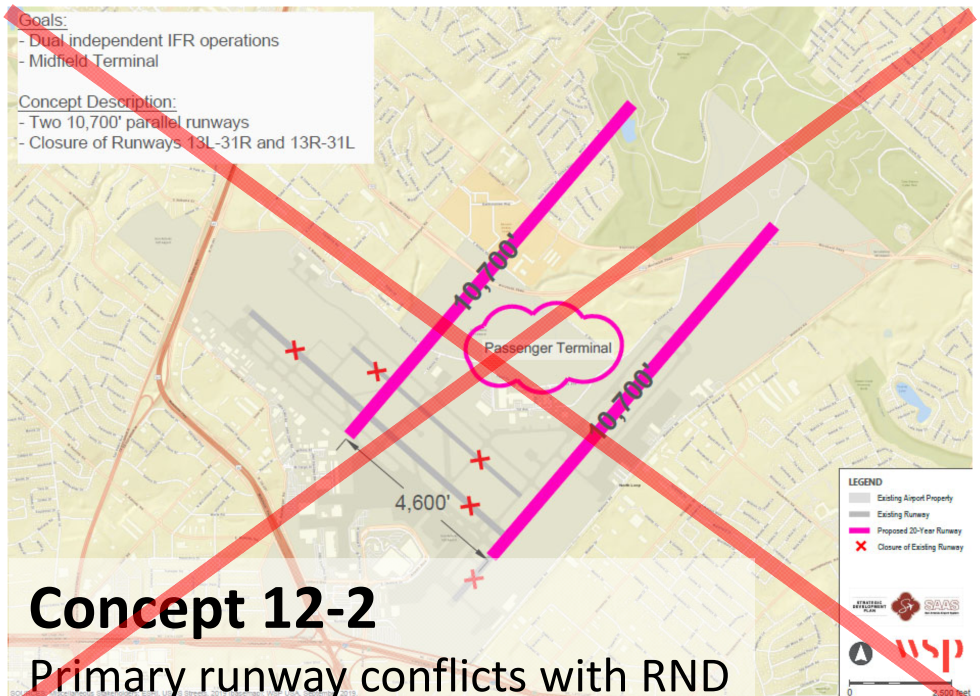


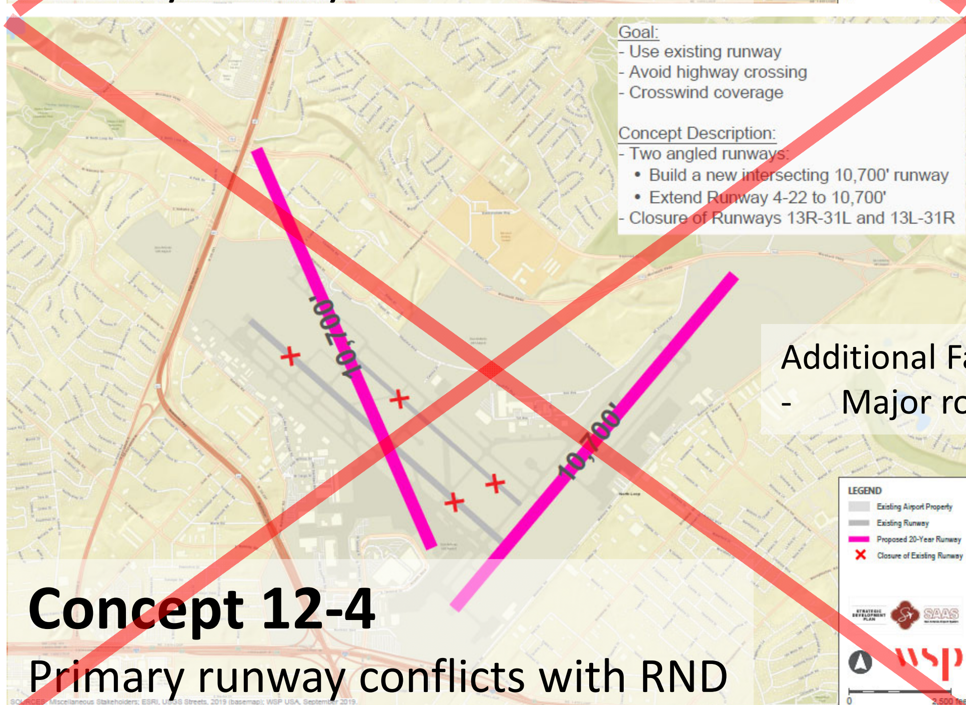
Additional Fatal Flaw:
- Major road/railroad impacts
- Runway layout



Round 1a Eliminated Concepts (Page 11 of 17)

Airspace Conflicts with RND

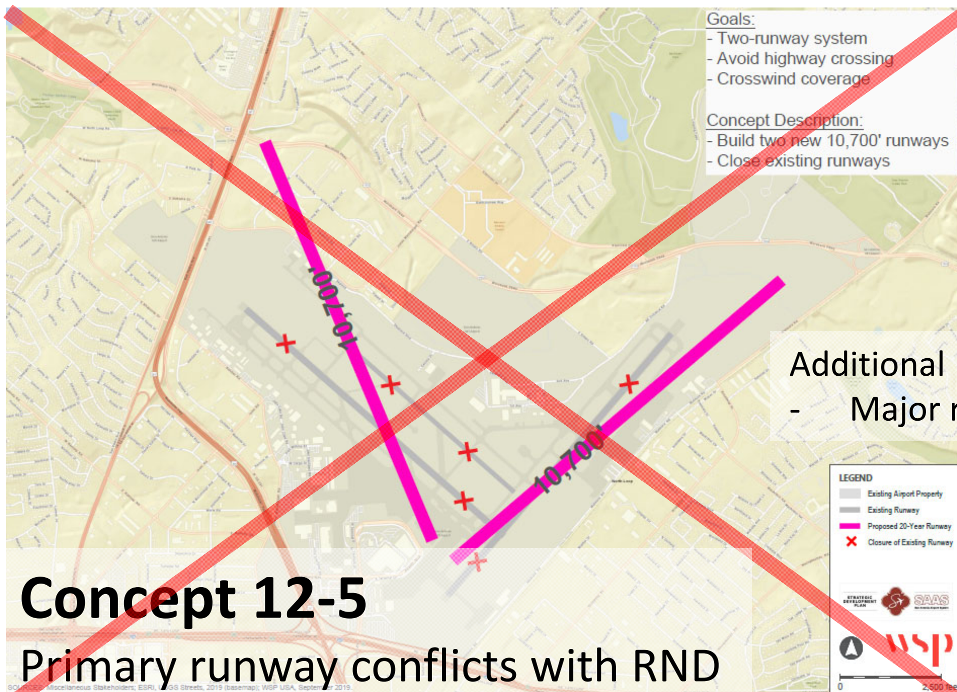




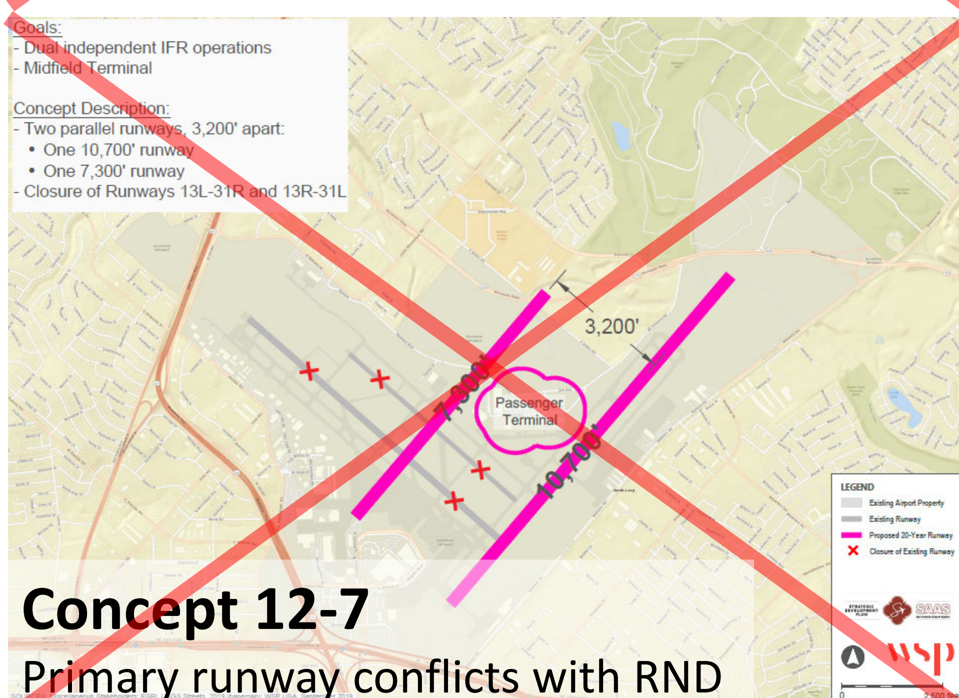
Additional Fatal Flaw:
- Major road impacts

Round 1a Eliminated Concepts (Page 12 of 17)

Airspace Conflicts with RND

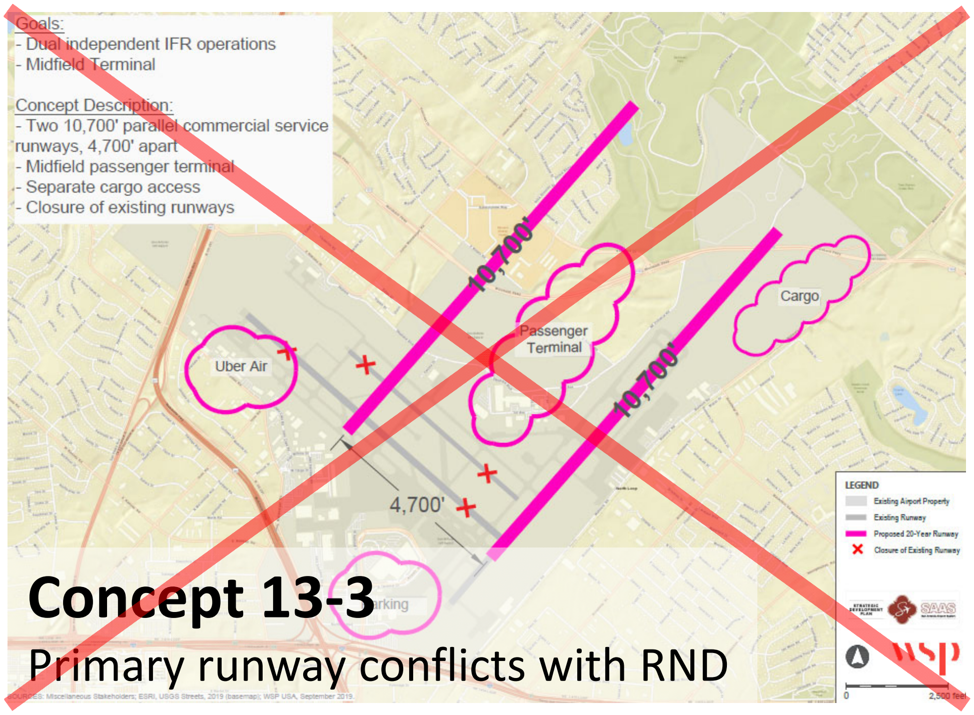


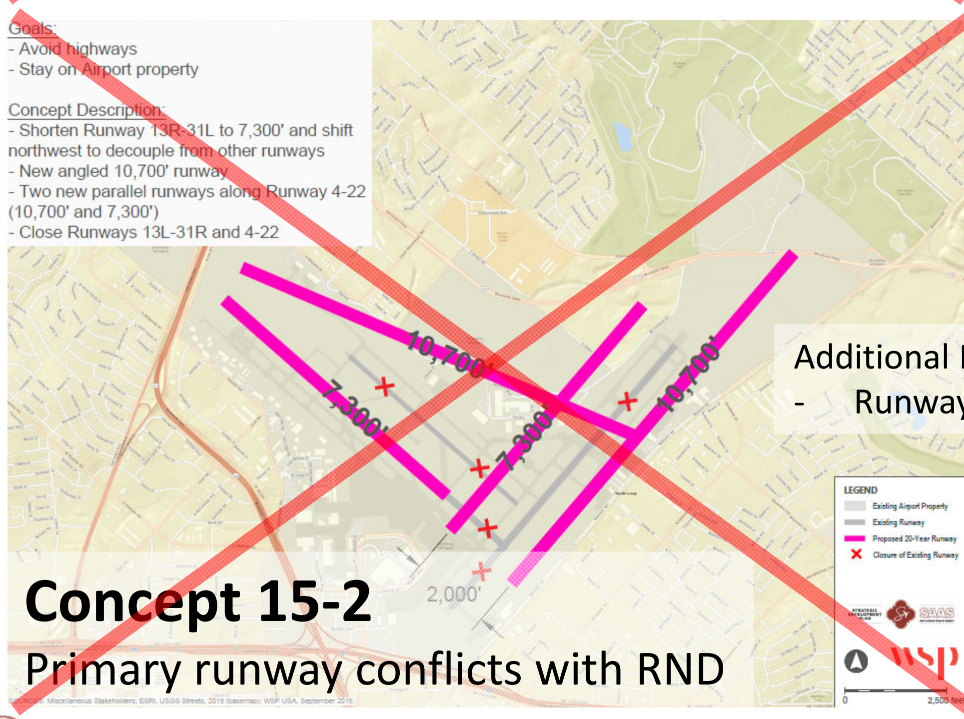
Additional Fatal Flaw:
- Major road impacts



Round 1a Eliminated Concepts (Page 13 of 17)

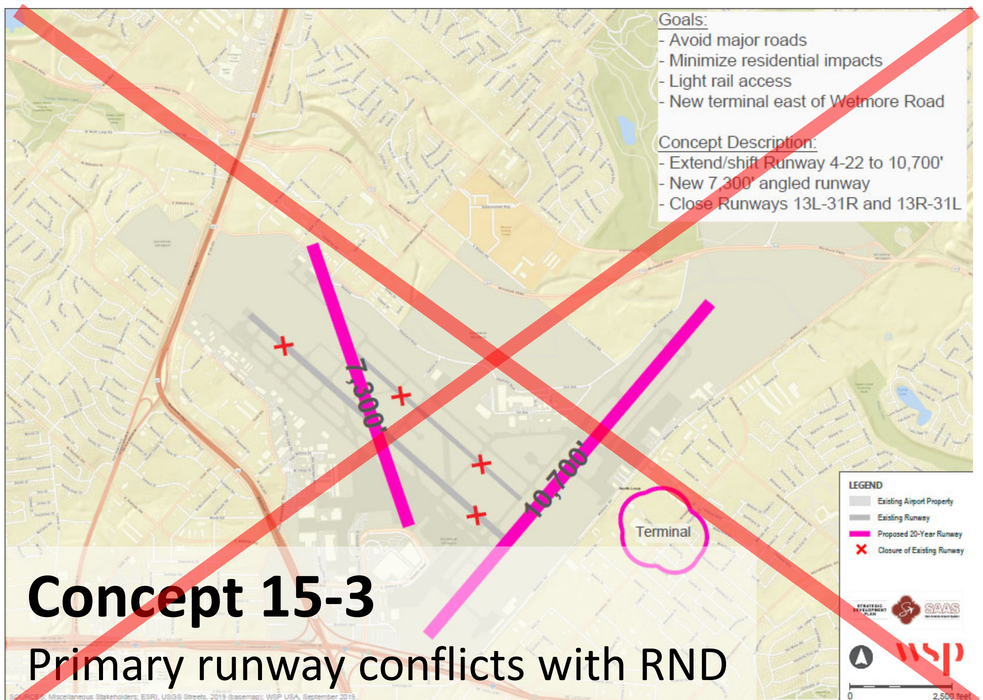
Airspace Conflicts with RND

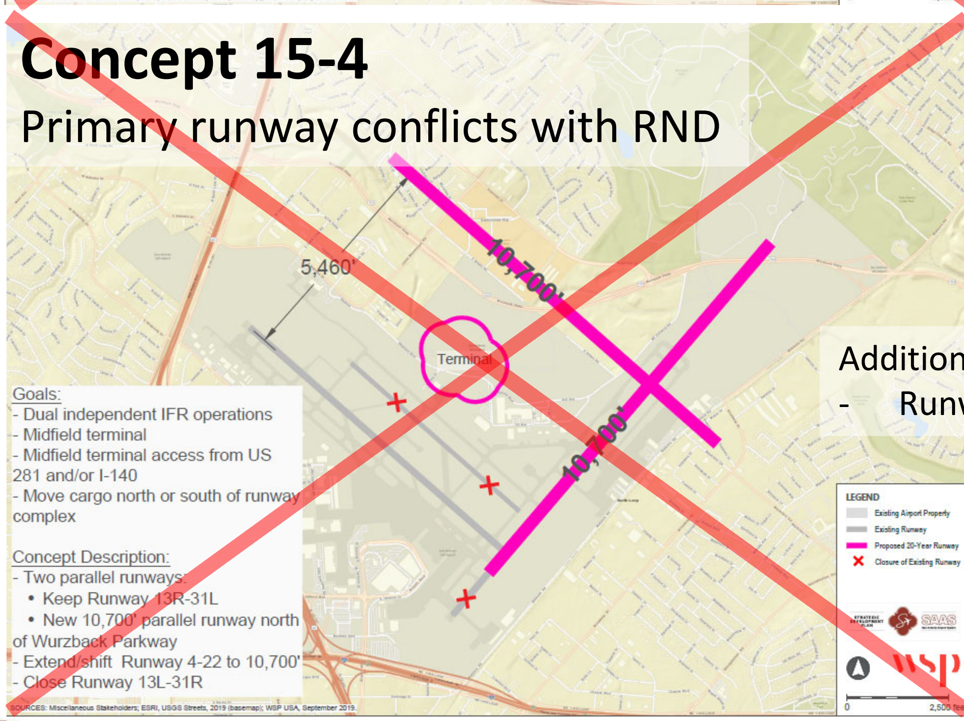




Round 1a Eliminated Concepts (Page 14 of 17)

Airspace Conflicts with RND

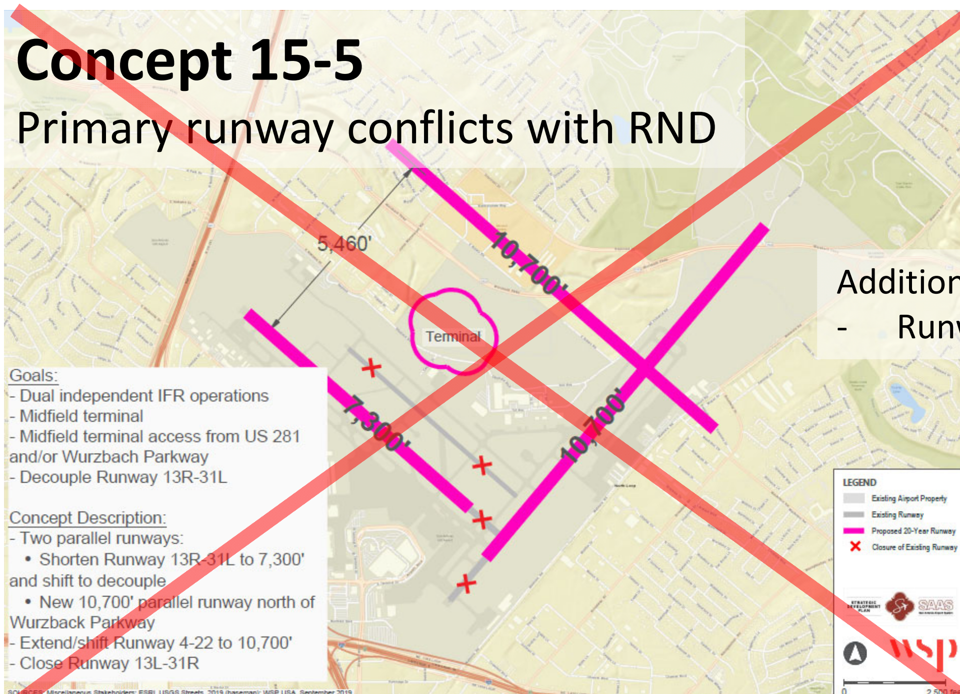




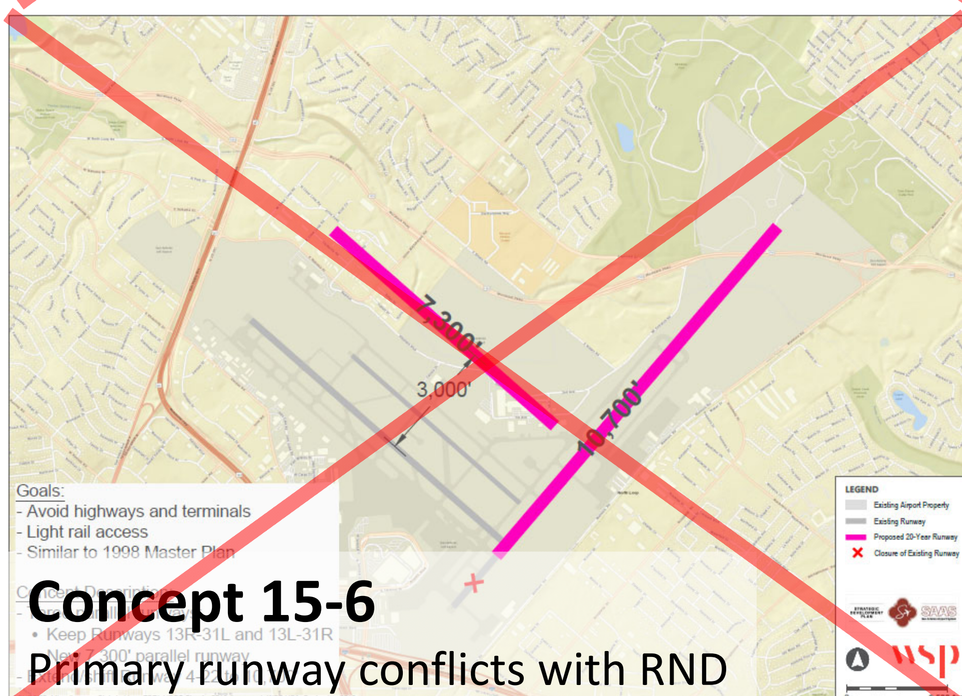
Additional Fatal Flaw:
- Runway layout

Round 1a Eliminated Concepts (Page 15 of 17)

Airspace Conflicts with RND

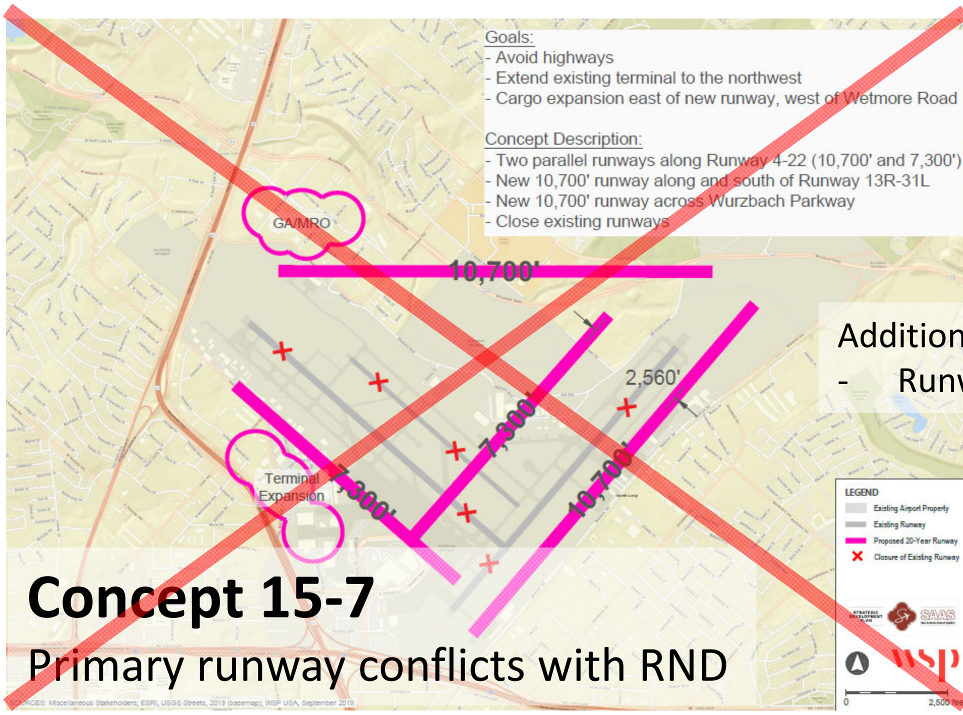


Additional Fatal Flaw:
- Runway layout

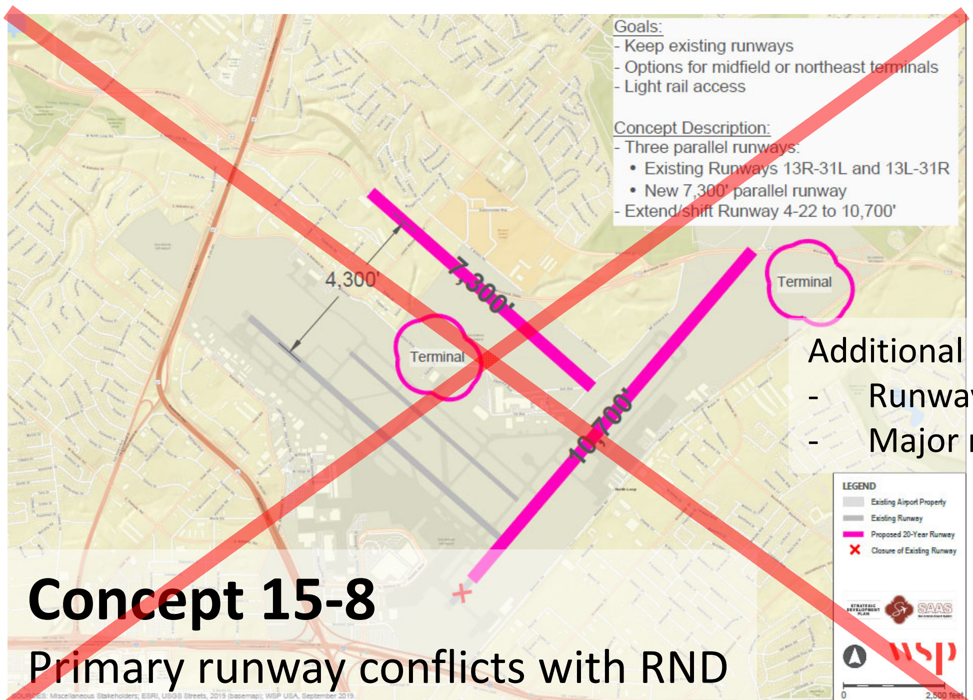


Round 1a Eliminated Concepts (Page 16 of 17)

Airspace Conflicts with RND

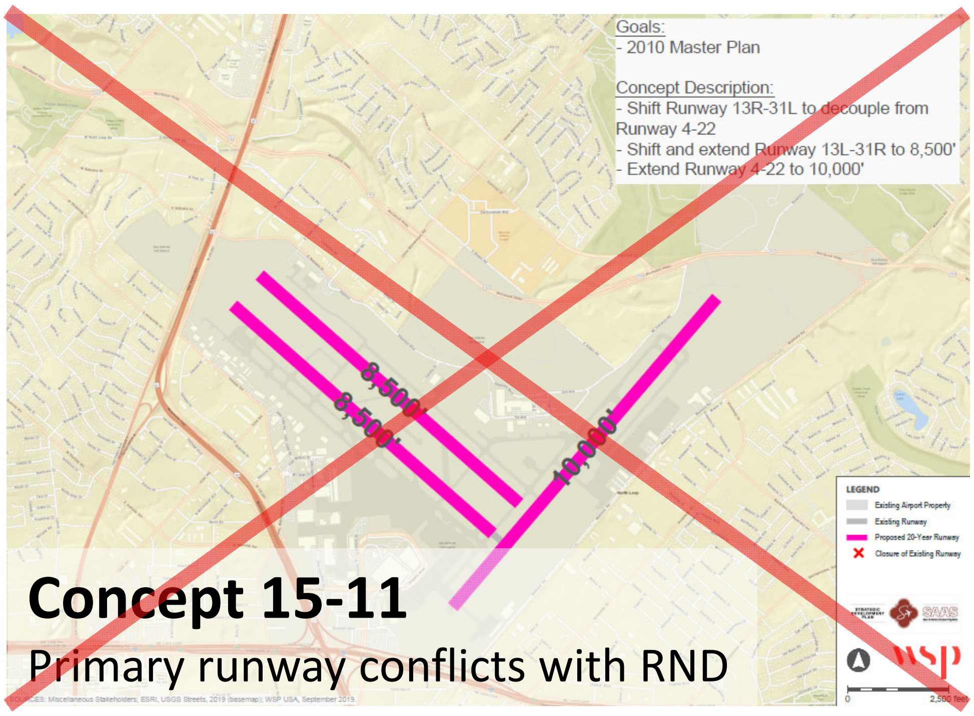


Additional Fatal Flaw:
- Runway layout



Additional Fatal Flaws:
- Runway layout
- Major road impacts

Round 1a Eliminated Concepts (Page 17 of 17)
Airspace Conflicts with RND



Round 1a Fatal Flaws Review
Runway Layout

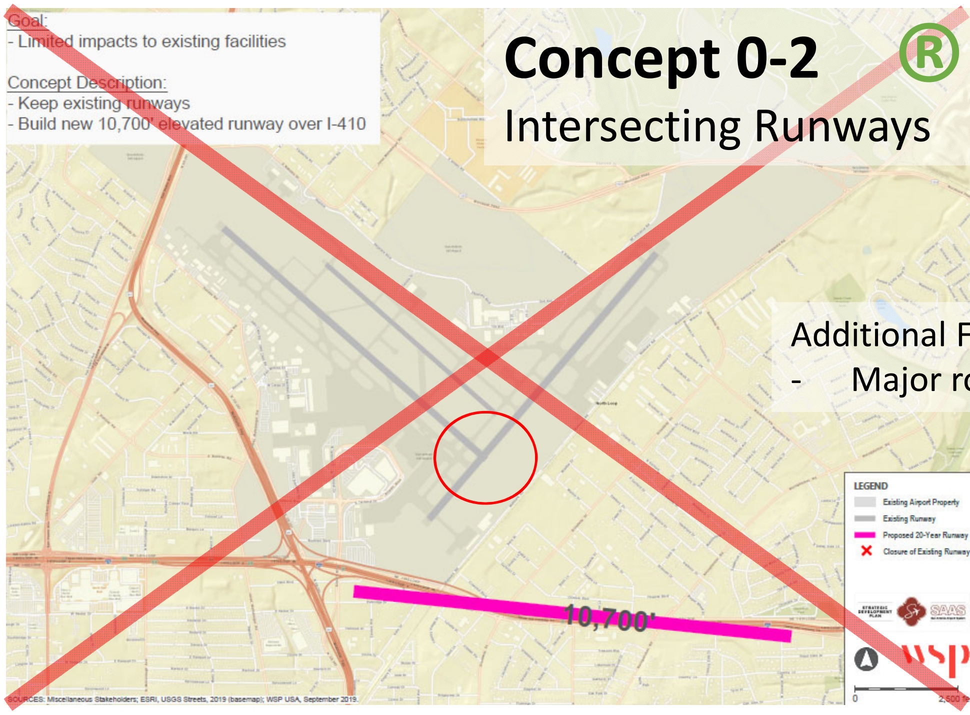
- Does the proposed runway layout have design flaws?

- Considerations :
  - Intersecting runways

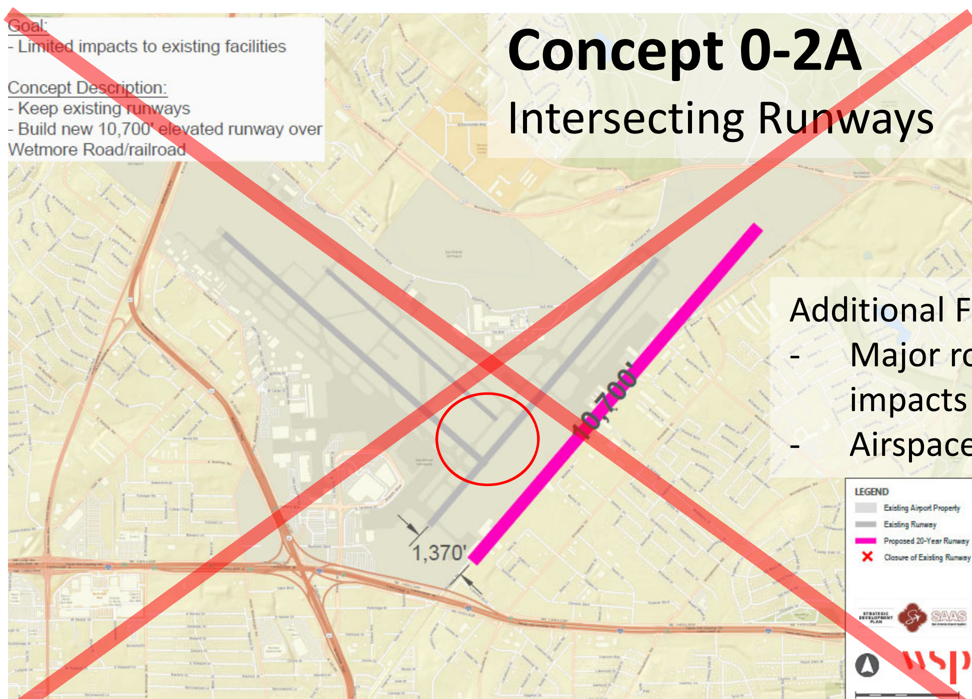
➢ 33 concepts have layouts with intersecting runways

Round 1a Eliminated Concepts (Page 1 of 17)

Runway Layout

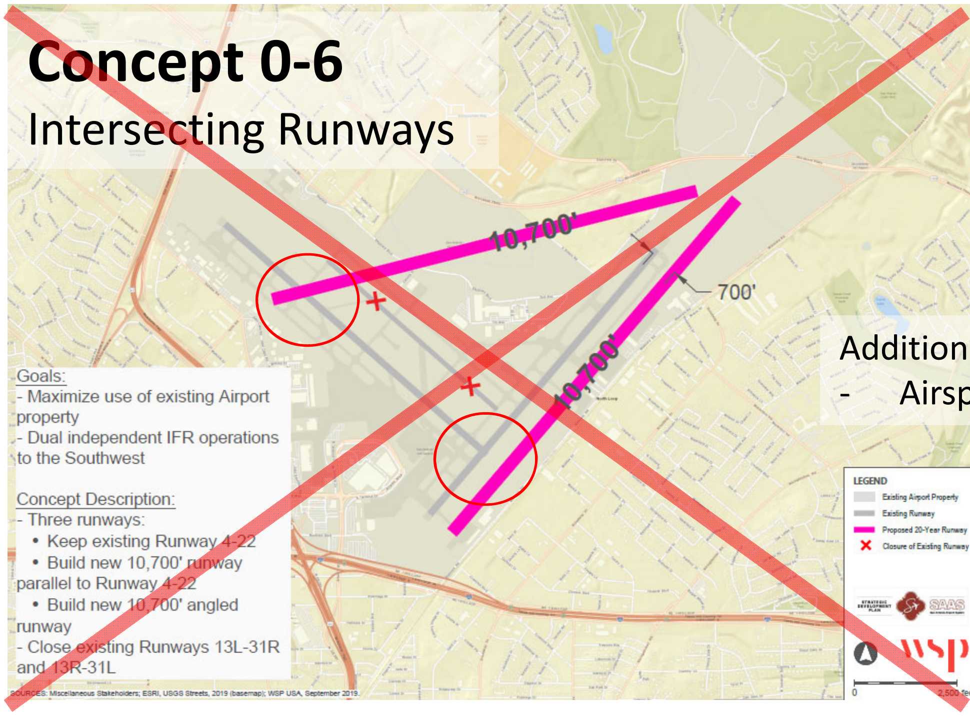


Additional Fatal Flaw:
- Major road impacts

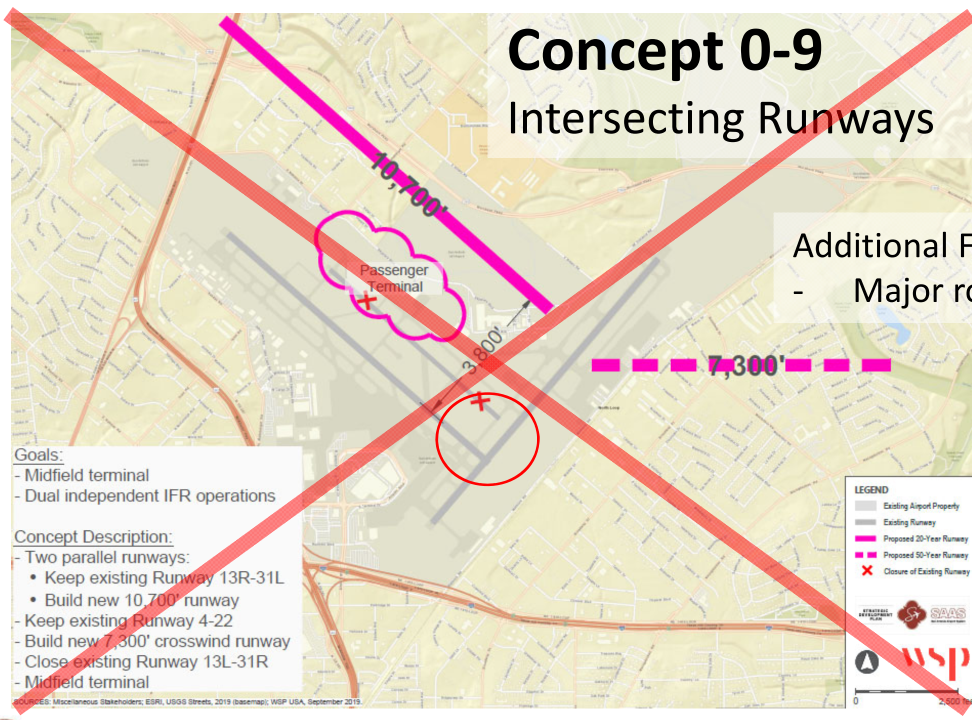


Additional Fatal Flaw:
- Major road/railroad impacts
- Airspace conflicts

Round 1a Eliminated Concepts (Page 2 of 17)
Runway Layout

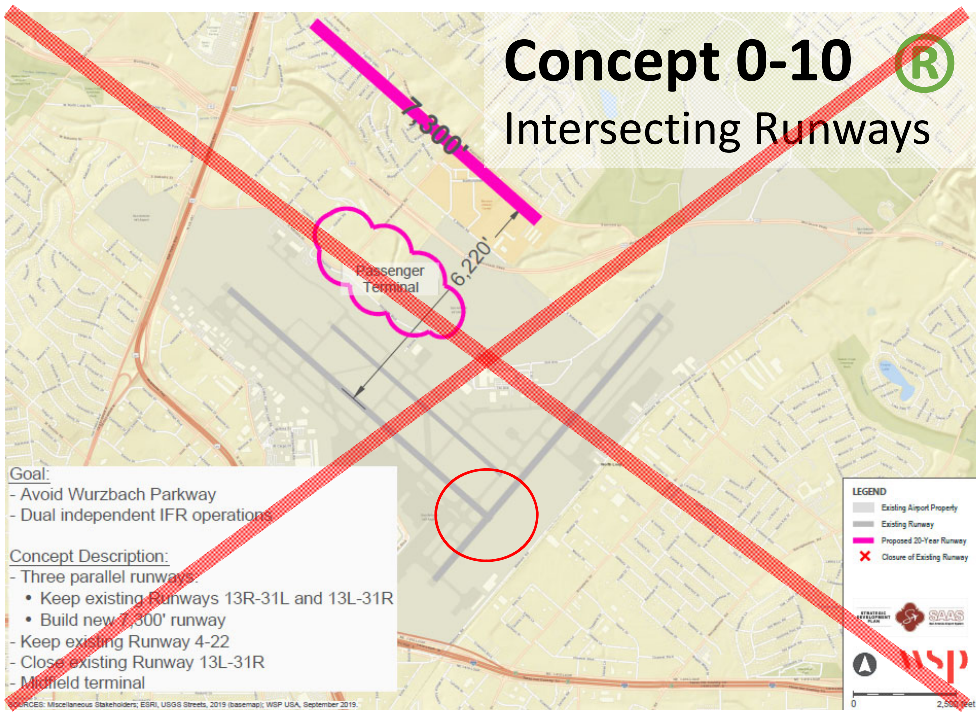


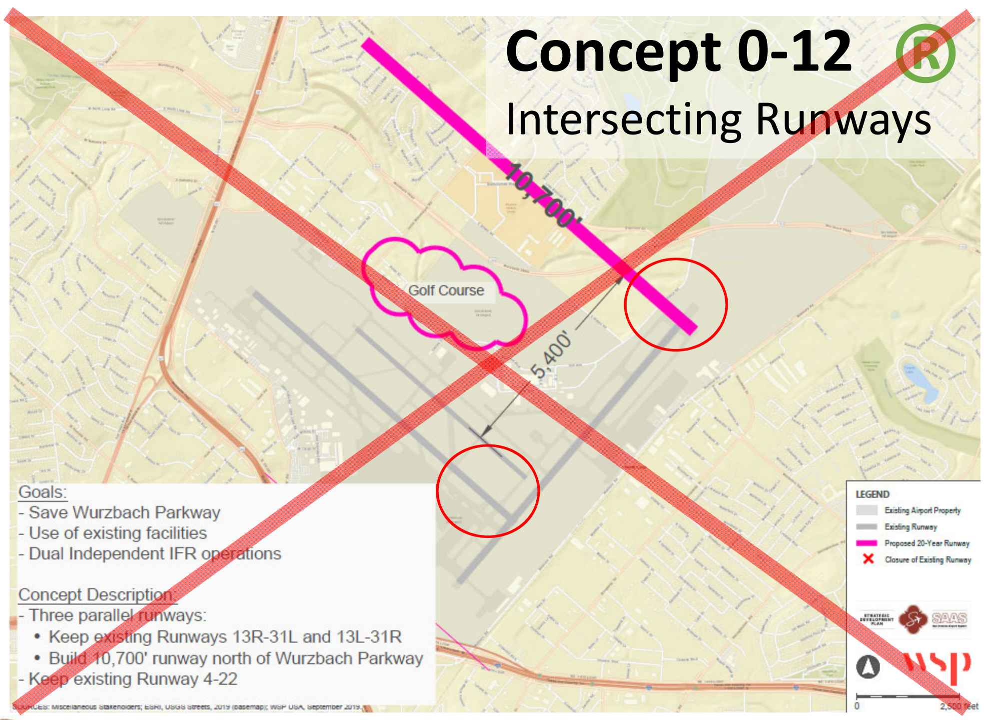
Additional Fatal Flaw:
- Airspace conflicts



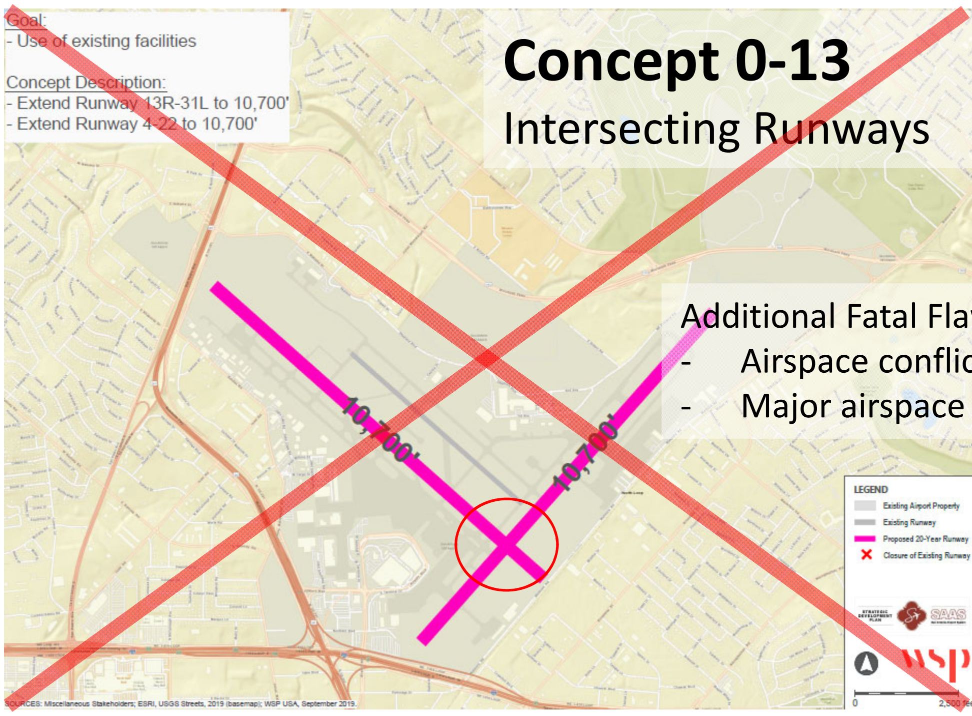
Additional Fatal Flaw:
- Major road impacts

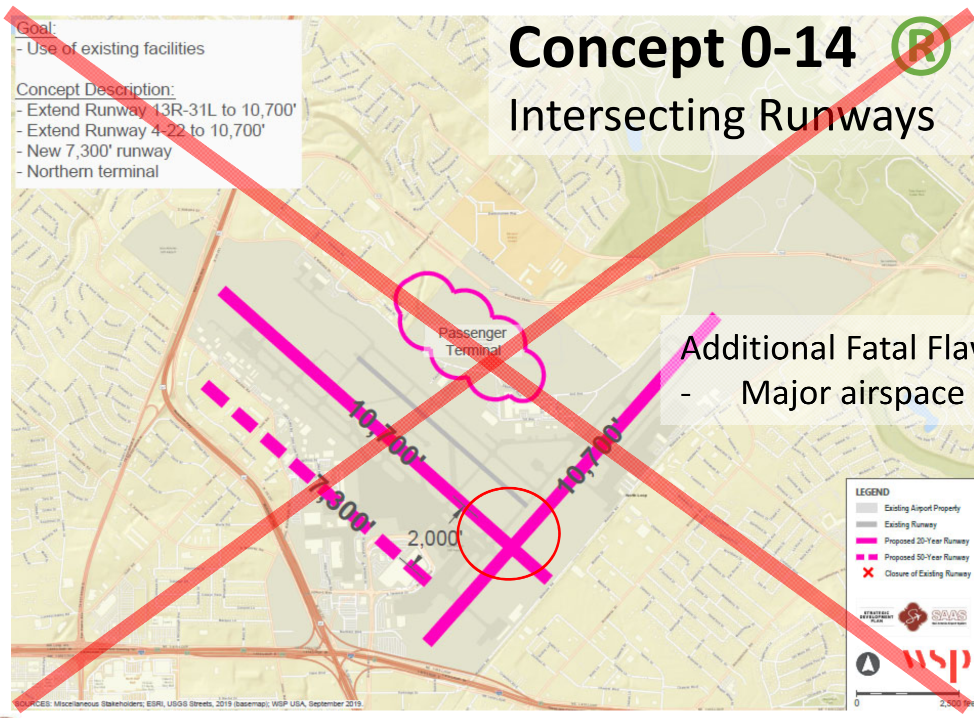
Round 1a Eliminated Concepts (Page 3 of 17)
Runway Layout



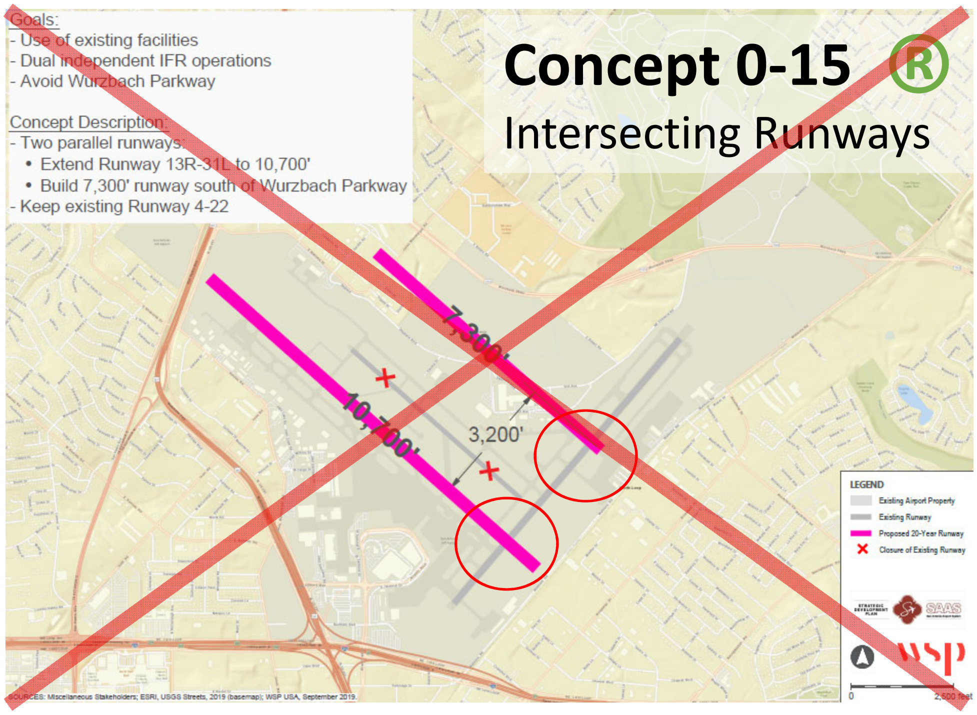


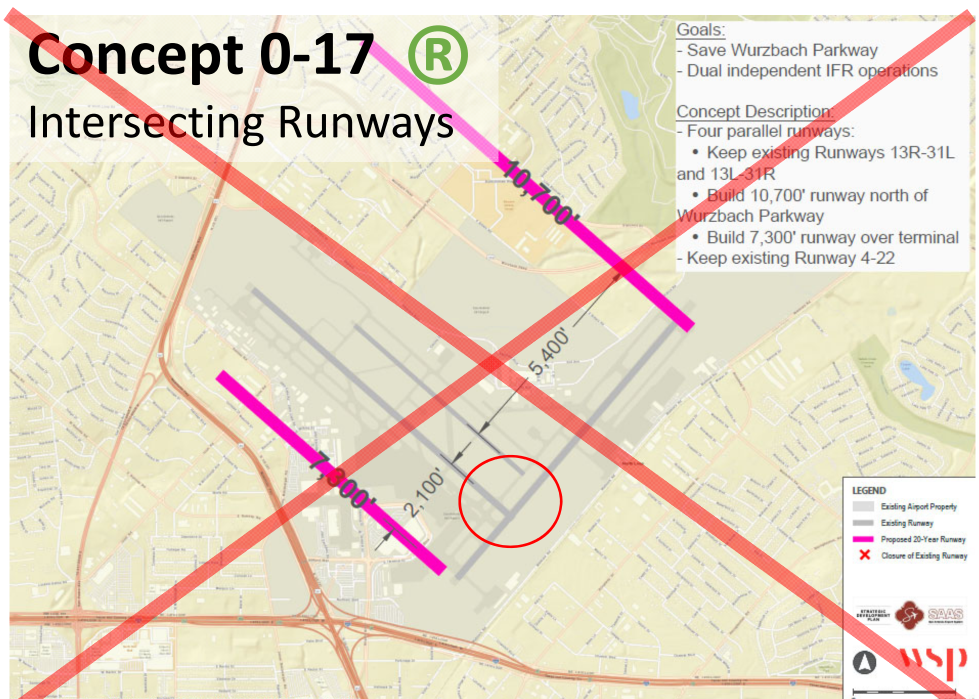
Round 1a Eliminated Concepts (Page 4 of 17)
Runway Layout





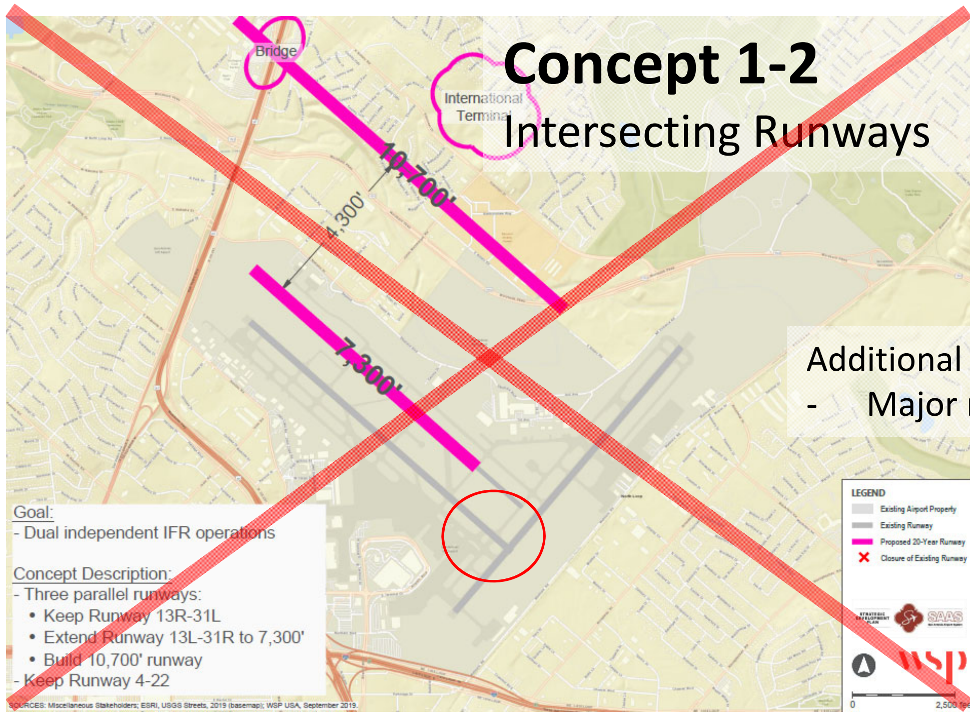
Round 1a Eliminated Concepts (Page 5 of 17)
Runway Layout



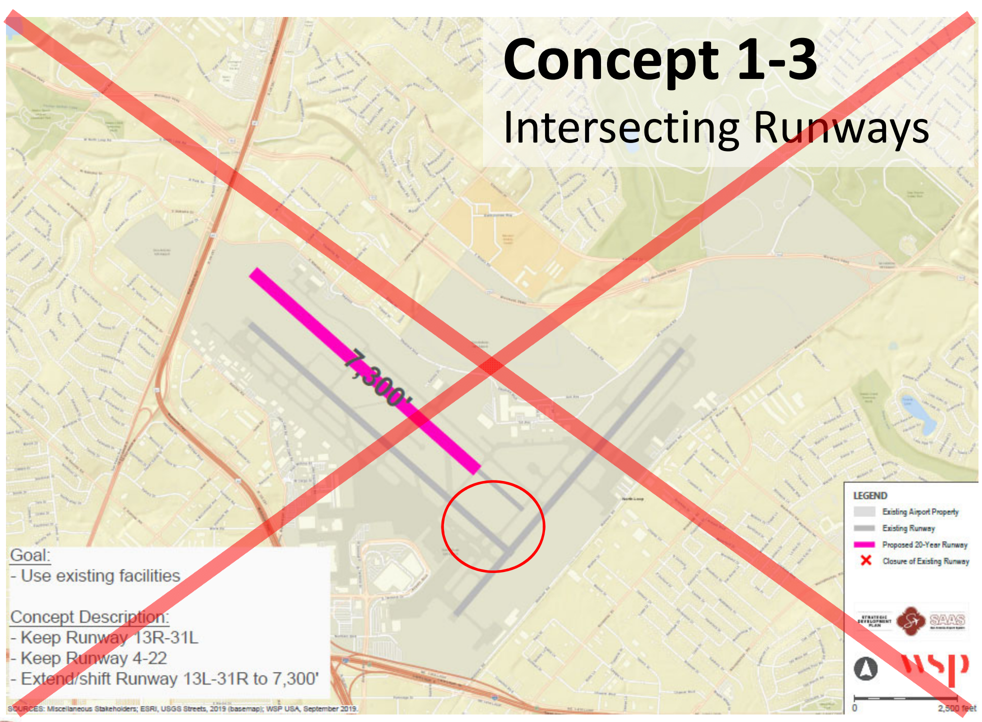


Round 1a Eliminated Concepts (Page 6 of 17)

Runway Layout

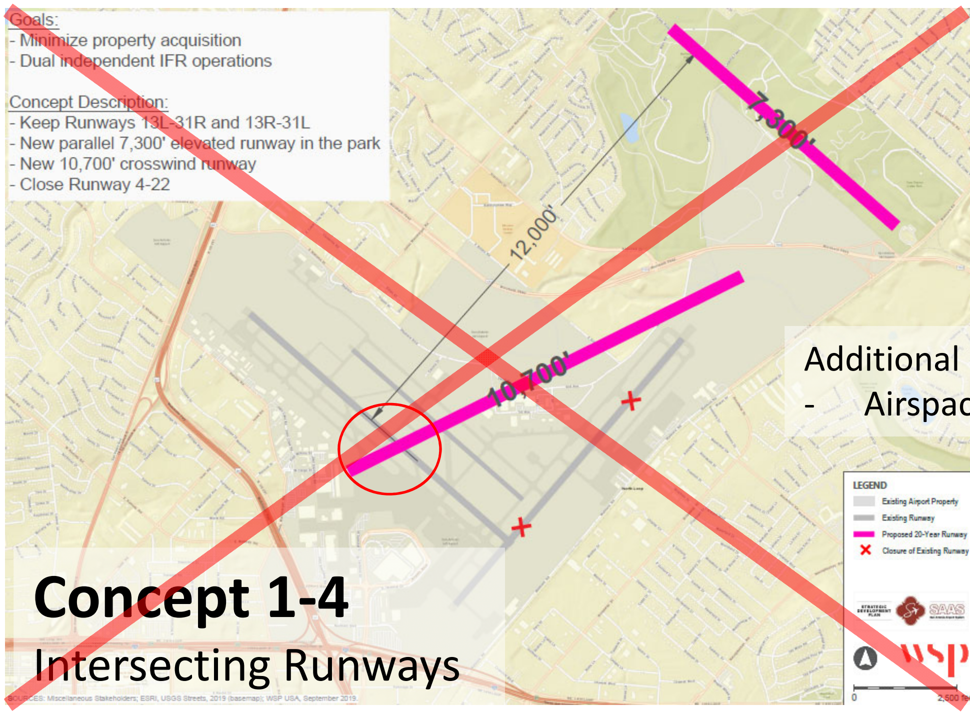


Additional Fatal Flaw:
- Major road impacts

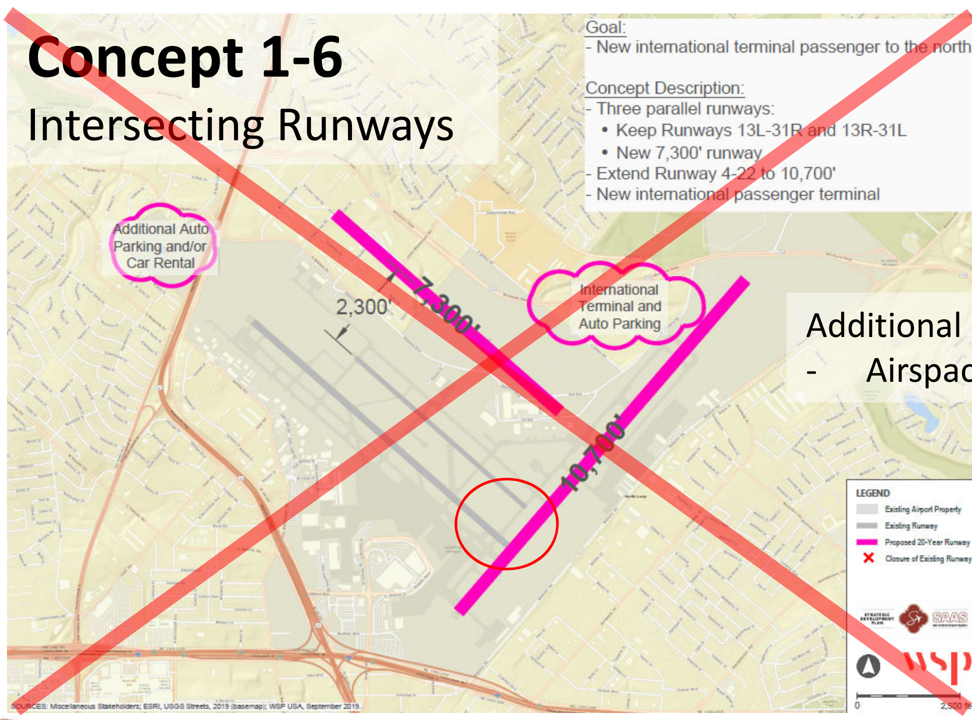


Round 1a Eliminated Concepts (Page 7 of 17)

Runway Layout



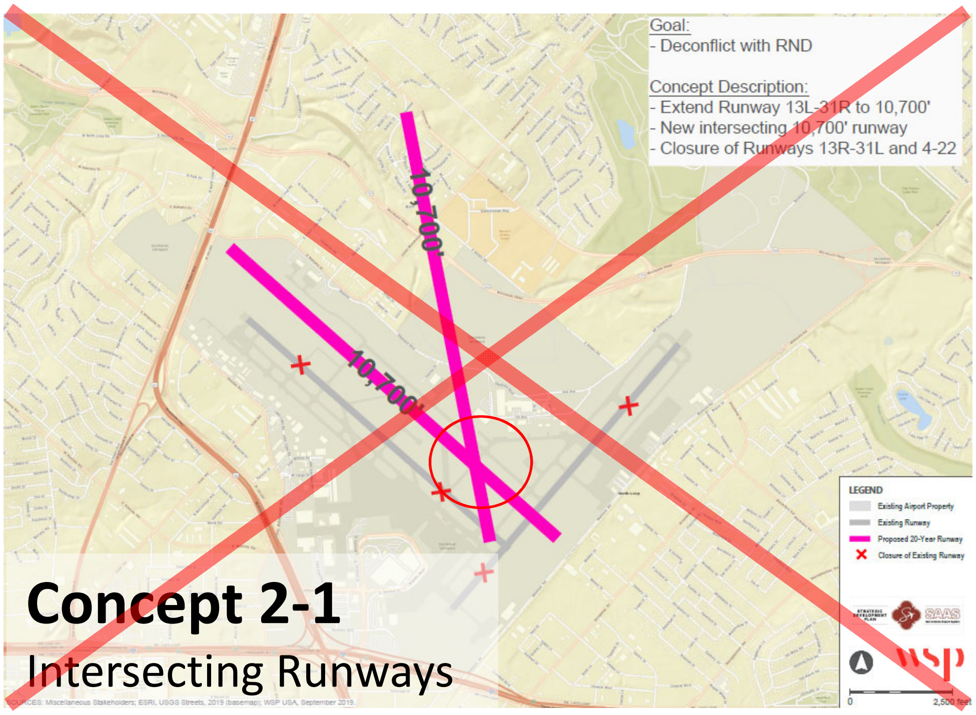
Additional Fatal Flaw:
- Airspace conflicts

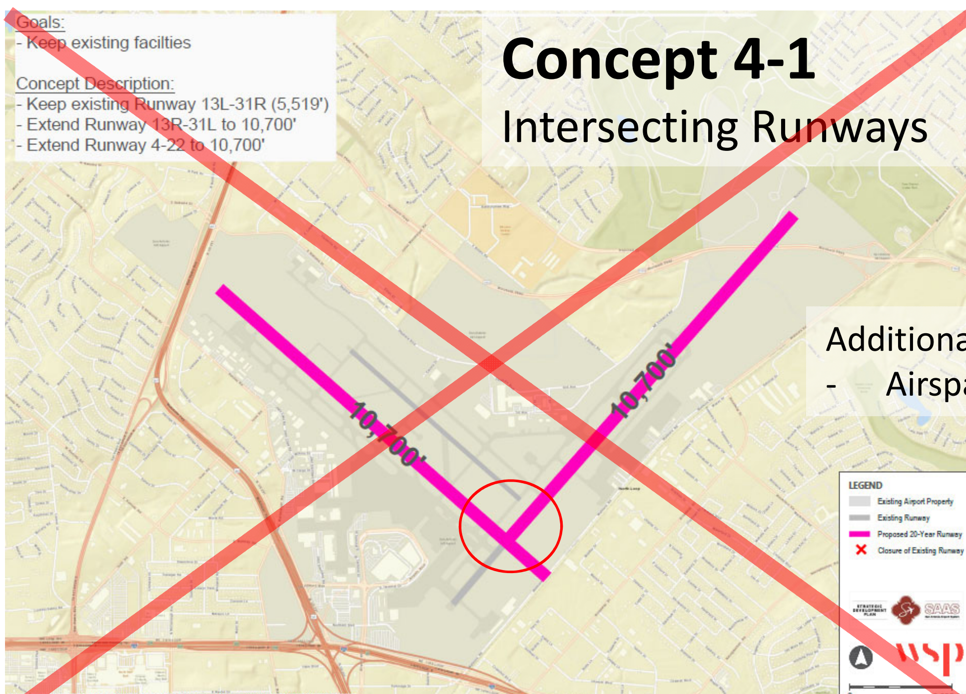


Additional Fatal Flaw:
- Airspace conflicts

Round 1a Eliminated Concepts (Page 8 of 17)

Runway Layout

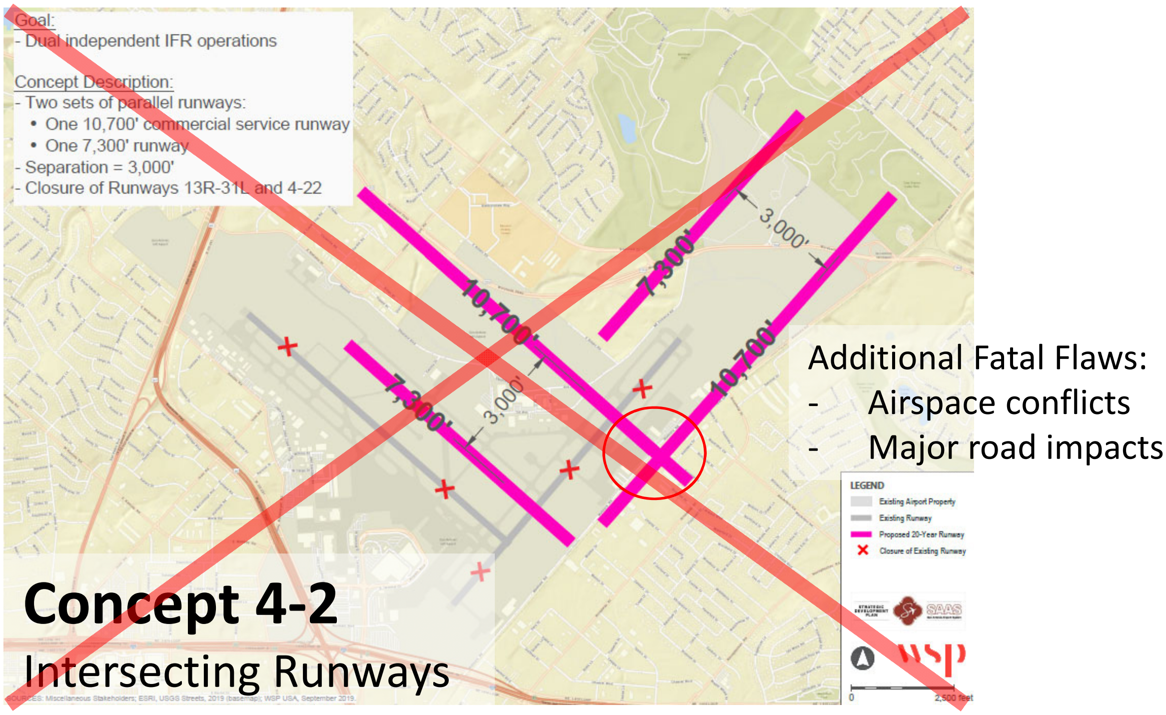


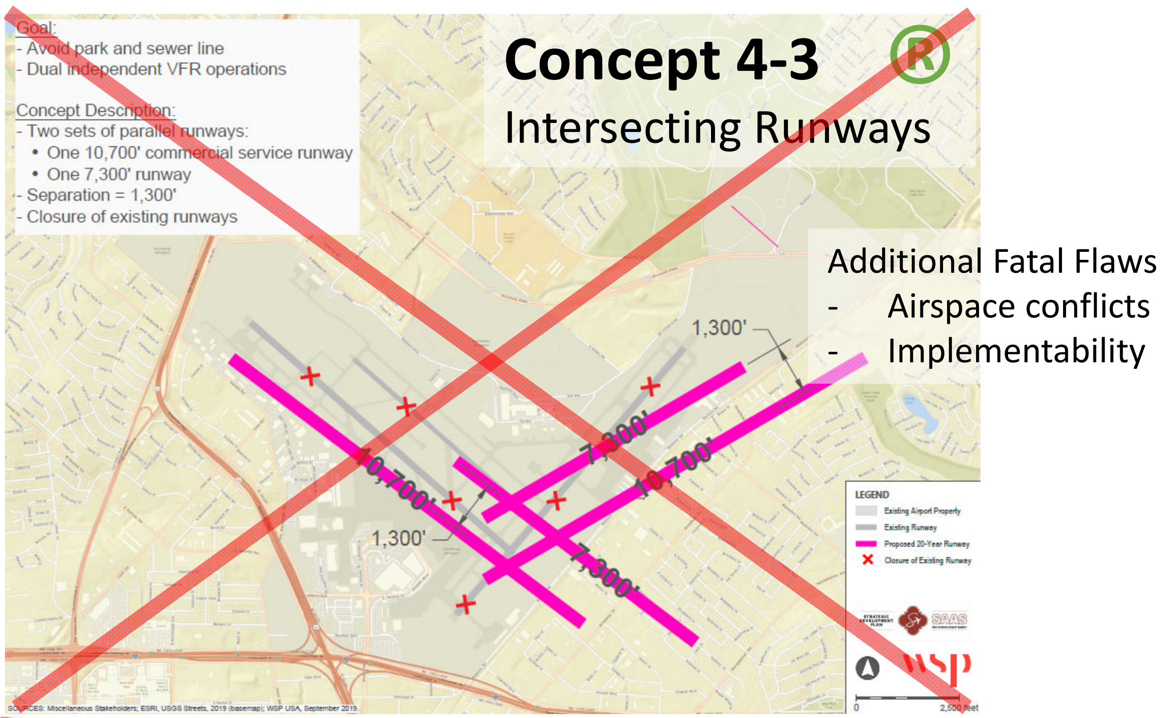


Additional Fatal Flaw:
- Airspace conflicts

Round 1a Eliminated Concepts (Page 9 of 17)

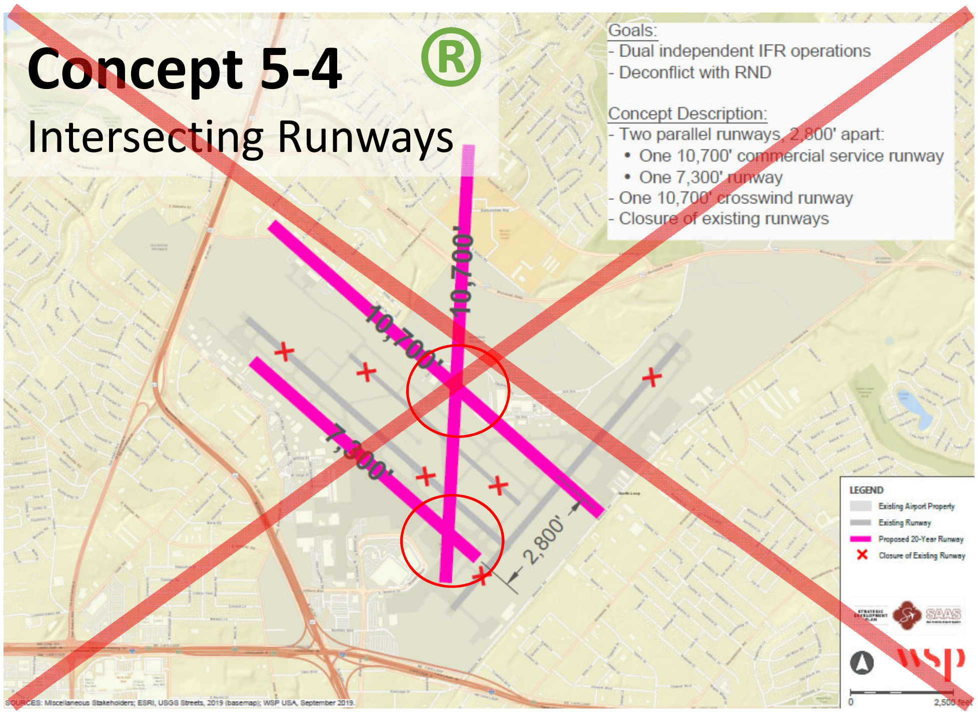
Runway Layout

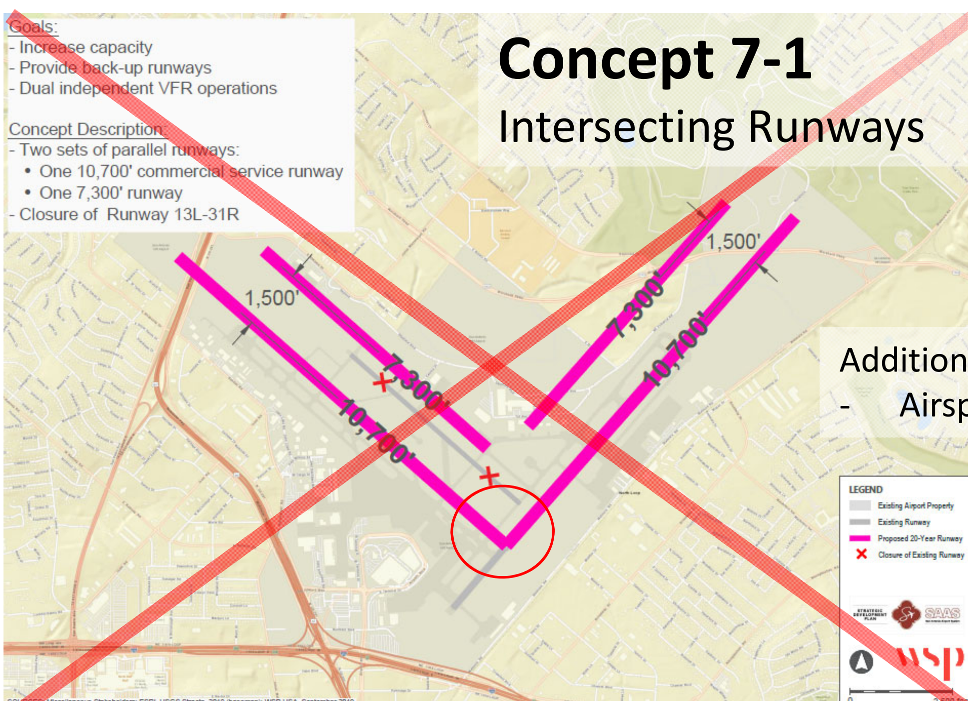




Round 1a Eliminated Concepts (Page 10 of 17)

Runway Layout



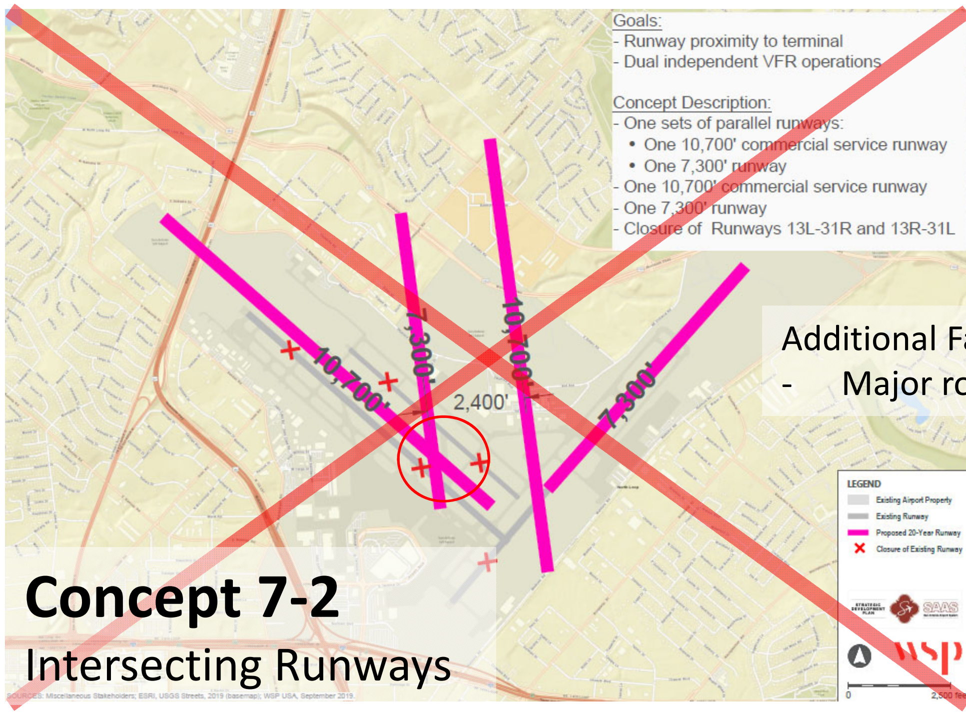


Additional Fatal Flaw:

- Airspace conflicts

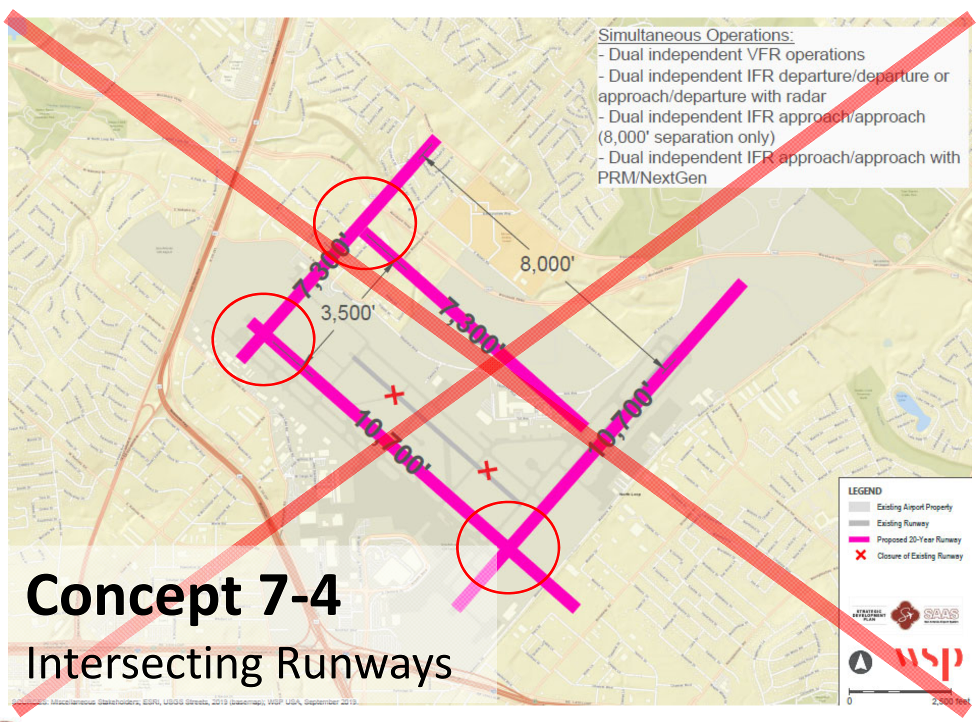
Round 1a Eliminated Concepts (Page 11 of 17)

Runway Layout



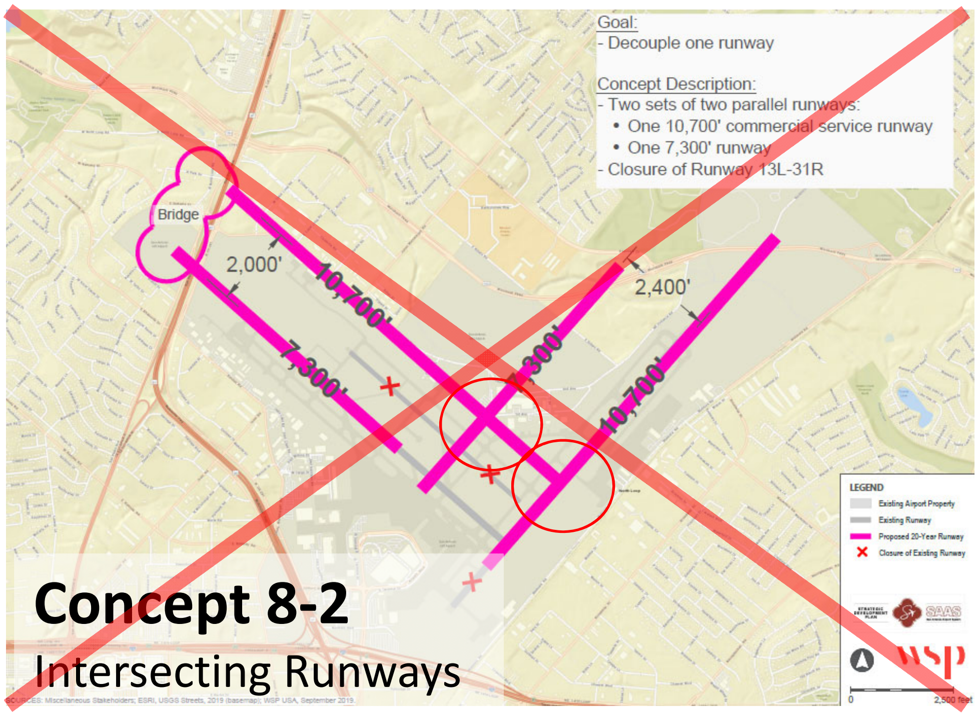
Additional Fatal Flaw:

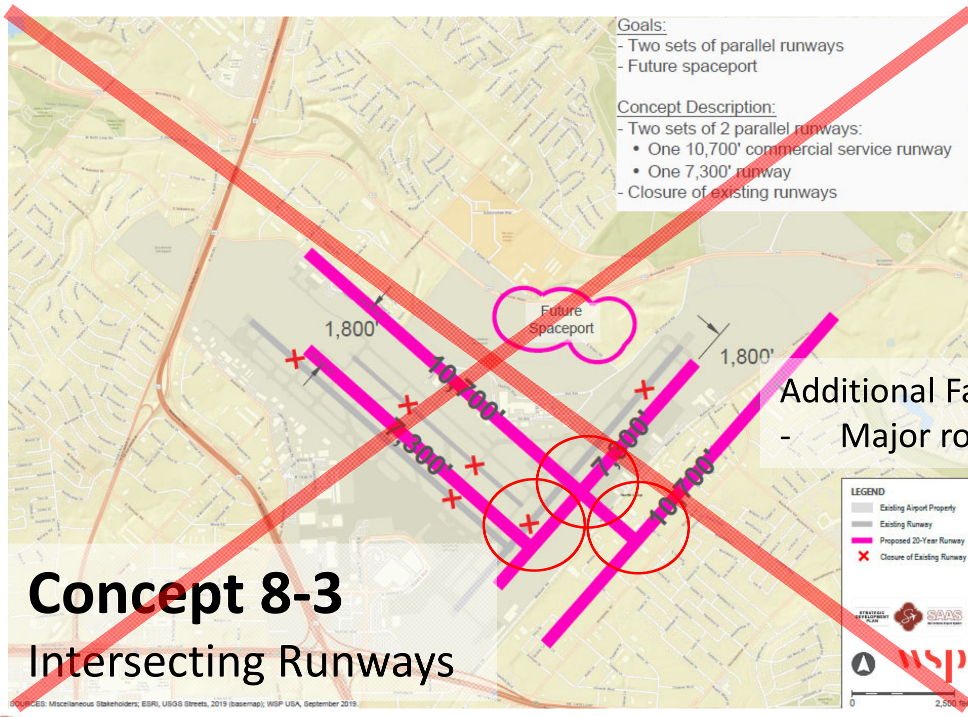
- Major road impacts



Round 1a Eliminated Concepts (Page 12 of 17)

Runway Layout

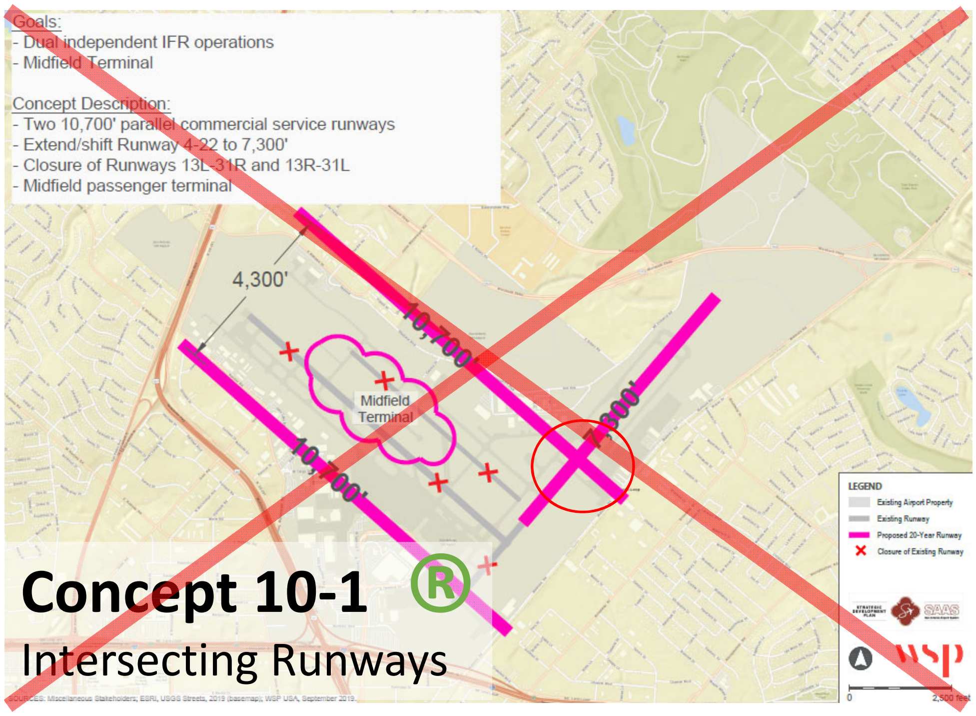


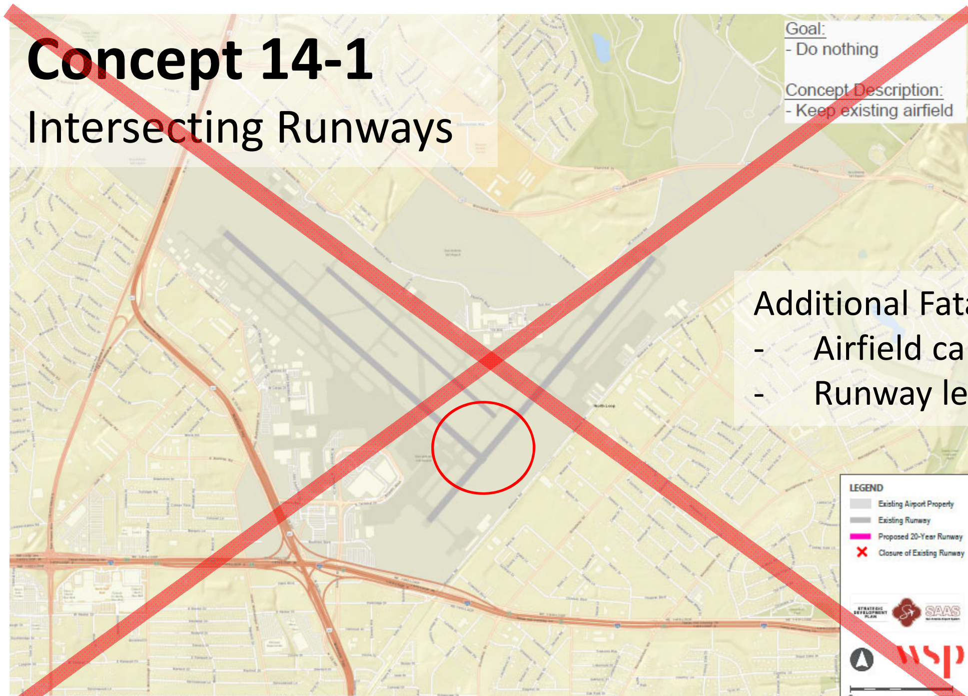


Additional Fatal Flaw:
- Major road impacts

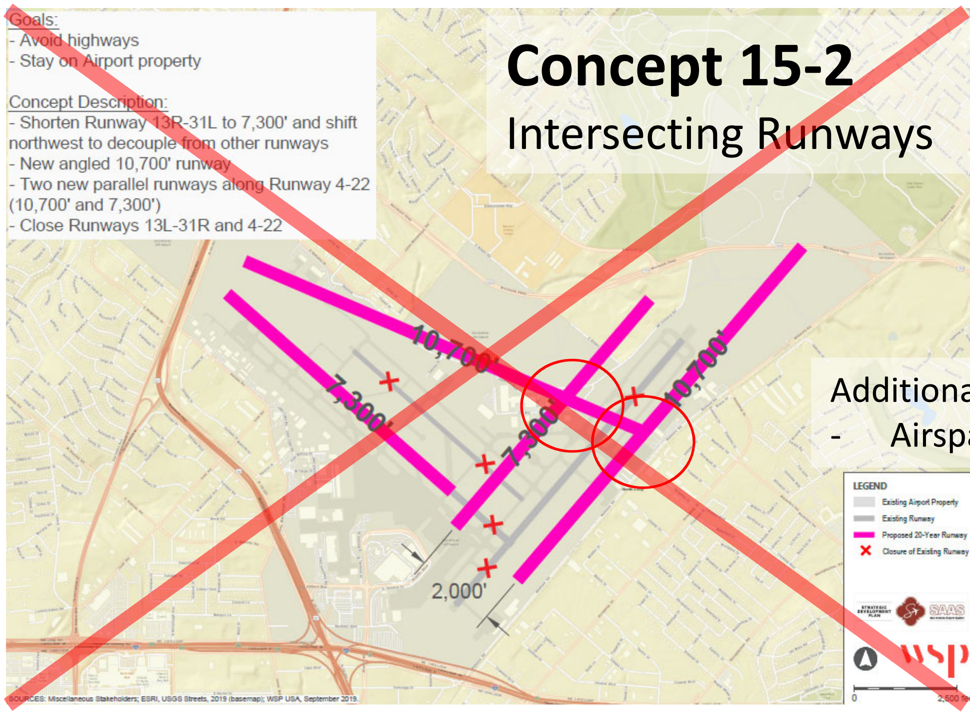
Round 1a Eliminated Concepts (Page 13 of 17)

Runway Layout

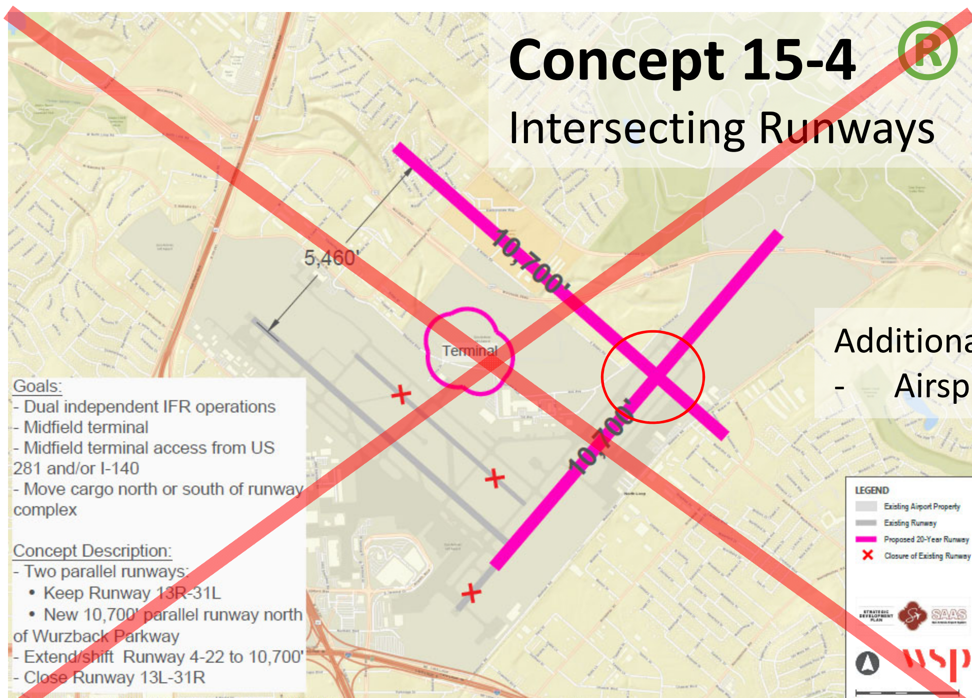




Round 1a Eliminated Concepts (Page 14 of 17)
Runway Layout



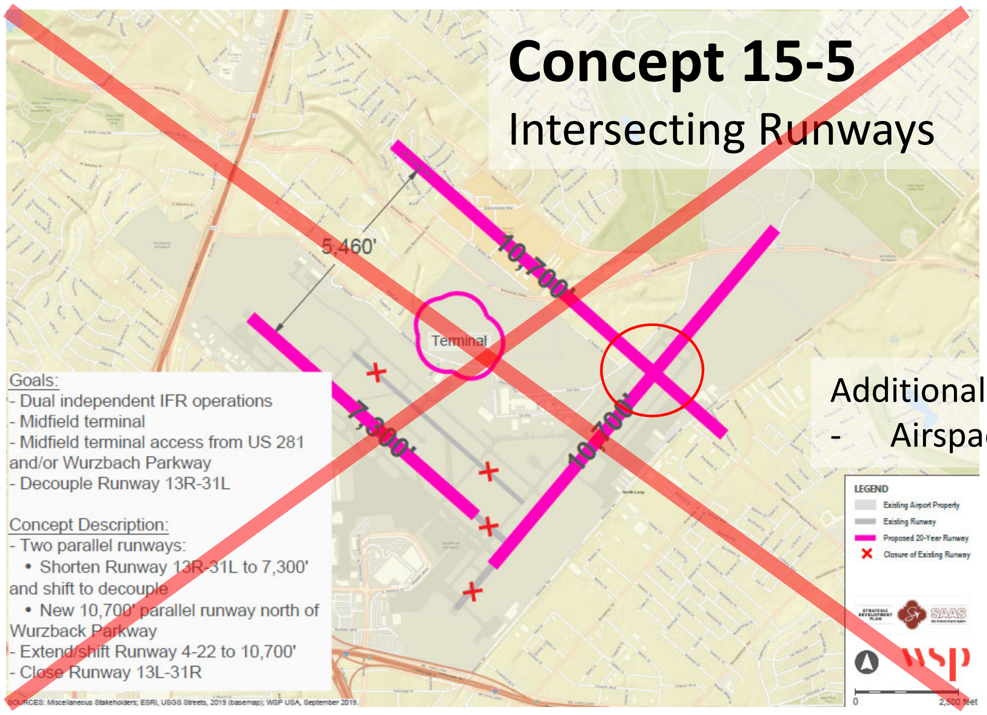
Additional Fatal Flaw:
- Airspace conflicts



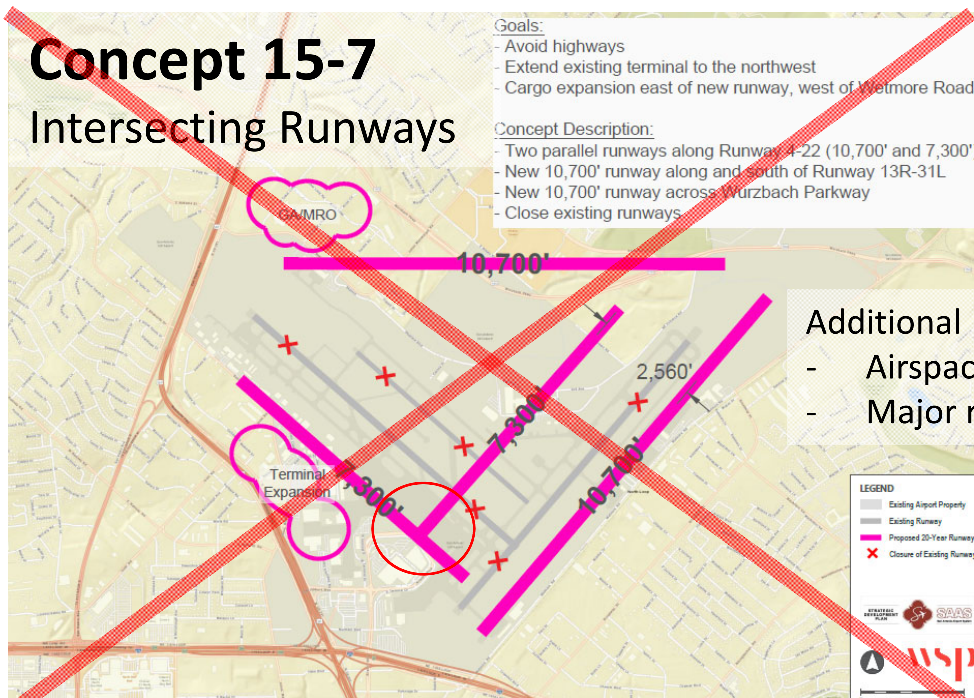
Additional Fatal Flaw:
- Airspace conflicts

Round 1a Eliminated Concepts (Page 15 of 17)

Runway Layout



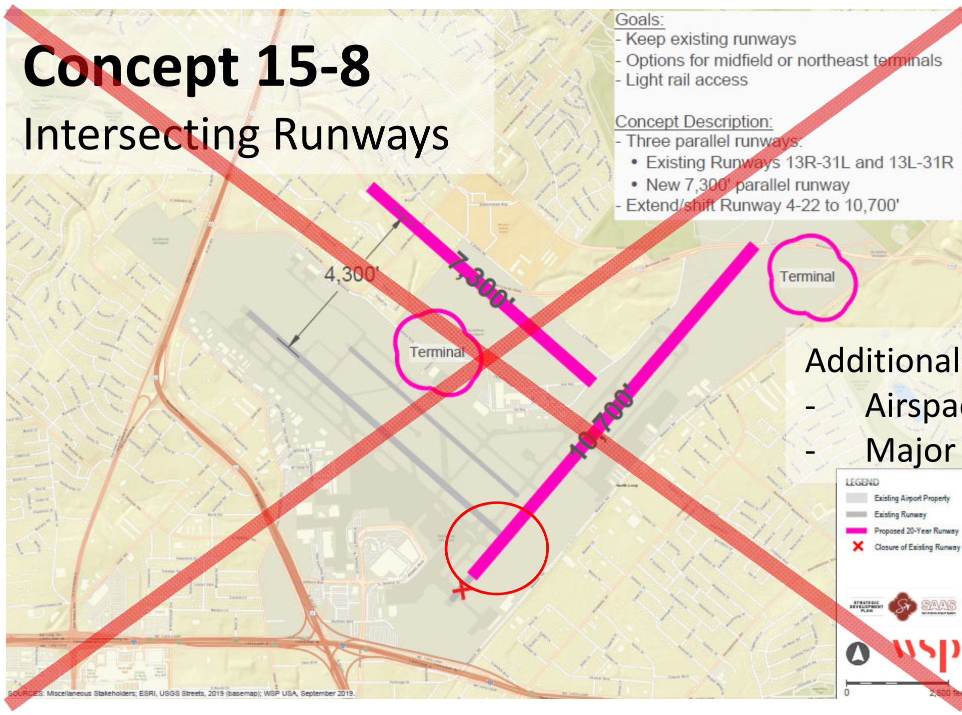
Additional Fatal Flaw:
- Airspace conflicts



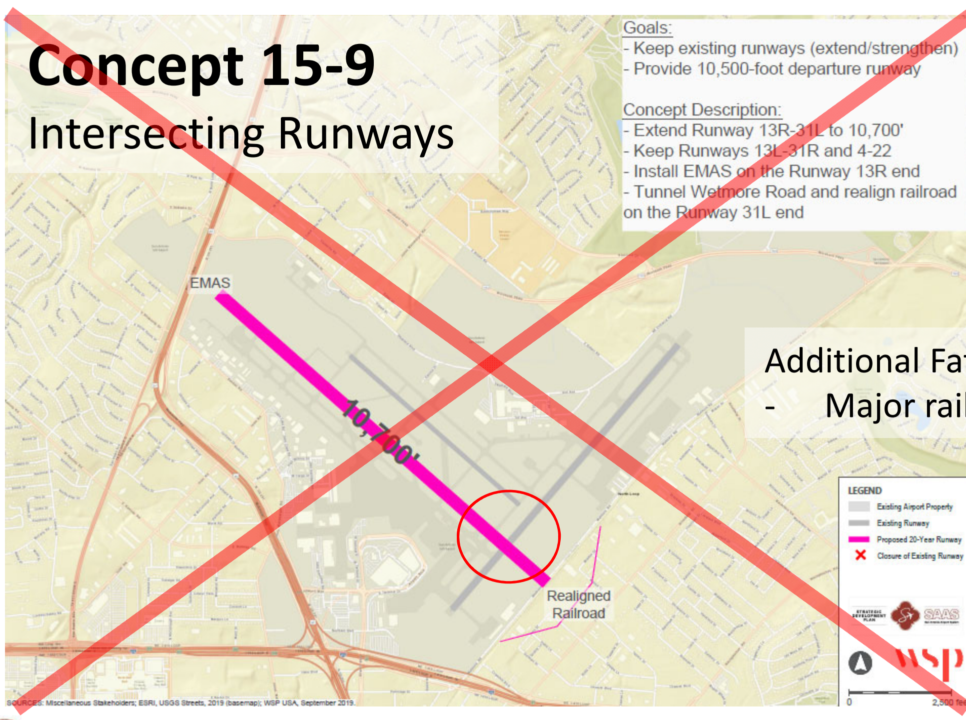
Additional Fatal Flaws:
- Airspace conflicts
- Major road impacts

Round 1a Eliminated Concepts (Page 16 of 17)

Runway Layout

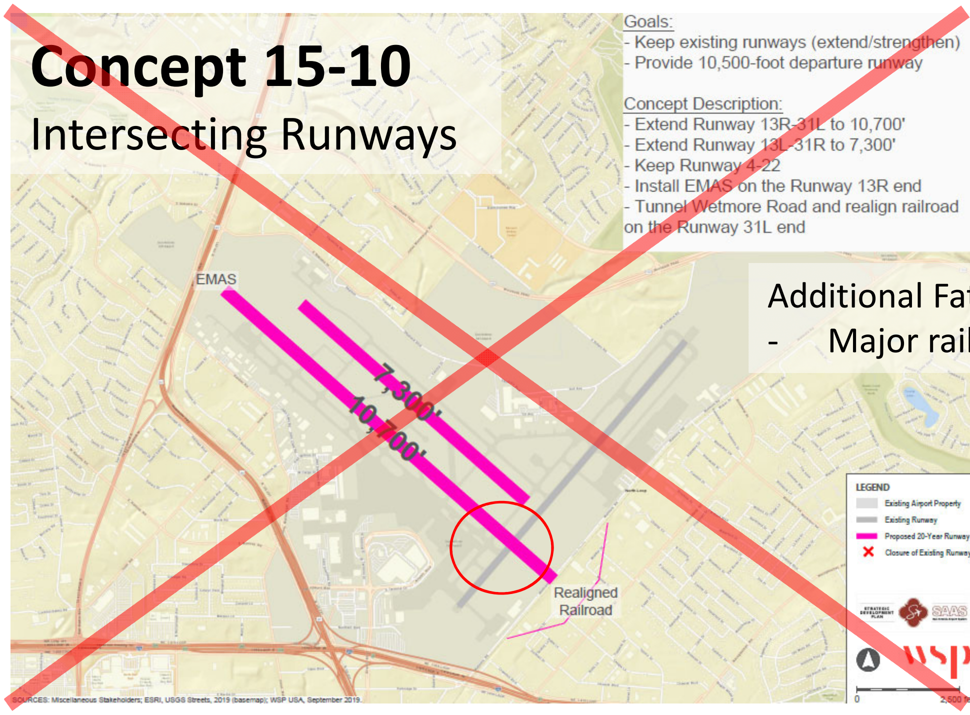


Additional Fatal Flaws:
- Airspace conflicts
- Major road impacts



Additional Fatal Flaw:
- Major railroad impacts

Round 1a Eliminated Concepts (Page 17 of 17)
Runway Layout



Additional Fatal Flaw:
- Major railroad impacts

Round 1a Fatal Flaws Review
Major Airspace Penetrations

- Are there major airspace penetrations?

- Includes:
  - Roadway interchange
  - Terminal building
  - Parking garage

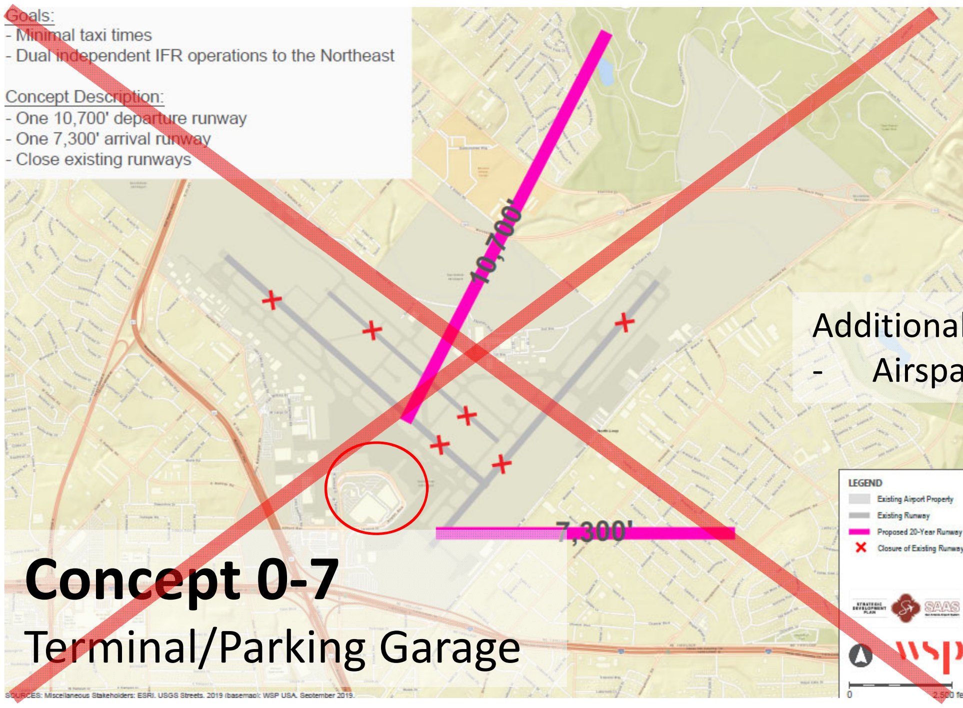
➢5 concepts have major airspace penetrations

STRATEGIC DEVELOPMENT PLAN

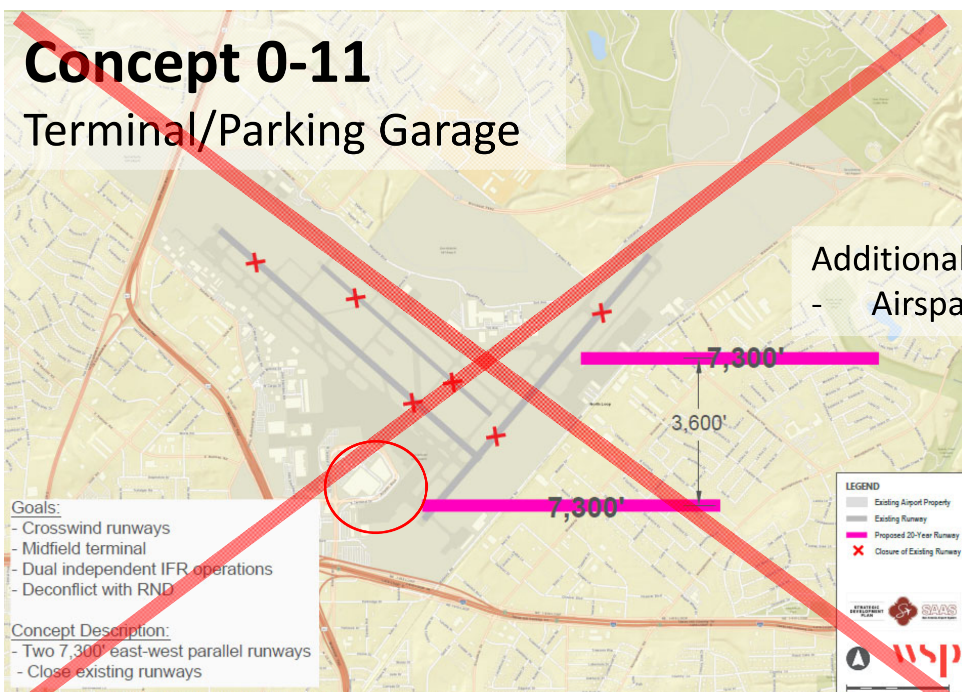
SAAS San Antonio Airport System

Round 1a Eliminated Concepts (Page 1 of 3)

Major Airspace Penetrations



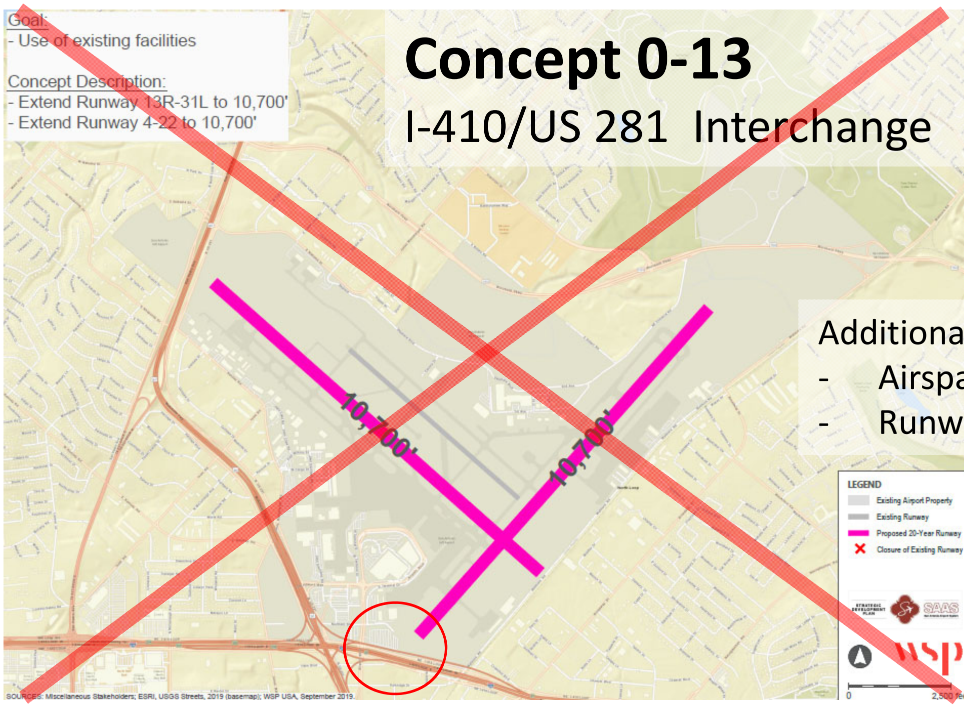
Additional Fatal Flaw:
- Airspace conflicts

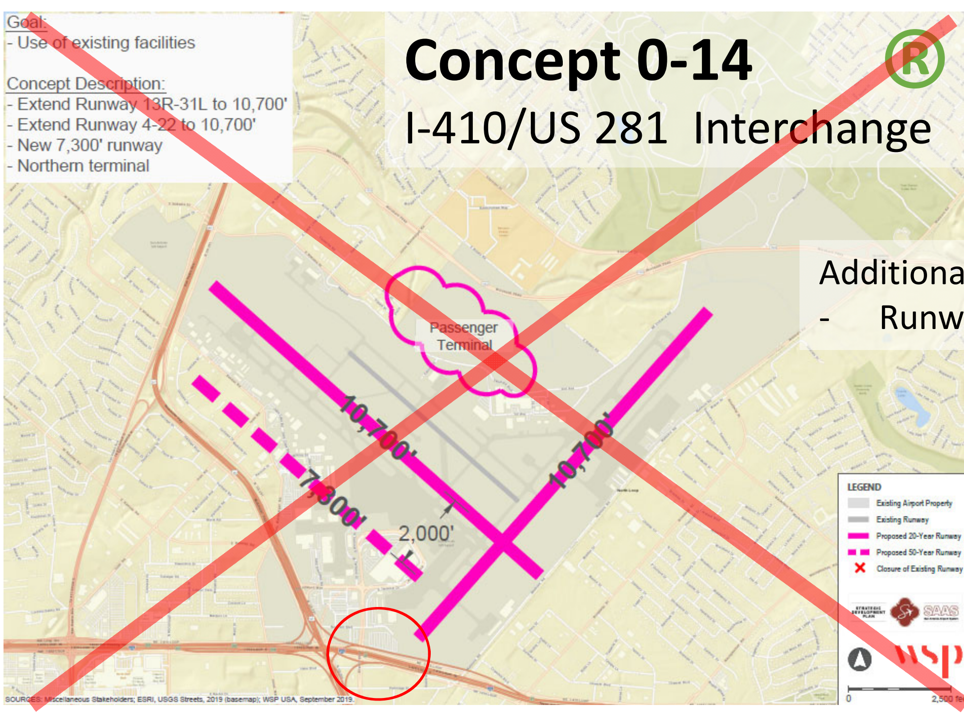


Additional Fatal Flaw:
- Airspace conflicts

Round 1a Eliminated Concepts (Page 2 of 3)

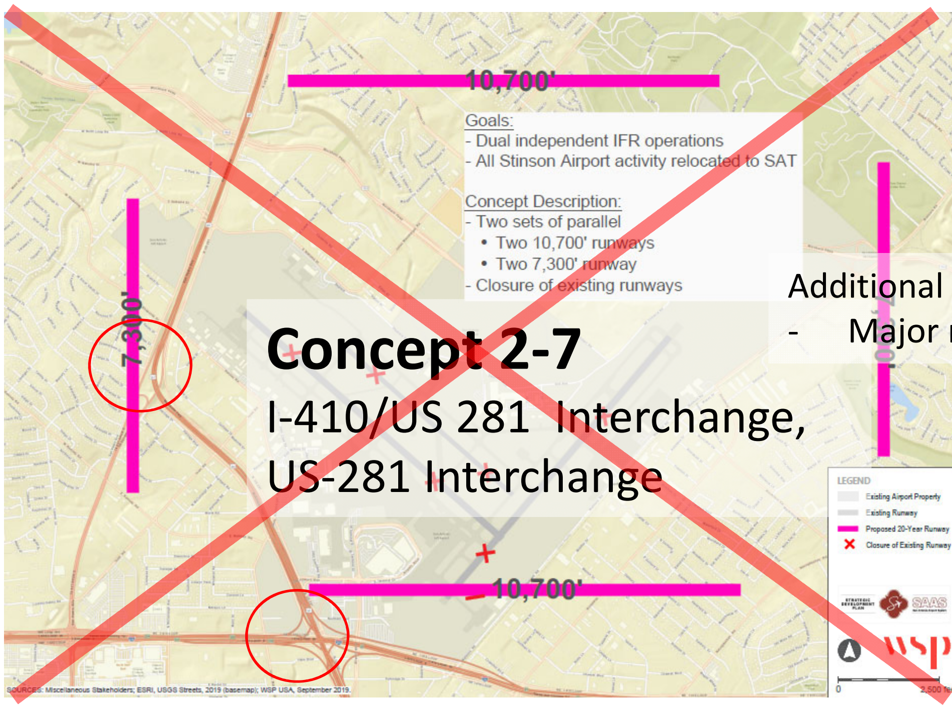
Major Airspace Penetrations





Round 1a Eliminated Concepts (Page 3 of 3)

Major Airspace Penetrations



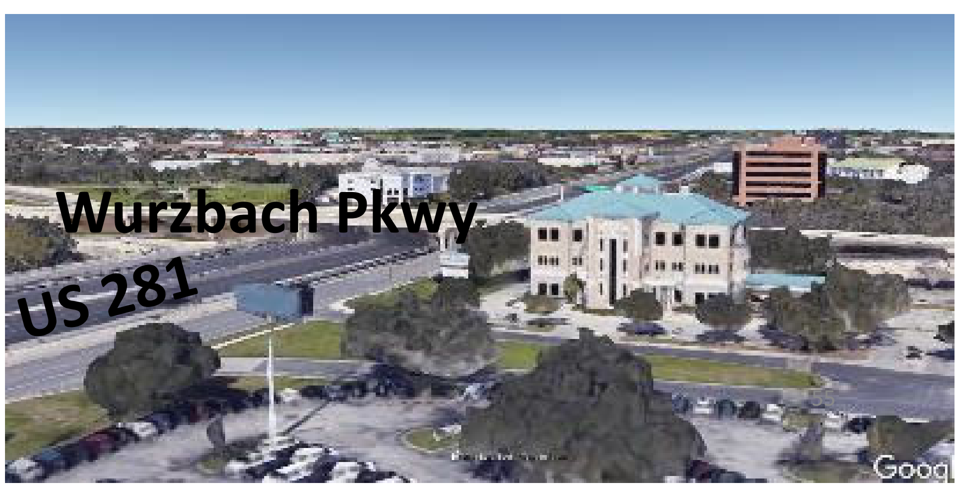
Additional Fatal Flaw:

- Major road impacts

Round 1a Fatal Flaws Review
Major Roadway/Railroad Impact

- Are there major impacts to roadways or railroads?
- Includes:
  - Runway proposed to cross the <u>elevated</u> portion of a roadway
  - Runway proposed to run over a significant portion of a roadway
  - Proposed runway requiring a railroad realignment

➢31 concepts have major roadway/railroads impacts

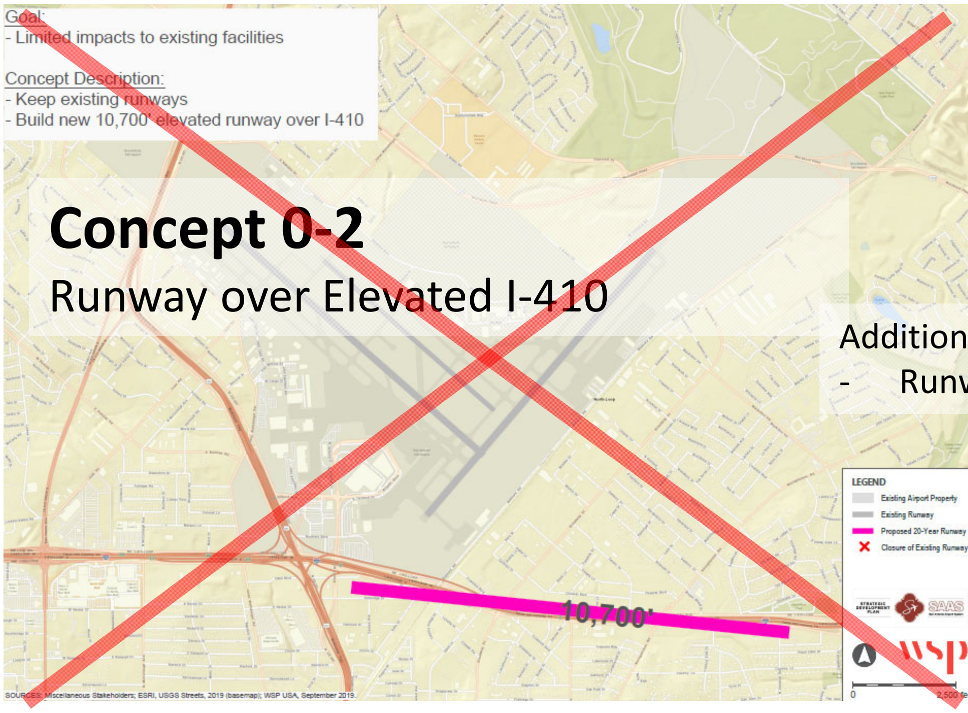


STRATEGIC DEVELOPMENT PLAN

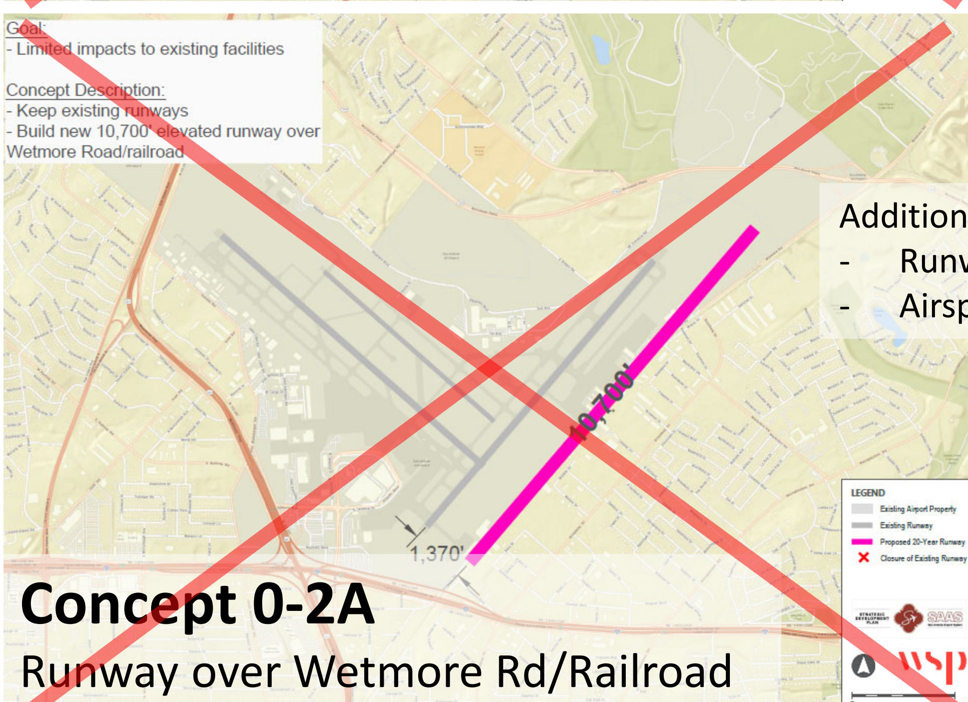
SAAS San Antonio Airport System

Round 1a Eliminated Concepts (Page 1 of 16)

Major Roadway/Railroad Impact



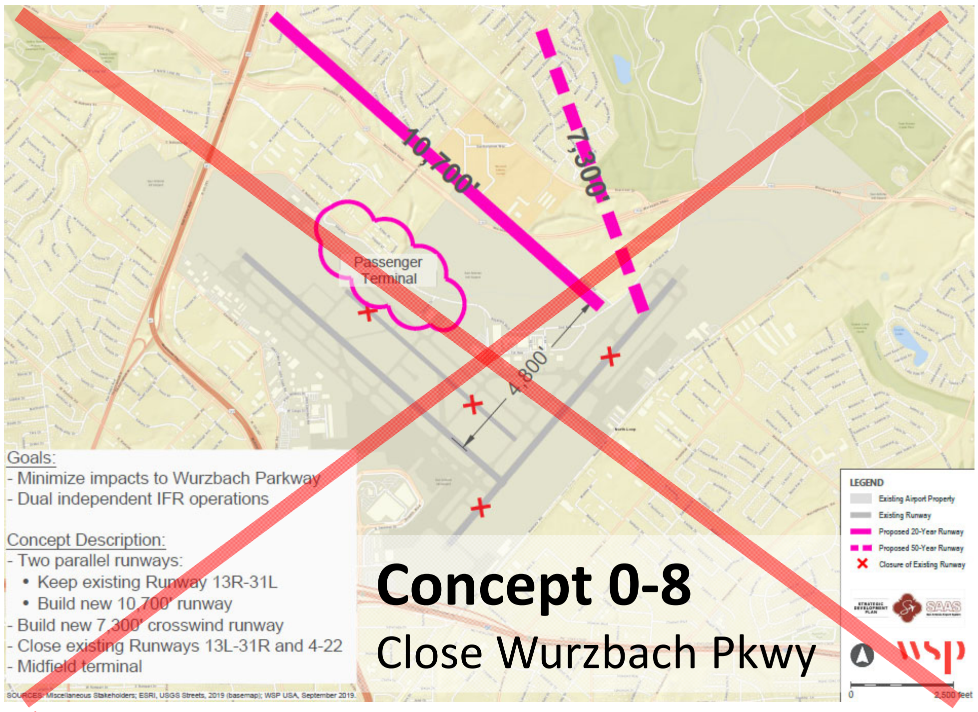
Additional Fatal Flaw:
- Runway layout

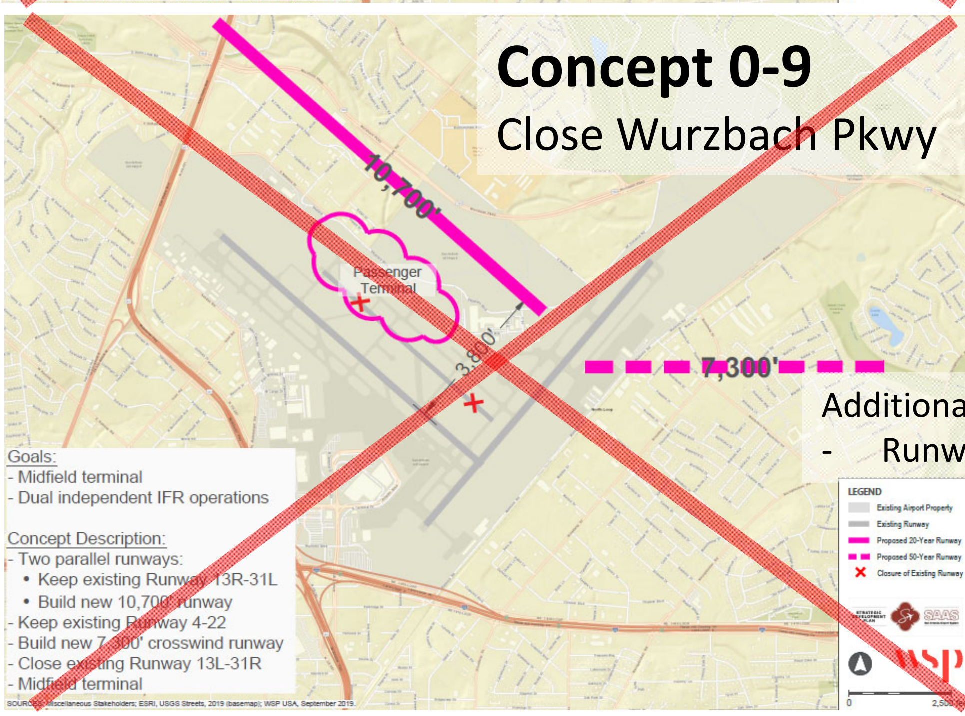


Additional Fatal Flaws:
- Runway layout
- Airspace conflicts

Round 1a Eliminated Concepts (Page 2 of 16)

Major Roadway/Railroad Impact

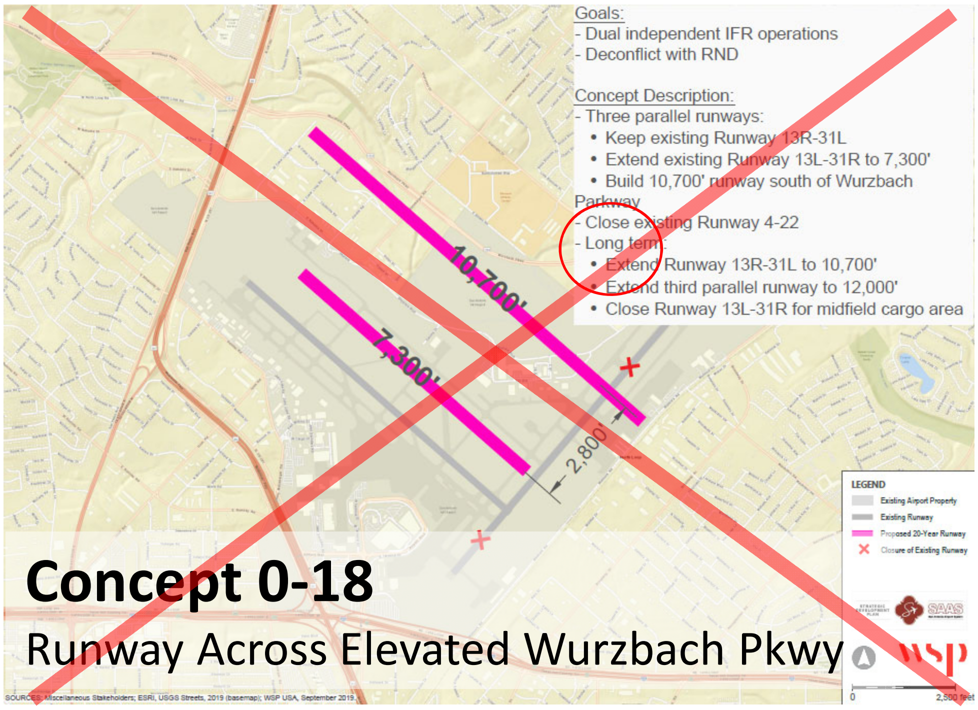


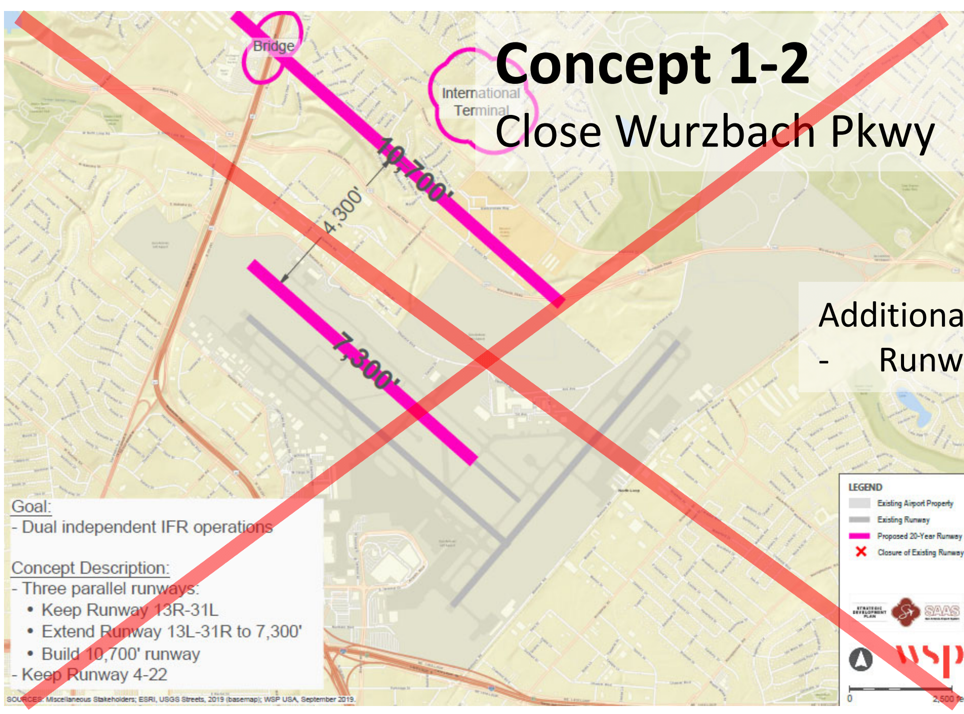


Additional Fatal Flaw:
- Runway layout

Round 1a Eliminated Concepts (Page 3 of 16)

Major Roadway/Railroad Impact

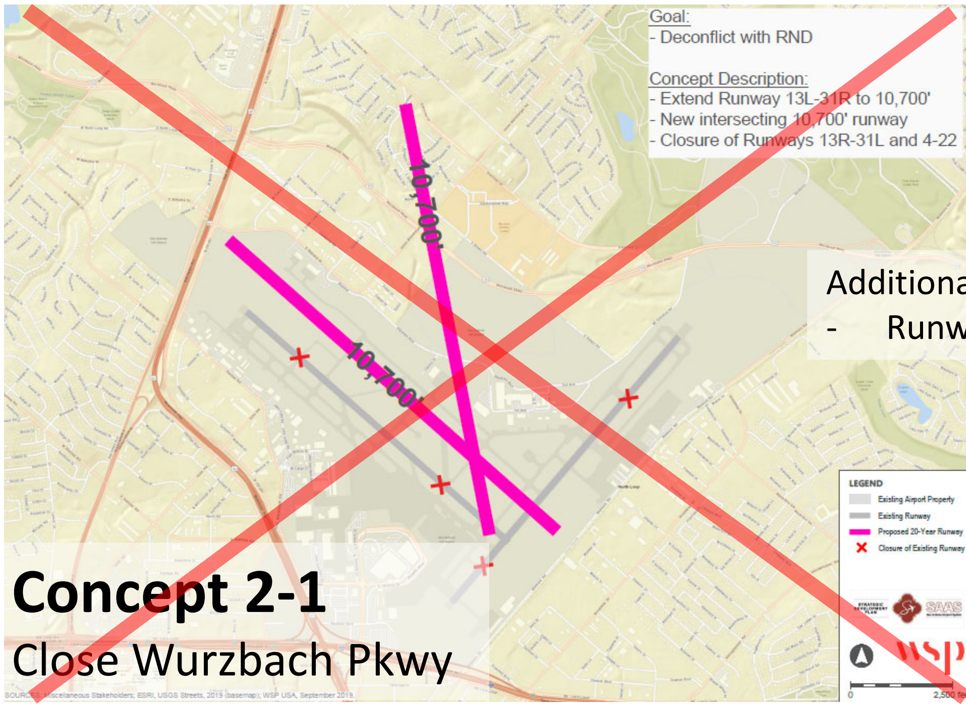




Additional Fatal Flaw:
- Runway layout

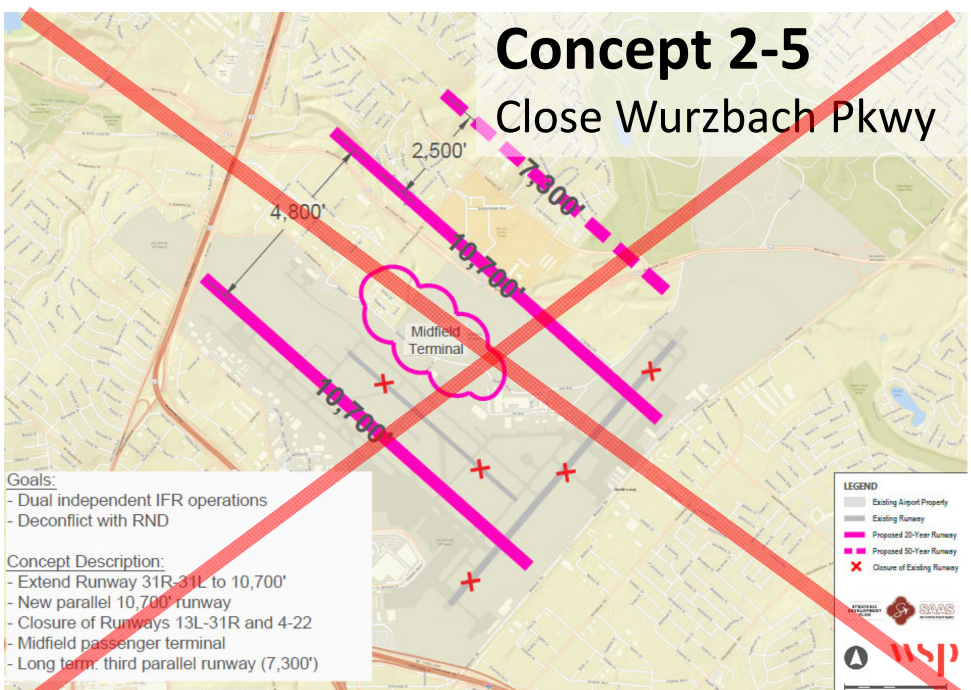
Round 1a Eliminated Concepts (Page 4 of 16)

Major Roadway/Railroad Impact



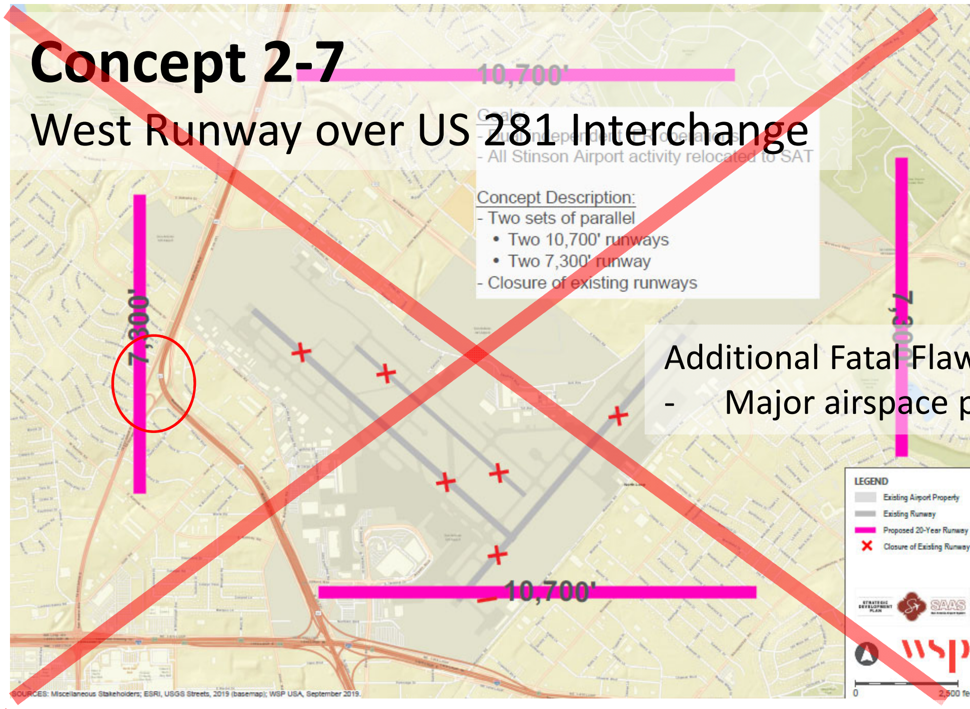
Additional Fatal Flaw:

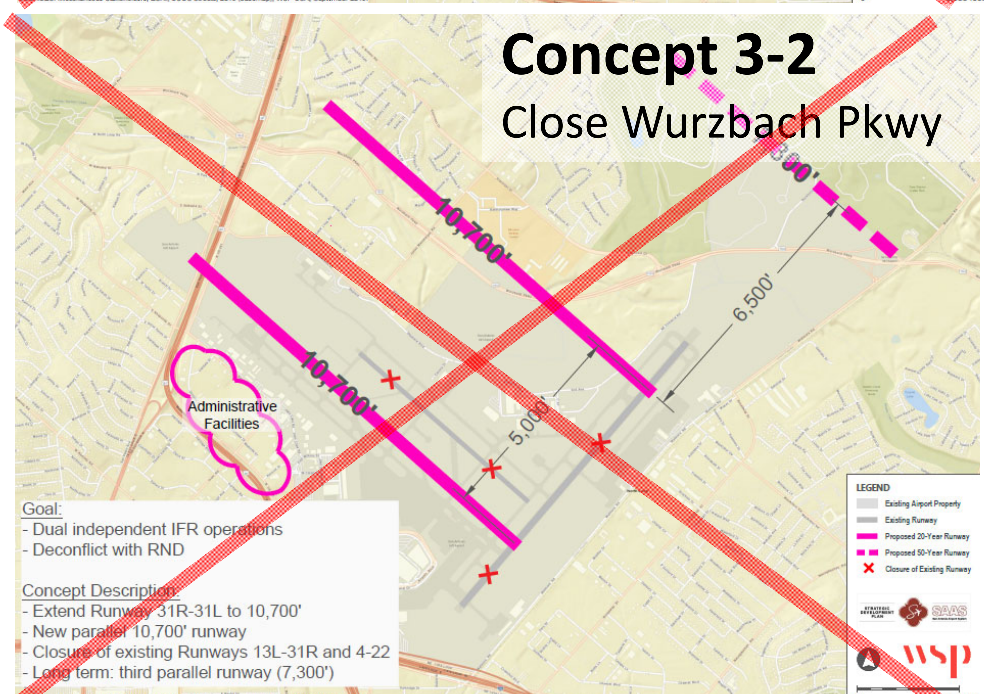
- Runway layout



Round 1a Eliminated Concepts (Page 5 of 16)

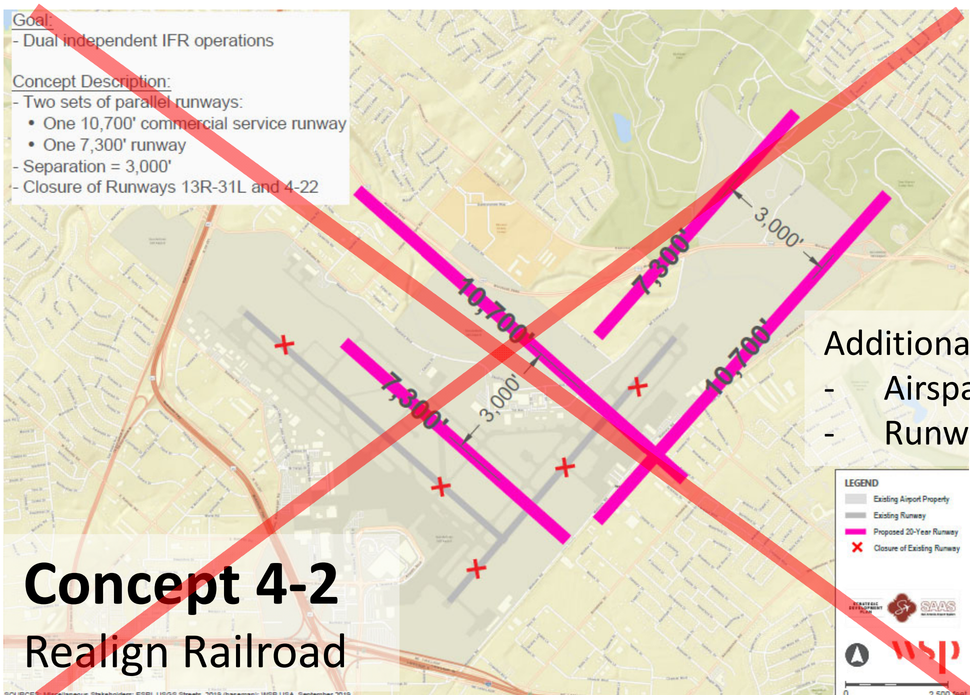
Major Roadway/Railroad Impact



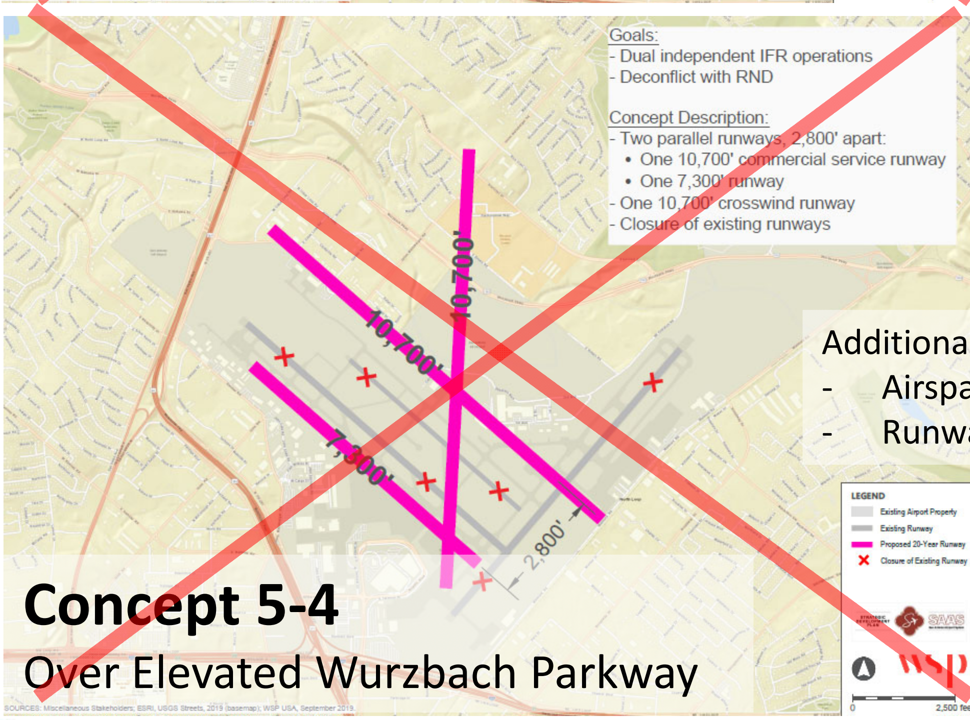


Round 1a Eliminated Concepts (Page 6 of 16)

Major Roadway/Railroad Impact



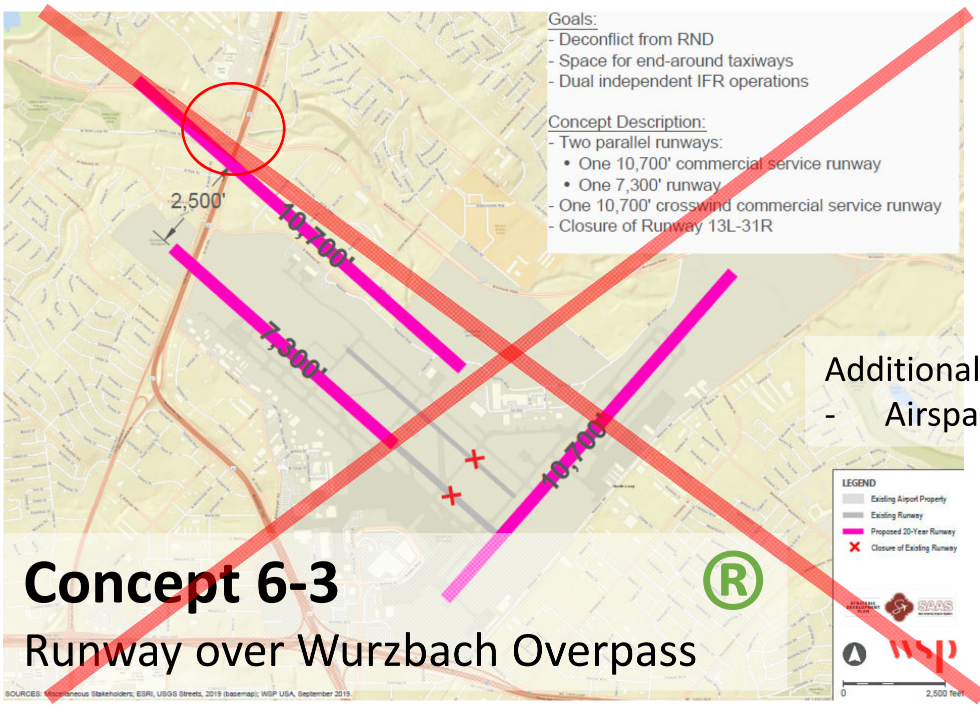
Additional Fatal Flaws:
- Airspace conflicts
- Runway layout



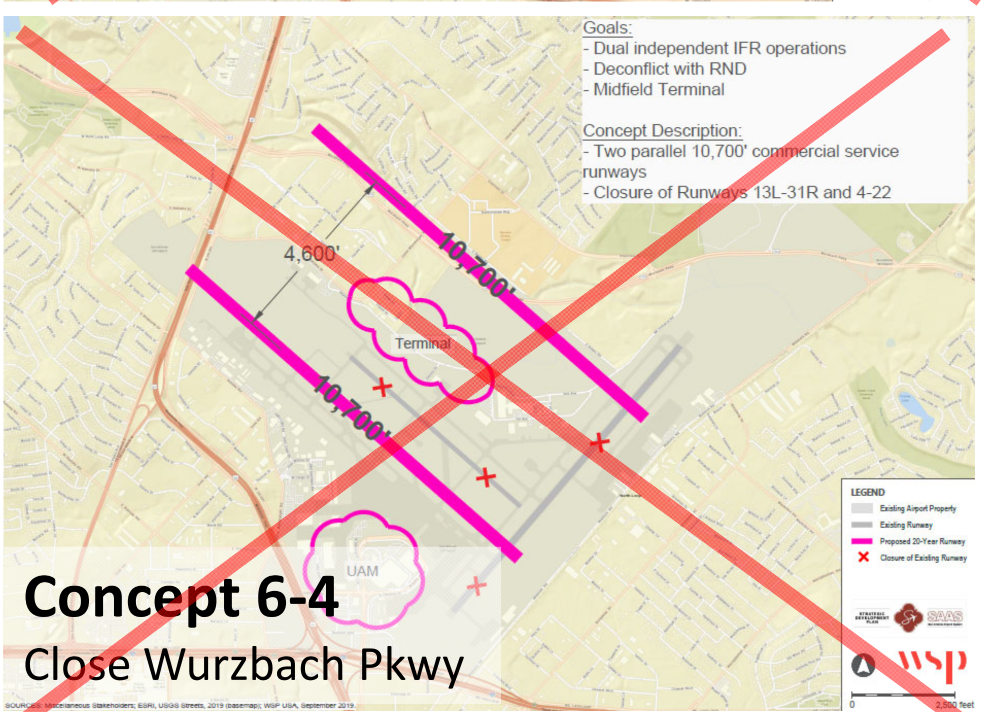
Additional Fatal Flaws:
- Airspace conflicts
- Runway layout

Round 1a Eliminated Concepts (Page 7 of 16)

Major Roadway/Railroad Impact

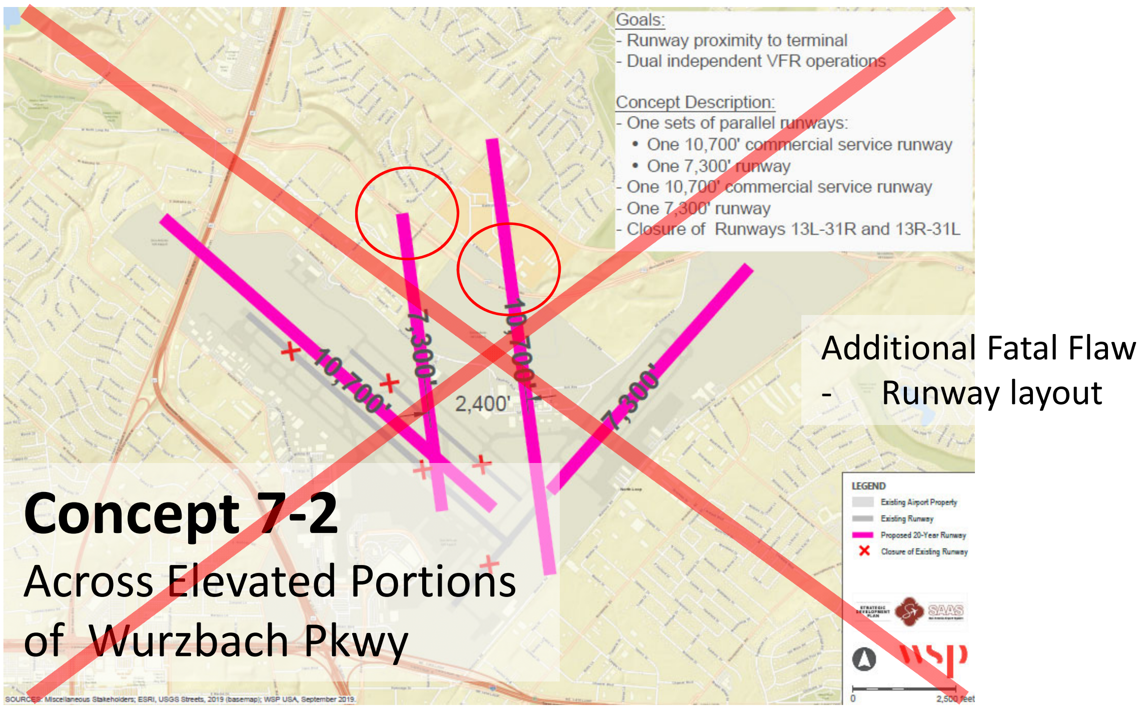


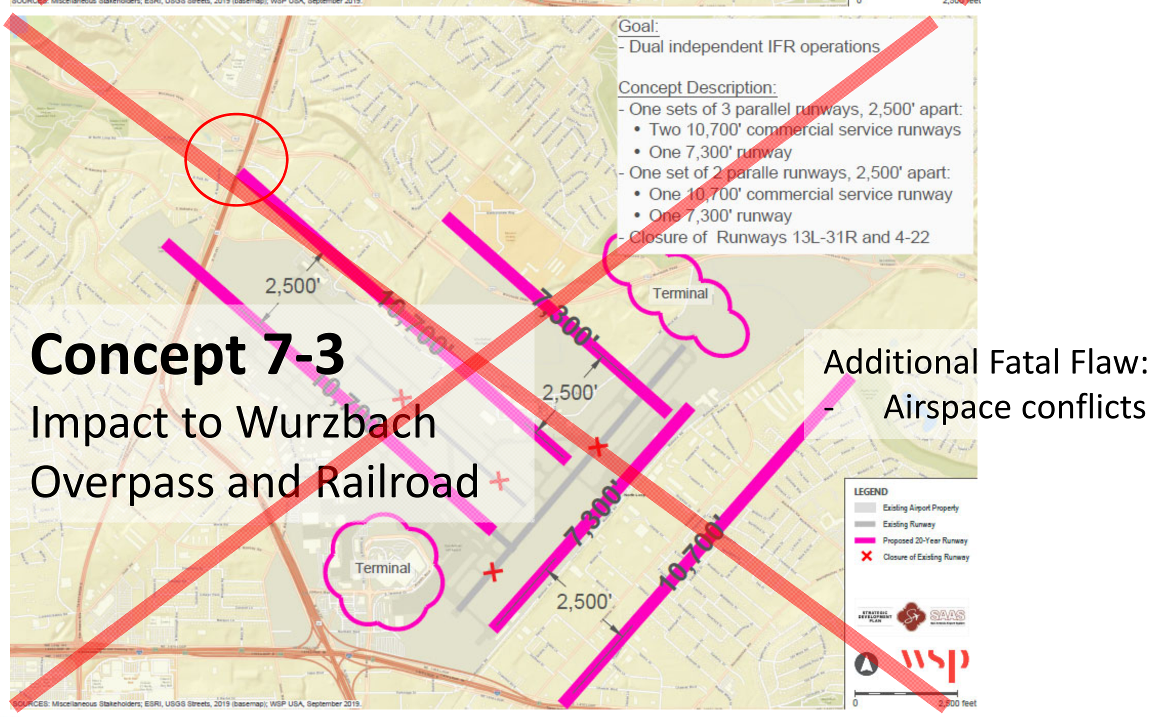
Additional Fatal Flaw:
- Airspace conflicts



Round 1a Eliminated Concepts (Page 8 of 16)

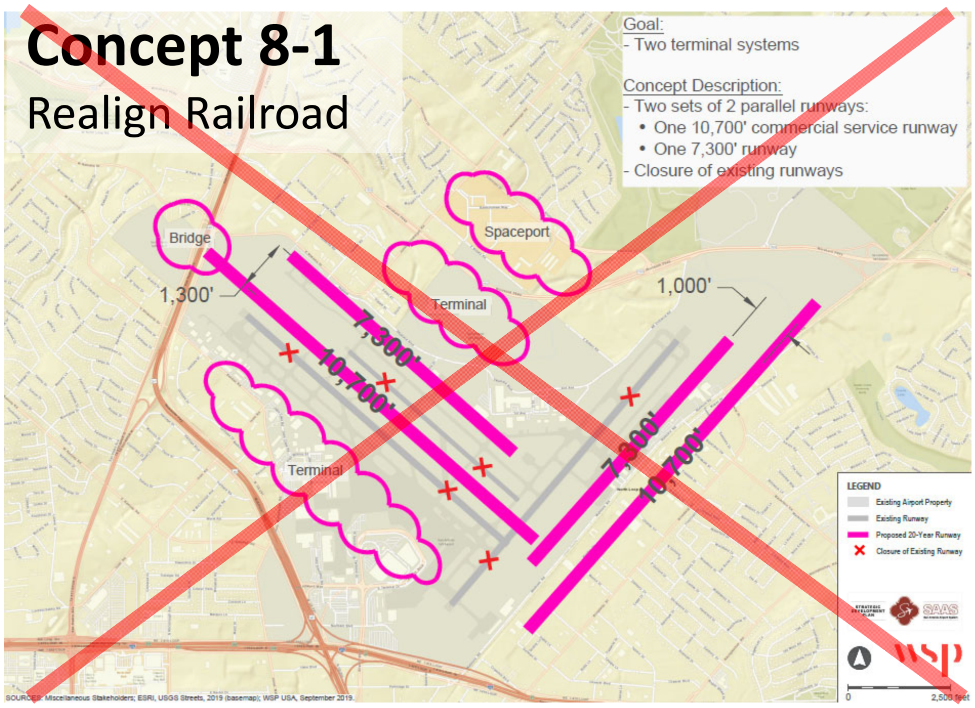
Major Roadway/Railroad Impact

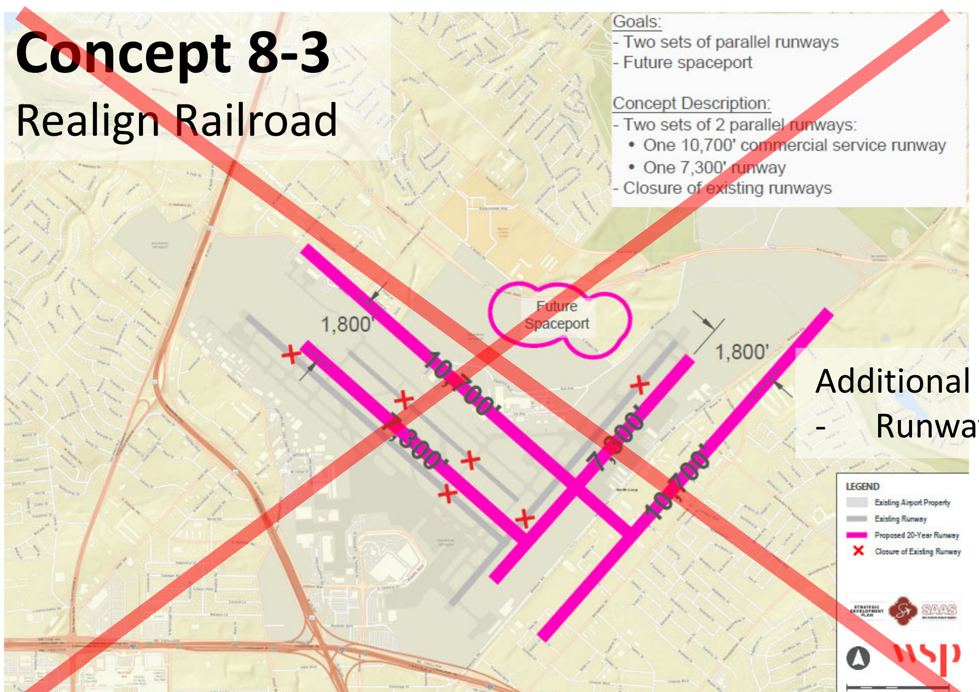




Round 1a Eliminated Concepts (Page 9 of 16)

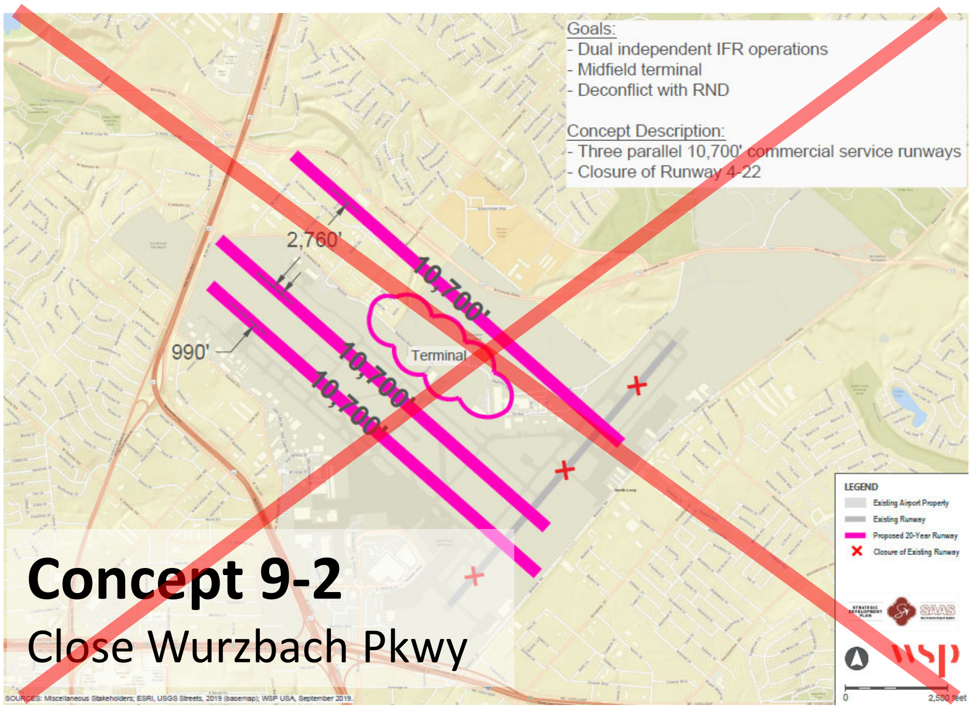
Major Roadway/Railroad Impact

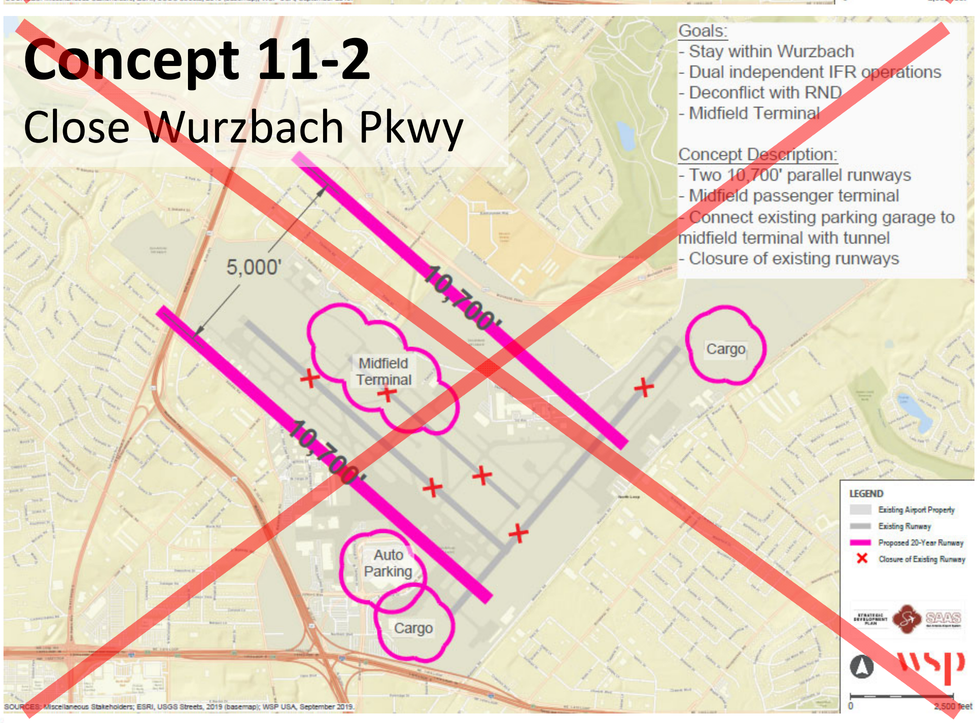




Round 1a Eliminated Concepts (Page 10 of 16)

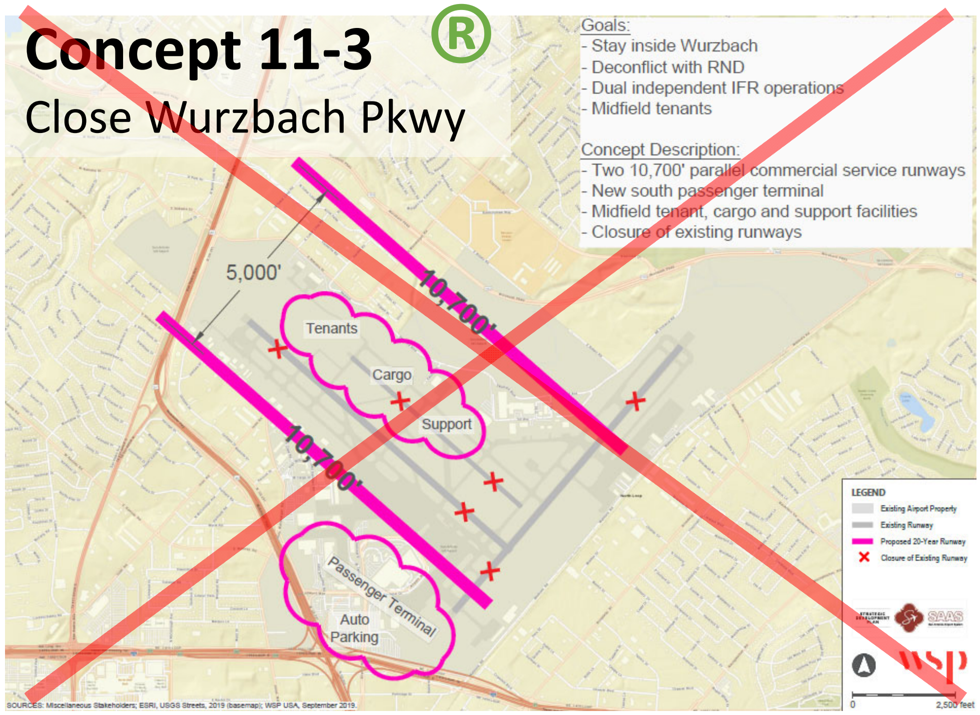
Major Roadway/Railroad Impact

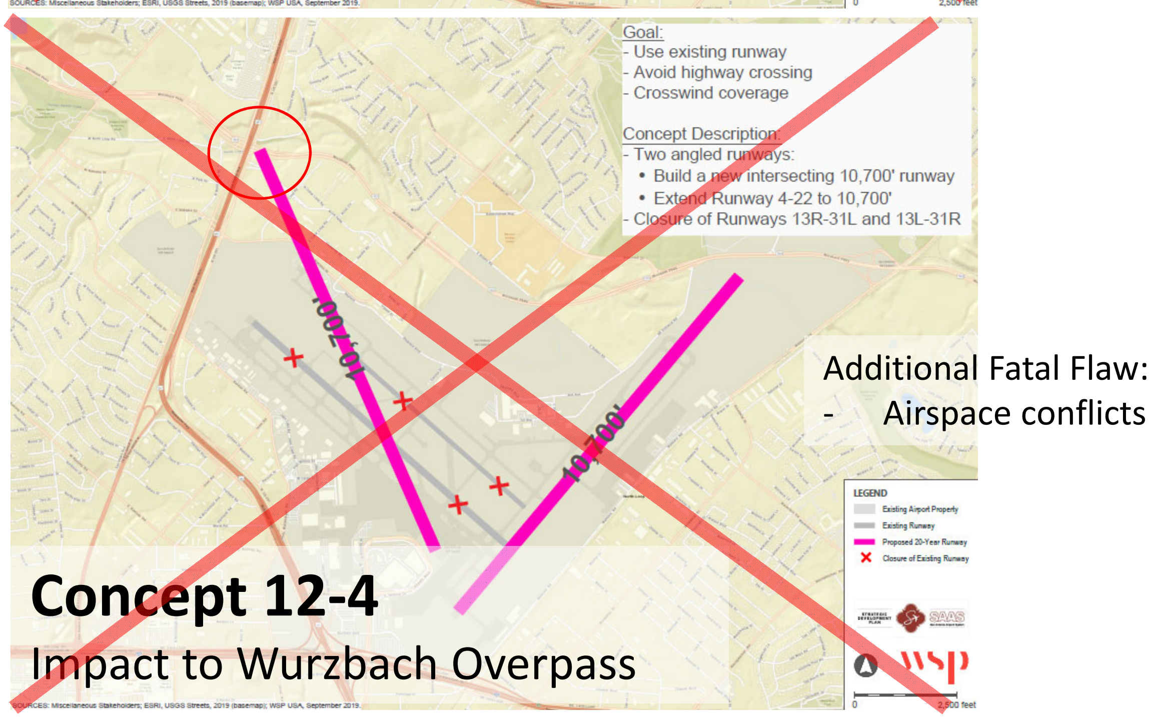




Round 1a Eliminated Concepts (Page 11 of 16)

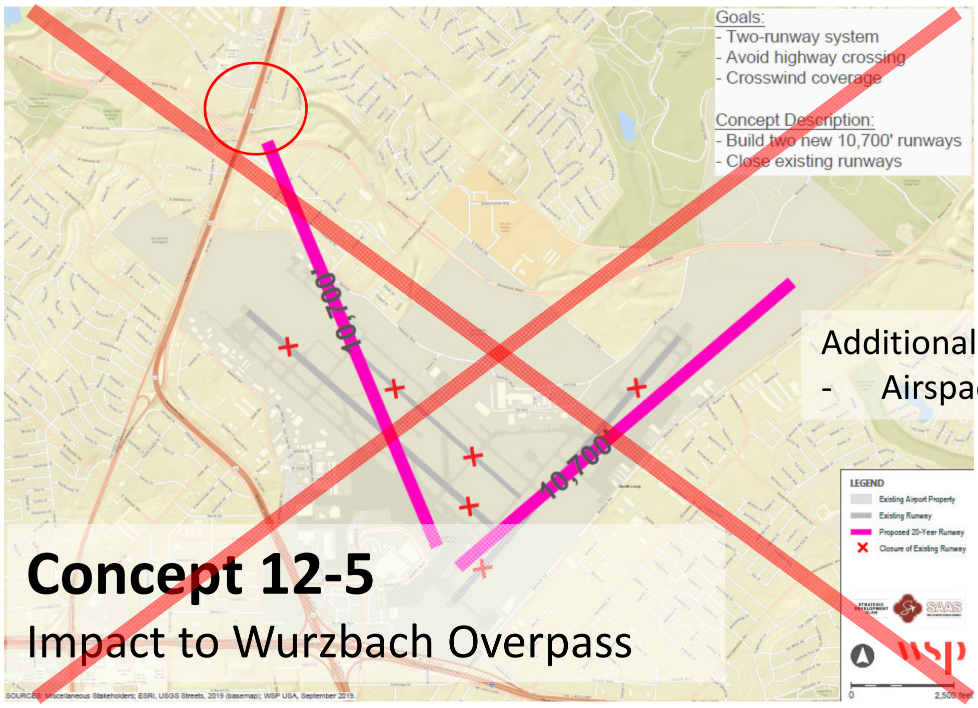
Major Roadway/Railroad Impact





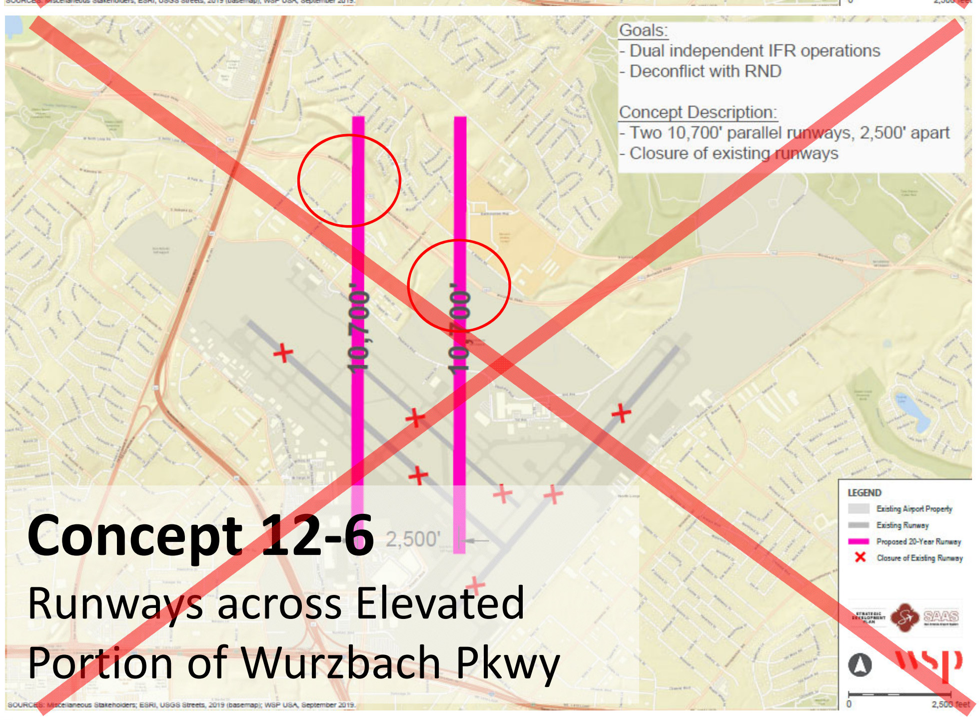
Round 1a Eliminated Concepts (Page 12 of 16)

Major Roadway/Railroad Impact



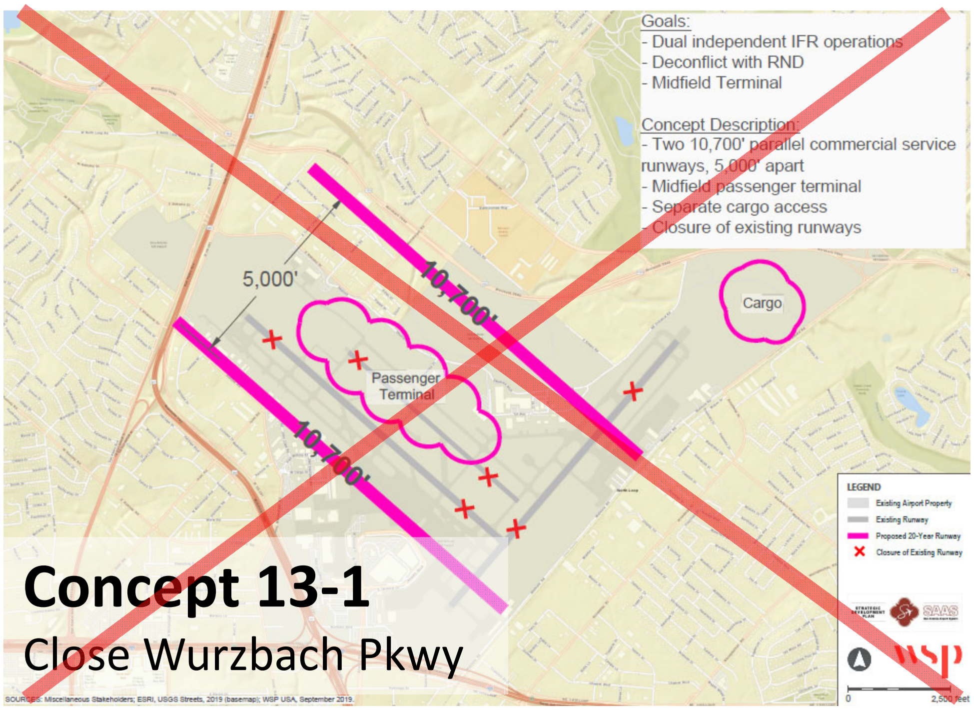
Additional Fatal Flaw:

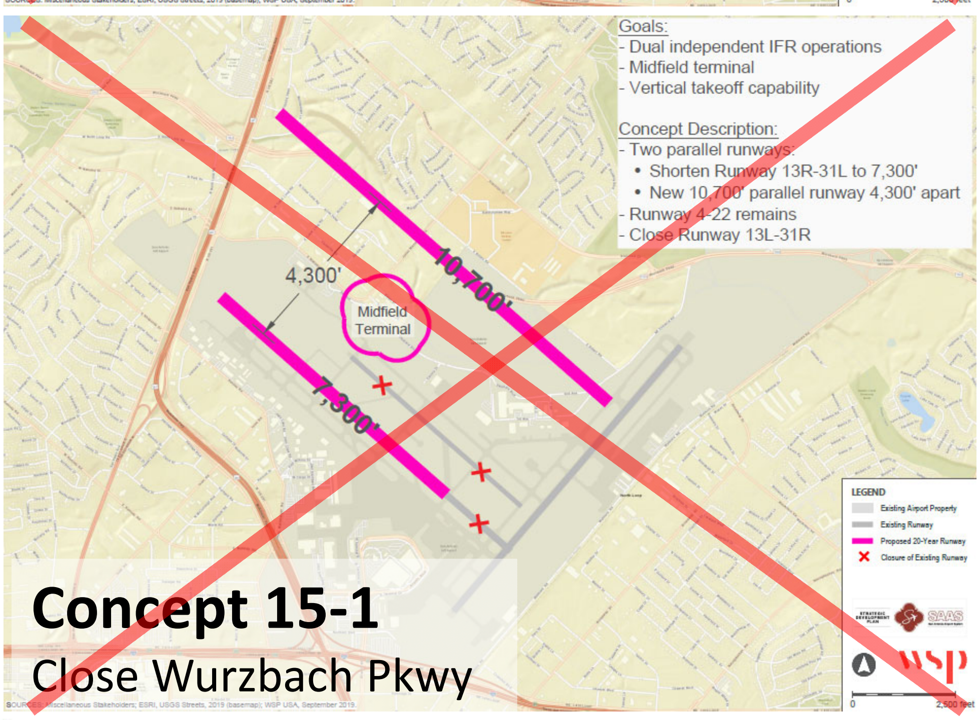
- Airspace conflicts



Round 1a Eliminated Concepts (Page 13 of 16)

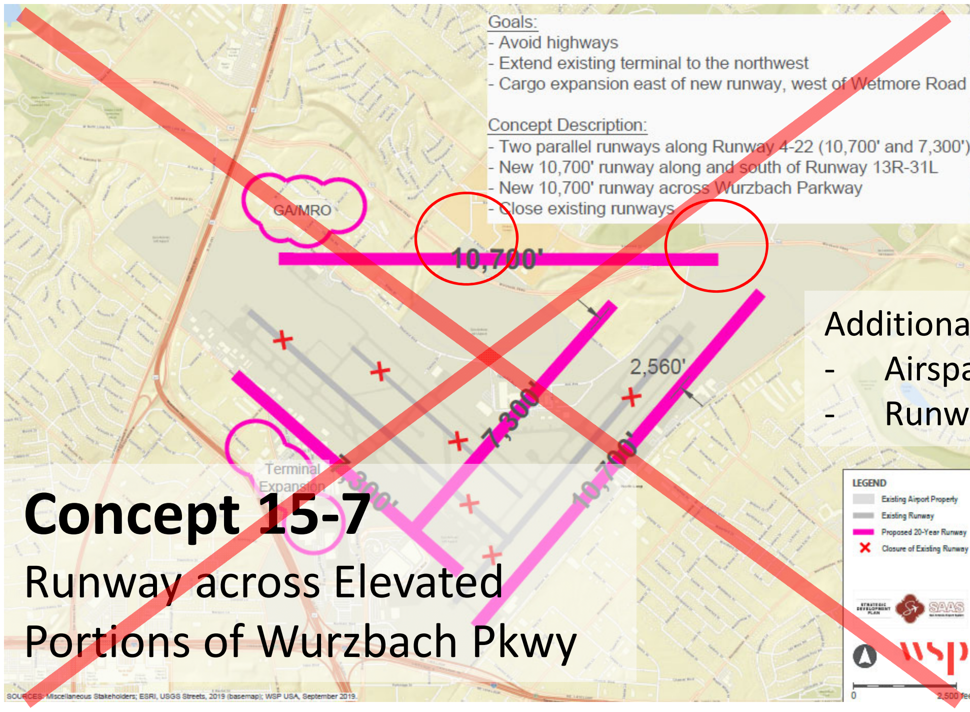
Major Roadway/Railroad Impact

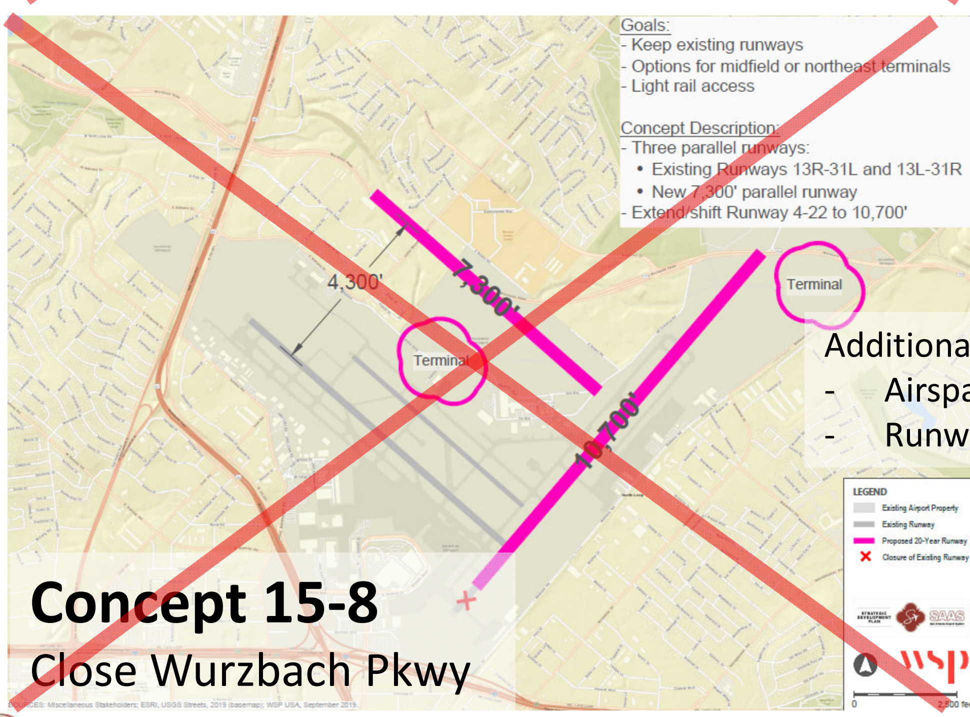




Round 1a Eliminated Concepts (Page 14 of 16)

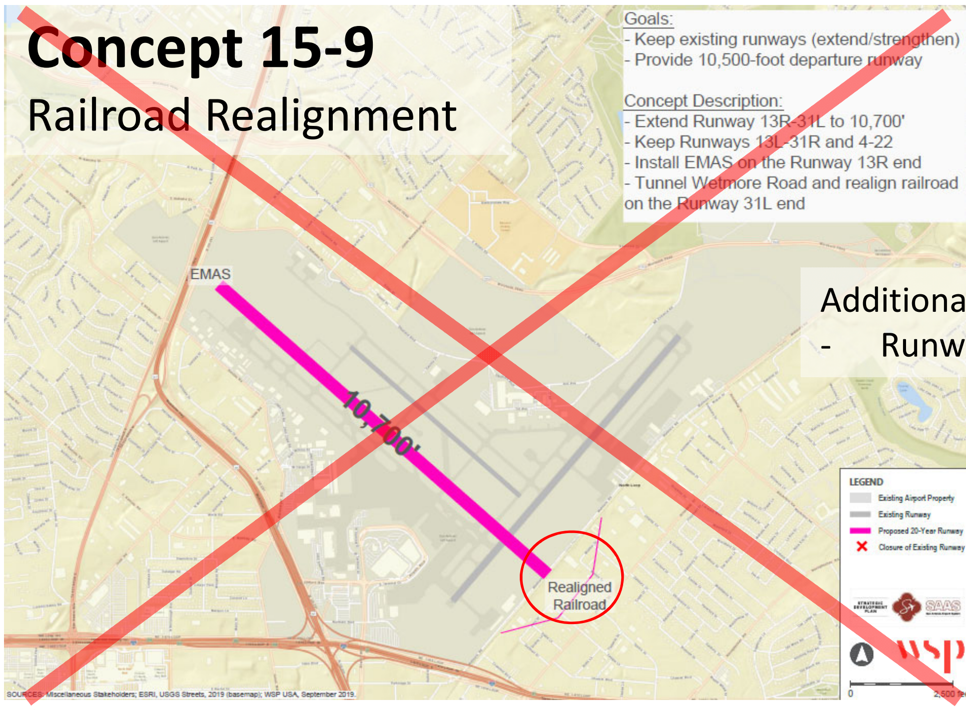
Major Roadway/Railroad Impact



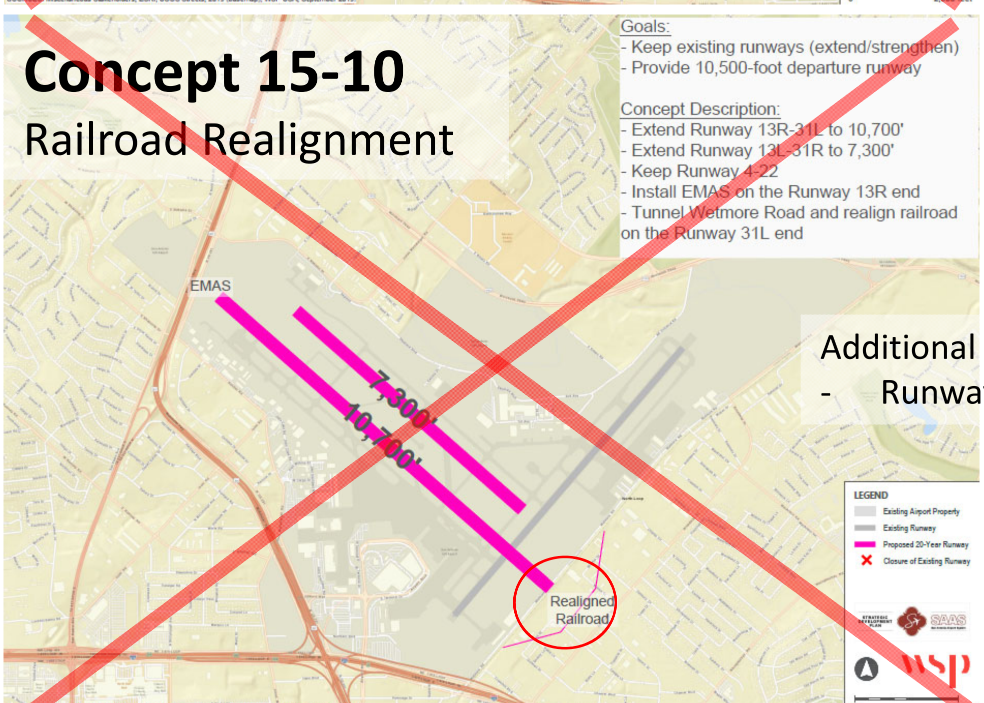


Round 1a Eliminated Concepts (Page 15 of 16)

Major Roadway/Railroad Impact



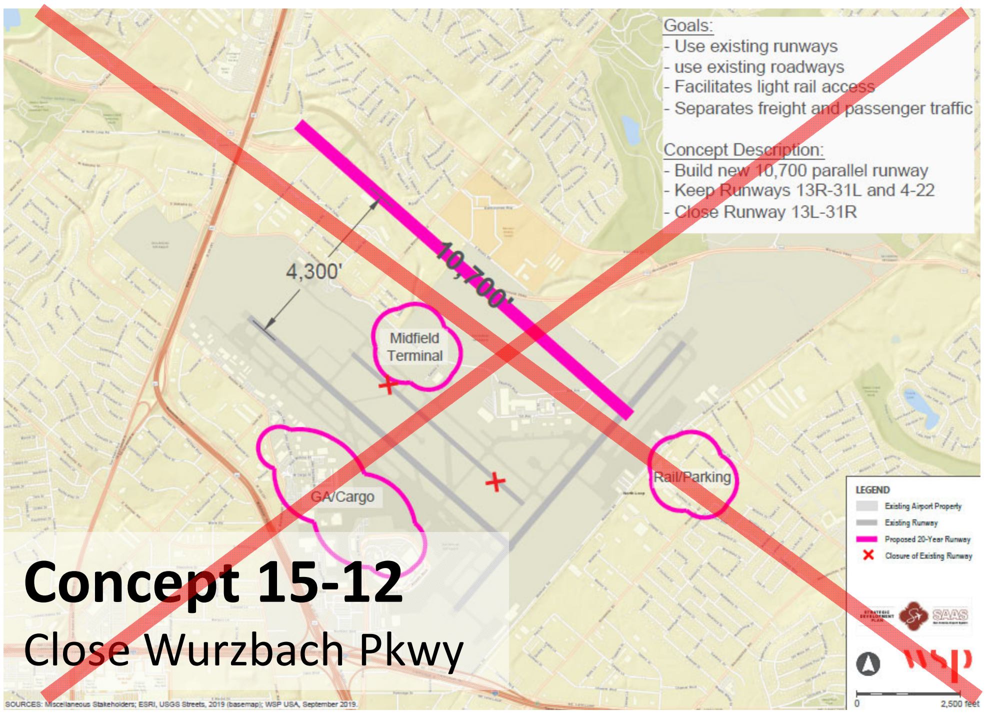
Additional Fatal Flaw:
- Runway layout



Additional Fatal Flaw:
- Runway layout

Round 1a Eliminated Concepts (Page 16 of 16)

Major Roadway/Railroad Impact



Round 1a Fatal Flaws Review
Implementability

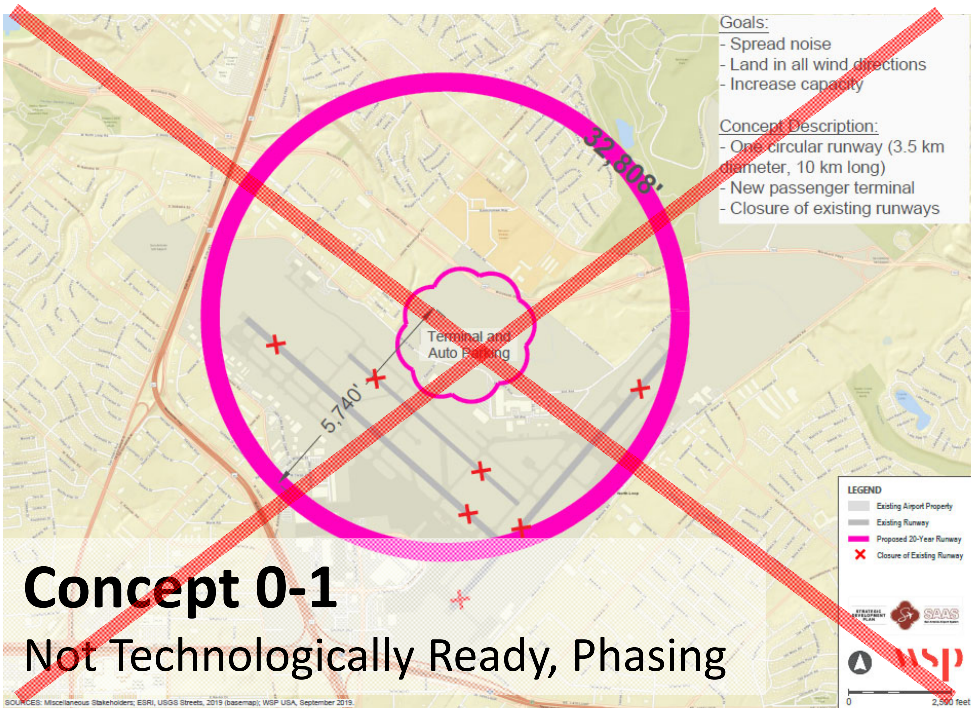
- Can we build it within the 20-year (2038) planning horizon?

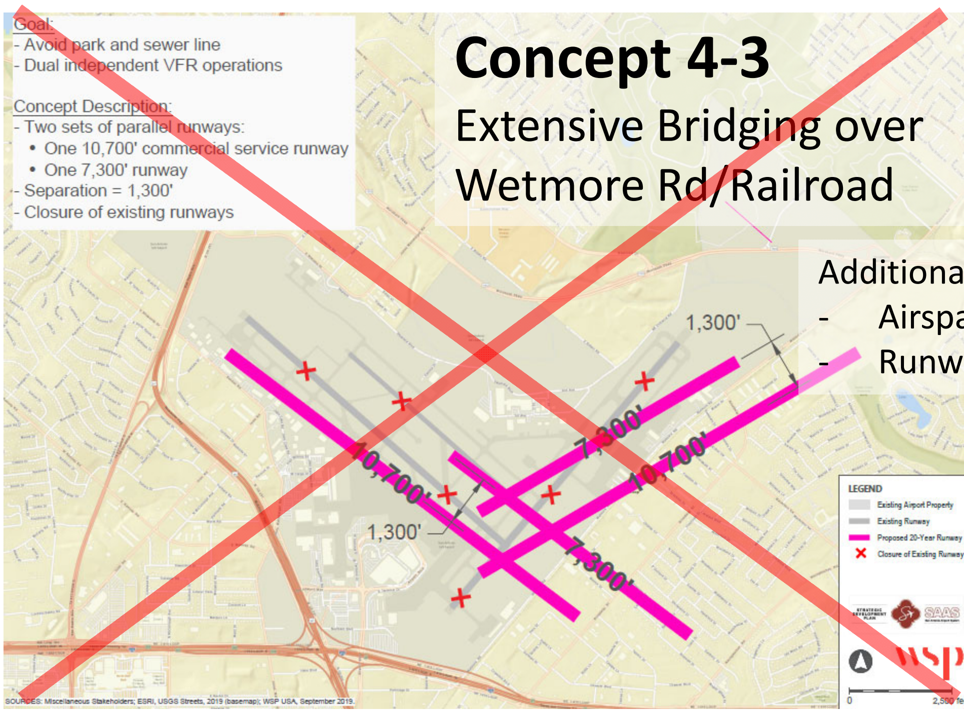
- Includes:
  - Technological readiness
  - Cannot be constructed by 2038

➢2 concepts are not considered implementable

Round 1a Eliminated Concepts (Page 1 of 1)

Implementable





Additional Fatal Flaws:
- Airspace conflicts
- Runway layout

STRATEGIC DEVELOPMENT PLAN

SAAS

San Antonio Airport System

Airfield Concepts Evaluation

Round 1b

Round 1b Evaluation
Fatal Flaw Criteria

- Additional airspace impacts
- Precludes 50-year airfield capacity
- 20-year runway is mostly/entirely off Airport property
- Excessive airfield capacity
- Major public park impacts

➢ Modified 8 concepts to eliminate fatal flaws

Round 1b Fatal Flaws Review
Additional Airspace Impacts

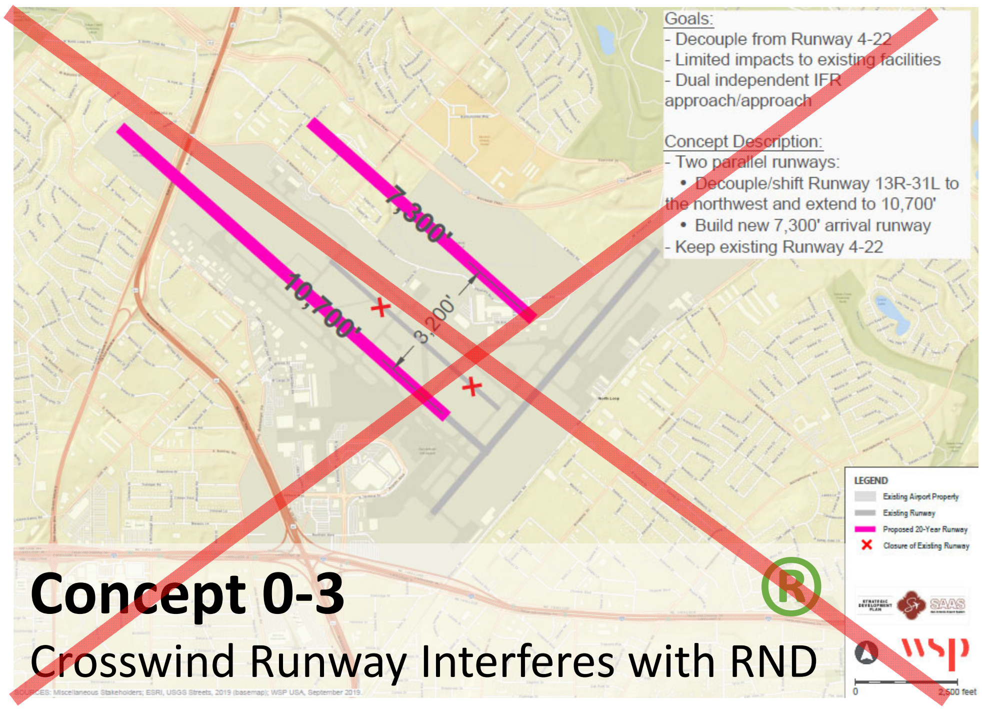
- Are there additional airspace impacts?

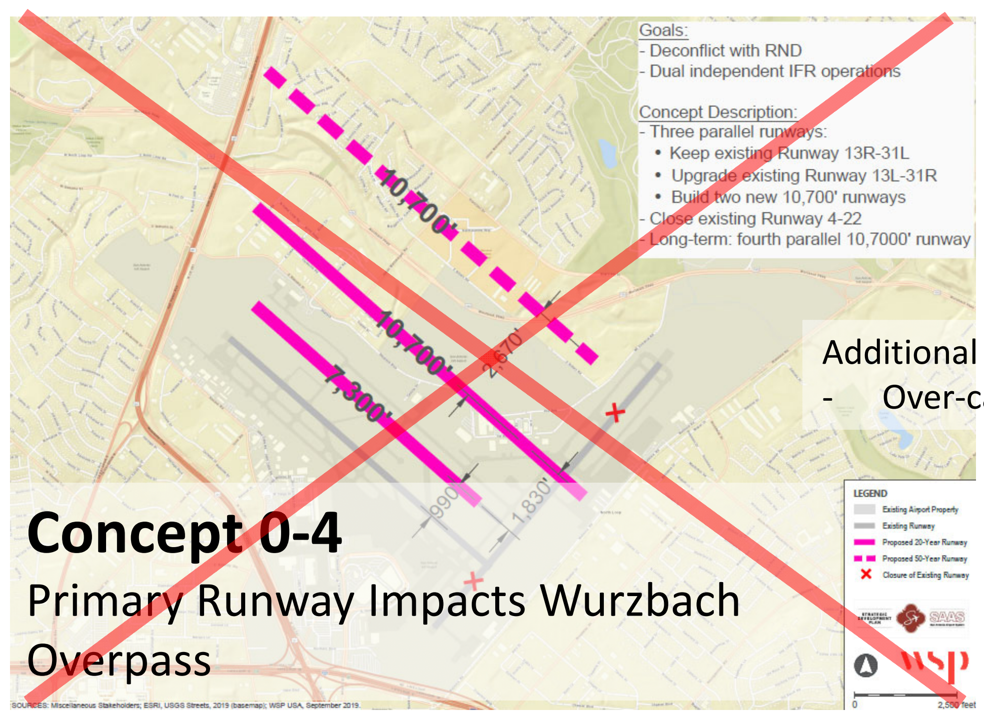
- Includes:
  - Crosswind arrival runway interferes with RND aircraft operations
  - Airspace surface for a 20- or 50-year runway impacts a roadway interchange/overpass

➢ 8 concepts have additional airspace impacts

Round 1b Eliminated Concepts (Page 1 of 4)

Additional Airspace Impacts

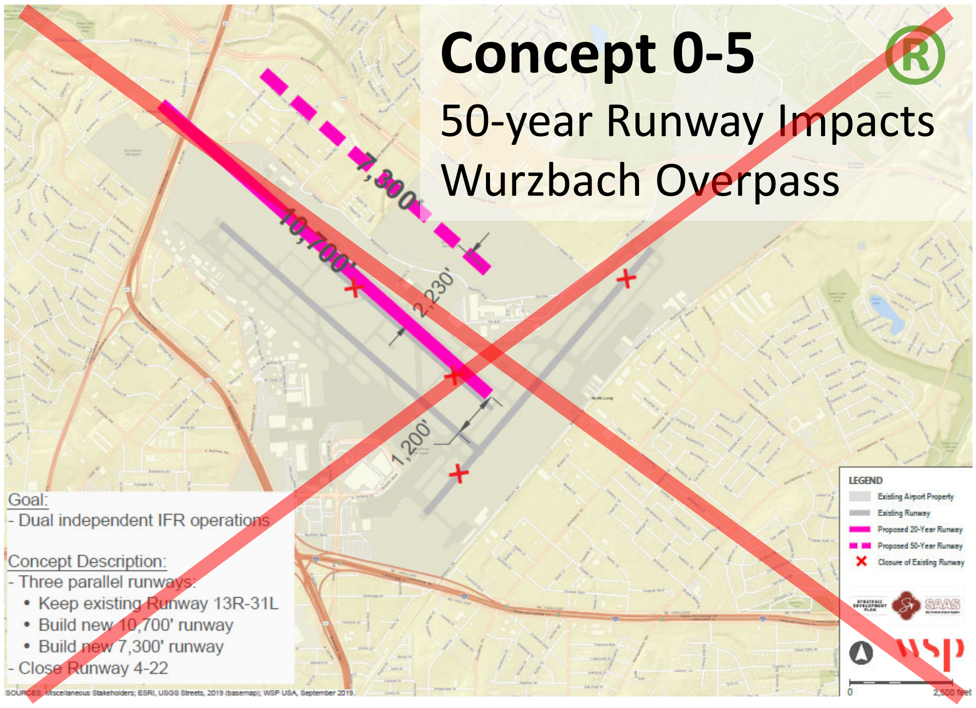


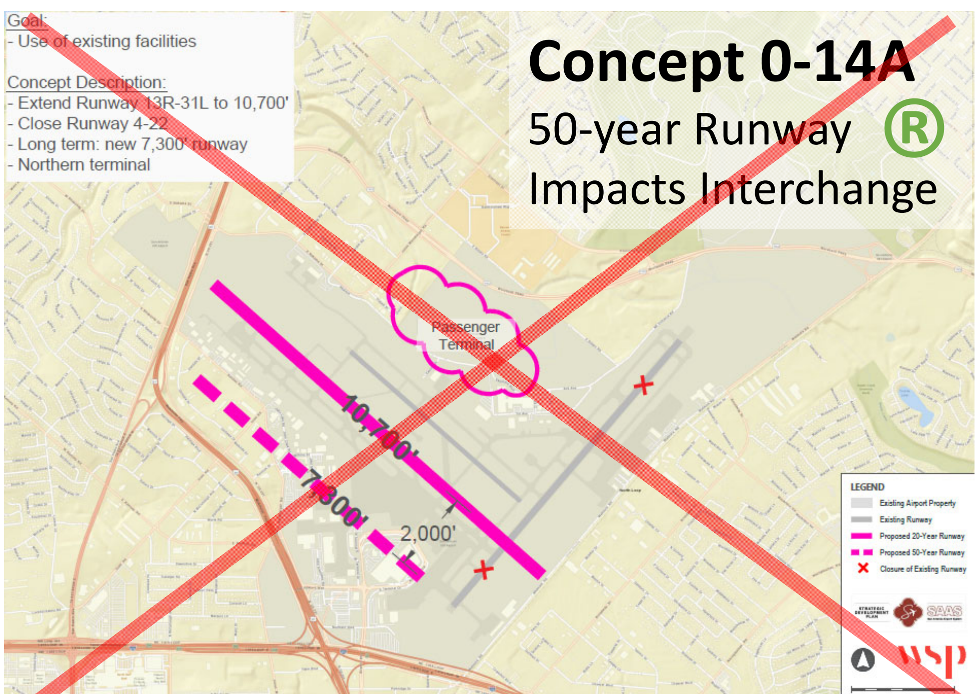


Additional Fatal Flaw:
- Over-capacity

Round 1b Eliminated Concepts (Page 2 of 4)

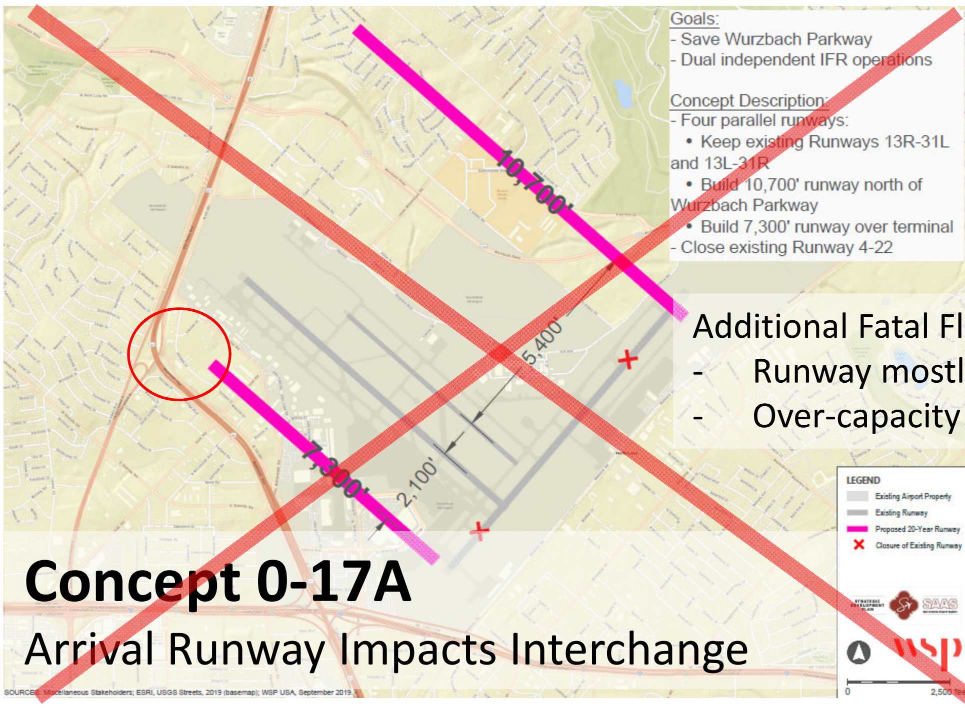
Additional Airspace Impacts

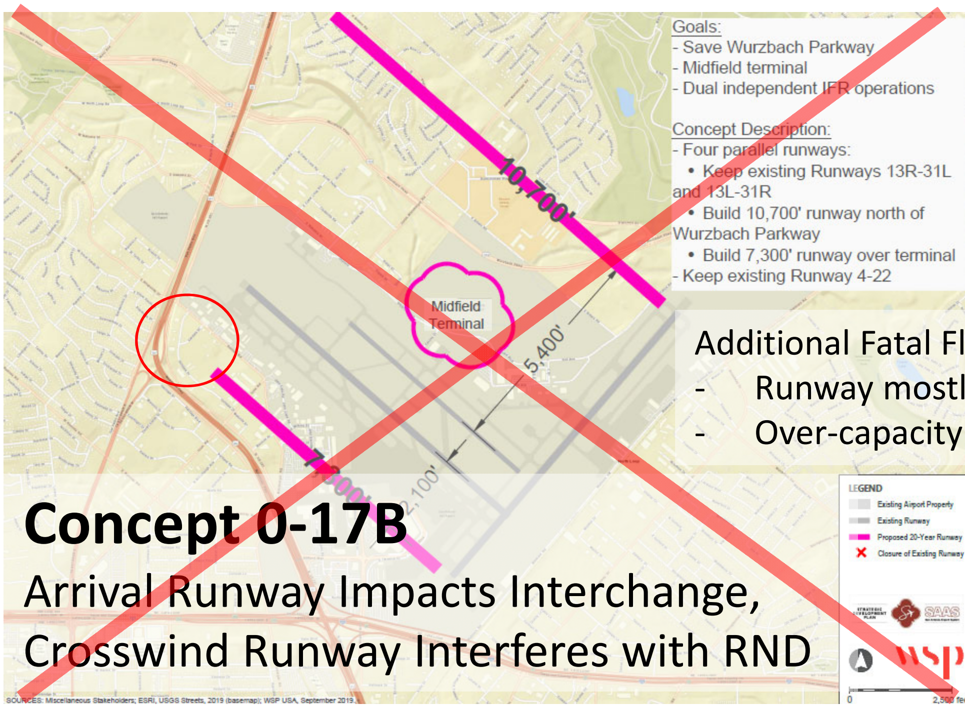




Round 1b Eliminated Concepts (Page 3 of 4)

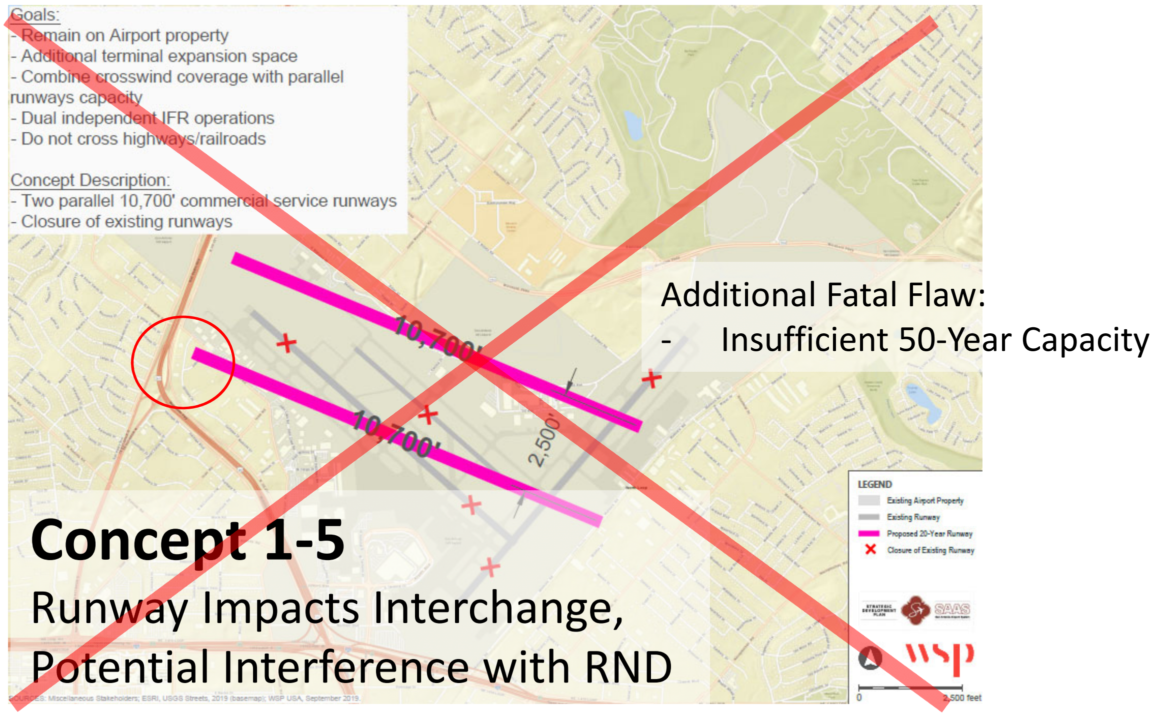
Additional Airspace Impacts

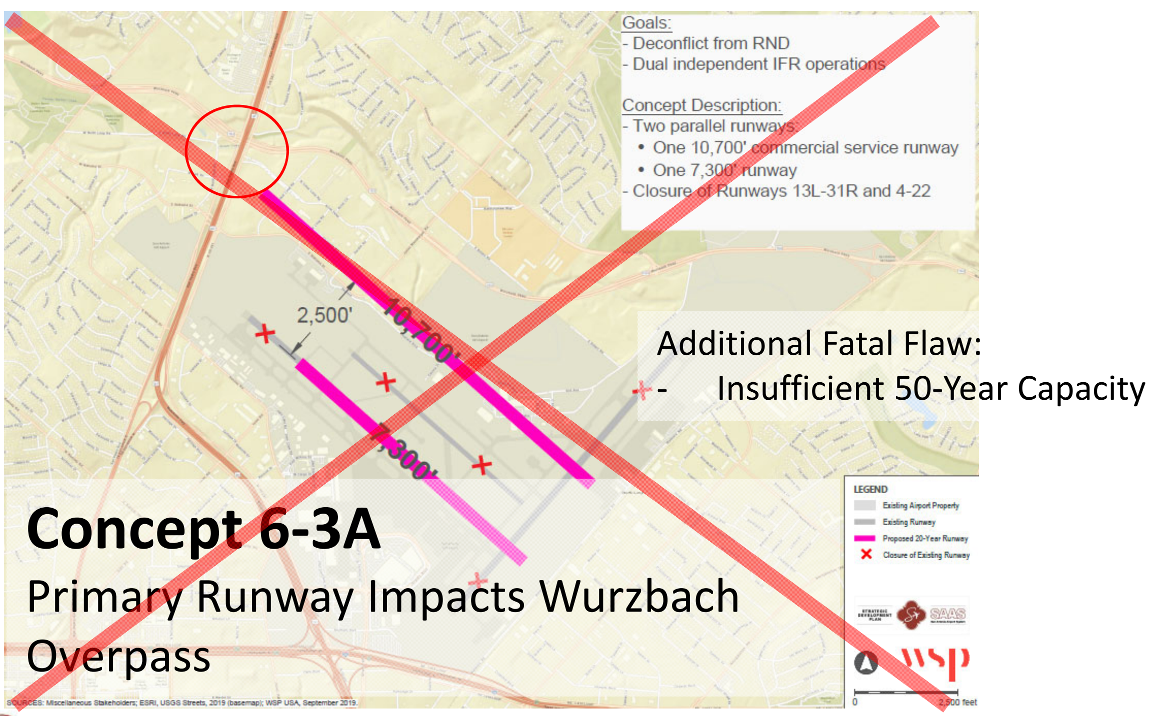




Round 1b Eliminated Concepts (Page 4 of 4)

Additional Airspace Impacts





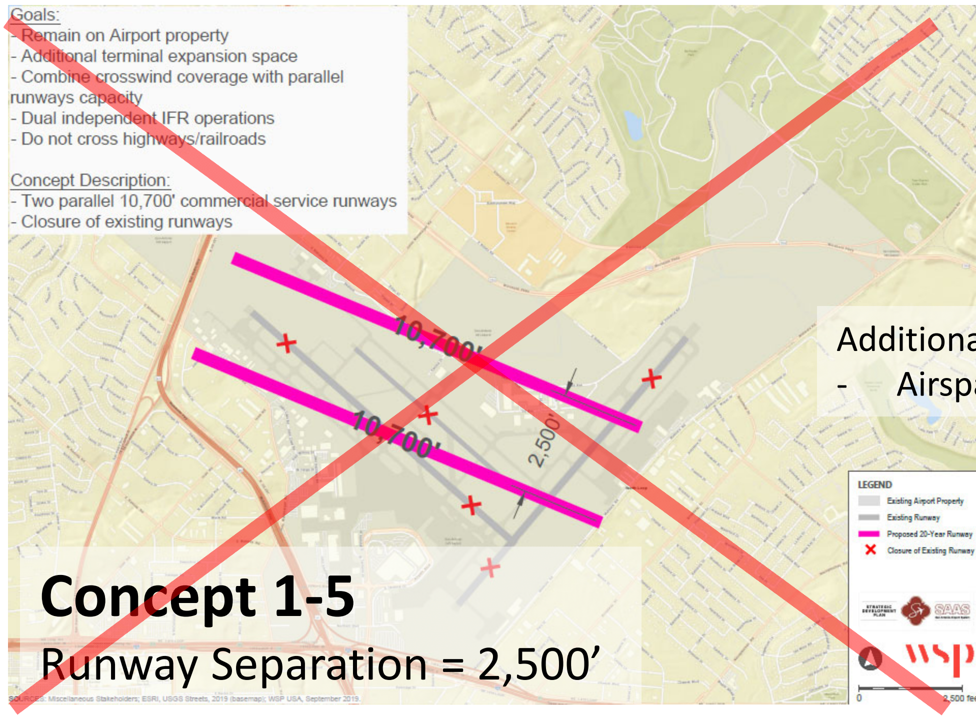
Round 1b Fatal Flaws Review
50-Year Airfield Capacity

- Can the concept be improved to achieve 50-year airfield capacity?
- Assumption:
  - 50-year airfield capacity requires independent runways
    - Parallel runways with a minimum separation of 3,000’
    - NextGen airspace procedures will be available for SAT
    - Special equipment may be required

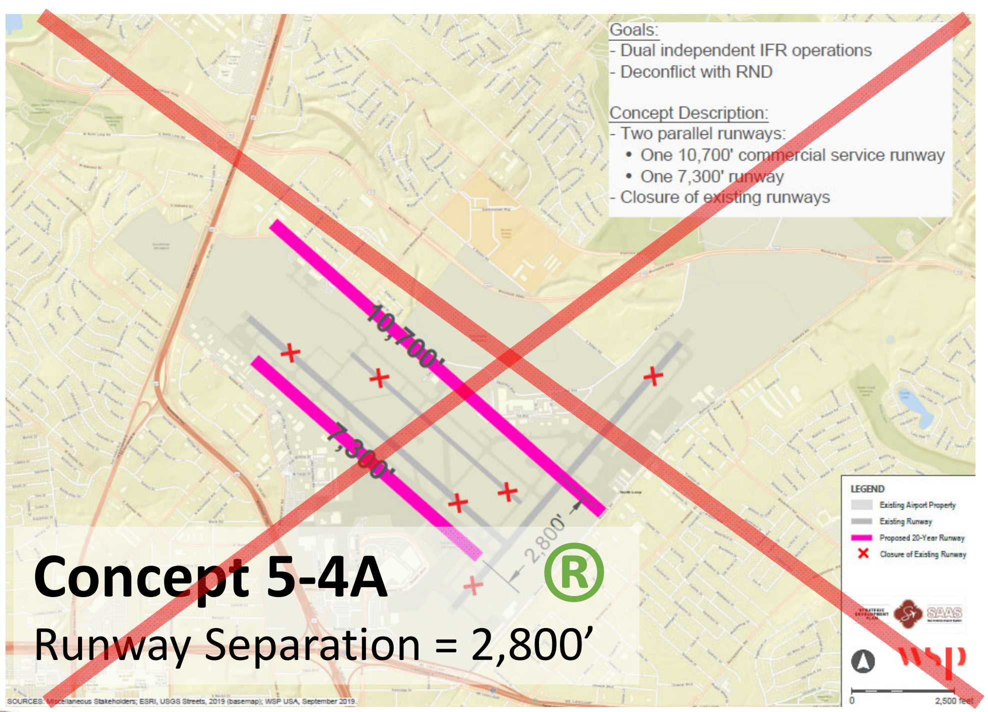
➢ 6 concepts could not be modified to provide parallel independent runways at least 3,000’ apart

Round 1b Eliminated Concepts (Page 1 of 3)

50-Year Airfield Capacity

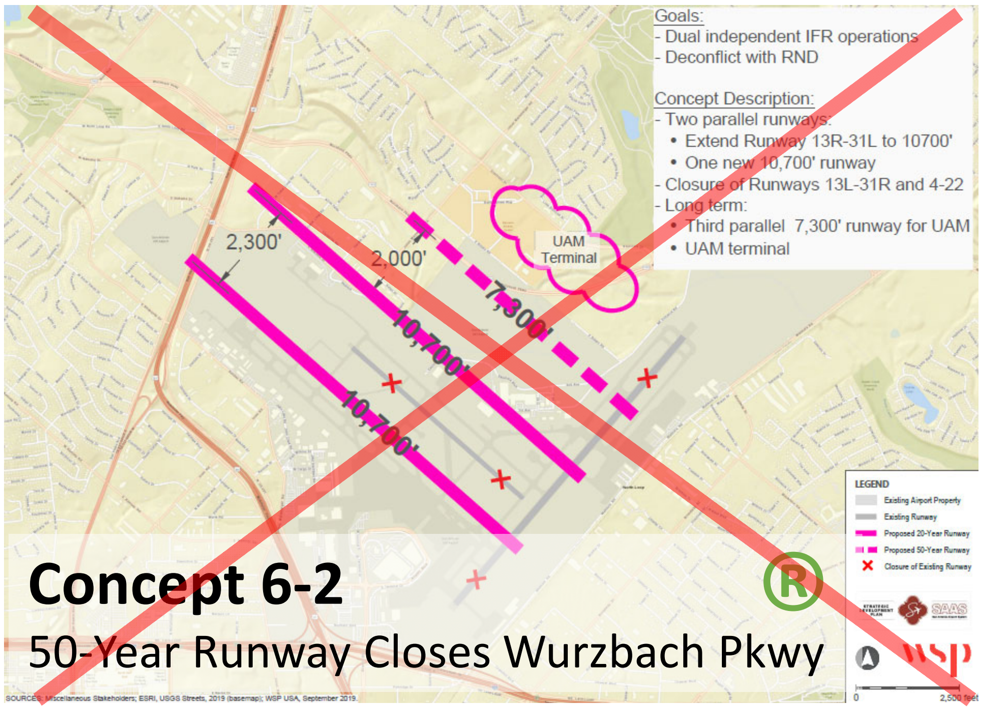


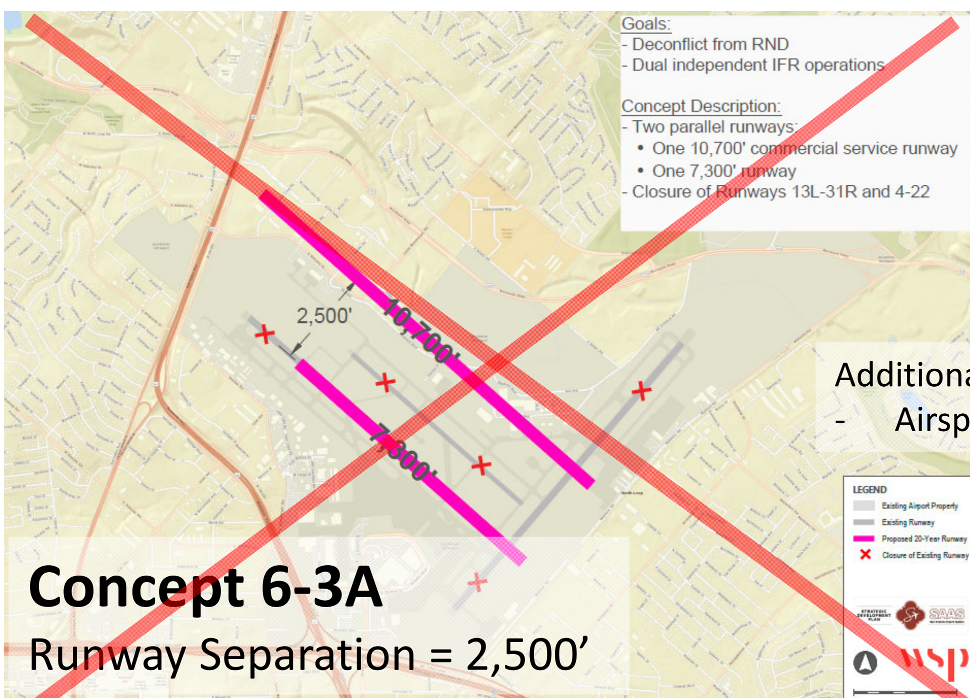
Additional Fatal Flaw:
- Airspace impacts



Round 1b Eliminated Concepts (Page 2 of 3)

50-Year Airfield Capacity

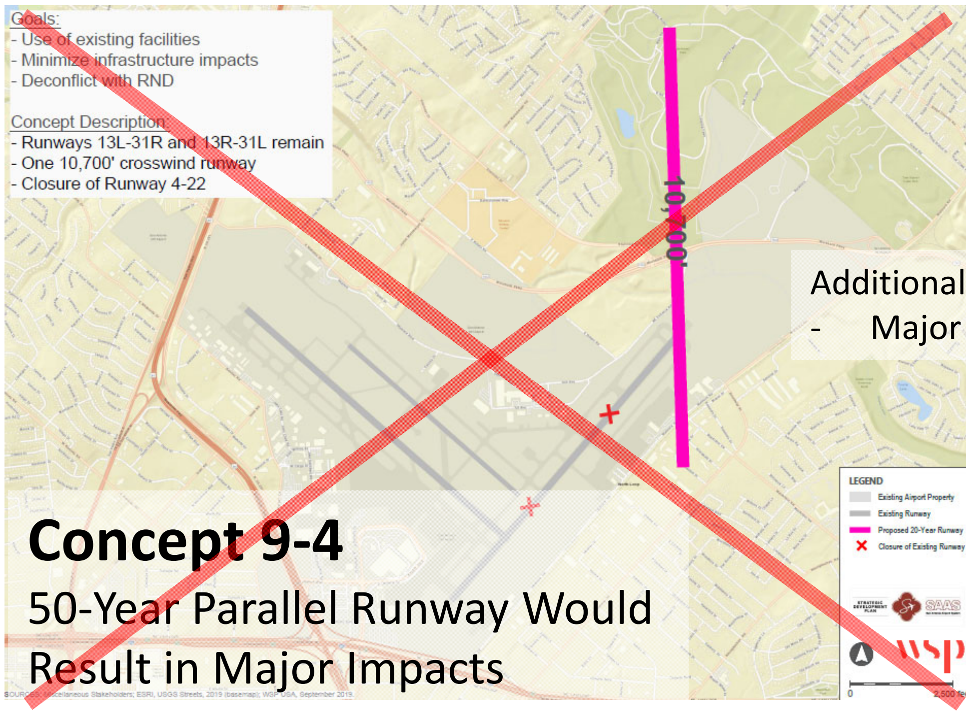




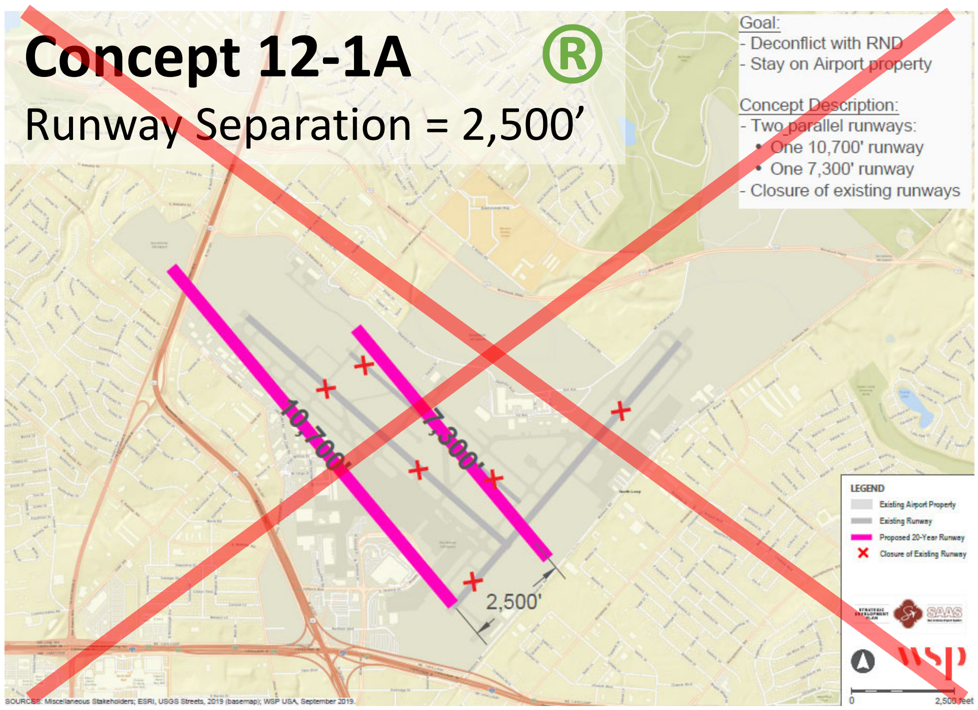
Additional Fatal Flaw:
- Airspace impacts

Round 1b Eliminated Concepts (Page 3 of 3)

50-Year Airfield Capacity



Additional Fatal Flaw:
- Major park impact



Round 1b Fatal Flaws Review
20-Year Runway is Mostly/Entirely off Airport

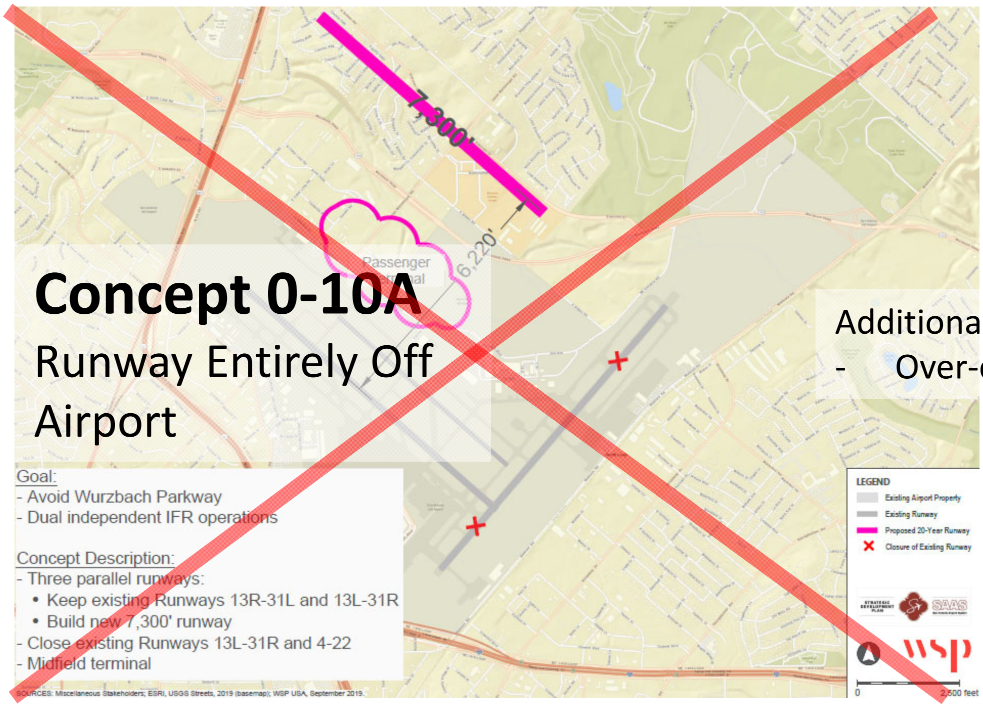
- Is one of the runways proposed as part of the 20-year plan mostly/entirely off Airport property?

- Assumption:
  - Land acquisition/land use impacts would be too extensive
  - 10,700-foot runway requires more than 600 acres

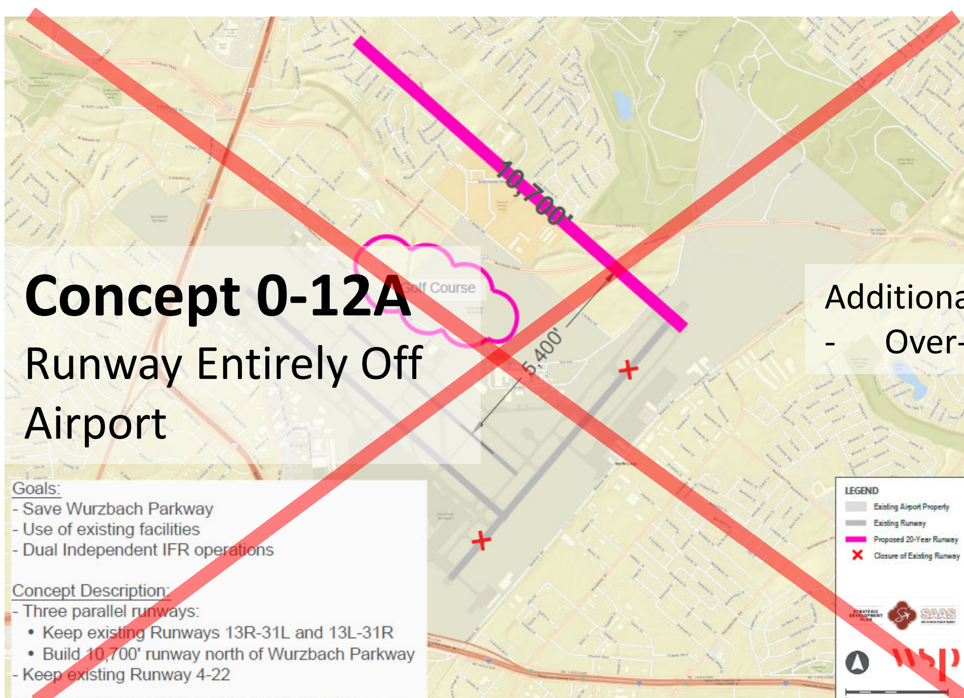
➢ 7 concepts have 20-year runways mostly/entirely off Airport property

Round 1b Eliminated Concepts (Page 1 of 4)

20-Year Runway Mostly/Entirely off Airport



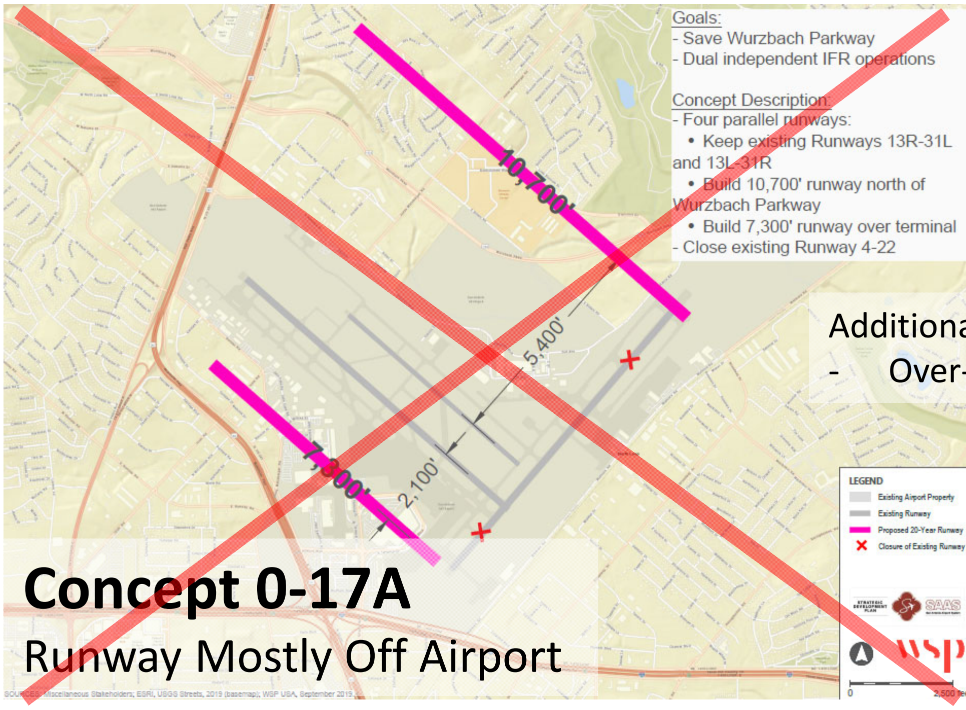
Additional Fatal Flaw:
- Over-capacity



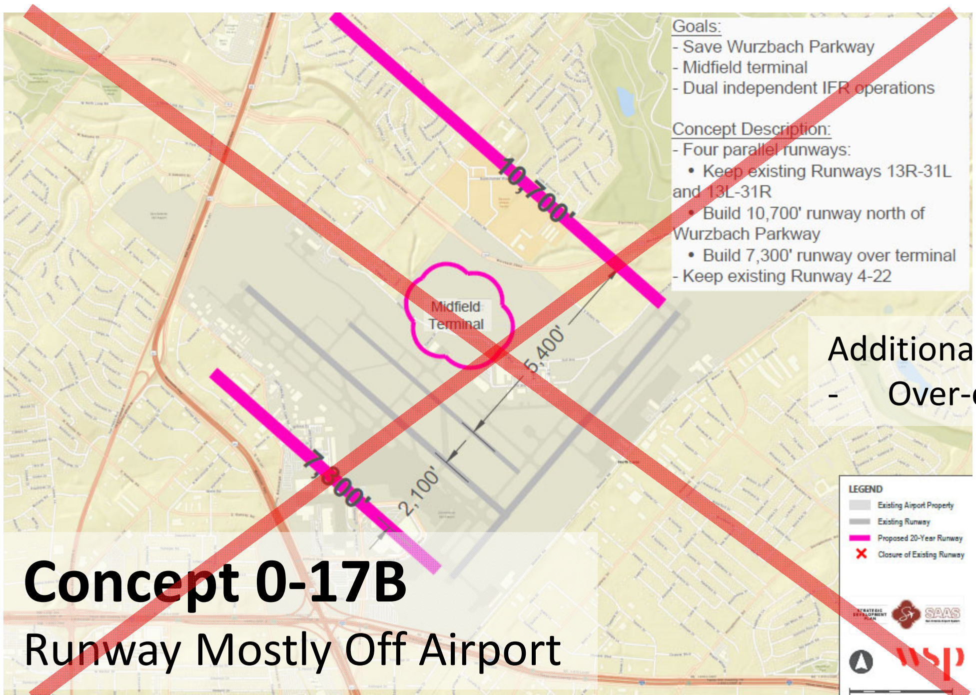
Additional Fatal Flaw:
- Over-capacity

Round 1b Eliminated Concepts (Page 2 of 4)

20-Year Runway Mostly/Entirely off Airport



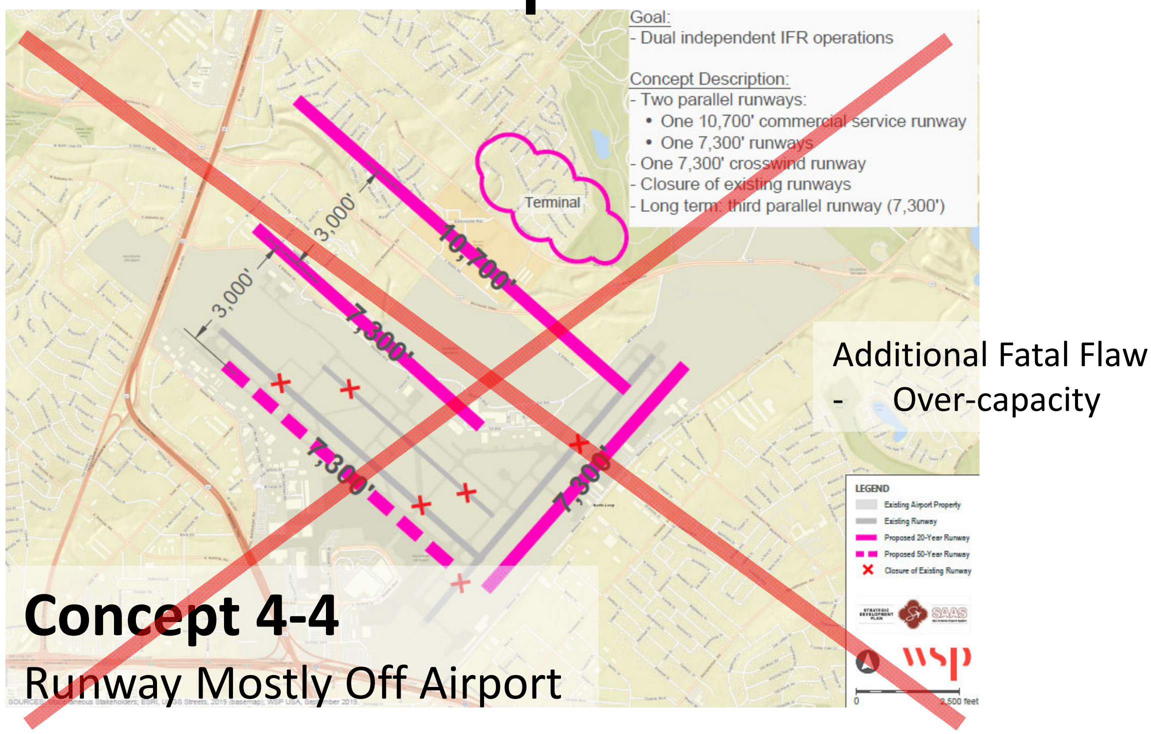
Additional Fatal Flaw:
- Over-capacity

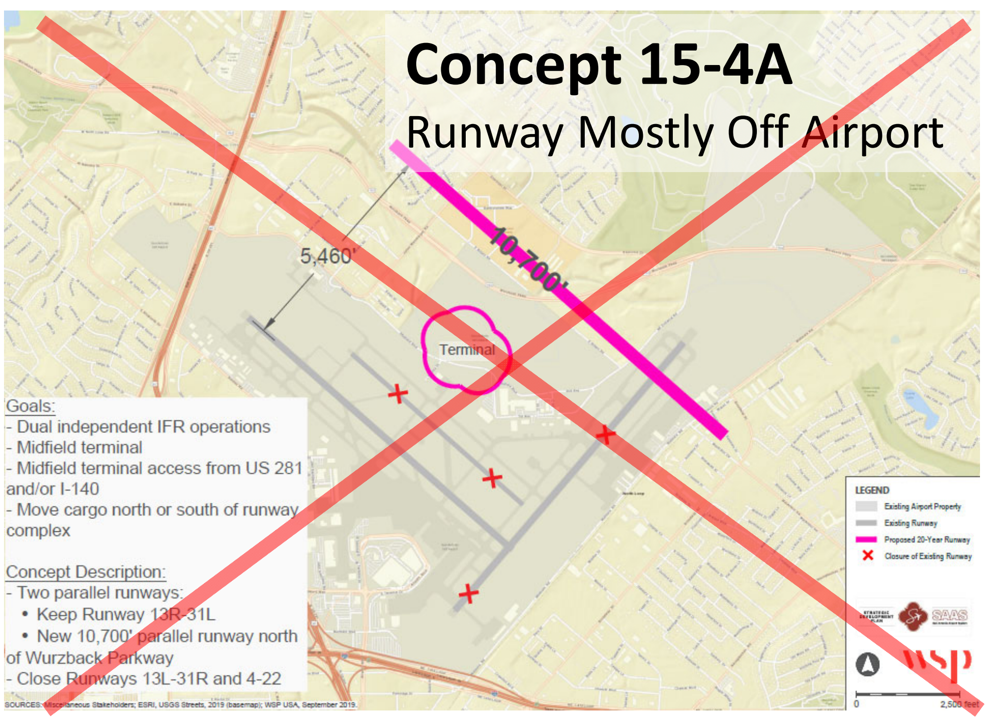


Additional Fatal Flaw:
- Over-capacity

Round 1b Eliminated Concepts (Page 3 of 4)

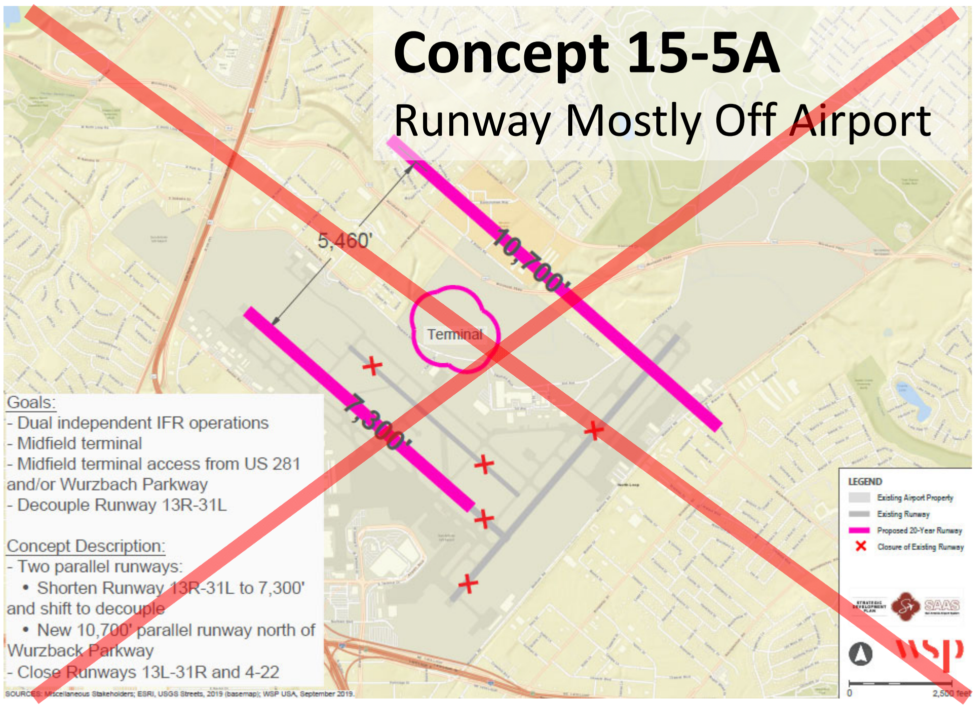
20-Year Runway Mostly/Entirely off Airport





Round 1b Eliminated Concepts (Page 4 of 4)

20-Year Runway Mostly/Entirely off Airport



Round 1b Fatal Flaws Review
Excessive Airfield Capacity

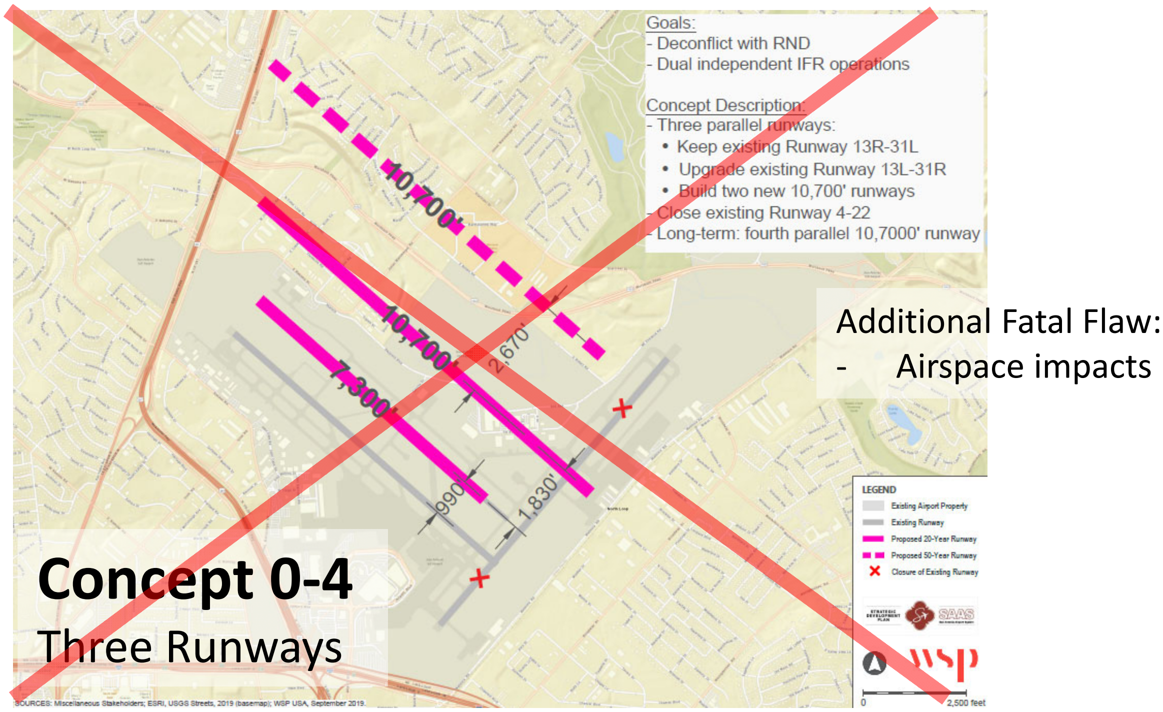
- Does the proposed plan results in excessive airfield capacity?

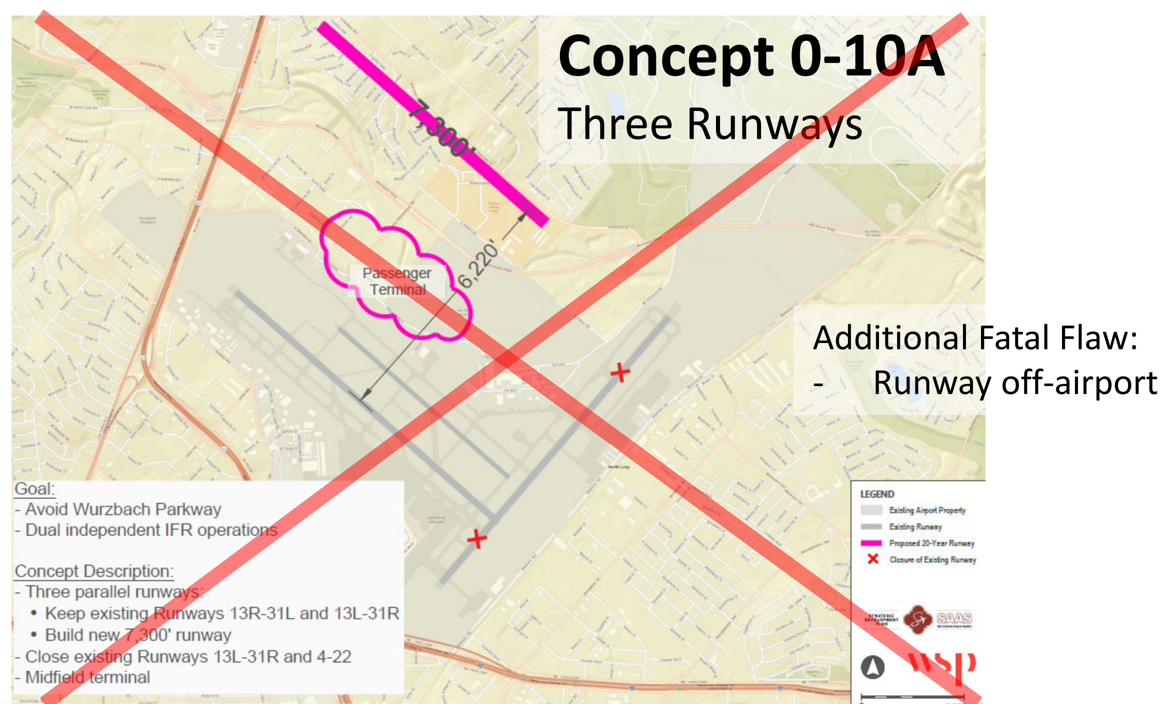
- Assumption:
  - No need for 3 primary runways for the 20-year plan

➢8 concepts result in excessive airfield capacity

Round 1b Eliminated Concepts (Page 1 of 4)

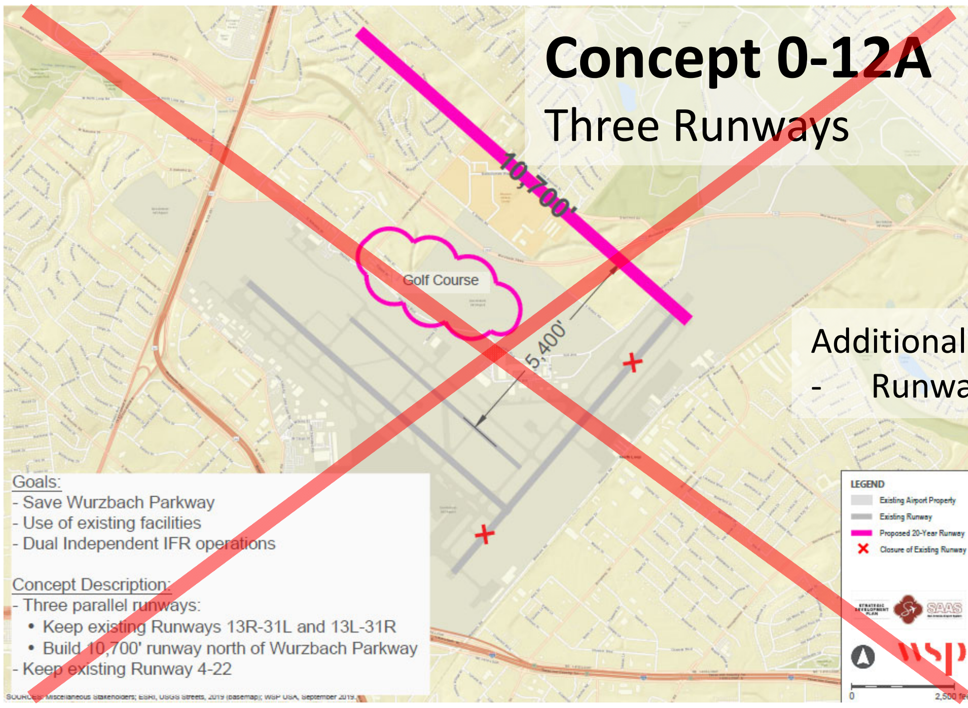
Excessive Airfield Capacity

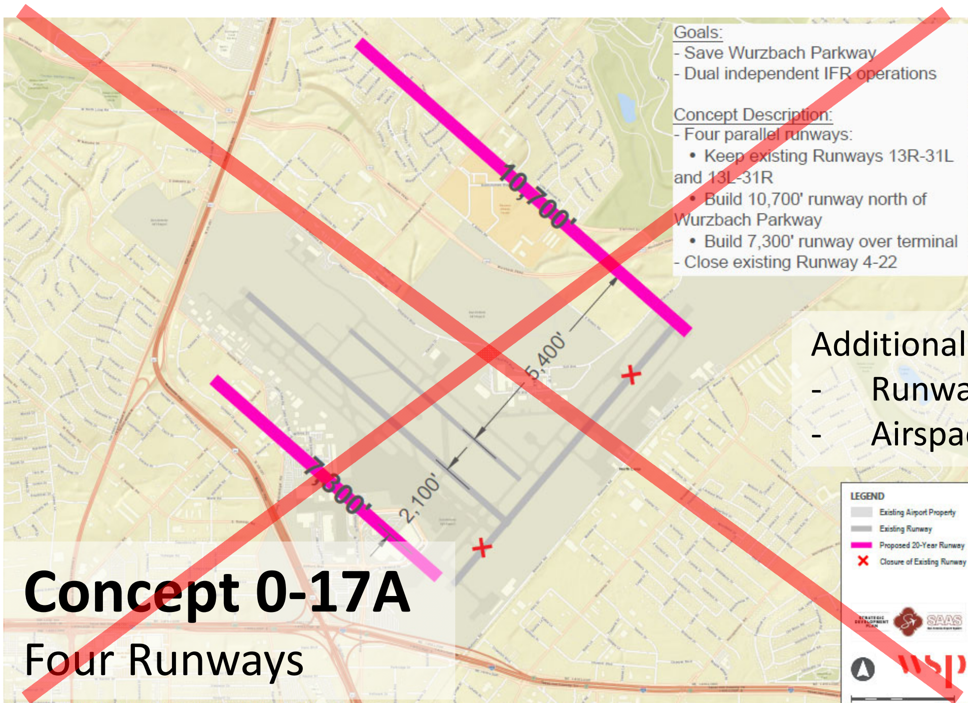




Round 1b Eliminated Concepts (Page 2 of 4)

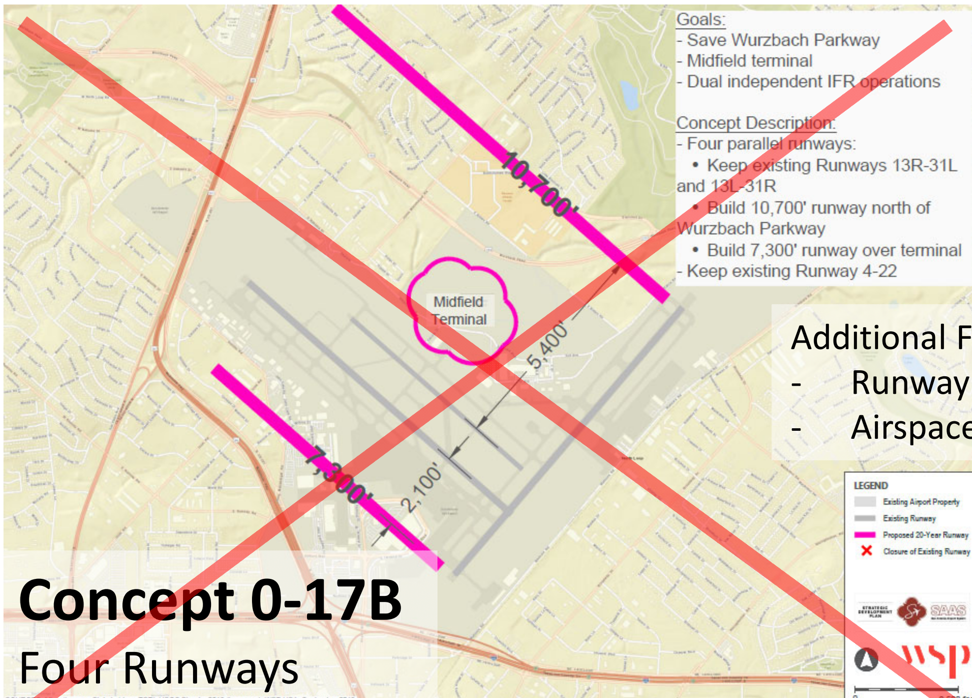
Excessive Airfield Capacity





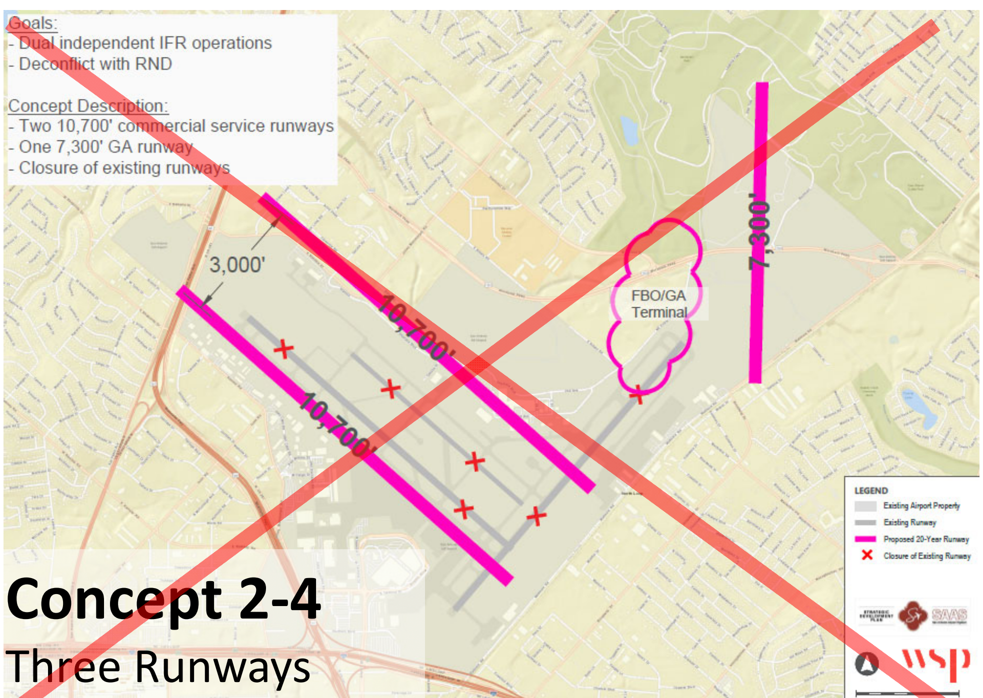
Round 1b Eliminated Concepts (Page 3 of 4)

Excessive Airfield Capacity



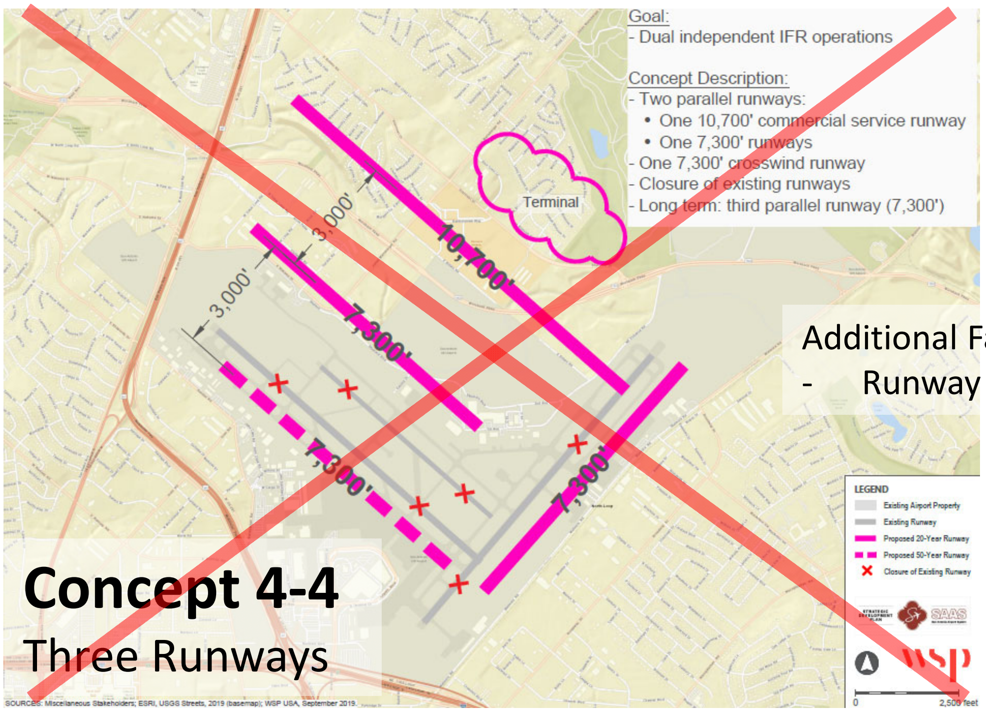
Additional Fatal Flaw:

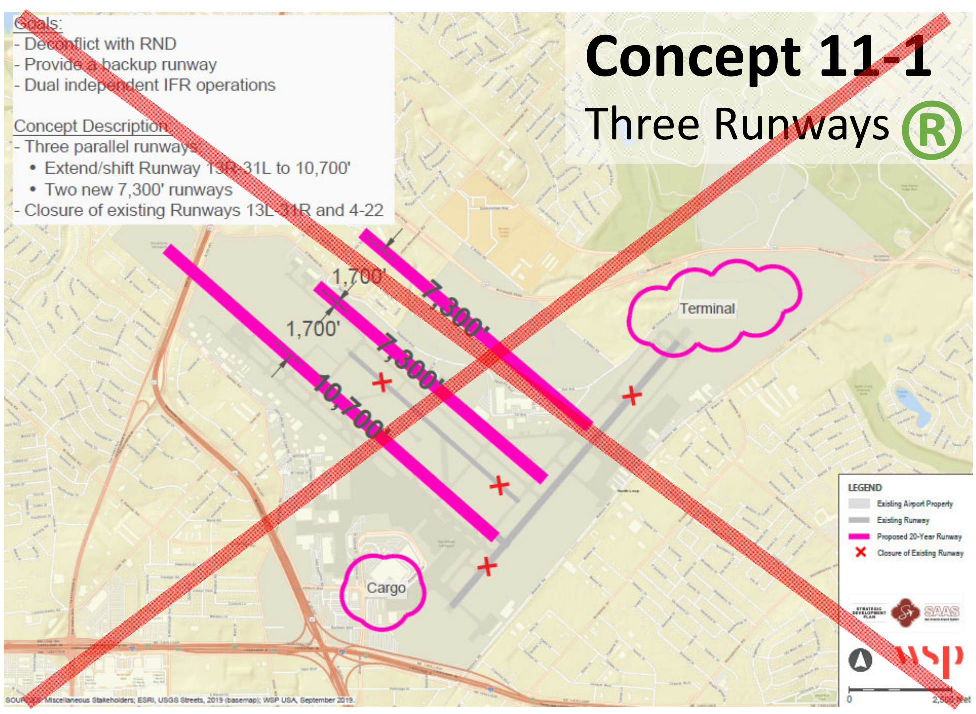
- Runway off-airport
- Airspace impacts



Round 1b Eliminated Concepts (Page 4 of 4)

Excessive Airfield Capacity





Round 1b Fatal Flaws Review
Major Public Park Impacts

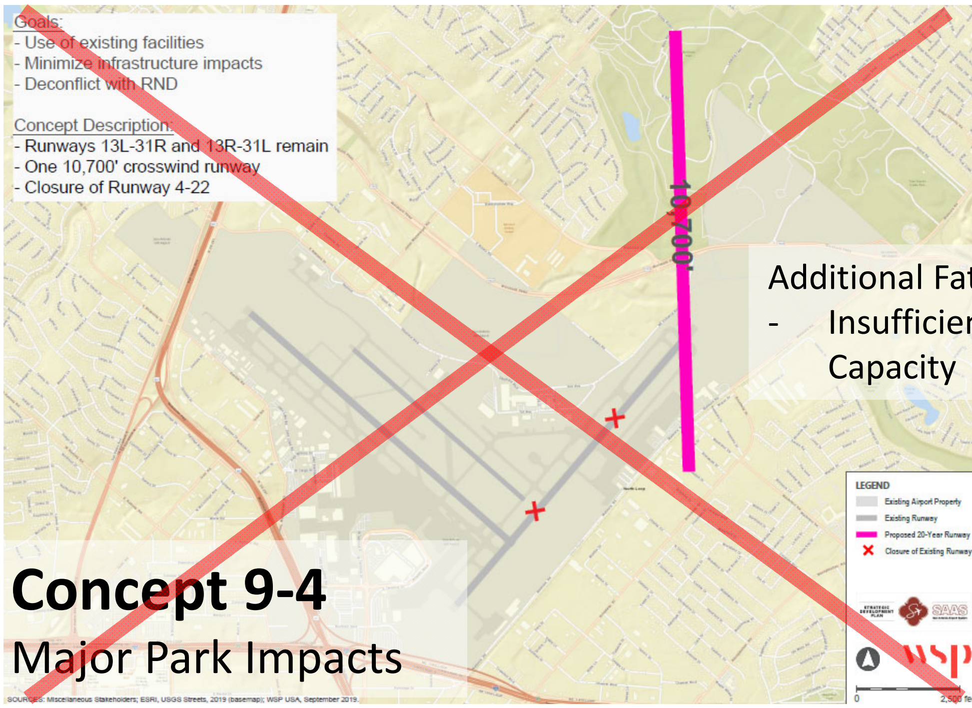
- Are there major impacts to public parks?

- Reason:
  - Major taking of public park requires replacement

➢ 1 concept results in major park impacts

Round 1b Eliminated Concepts (Page 1 of 1)

Major Public Park Impacts



Additional Fatal Flaw:
- Insufficient 50-Year Capacity

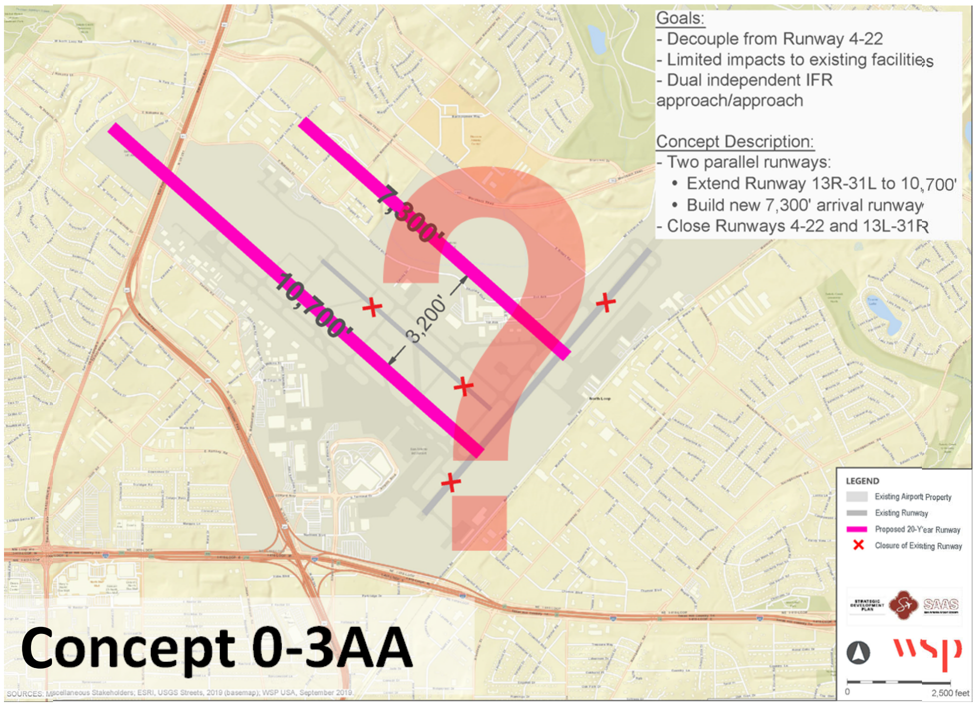
STRATEGIC DEVELOPMENT PLAN

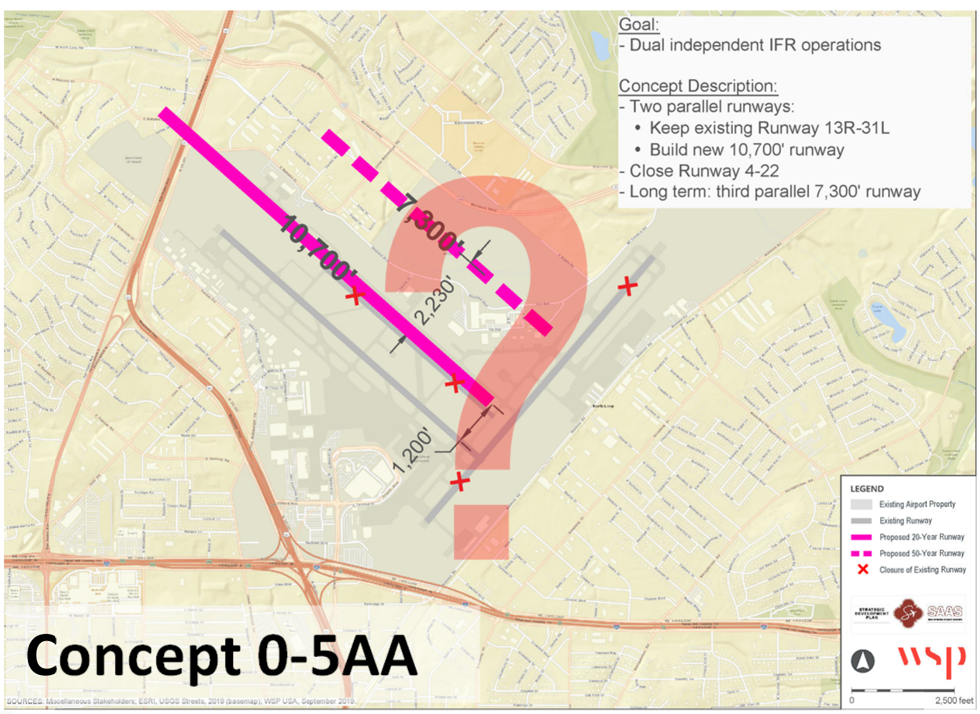
SAAS
San Antonio Airport System

Airfield Concepts Evaluation

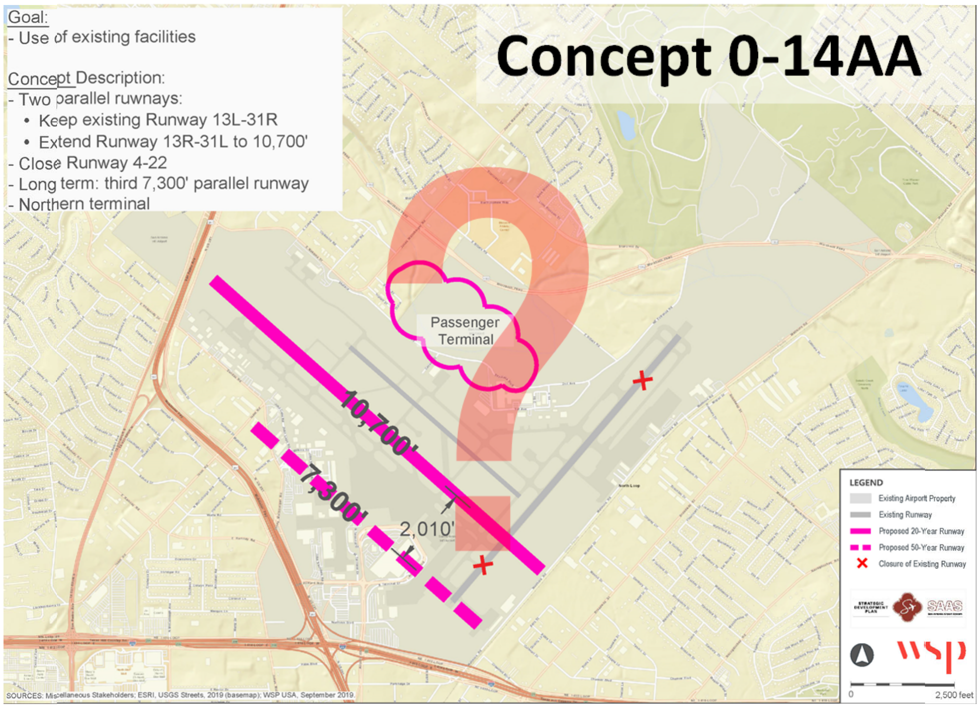
Summary of Concepts Moving to Round 2

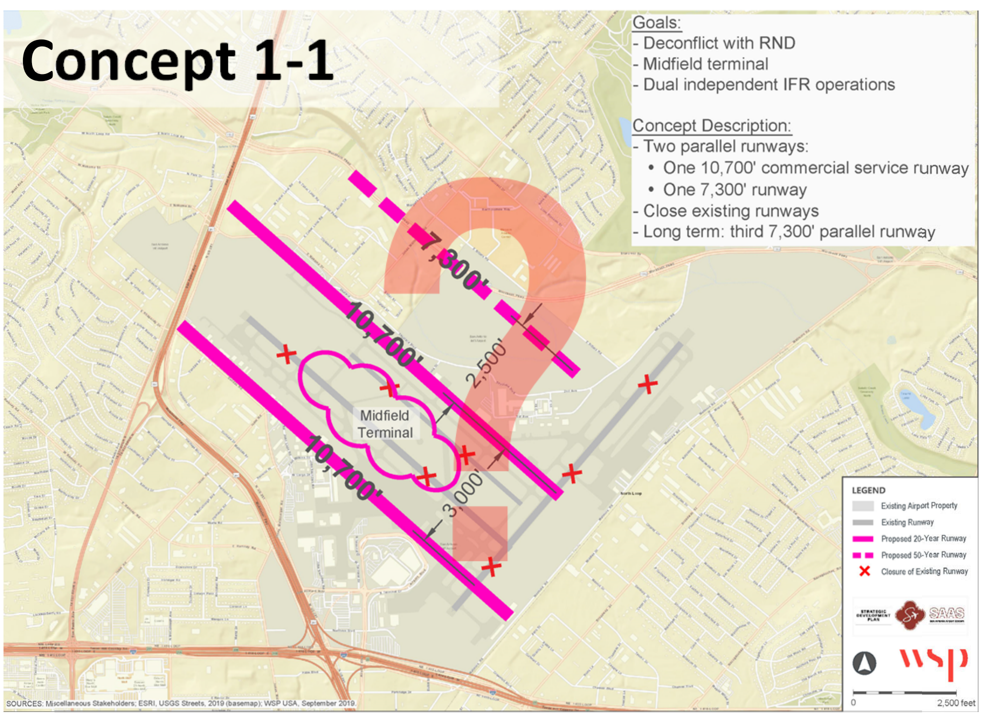
Concepts Moving to Round 2 (Page 1 of 7)



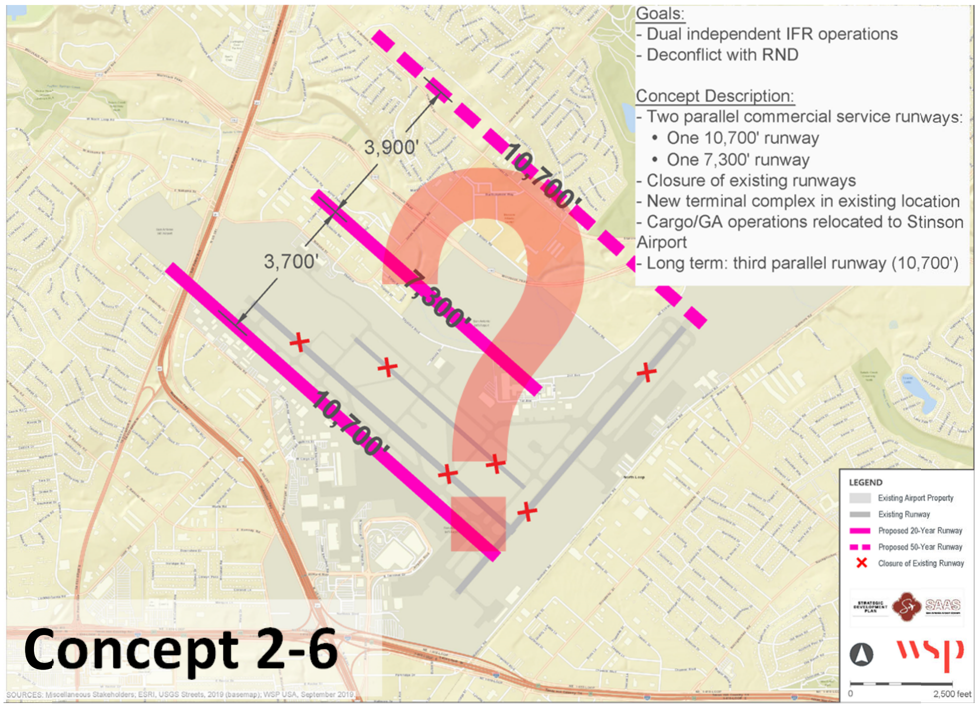


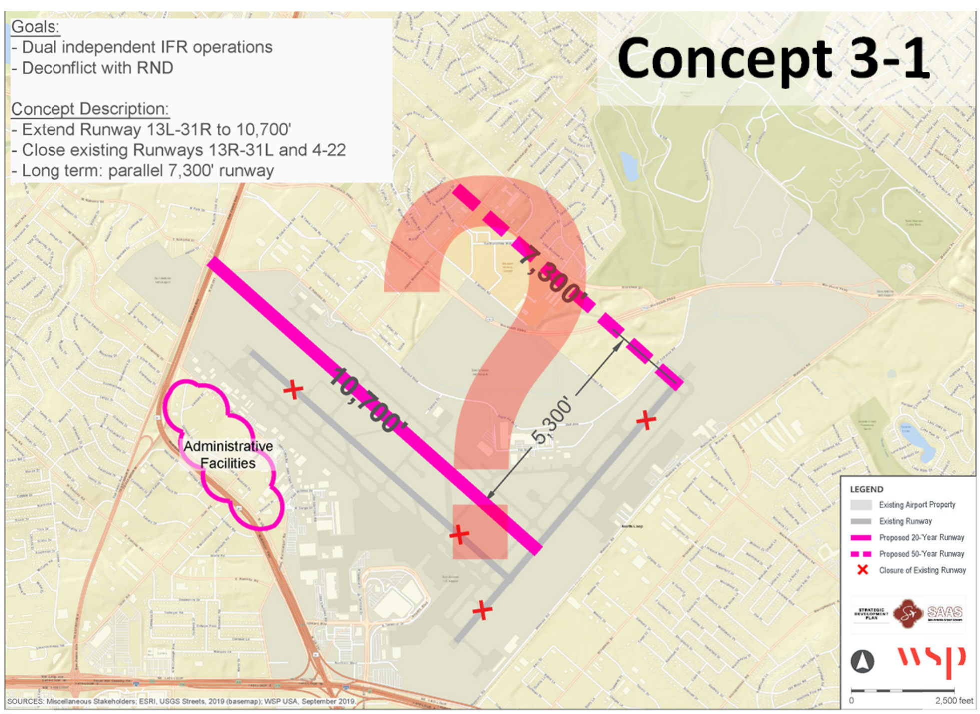
Concepts Moving to Round 2 (Page 2 of 7)



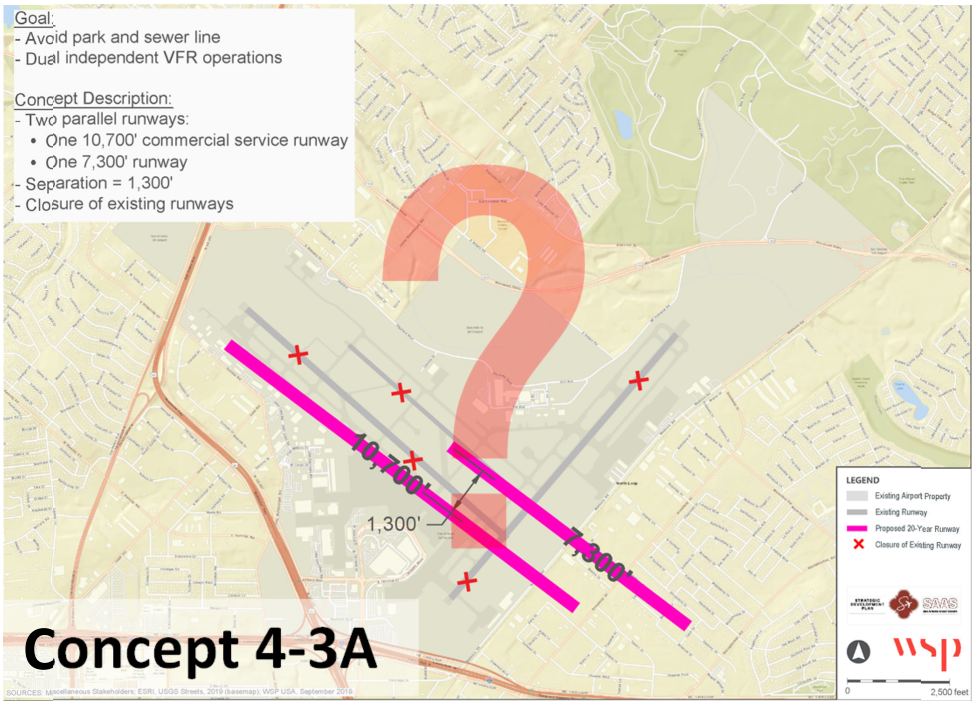


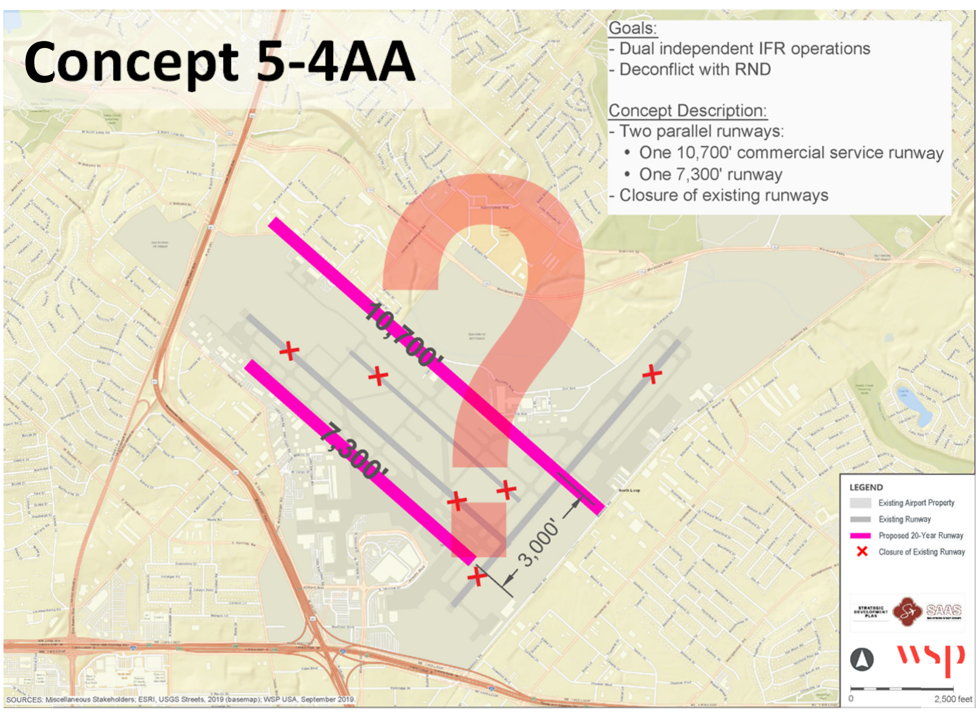
Concepts Moving to Round 2 (Page 3 of 7)



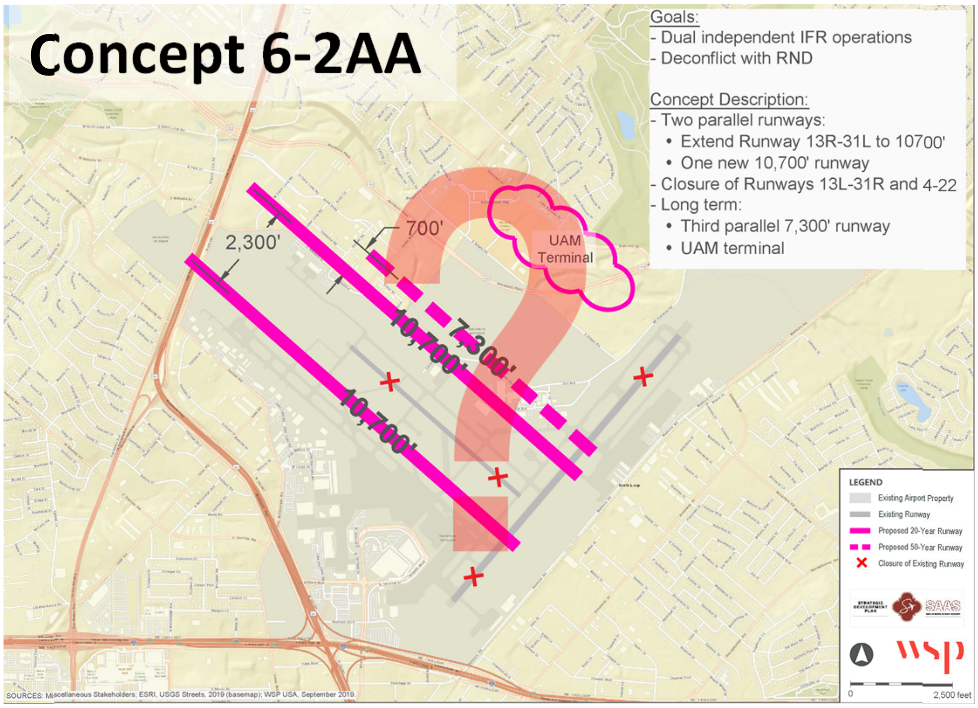


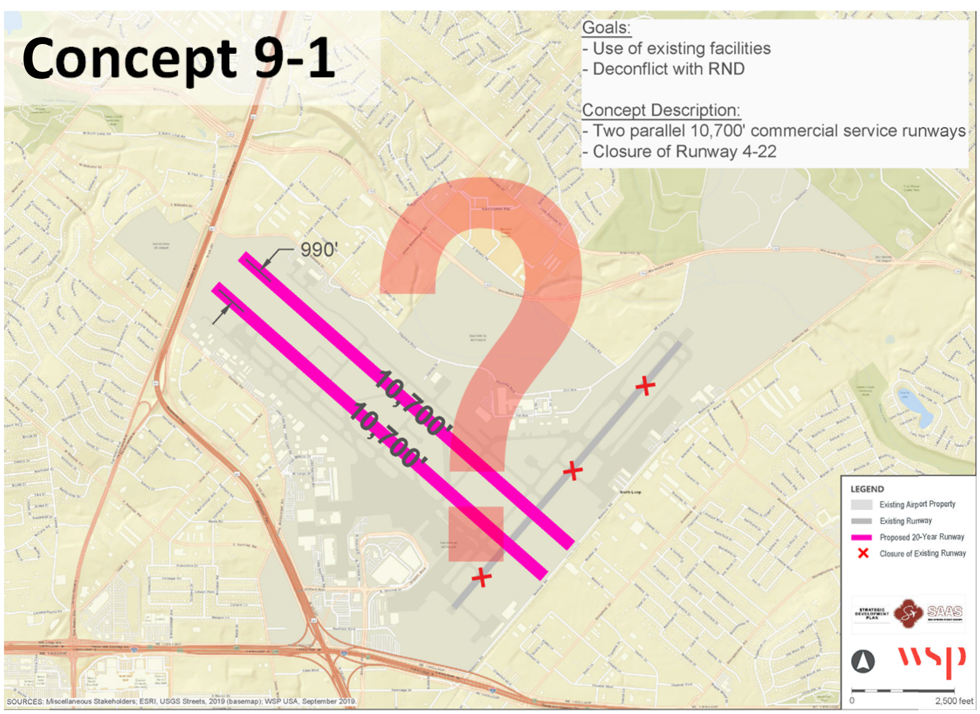
Concepts Moving to Round 2 (Page 4 of 7)



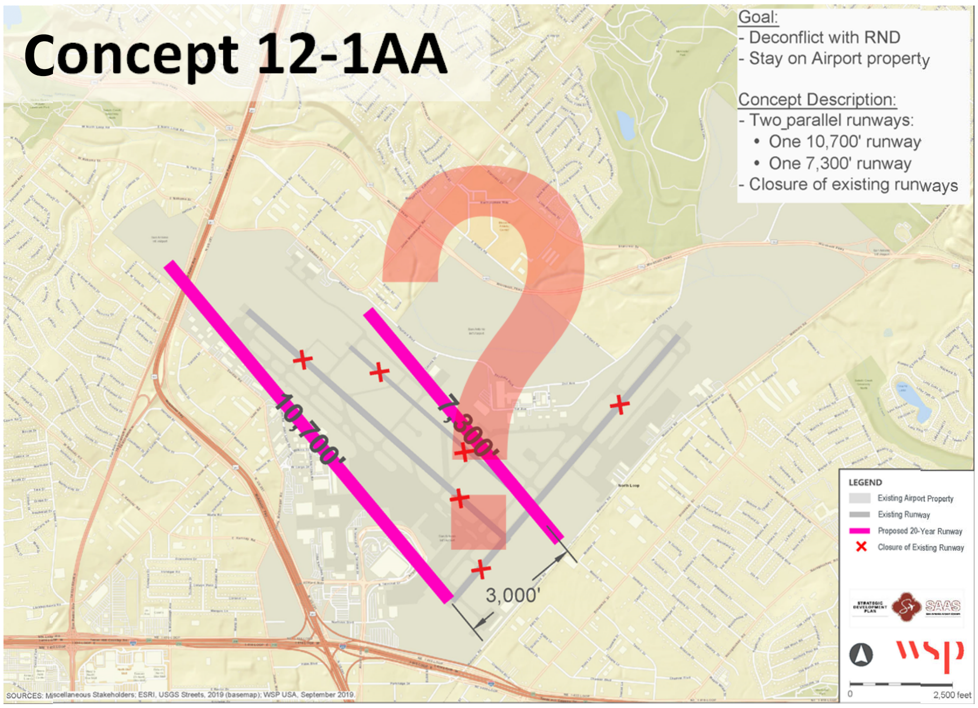


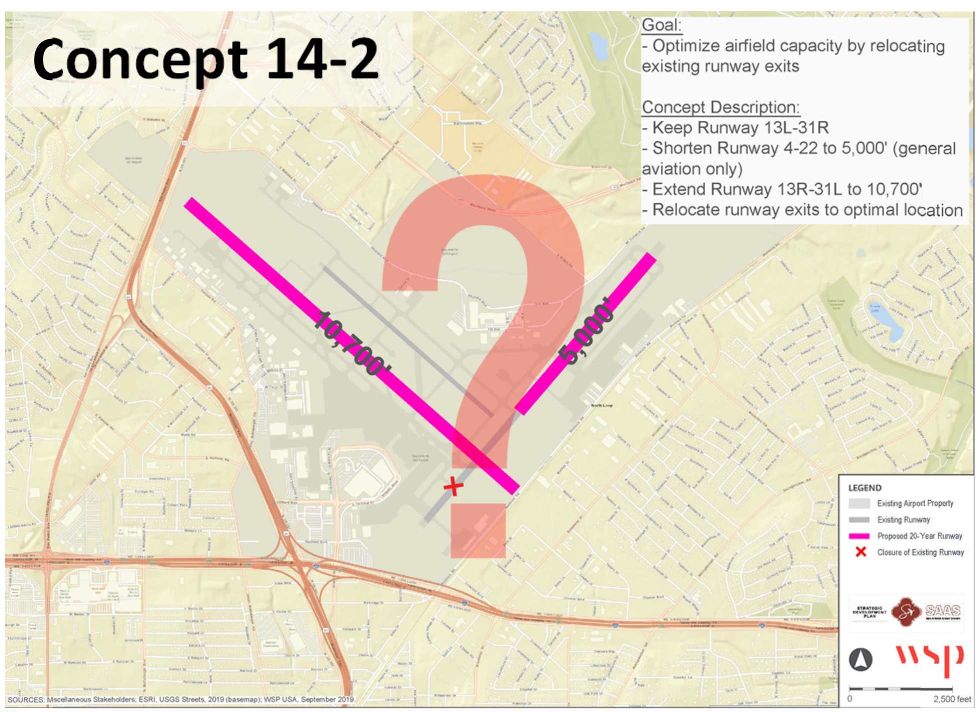
Concepts Moving to Round 2 (Page 5 of 7)



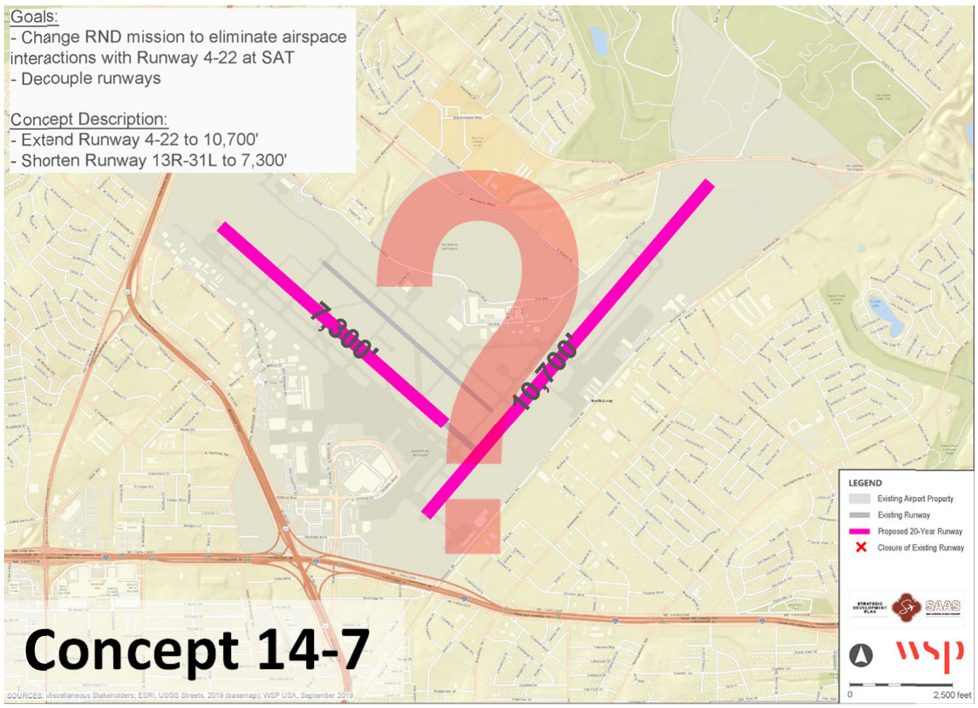


Concepts Moving to Round 2 (Page 6 of 7)





Concepts Moving to Round 2 (Page 7 of 7)



STRATEGIC DEVELOPMENT PLAN

SAAS
San Antonio Airport System

Airfield Concepts Evaluation

Next Steps

Next Steps

Round 2 – Airfield Alternatives/ Terminal Concepts

- Round 2a: evaluation of feasible airfield alternatives (up to 5):
  - Comparative costs
  - Major environmental (red flag drainage issues)
  - Ease of implementation
  - Operational flexibility

- Round 2b: initial terminal concepts:
  - Long-term flexibility
  - Passenger convenience
  - Ease of phasing
  - Comparative cost

Next Steps

Round 3 – Airfield/Terminal Alternatives

- Select 2 or 3 preferred airfield alternatives:
  - Airport system impacts
  - Noise issues
  - Additional environmental
  - ROM cost estimates

- Refine terminal concepts:
  - Airspace tail penetrations
  - Terminal/apron outlines

- Select 2 or 3 preferred combinations of airfield/terminal alternatives

Next Steps

Round 4 – Preferred Airfield/Terminal Alternatives with Access and Support Facilities Alternatives

- Refine terminal alternatives
  - Select a preferred terminal alternative for each airfield alternative

- Develop roadway/support alternatives

Next Steps

Composite Alternatives

- Combine airfield/terminal alternatives with access and support alternatives
  - Select a preferred access/support alternative for each airfield/terminal alternative

- Select a Preferred Alternative

LEGEND

- Existing Airport Property
- Existing Runway
- Proposed 20-Year Runway
- Proposed 50-Year Runway
- Closure of Existing Runway

STRATEGIC DEVELOPMENT PLAN

SAAS San Antonio Airport System

LEGEND

- Existing Airport Property
- Existing Runway
- Proposed 20-Year Runway
- Proposed 50-Year Runway
- Closure of Existing Runway

STRATEGIC DEVELOPMENT PLAN

SAAS San Antonio Airport System

About the Alternatives Evaluation Process

The San Antonio Airport System started a Strategic Development Plan (SDP) in 2018 to examine whether the existing San Antonio International Airport (SAT) site could accommodate expected long-term growth and expansion needs. The first phase of the data-driven study determined that the 50-year airport could be made to fit at the current location.

As part of Phase II of the study, potential policy and development alternatives were developed for SAT and are now being evaluated to produce, by the end of 2020, a preferred airport development plan for the airfield, terminal, and airport access. This document represents the results of Round 2 of alternatives evaluation, as of January 2020.

Alternatives Evaluation Process Highlights

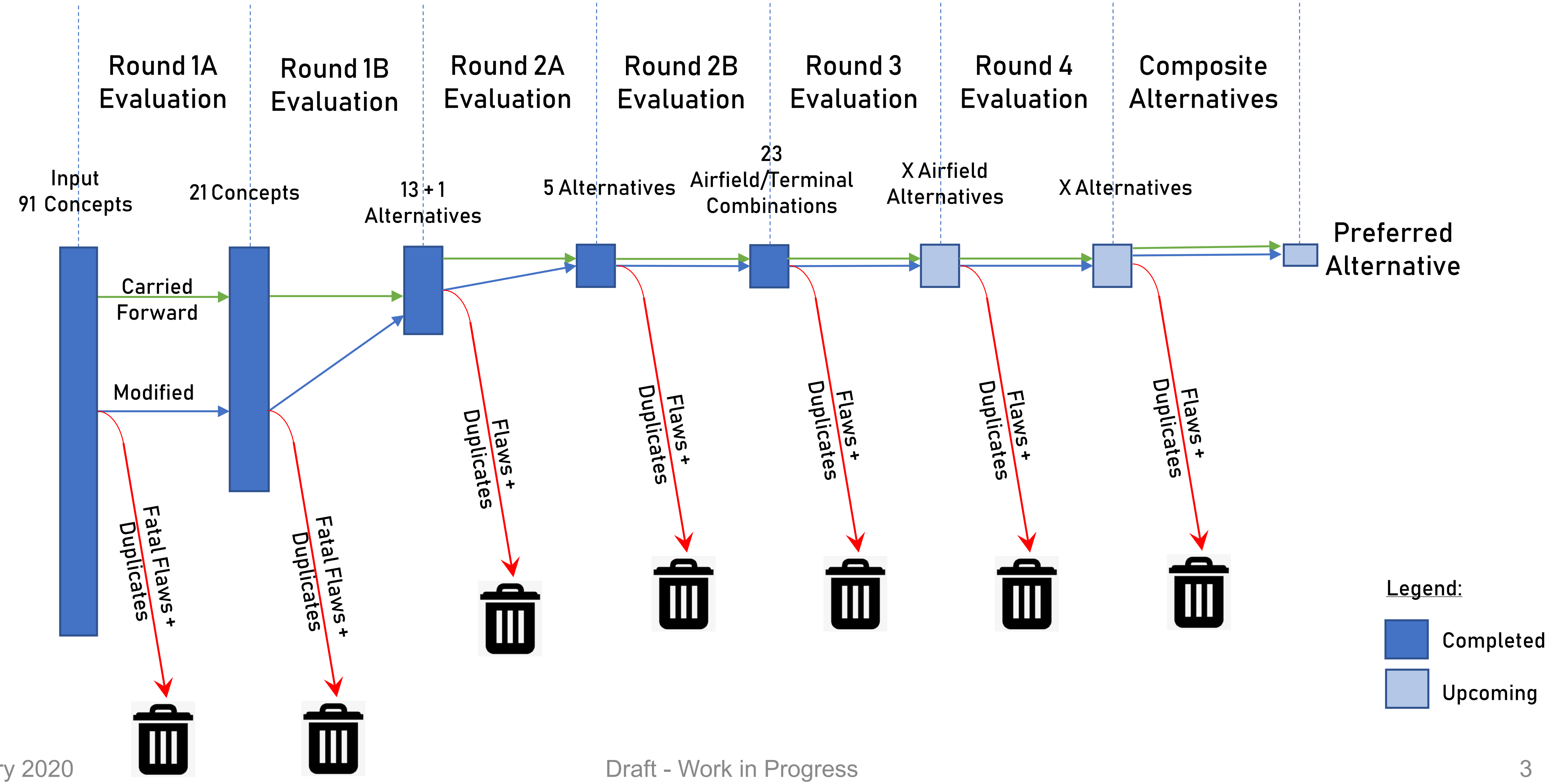
The goal of the Strategic Development Plan (SDP) Sketch Planning process was to get all ideas about development of SAT on the table. Six technical sketch planning sessions took place, which included 107 participants who identified a total of 91 initial airfield concepts.

The SDP technical team screened the 91 concepts to identify technically feasible alternatives that will undergo further evaluation. This two-step screening (Round 1) resulted in 13 airfield alternatives that moved ahead for further evaluation (Round 2), using objective and technical criteria. In Round 2, a 14th airfield alternative was identified and added for evaluation. After the Round 2 evaluation process was completed, 5 airfield alternatives remain, resulting in 23 airfield/terminal combinations.

There will be multiple rounds of evaluation. The final results will be the basis for preparing the Preferred Development Plan, illustrating SAT's proposed projects for the 20-year planning period, and a potential 50-year concept. The plan will depict proposed airfield, terminal, access, support, and tenant facilities, and include high-level phasing for the 6, 10, and 20-year planning periods.

The proposed projects that will eventually be recommended can proceed only if the need actually materializes. All eventual SDP proposed projects will be subject to further financial and environmental approvals.

Concept Evaluation
Considering all ideas



Summary of Round 2 Findings

Round 2A Steps:

- Renamed 13 remaining airfield alternatives from Round 1: “A1” through “A13”
- Identified a 14th airfield alternative for evaluation: “A14”
- Modified alternatives with flaws, when possible
- Refined alternatives (added letter “R” after alternative number, e.g. A14R):
  - Added detail (runway areas, parallel taxiways, operating configurations, airport facilities)
  - Considered keeping a shortened version of Runway 4-22
  - Removed runways that would result in excess long-term capacity
  - Optimized runway separation (maximize airfield capacity, minimize impacts…)
- Evaluated alternatives

Alternatives Eliminated in Round 2A, due to:

Note: some alternatives were eliminated for more than one reason.

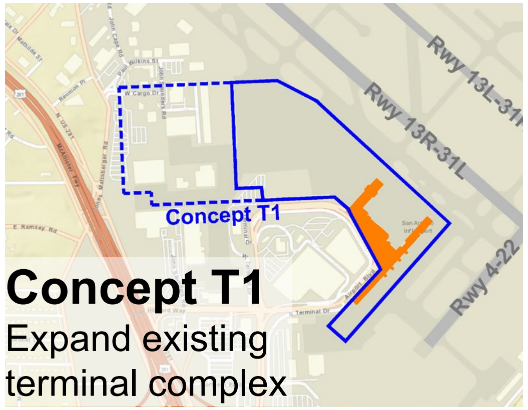
- Insufficient 20-year airfield capacity *[3 eliminated]*
- Implementability within 20 years (timing/phasing) *[5 eliminated]*
- Precludes independent parallel runways in 50 years *[3 eliminated]*
- Policy alternative *[1 eliminated]*

➢5 airfield alternatives remain

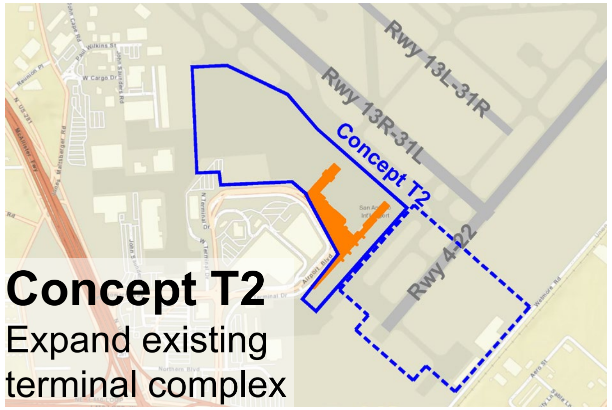
Round 2B Steps:

- Developed 10 potential terminal concepts:
  - Expand/modify existing terminal complex
  - Build new midfield terminal concourse/complex
  - Build new terminal complex north of the airfield
- Combined 5 remaining airfield alternatives with 10 potential terminal sites/concepts = 50 airfield/terminal combinations
- Evaluated combinations

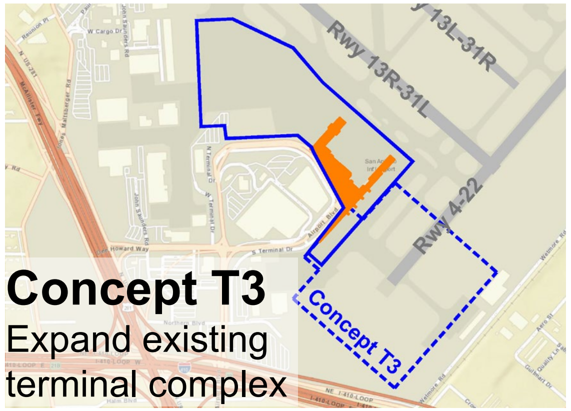
Potential Terminal Concepts



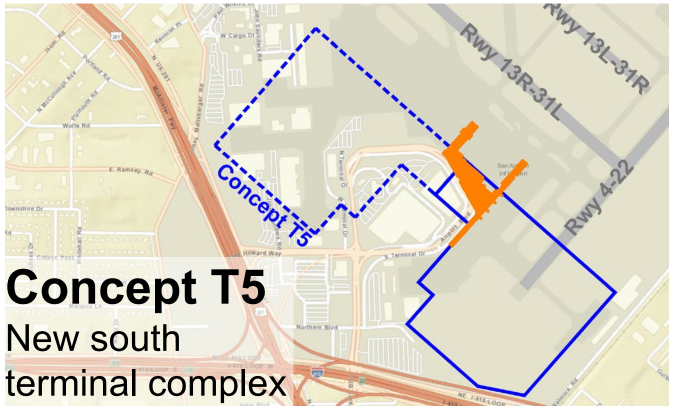
Concept T1
Expand existing terminal complex



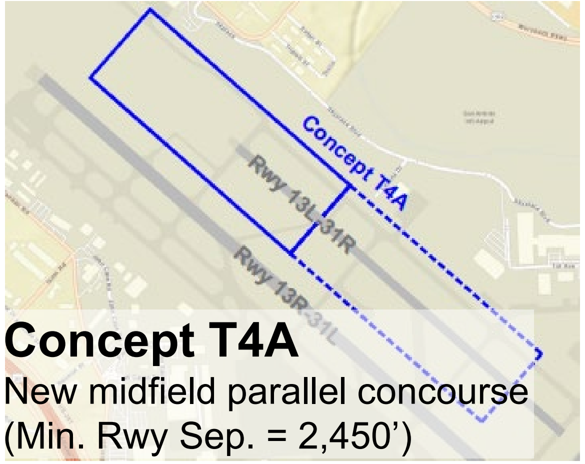
Concept T2
Expand existing terminal complex



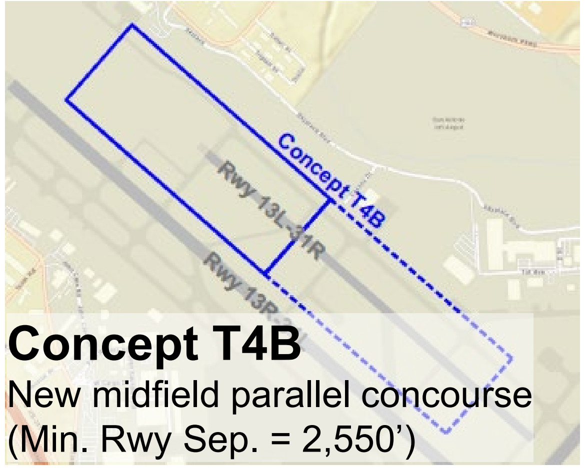
Concept T3
Expand existing terminal complex



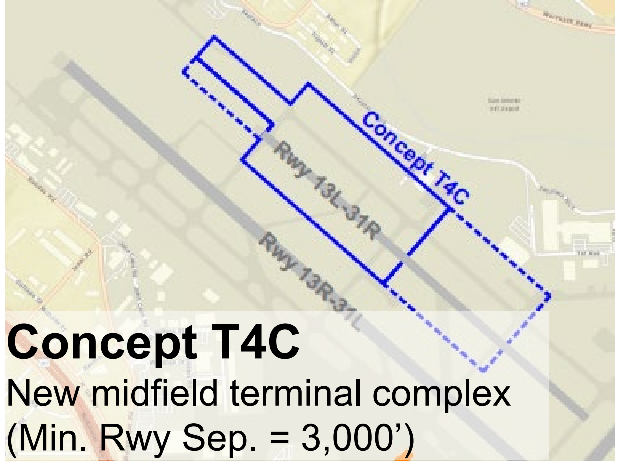
Concept T5
New south terminal complex



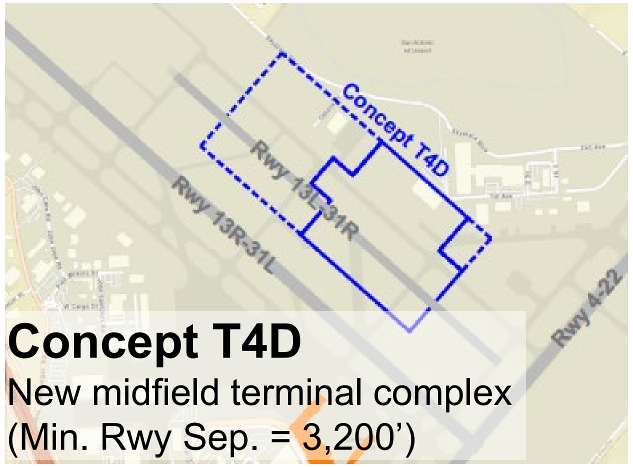
Concept T4A
New midfield parallel concourse
(Min. Rwy Sep. = 2,450')



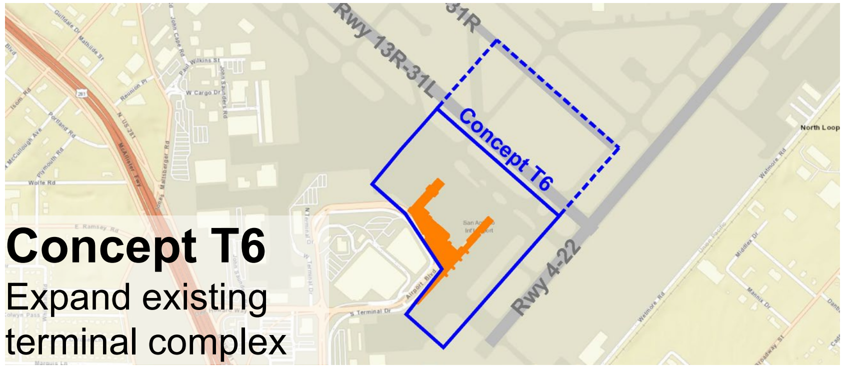
Concept T4B
New midfield parallel concourse
(Min. Rwy Sep. = 2,550')



Concept T4C
New midfield terminal complex
(Min. Rwy Sep. = 3,000')



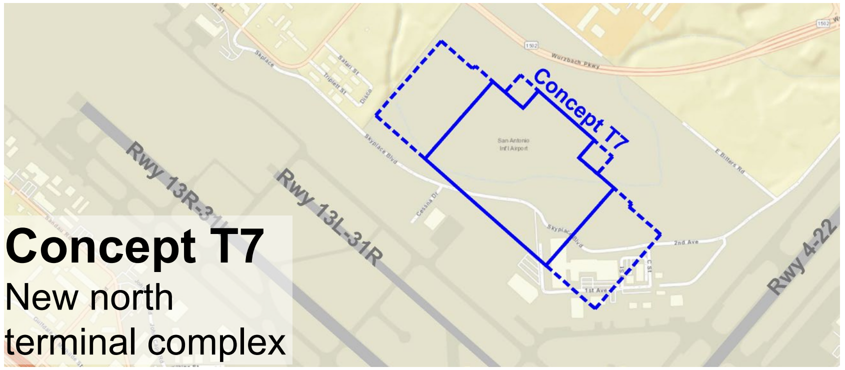
Concept T4D
New midfield terminal complex
(Min. Rwy Sep. = 3,200')



Concept T6
Expand existing terminal complex

LEGEND

- Existing Airport Property
- Existing Runway
- Existing Terminal Complex
- 2038 Development
- 2068 Development



Concept T7
New north terminal complex

Airfield/Terminal Combinations Eliminated in Round 2B, due to:

Note: some combinations were eliminated for more than one reason.

- Terminal site impacts proposed airfield (pavement, safety surfaces) *[21 combinations eliminated]*
- Only keep best suited midfield terminal concept (out of 4 midfield terminal options) for each airfield alternative *[5 combinations eliminated]*
- Duplicate *[1 combination eliminated]*

➢23 airfield/terminal combinations remain

Alternatives Moving to Round 3:

The Round 2A technical evaluation resulted in 5 airfield alternatives moving ahead to Round 2B.

Round 2B paired these remaining 5 airfield alternatives with 10 potential terminal concepts, and evaluated their viability, using objective and technical criteria. At the outcome of the Round 2B evaluation, 23 airfield/terminal combinations remain, and are moving to Round 3.

The 23 remaining airfield/terminal combinations are included in the pages that follow.

STRATEGIC DEVELOPMENT PLAN

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About the Following Figures

The 5 following figures represent the 5 airfield alternatives that survived the Round 2A evaluation. The terminal concepts that survived the Round 2B evaluation are shown for each airfield alternative.

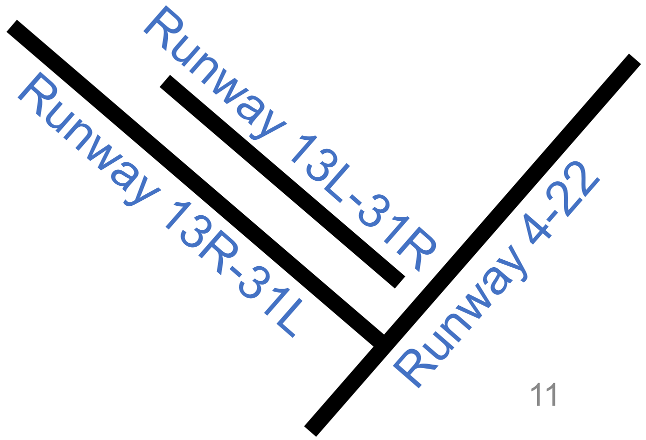
Although potential 50-year runways are depicted (dashed magenta lines), evaluation criteria only apply to 20-year runways (continuous magenta lines).

The footprints of the proposed terminal concepts are depicted in continuous lines (20-year development) and dashed lines (50-year development).

Legend for the Figures:

- Existing Airport Property
- Existing Runway
- Proposed 20-Year Runway
- Proposed 50-Year Runway
- Proposed Parallel Taxiway
- Taxiway Object Free Area
- Closure of Existing Runway
- Runway Safety Area
- Runway Object Free Area
- Runway Protection Zone
- Predominant Arrival/ Departure Flows

SAT Runway Layout:



Airfield Alternative A1R and Remaining Terminal Concepts Moving to Round 3

Remaining Terminal Concepts:

- A1R-T1
- A1R-T2
- A1R-T3
- A1R-T4C
- A1R-T7

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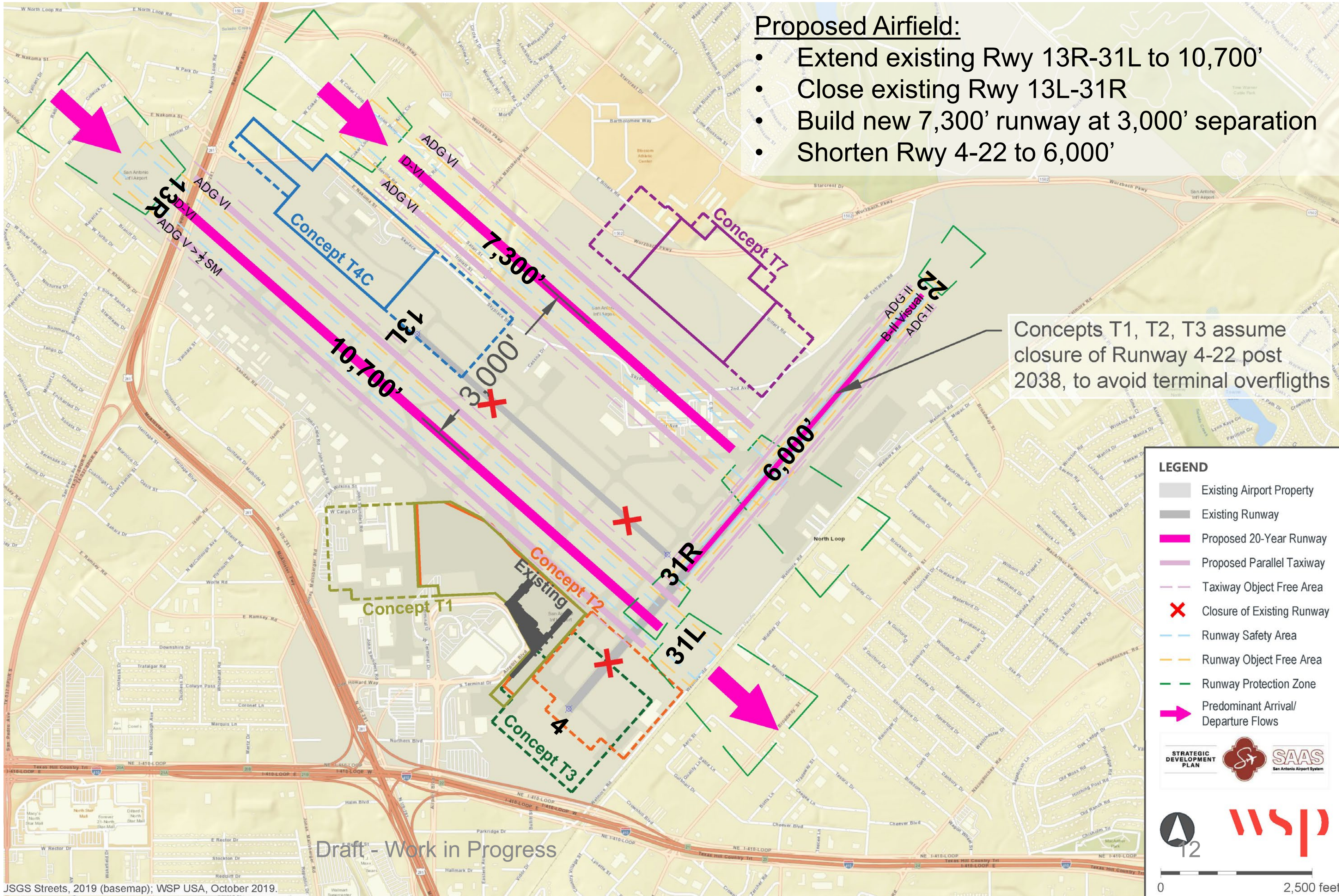
Figure 1 – Airfield Alternative A1R and Remaining Terminal Concepts



Airfield Alternative A2R and Remaining Terminal Concepts Moving to Round 3

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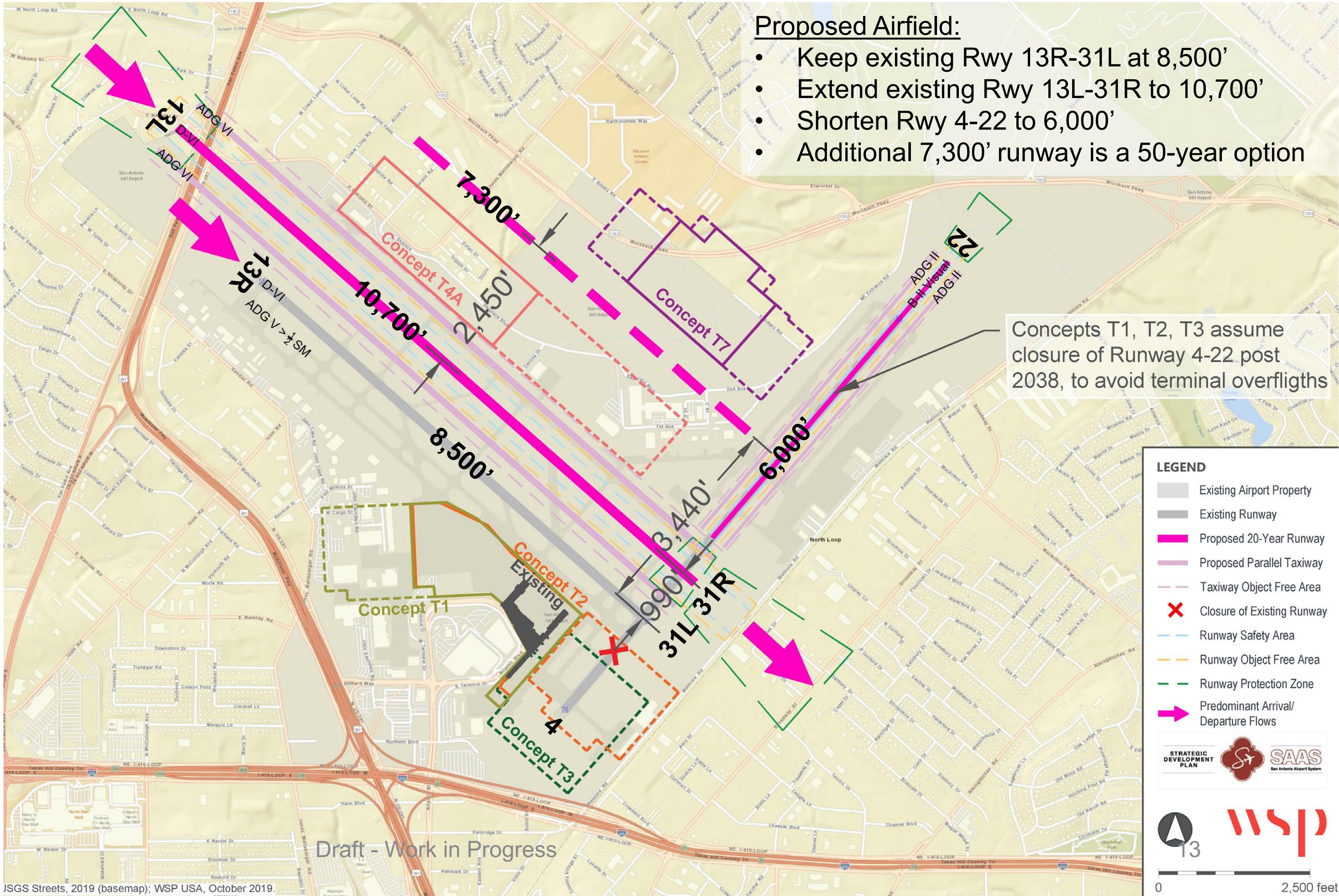
Figure 2 – Airfield Alternative A2R and Remaining Terminal Concepts

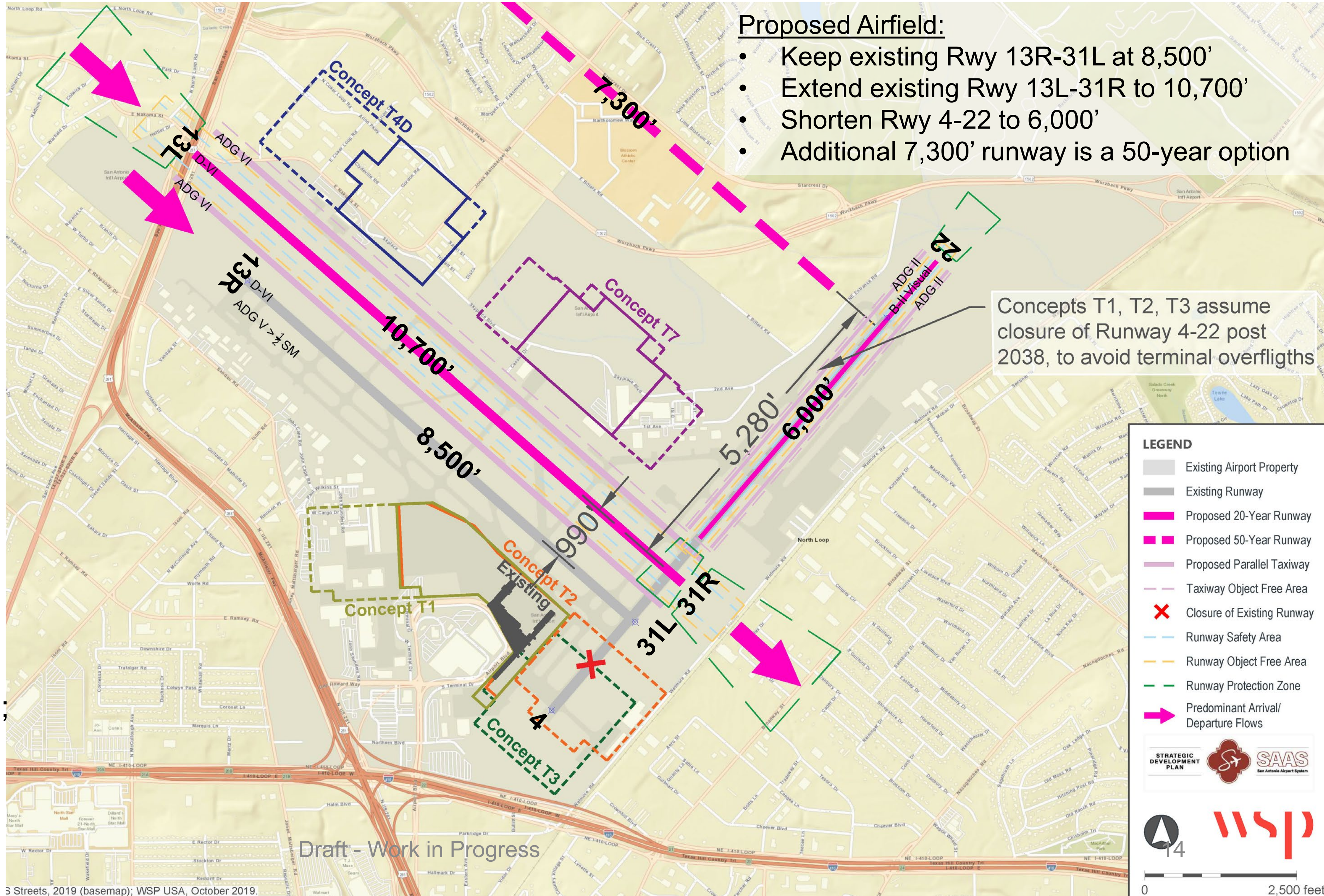


Remaining Terminal Concepts:

- A2R-T1
- A2R-T2
- A2R-T3
- A2R-T4A
- A2R-T7

Airfield Alternative A6R and Remaining Terminal Concepts Moving to Round 3

Figure 3 – Airfield Alternative A6R and Remaining Terminal Concepts



Remaining Terminal Concepts:

- A6R-T1
- A6R-T2
- A6R-T3
- A6R-T4D
- A6R-T7 (duplicate of A6R-T4D; both are new terminal complexes north of the main runway)

Airfield Alternative A9R and Remaining Terminal Concepts Moving to Round 3

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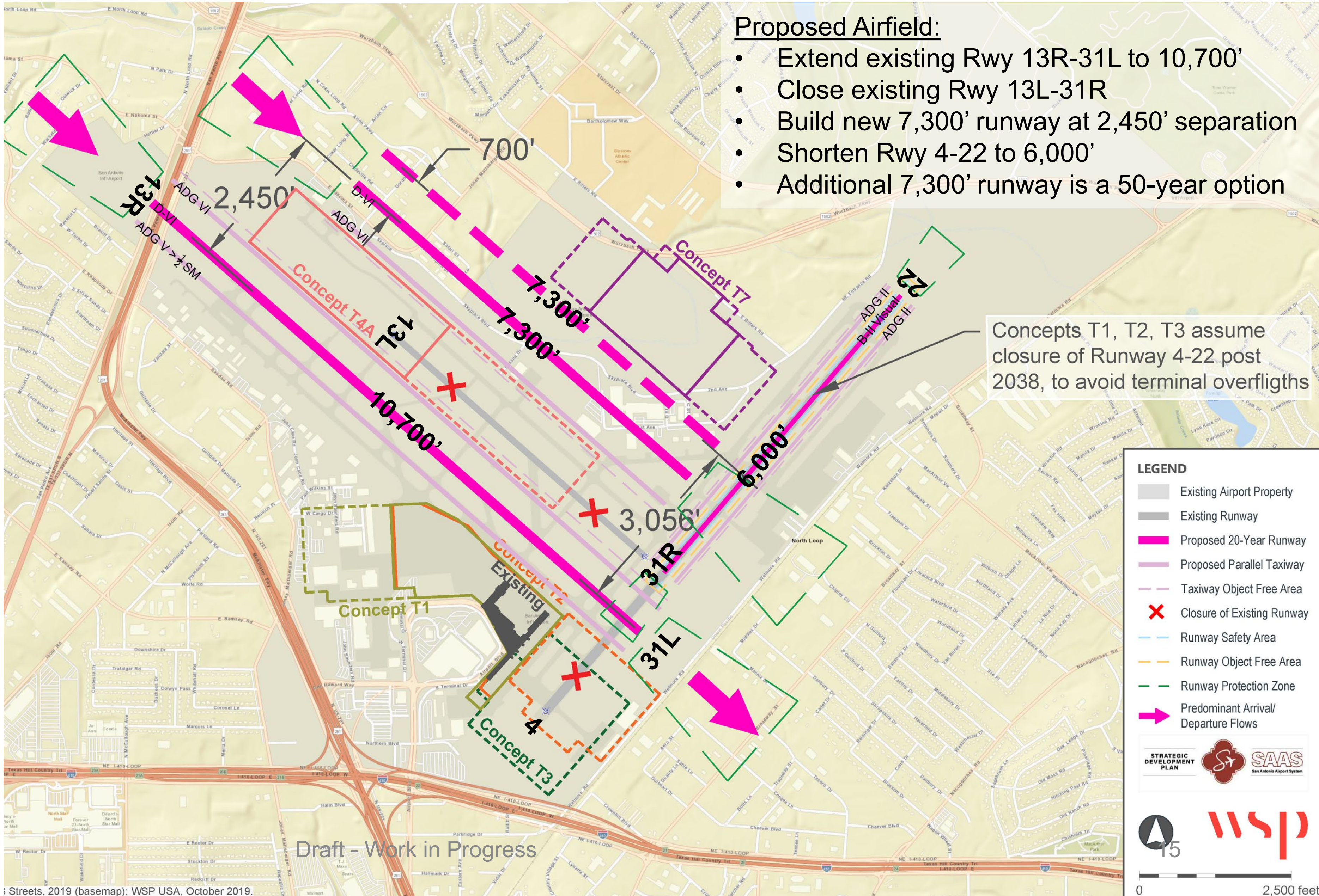
Figure 4 – Airfield Alternative A9R and Remaining Terminal Concepts

Remaining Terminal Concepts:

- A9R-T1
- A9R-T2
- A9R-T3
- A9R-T4A
- A9R-T7



Airfield Alternative A14R and Remaining Terminal Concepts Moving to Round 3

STRATEGIC DEVELOPMENT PLAN
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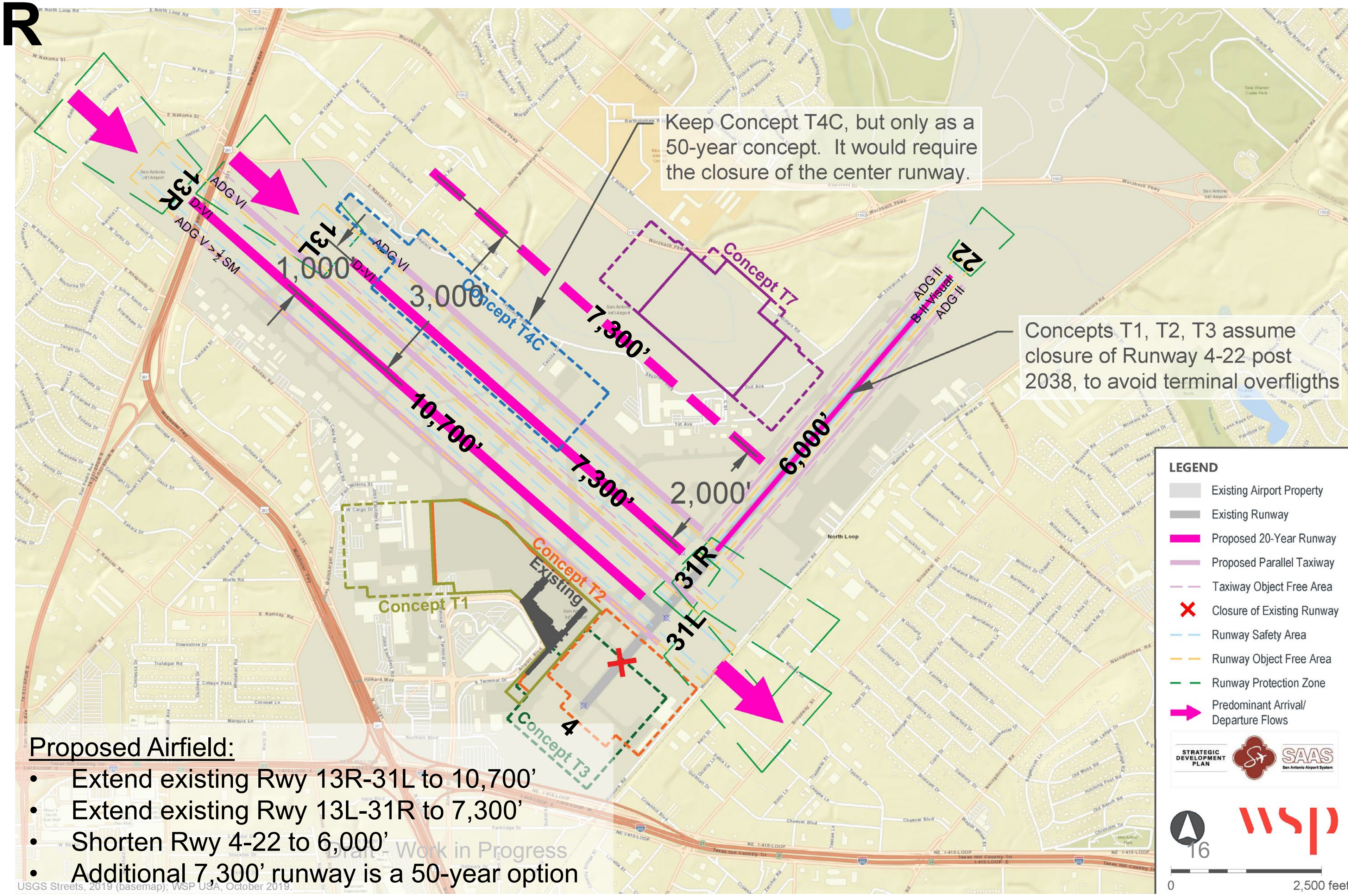
Figure 5 – Airfield Alternative A14R and Remaining Terminal Concepts

Remaining Terminal Concepts:

- A14R-T1
- A14R-T2
- A14R-T3
- A14R-T7



Proposed Airfield:

- Extend existing Rwy 13R-31L to 10,700’
- Extend existing Rwy 13L-31R to 7,300’
- Shorten Rwy 4-22 to 6,000’
- Additional 7,300’ runway is a 50-year option

Round 2 Through Final Plan - Overview

Round 2A
(Airfield)
Review of airfield capacity, ease of implementation, and operational flexibility.

Round 2B
(Terminal)
Review of airfield impacts and constructability/ phasing feasibility.

Round 3A
(Airfield)
Review of special purpose environmental laws and 20-year implementability.

Round 3B
(Refined Terminal Concepts)
Evaluation of terminal concepts, including airspace penetrations of parked aircraft, walking distances, passenger convenience and experience, and rough order-of-magnitude cost estimates.

Round 3C
(Runway Ends Siting Analysis)
Review of runway end siting impacts to roadways and railroad, achievable runway length, and runway extension timing.

Round 4
(Airfield & Terminal)
Review preferred airfield/terminal alternative for comparative costs, operational and engineering feasibility.

Composite Alternatives
(Airfield/Terminal/ Landside/Support)
Develop overall composite alternatives for all airport functional areas, combining the preferred airfield and terminal alternatives with the preferred access and support alternatives.

Preferred Development Plan
Will illustrate SAT's proposed projects for the 20-year planning period and will depict proposed airfield, terminal, access, support, and tenant facilities, and include high-level phasing for the 6, 10, and 20-year planning periods.

Resources

To learn more about the SDP:

Community members and stakeholders are encouraged to check the airport's Strategic Development Plan (SDP) website for updates: www.sanantonio.gov/SATfuture

Email: SATfuture@sanantonio.gov

Phone: 210-207-3403

In Person: Brook Hollow Library
530 Heimer Rd
San Antonio, TX 78232
210-207-9030

FAA guidance materials:

- FAA Advisory Circular - Airport Design AC 150/5300-13A Airport Design
- Standard Procedure for FAA Review and Approval of Airport Layout Plans (ALP SOP)
- FAA Advisory Circular - Airport Master Plans AC 150/5070-6B

STRATEGIC DEVELOPMENT PLAN

SAAS
San Antonio Airport System

About the Alternatives Evaluation Process

The San Antonio Airport System started a Strategic Development Plan (SDP) in 2018 to examine whether the existing San Antonio International Airport (SAT) site could accommodate expected long-term growth and expansion needs. The first phase of the data-driven study determined that the 50-year airport could be made to fit at the current location.

As part of Phase II of the study, potential policy and development alternatives were developed for SAT. These alternatives are now being evaluated to produce (by the end of 2020) a preferred airport development plan for the airfield, terminal, and airport multimodal access. This document represents the results of Rounds 3A and 3B of the alternatives evaluation, as of February 2020.

Alternatives Evaluation Process Highlights

The goal of the Strategic Development Plan (SDP) Sketch Planning process was to get all ideas about development of SAT on the table. Six technical sketch planning sessions took place, which included 107 participants who identified a total of 91 initial airfield concepts.

The SDP technical team screened the 91 concepts to identify technically feasible alternatives that will undergo further evaluation. This two-step screening (Round 1) resulted in 13 airfield alternatives that moved ahead for further evaluation (Round 2), using objective and technical criteria. In Round 2, a 14th airfield alternative was identified and added for evaluation. After the Round 2 evaluation process was completed, 5 airfield alternatives remained, resulting in 23 airfield/terminal combinations. In Round 3, 12 airfield/terminal combinations remained after Round 3A, then 10 combinations were eliminated, so 2 airfield/terminal combinations remain at the end of Round 3B. Round 3 will also include additional evaluation as part of Rounds 3C and 3D, and be followed by Round 4.

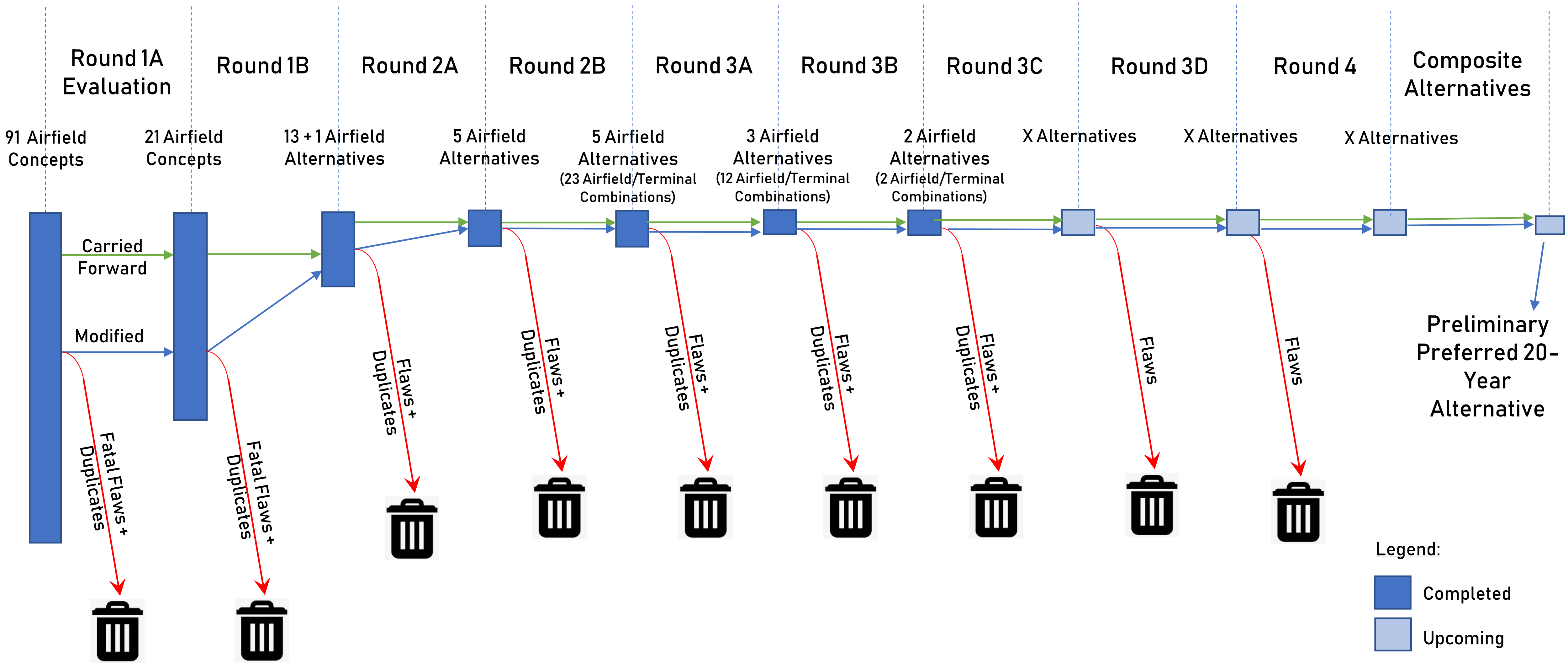
Preliminary preferred 20-year alternative. The final evaluation results will be the basis for preparing the Preferred Development Plan, illustrating SAT's proposed projects for the 20-year planning period, and a potential 50-year concept. The plan will depict proposed airfield, terminal, access, support, and tenant facilities, and include high-level phasing for the 6, 10, and 20-year planning periods.

The proposed projects that will eventually be recommended can proceed only if the need actually materializes. All eventual SDP proposed projects will be subject to further financial and environmental approvals.

Concept Evaluation Considering all ideas

STRATEGIC DEVELOPMENT PLAN

SAAS San Antonio Airport System



Legend:

Completed

Upcoming

Summary of Rounds 3A and 3B Findings

Round 3A Steps:

- Refine remaining 5 airfield alternatives
  - Shorten or close Runway 4-22
  - Rename refined alternatives:
    - Eg: "A14" becomes "AF14"
- Evaluate refined airfield/terminal combinations:
  - Special purpose environmental laws:
    - 20-year horizon
    - Applied to airfield, then terminal. In NEPA, if impact to the following resources is **avoidable**, **it MUST be avoided**:
      - Wetlands
      - Section 4(f): public park, recreation area, wildlife and waterfowl refuge, historic site
      - Floodplains
    - Moved some terminal concepts to mitigate flaws
  - 20-year implementability:
    - Eliminated concepts when not able, in the 20-year planning period, to:
      - acquire all needed land without using eminent domain and
      - build new terminal complex on that land
    - Eliminated terminal concepts that required closure of Runway 4-22 in the short term

Alternatives Eliminated in Round 3A, due to:

Note: some alternatives were eliminated for more than one reason.

- Special purpose environmental laws *[2 airfield alternatives eliminated]*
- 20-year implementability *[3 terminal alternatives eliminated]*

➢ 3 airfield alternatives remain, thus12 airfield/terminal combinations remain

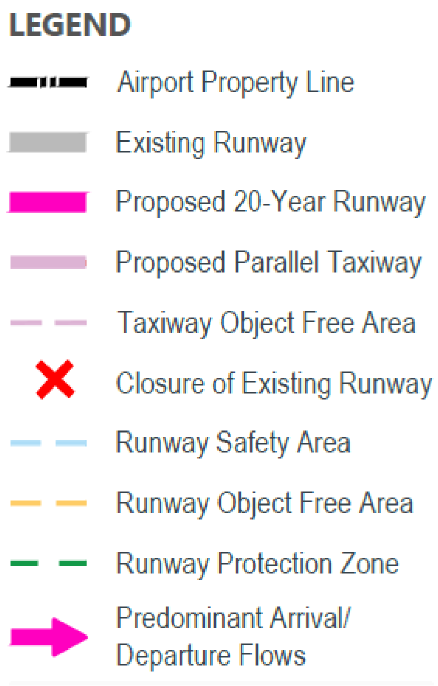
About the Following Figures

The following figures represent the airfield/terminal combinations that survived the Round 3A evaluation.

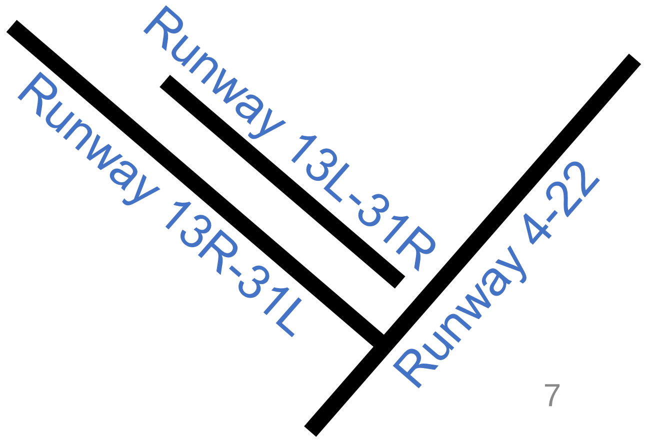
Although potential 50-year runways are depicted (dashed magenta lines), evaluation criteria only apply to 20-year runways (continuous magenta lines).

The footprints of the proposed terminal concepts are depicted in continuous lines (20-year development) and dashed lines (50-year development).

Legend for the Figures:



SAT Runway Layout:



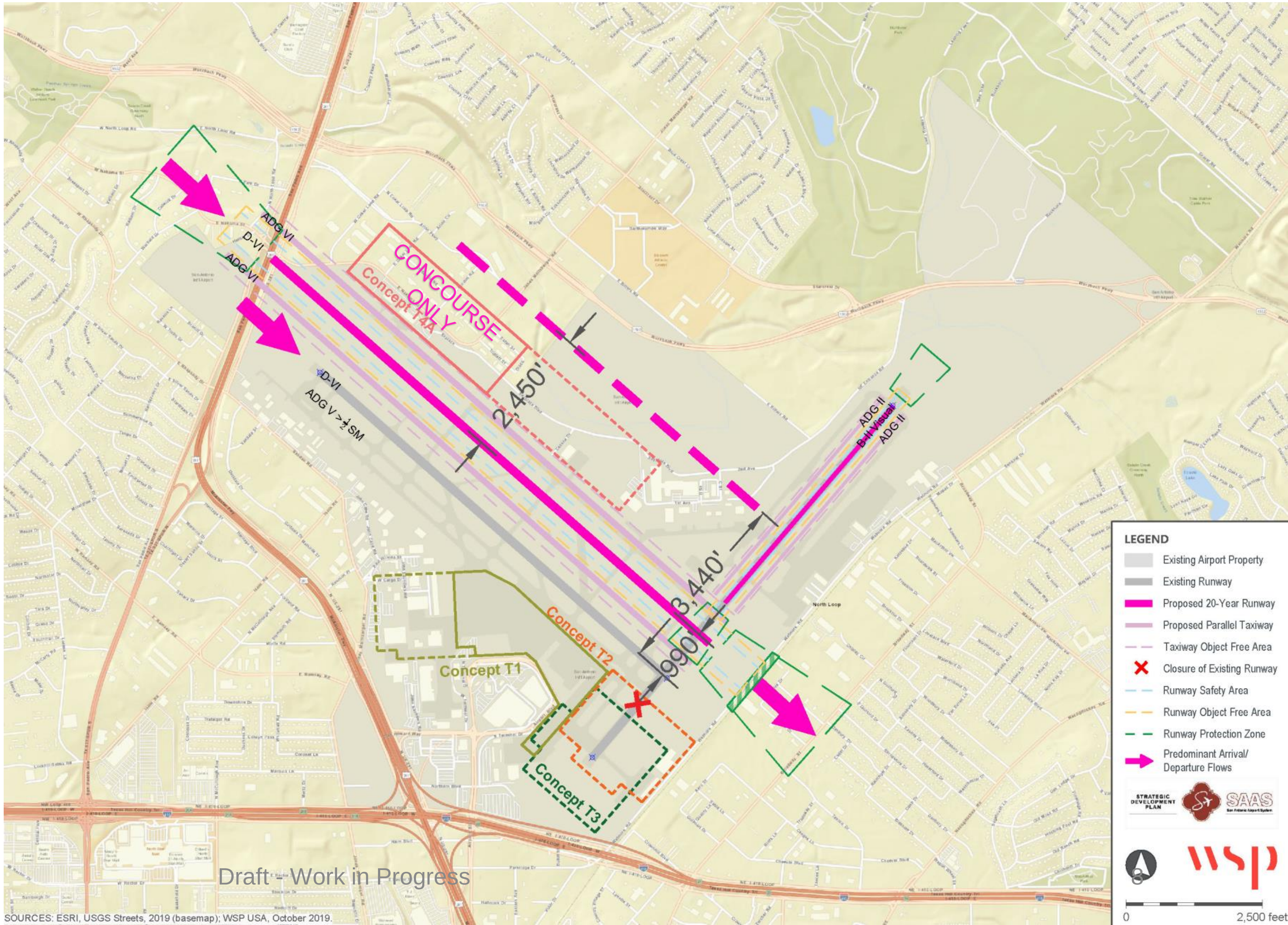
Remaining Airfield AF2/Terminal Combinations after Round 3A

Remaining Airfield-Terminal Combinations moving to Round 3B:

- AF2-T1
- AF2-T2
- AF2-T3
- AF2-T4A

Notes on Terminal Concept Footprints:

- Continuous line = 20-year footprint
- Dashed line = 50-year footprint
- T2 and T3 20-year footprint is the same as T1



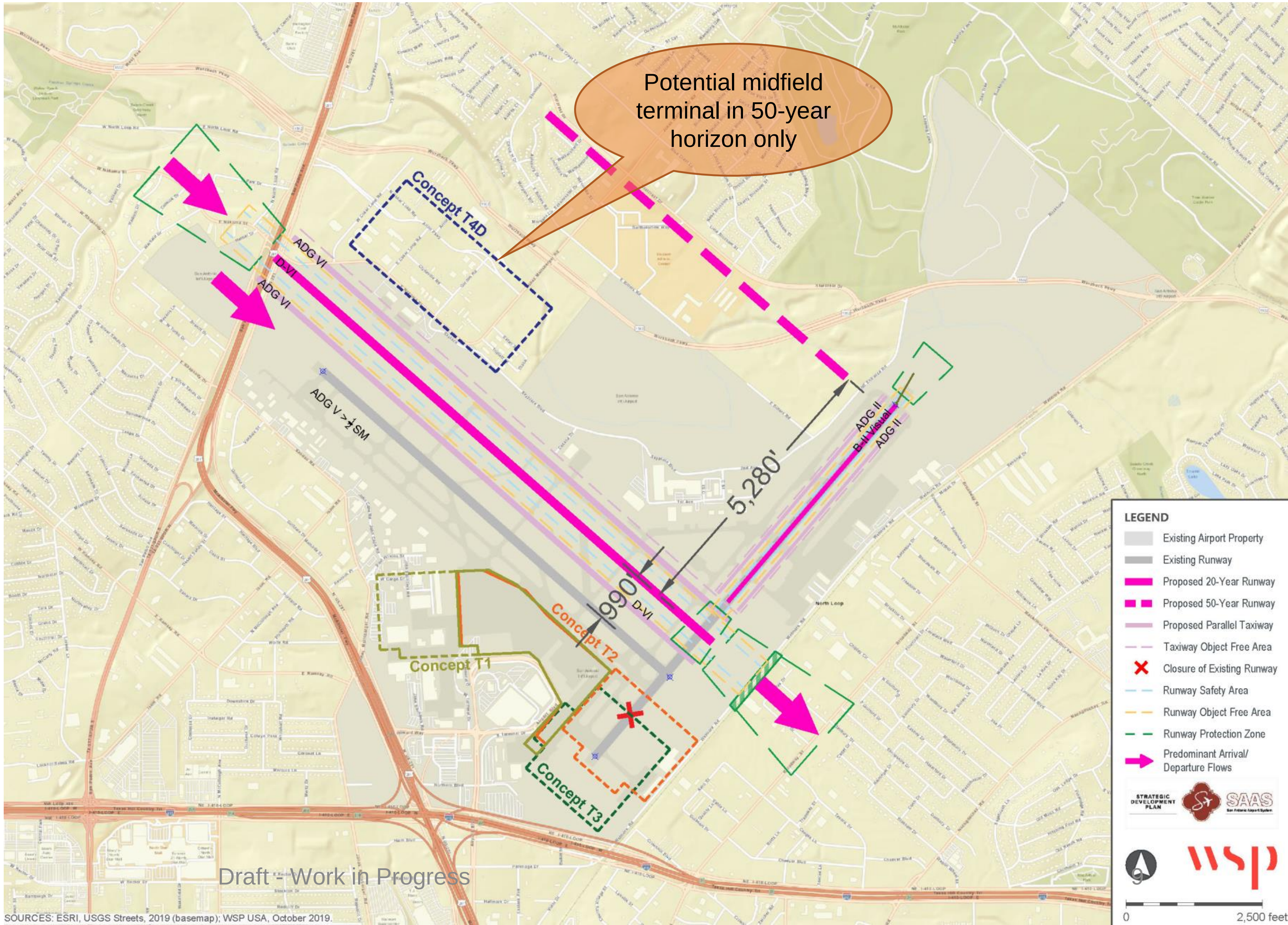
Remaining Airfield AF6/Terminal Combinations After Round 3A

Remaining Airfield-Terminal Combinations moving to Round 3B:

- AF6-T1
- AF6-T2
- AF6-T3
- AF6-T4D

Notes on Terminal Concept Footprints:

- Continuous line = 20-year footprint
- Dashed line = 50-year footprint
- T2 and T3 20-year footprint is the same as T1



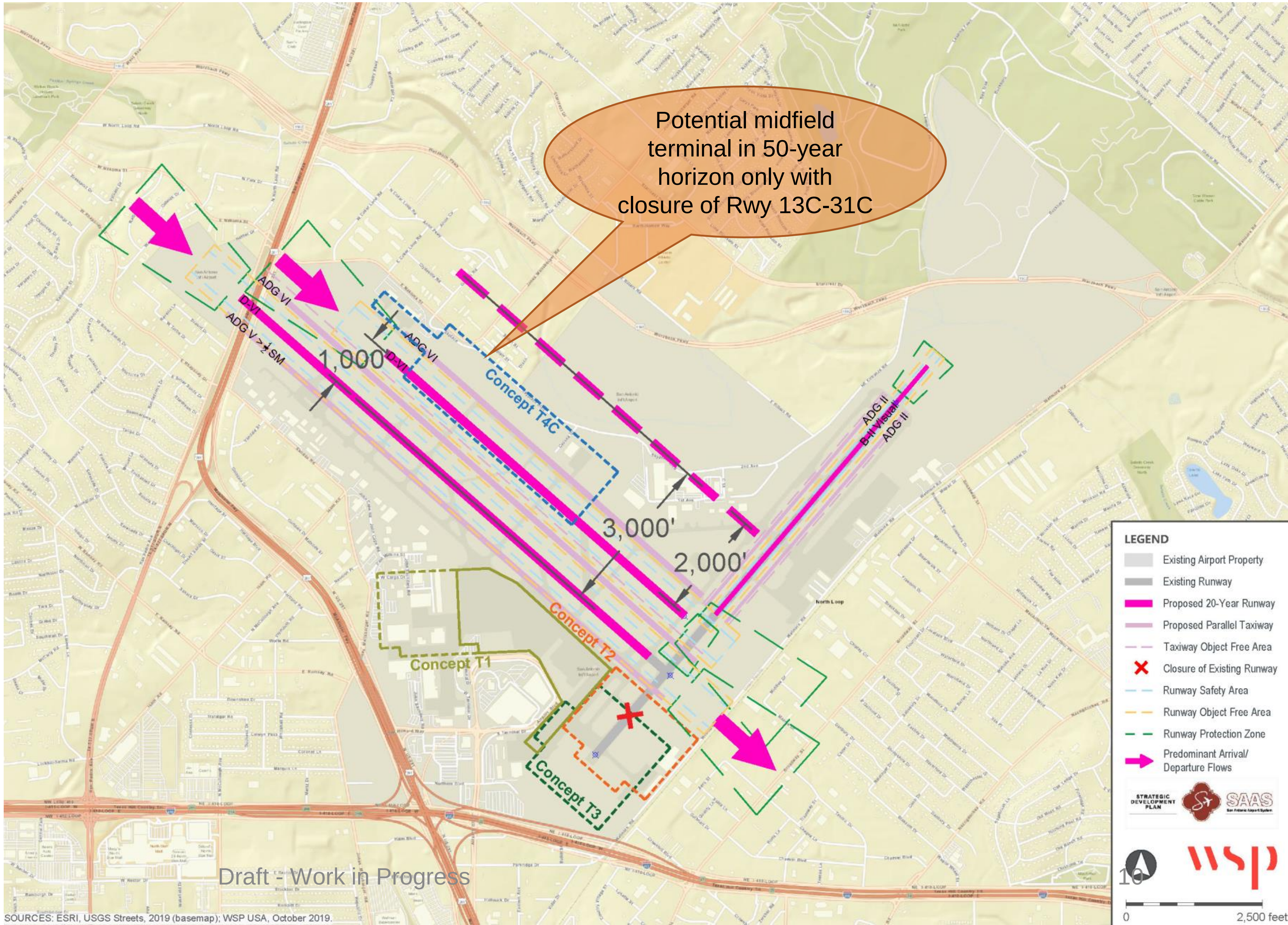
Remaining Airfield AF14/Terminal Combinations After Round 3A

Remaining Airfield-Terminal Combinations moving to Round 3B:

- AF14-T1
- AF14-T2
- AF14-T3
- AF14-T4C

Notes on Terminal Concept Footprints:

- Continuous line = 20-year footprint
- Dashed line = 50-year footprint
- T2 and T3 20-year footprint is the same as T1



Round 3B Steps:

- Refined terminal concepts:
  - 3 airfields, 4 terminal concepts each = 12 combinations
  - Add building outlines, apron layout, aircraft, taxilanes
- Evaluated airfield/terminal combinations for:
  - Aircraft tail airspace surface penetrations
  - World-class terminal (space, passenger comfort)
  - Terminal operational efficiency (walking distances, level changes, train connections)

Airfield/Terminal Combinations Eliminated in Round 3B, due to:

Note: some combinations were eliminated for more than one reason.

- Low passenger convenience *[1 combination eliminated – AF2-T4A]*
- Not implementable within 20 years *[2 combinations eliminated – AF6-T4D & AF14-T4C]*
- Impacts to Runway 4-22 within 20 years *[3 combinations eliminated – all T3 combinations]*
- Duplicate airfield layout within 20 years *[4 combinations eliminated – all AF6 combinations]*
- Duplicate terminal layout within 20 years *[3 combinations eliminated – all T2 combinations]*

➢ 2 airfield/terminal combinations remain: AF2-T1 & AF14-T1

About the Following Figures

The following figures represent the airfield/terminal combinations evaluated in Round 3B.

Although potential 50-year runways are depicted (dashed magenta lines), evaluation criteria only apply to 20-year runways (continuous magenta lines).

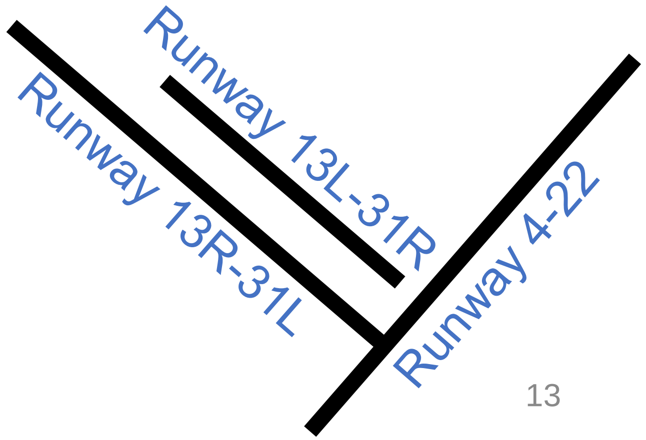
The footprints of the proposed terminal concepts are depicted in continuous lines (20-year development) and dashed lines (50-year development).

Legend for the Figures:

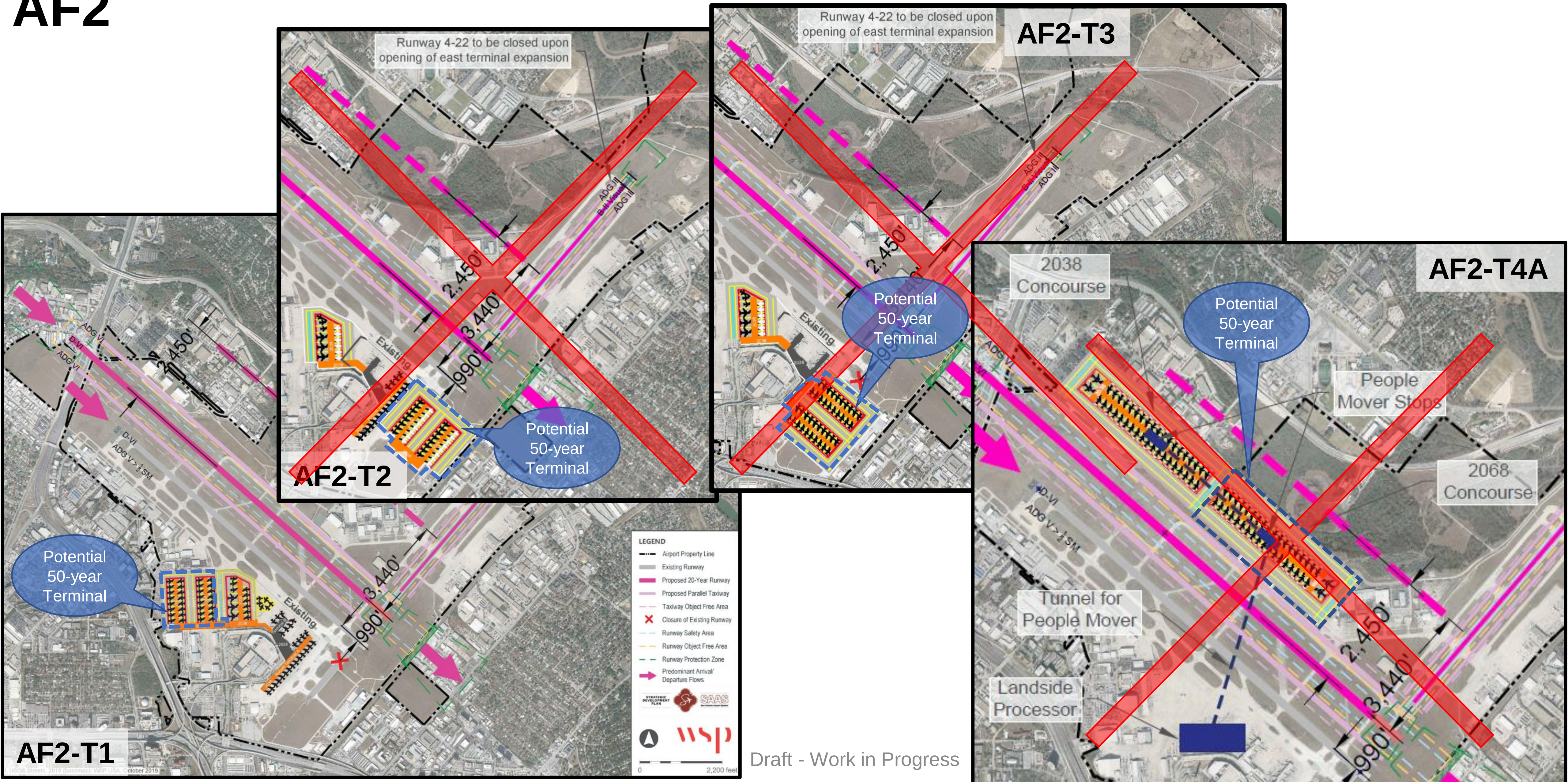
LEGEND

- Airport Property Line
- Existing Runway
- Proposed 20-Year Runway
- Proposed Parallel Taxiway
- Taxiway Object Free Area
- Closure of Existing Runway
- Runway Safety Area
- Runway Object Free Area
- Runway Protection Zone
- Predominant Arrival/ Departure Flows

SAT Runway Layout:

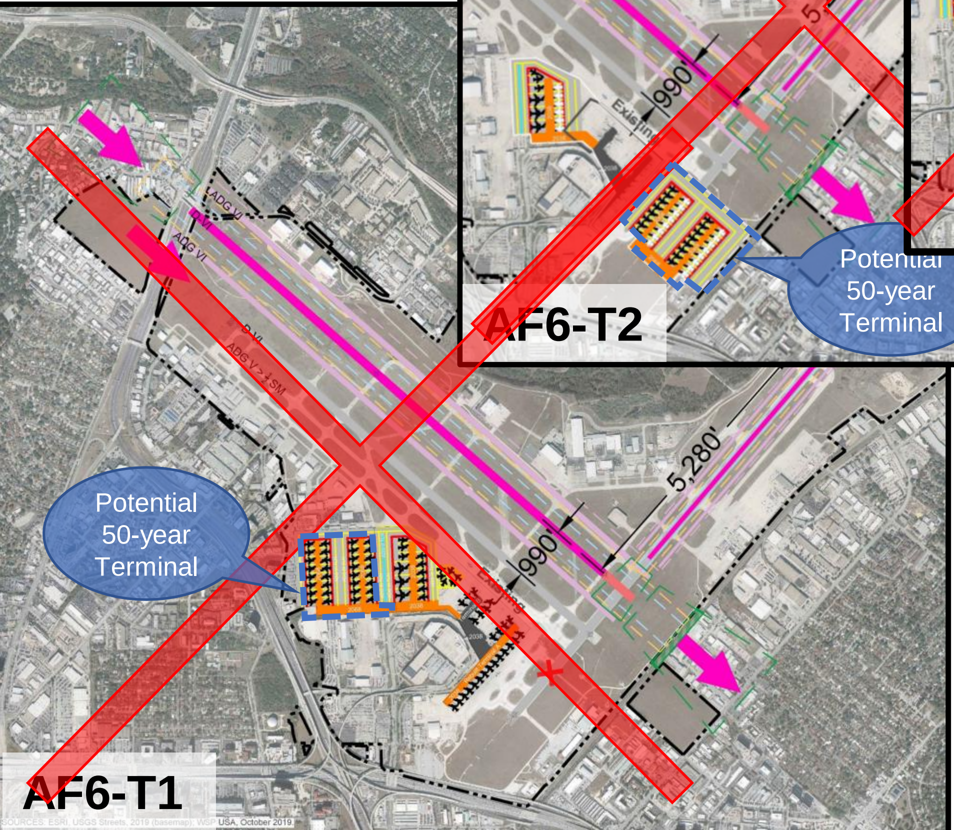


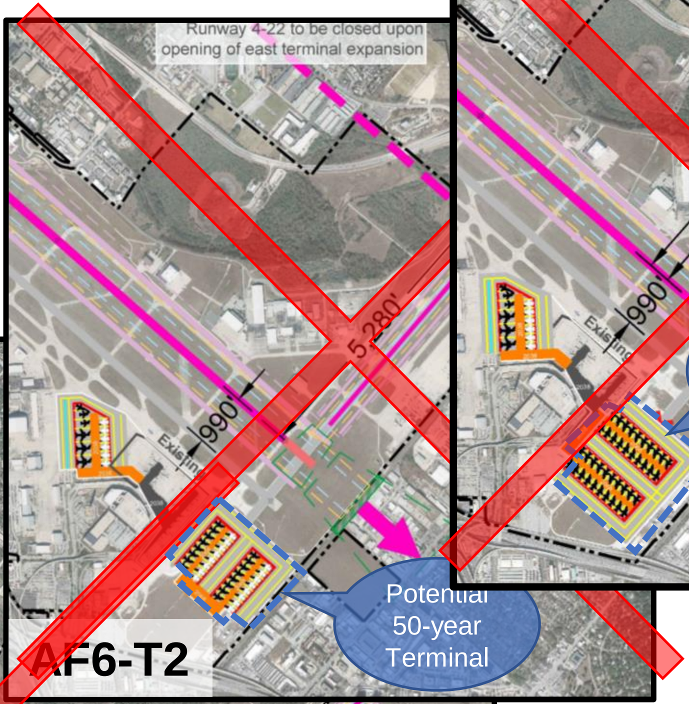
Refined Airfield/Terminal Combinations (Round 3B)
AF2

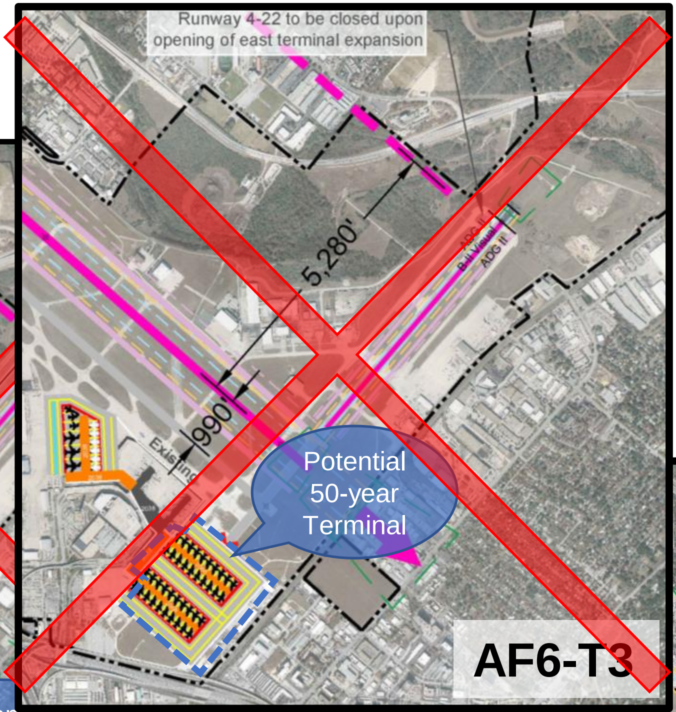


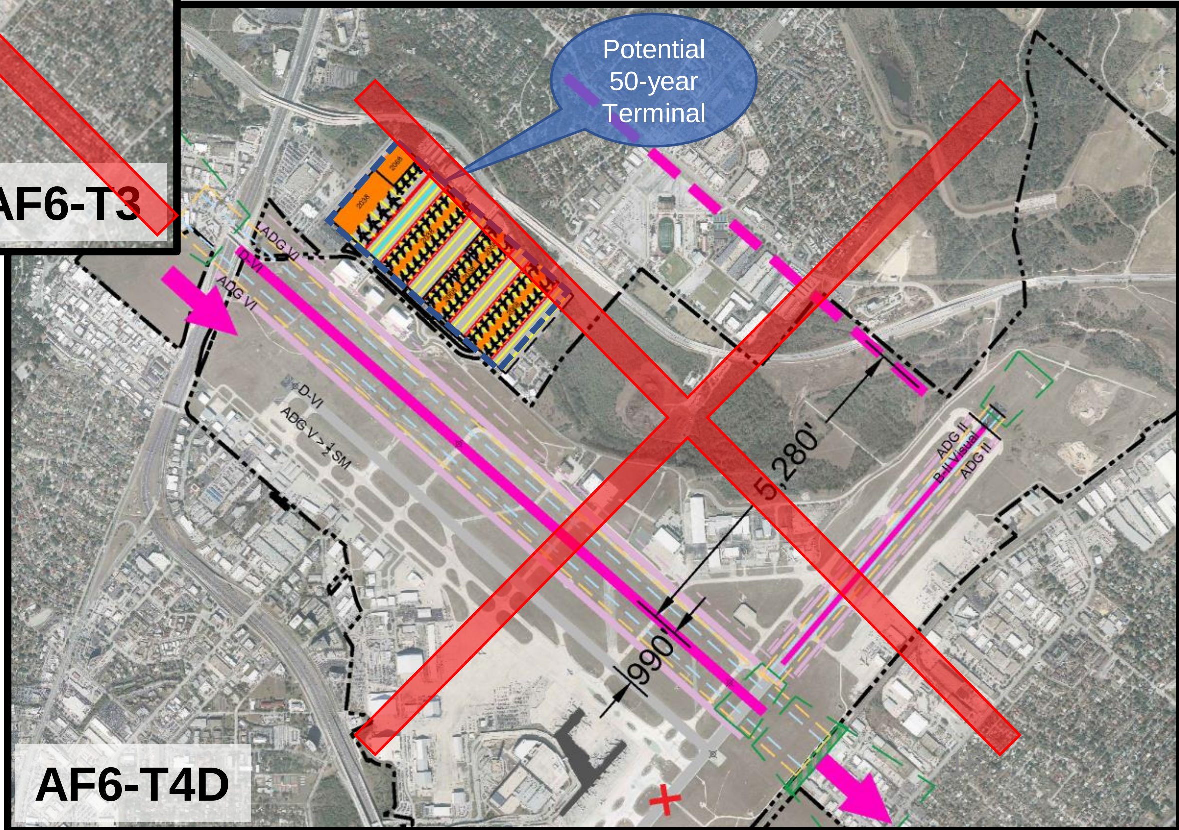
Draft - Work in Progress

Refined Airfield/Terminal Combinations (Round 3B)
AF6



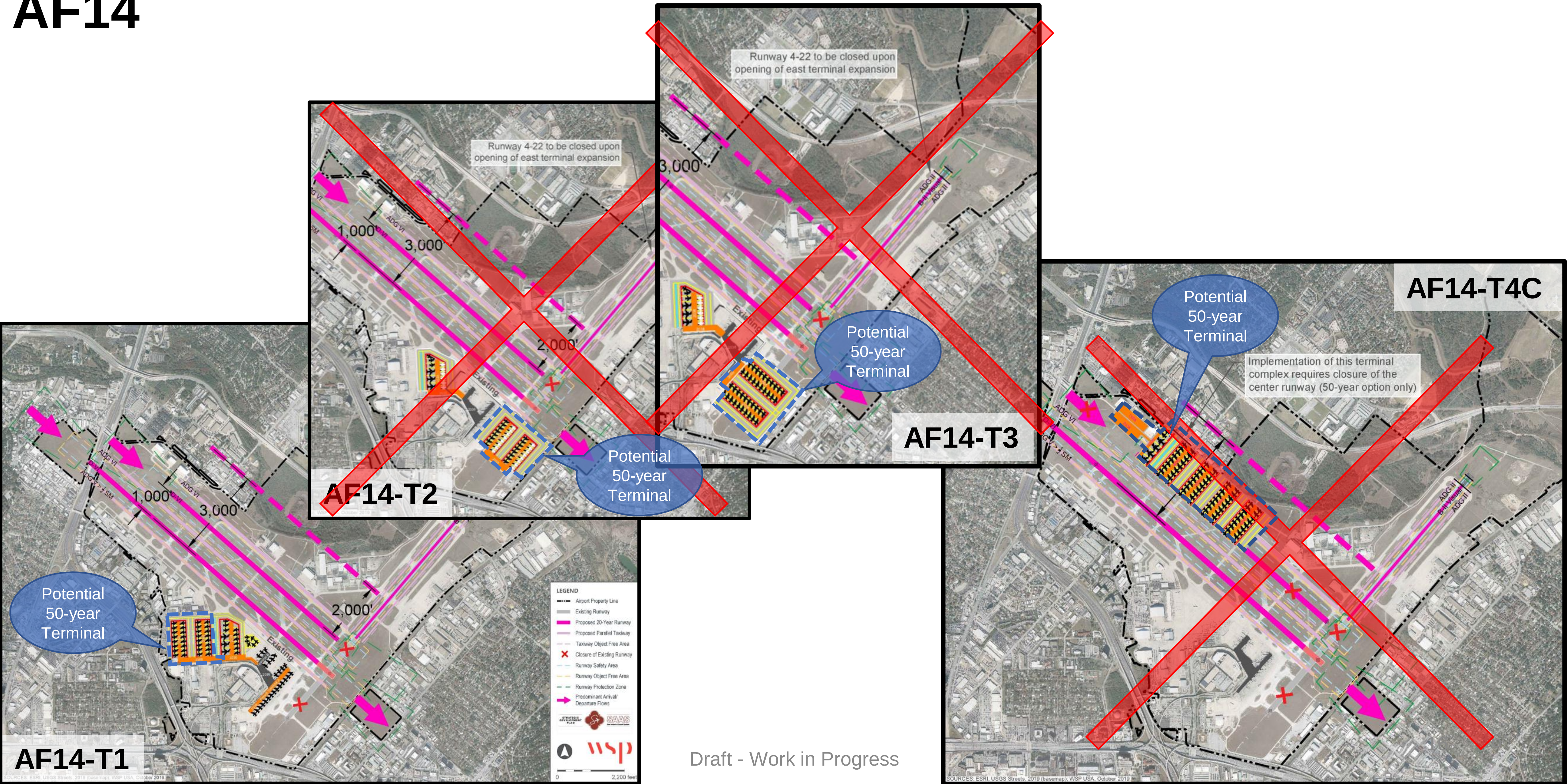






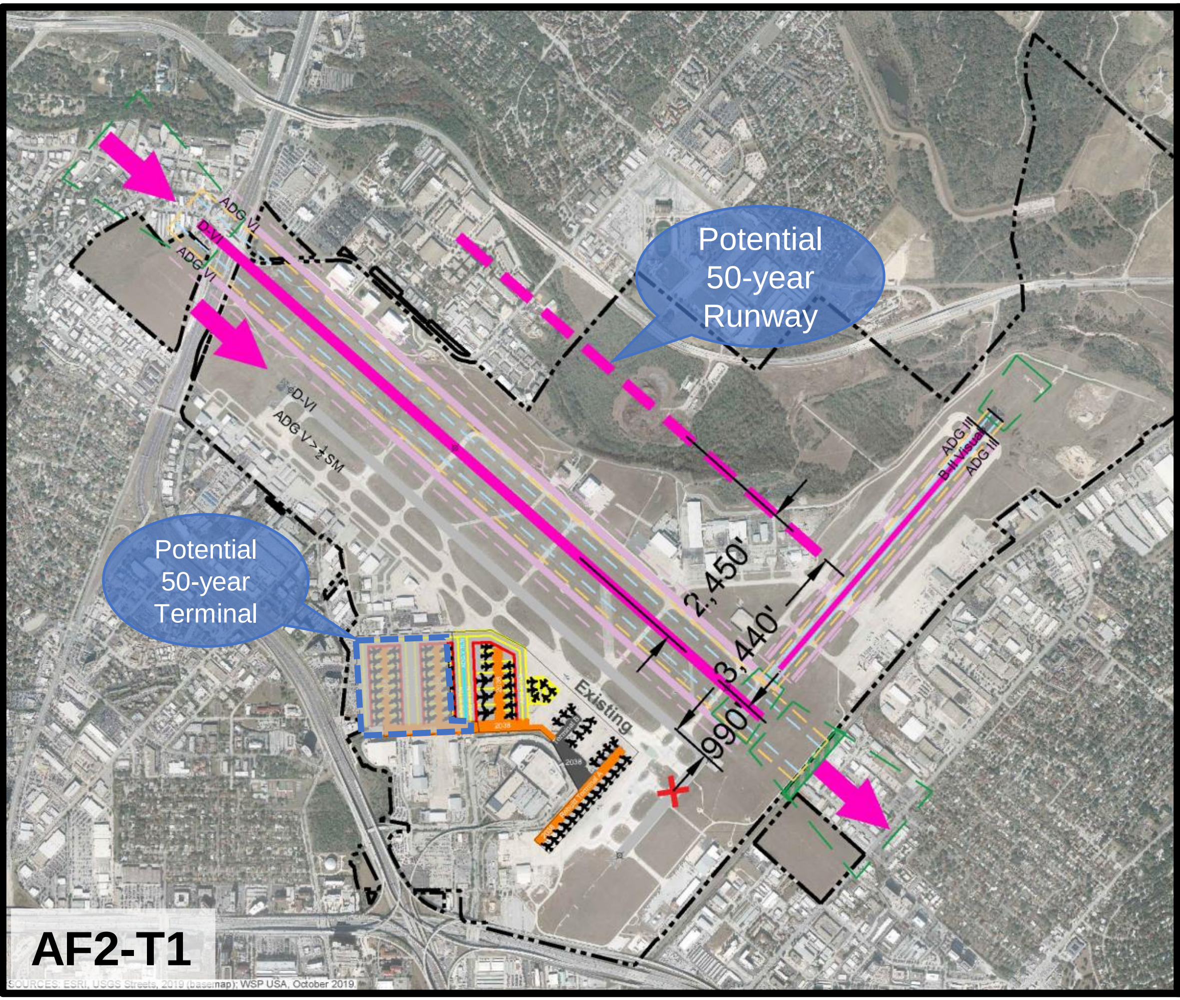
Draft - Work in Progress

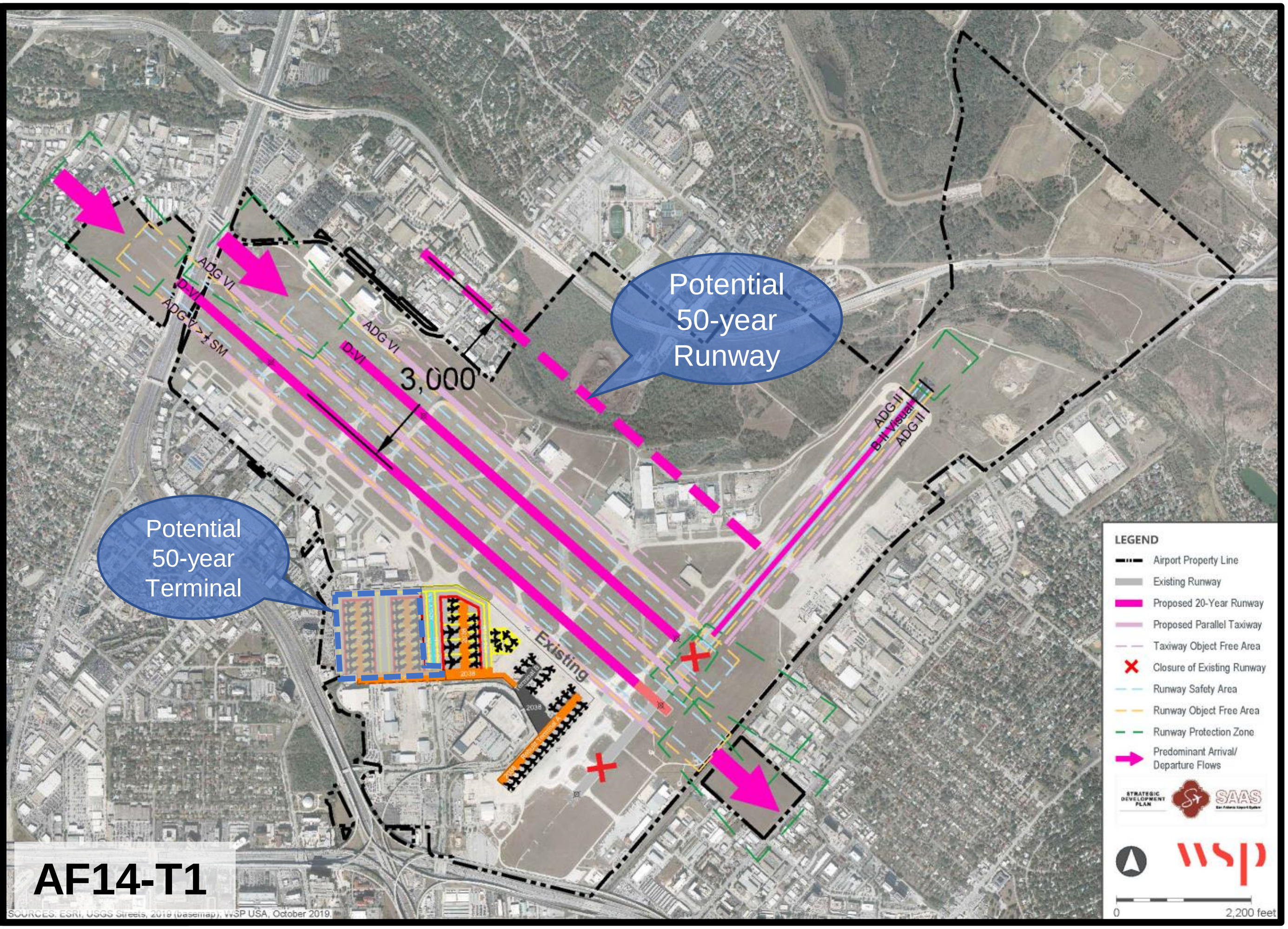
Refined Airfield/Terminal Combinations (Round 3B)
AF14



Draft - Work in Progress

Remaining Combinations After Round 3B





Next Steps
Rounds 3 and 4

- Analyze the locations and elevations of the runway ends
- Engineering evaluation
- Rough order-of-magnitude cost estimates
- Noise analysis (20-year comparative footprints)

STRATEGIC DEVELOPMENT PLAN

SAAS San Antonio Airport System

Round 2 Through Final Plan - Overview

Round 2A (Airfield)
Review of airfield capacity, ease of implementation, and operational flexibility.

Round 2B (Terminal)
Review of airfield impacts and constructability/ phasing feasibility.

Round 3A (Airfield)
Review of special purpose environmental laws and 20-year implementability.

Round 3B (Refined Terminal Concepts)
Evaluation of terminal concepts, including airspace penetrations of parked aircraft, walking distances, and passenger convenience and experience

Round 3C (Runway Ends Siting Analysis)
Review of runway end siting impacts to roadways and railroad, achievable runway length, and runway extension timing.

Round 3D (Airfield & Terminal)
Review preliminary preferred alternative for comparative costs, engineering feasibility.

Round 4 (Terminal/Landside/Support)
Refine terminal concepts. Prepare landside/support alternatives. Prepare noise contours.

Composite Alternatives (Airfield/Terminal/Landside/Support)
Develop overall composite alternatives for all airport functional areas, combining the preferred airfield and terminal alternatives with the preferred access and support alternatives.

Preferred Development Plan
Will illustrate SAT's proposed projects for the 20-year planning period and will depict proposed airfield, terminal, access, support, and tenant facilities, and include high-level phasing for the 6, 10, and 20-year planning periods.

Resources

To learn more about the SDP:

Community members and stakeholders are encouraged to check the airport's Strategic Development Plan (SDP) website for updates: www.sanantonio.gov/SATfuture

Email: SATfuture@sanantonio.gov

Phone: 210-207-3403

In Person: Brook Hollow Library
530 Heimer Rd
San Antonio, TX 78232
210-207-9030

FAA guidance materials:

- FAA Advisory Circular - Airport Design AC 150/5300-13A Airport Design
- Standard Procedure for FAA Review and Approval of Airport Layout Plans (ALP SOP)
- FAA Advisory Circular - Airport Master Plans AC 150/5070-6B

STRATEGIC DEVELOPMENT PLAN

SAAS
San Antonio Airport System

About the Alternatives Evaluation Process

The San Antonio Airport System started a Strategic Development Plan (SDP) in 2018 to examine whether the existing San Antonio International Airport (SAT) site could accommodate expected long-term growth and expansion needs. The first phase of the data-driven study determined that the 50-year airport could be made to fit at the current location.

As part of Phase II of the study, potential policy and development alternatives were developed for SAT. These alternatives are now being evaluated to produce (by the end of 2020) a preferred airport development plan for the airfield, terminal, and airport multimodal access. This document represents the results of Rounds 3C and 3D of the alternatives evaluation, as of March 2020.

Alternatives Evaluation Process Highlights

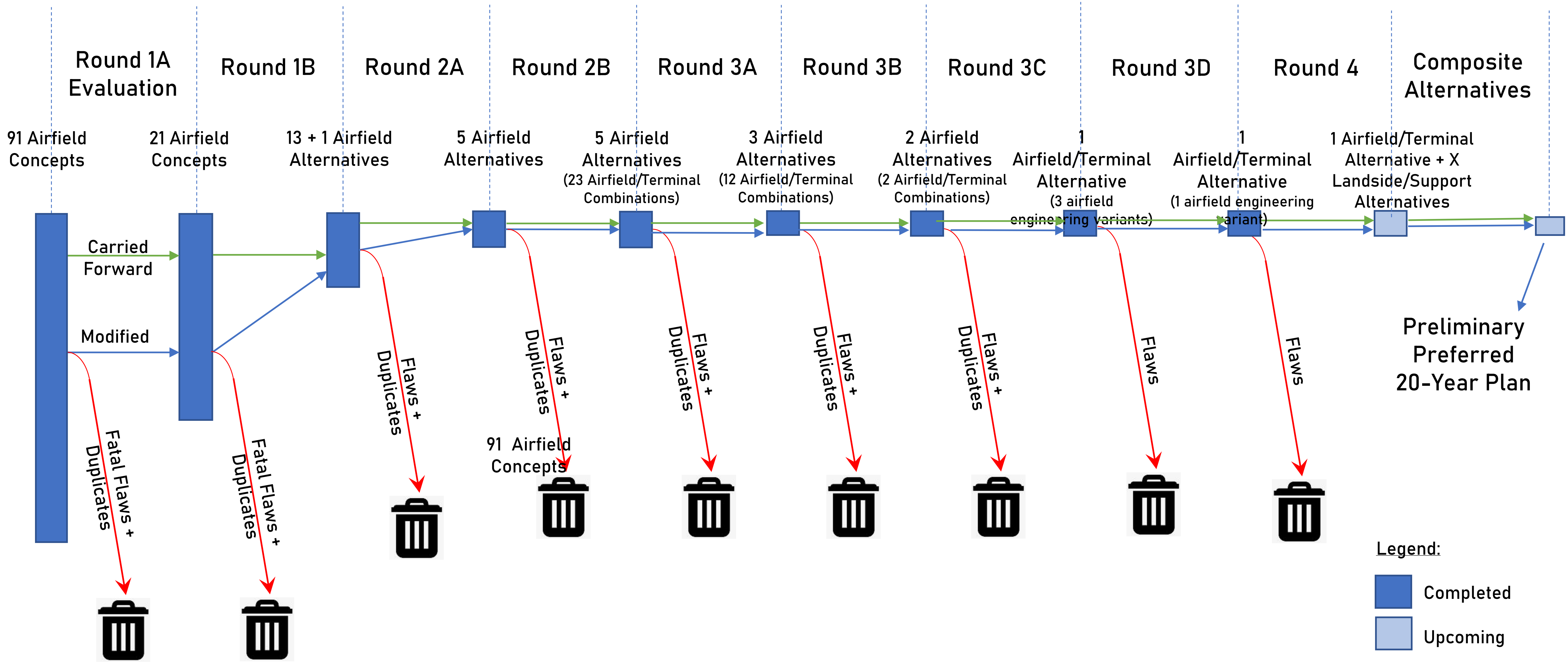
The goal of the Strategic Development Plan (SDP) Sketch Planning process was to get all ideas about development of SAT on the table. Six technical sketch planning sessions took place, which included 107 participants who identified a total of 91 initial airfield concepts.

The SDP technical team screened the 91 concepts to identify technically feasible alternatives that will undergo further evaluation. This two-step screening (Rounds 1A and 1B) resulted in 13 airfield alternatives that moved ahead for further evaluation (Round 2), using objective and technical criteria. In Round 2, a new airfield alternative was identified and added for evaluation (total of 14 airfield alternatives). After the Round 2 evaluation process was completed, 5 airfield alternatives remained, which were paired with 10 terminal concepts. Only viable airfield/terminal combinations were retained, resulting in 23 airfield/terminal combinations. In Round 3, 12 airfield/terminal combinations remained after Round 3A, then 10 combinations were eliminated, so 2 airfield/terminal combinations remained at the end of Round 3B. After the Round 3C evaluation process, 1 airfield/terminal combination remained. Three engineering variants of that final airfield/terminal combination were developed. In Round 3D, a final engineering variant was selected, resulting in the preferred airfield/terminal alternative. Round 4 is underway, and includes preparation of noise contours, cost estimates and alternatives for intermodal access, support and tenant facilities.

Preliminary preferred 20-year alternative. The final evaluation results will be the basis for preparing the Preferred Development Plan, illustrating SAT's proposed projects for the 20-year planning period, and a potential 50-year concept. The plan will depict proposed airfield, terminal, access, support, and tenant facilities, and include high-level phasing for the 6, 10, and 20-year planning periods.

The proposed projects that will eventually be recommended can proceed only if the need actually materializes. All eventual SDP proposed projects will be subject to further financial and environmental approvals.

Concept Evaluation Considering all ideas



STRATEGIC DEVELOPMENT PLAN

SAAS San Antonio Airport System

Summary of Rounds 3C and 3D Findings

Round 3C Steps:

- Prepared 6 runway profiles each for AF2 and AF14, to identify optimal location of proposed runway ends along proposed runway centerline. (Each runway profile is referred to as an “engineering variant” of AF2 or AF14.)
- Scenarios included:
  - Extend runway west over US 281 (requires a bridge)
  - Extend runway east and install EMAS bed (engineered materials arrestor system, that is, an aircraft arrestor bed made of crushable concrete)
  - Extend runway east over Wetmore Road and railroad (requires a bridge)
- Identified associated runway protection zone (RPZs)
- Evaluated runway profiles

Airfield Engineering Variants Eliminated in Round 3C, due to:

Note: some variants were eliminated for more than one reason.

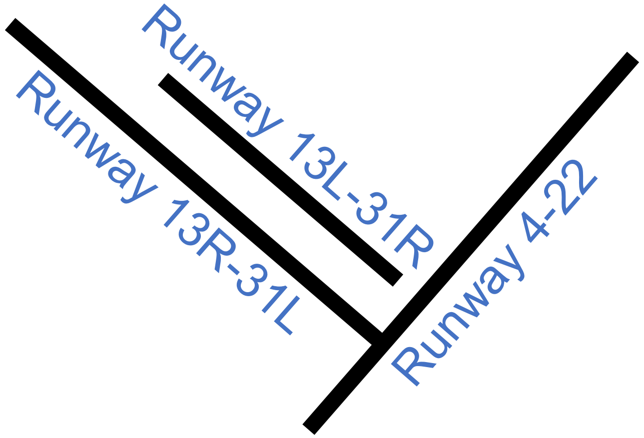
- Lack of flexibility in timing of runway length extension *[6 variants eliminated – all AF2]*
- Proposed pavement exceeds slope standards *[2 variants eliminated – AF14-1A & AF14-2A]*
- Drainage, slopes & early closure of Runway 4-22 *[1 variant eliminated – AF14-3]*

➢ 3 airfield variants remain: AF14-1B, AF14-1C and AF14-2D

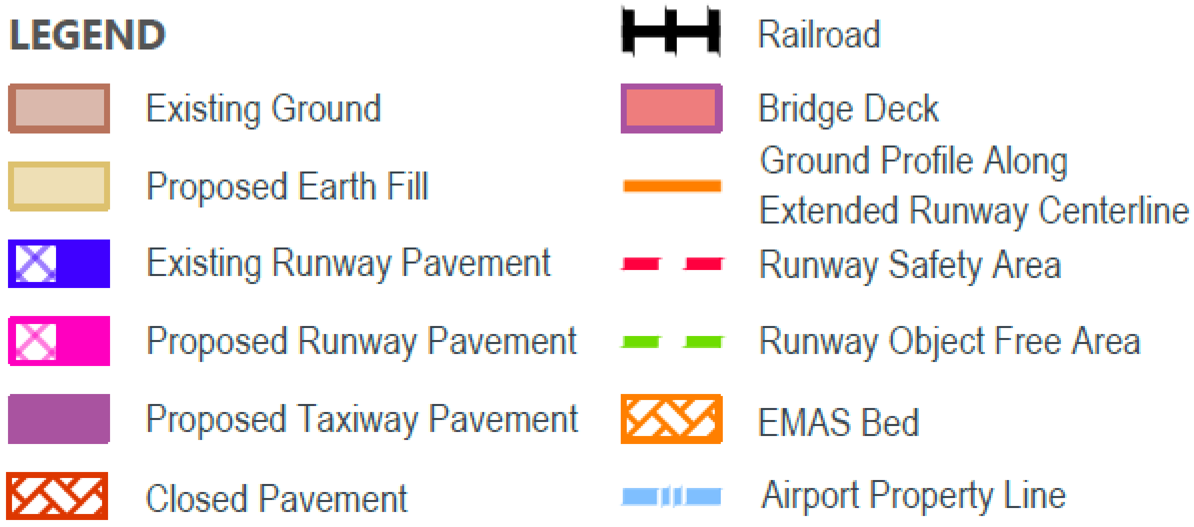
About the Following Figures

The following figures represent the airfield engineering variants (runway profiles) for the airfield alternatives that survived Round 3B.

SAT Runway Layout:

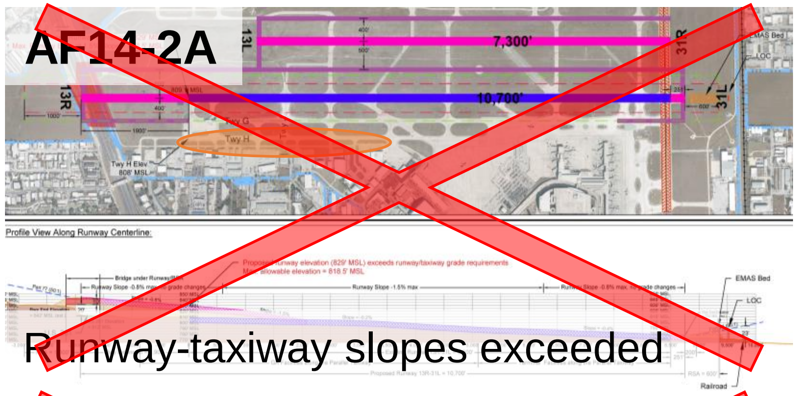


Legend for the Figures:

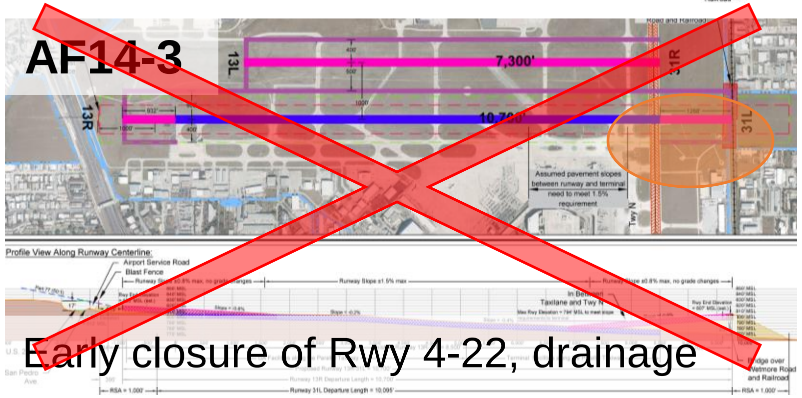


Round 3C – Eliminated AF14 Engineering Variants

- Extension to the west only, bridge over existing US 281
- Proposed runway elevation exceeds pavement slopes to Taxiway H



- Extension to the east and west, EMAS on east, bridge over existing US 281
- Proposed runway elevation exceeds pavement slopes to Taxiway H

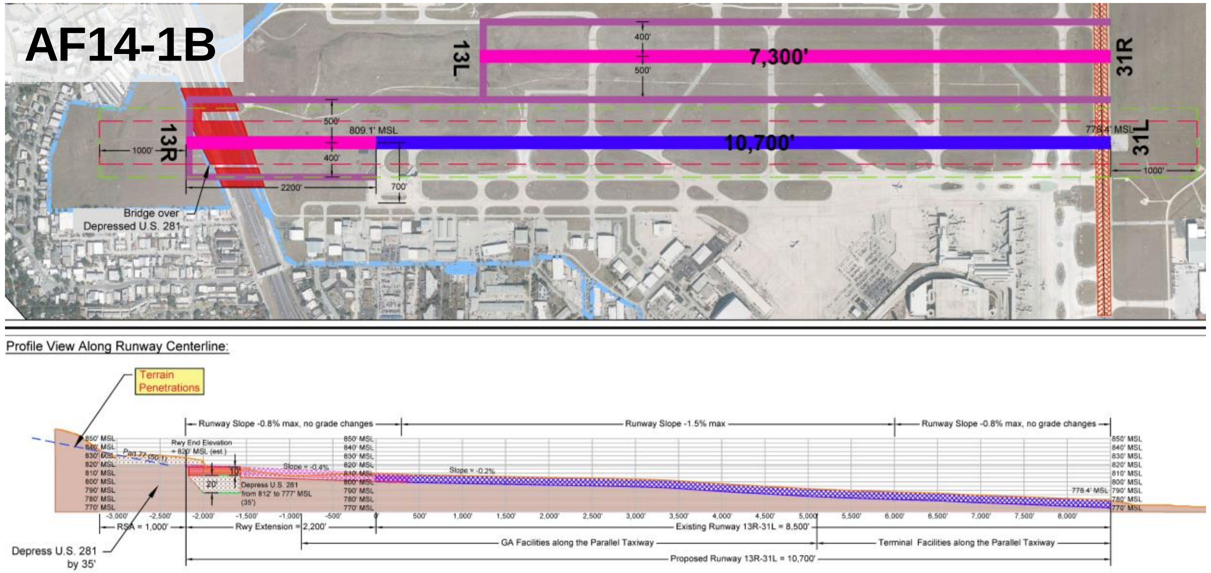


- Extension to the east and west, bridge over Wetmore Road and railroad
- Early closure of Runway 4-22
- Drainage/engineering

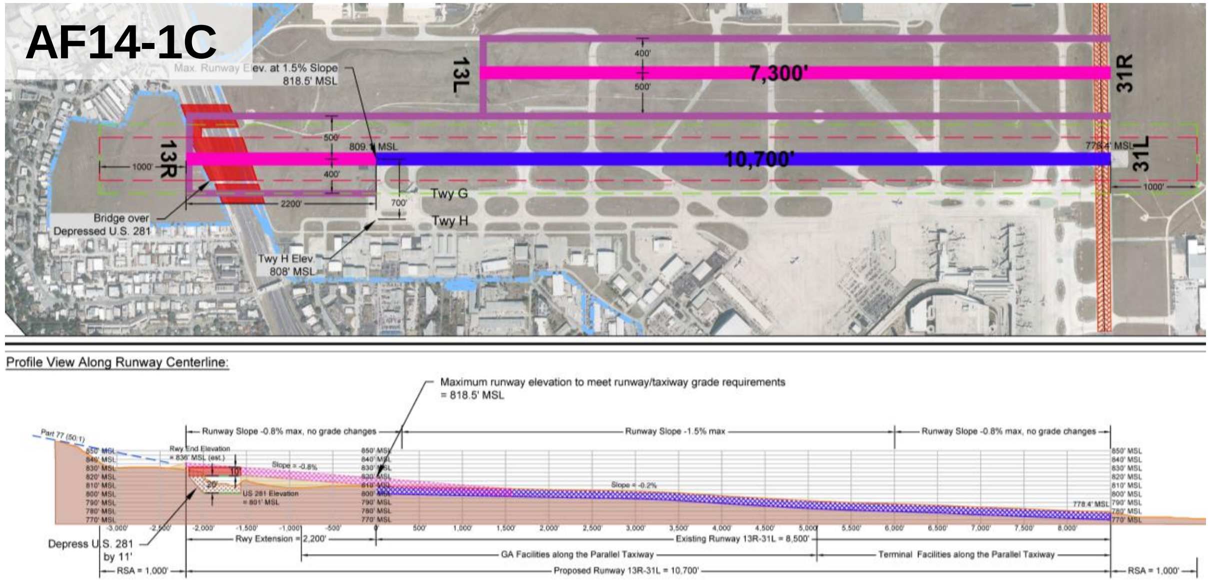
Summary:

- 6 AF14 engineering variants:
  - ⇨ 3 eliminated
  - ⇨ 3 remaining

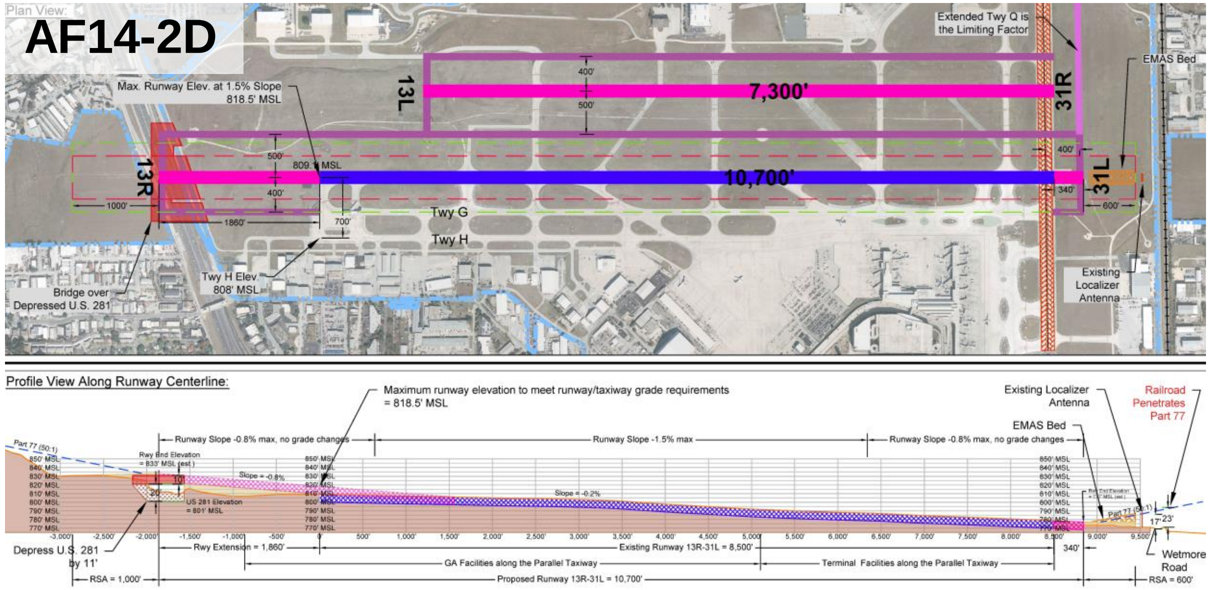
Remaining AF14 Engineering Variants after Round 3C:



- Extension to the west only
- Bridge over US 281 (depressed 35')



- Extension to the west only
- Bridge over US 281 (depressed 11')



- Extension to the east and west
- Engineered material arresting system (EMAS) on east end
- Bridge over existing US 281 (depressed 11')

STRATEGIC DEVELOPMENT PLAN SAAS San Antonio Airport System

Round 3D Steps:

- Assessed drainage feasibility
- Assessed runway end locations for preferred airfield alternative

Airfield Variants Eliminated in Round 3D, due to:

Note: some variants were eliminated for more than one reason.

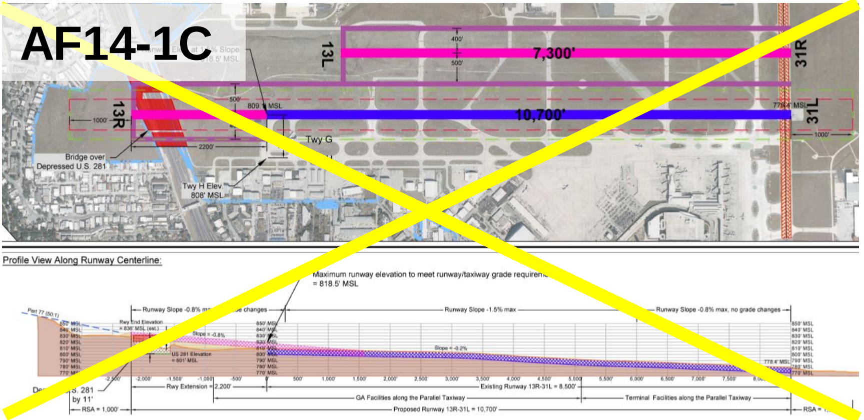
- Extensive engineering challenges (drainage) *[1 variant eliminated – AF14-1B]*
- Does not take advantage of east extension *[1 variant eliminated – AF14-1C]*

➢ 1 airfield variant remains: AF14-2D

Remaining Engineering Variant After Round 3D

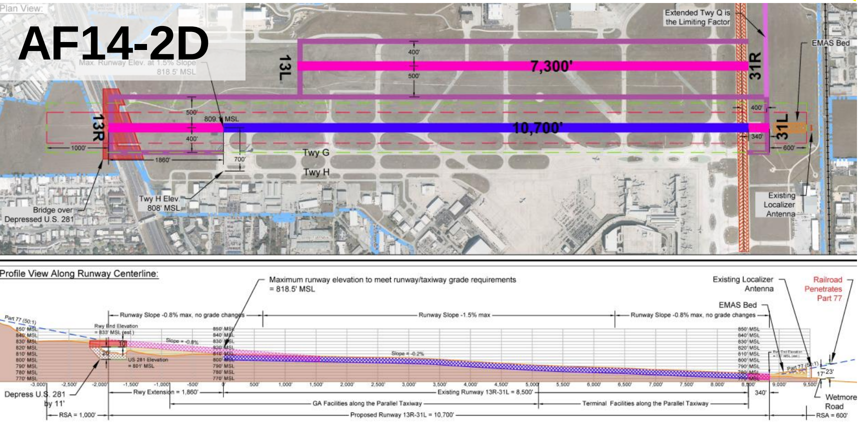
Extension to the west only, bridge over US 281 (road depressed 35')

Technically doable, but significant engineering challenges



Extension to the west only, bridge over US 281 (road depressed 11')

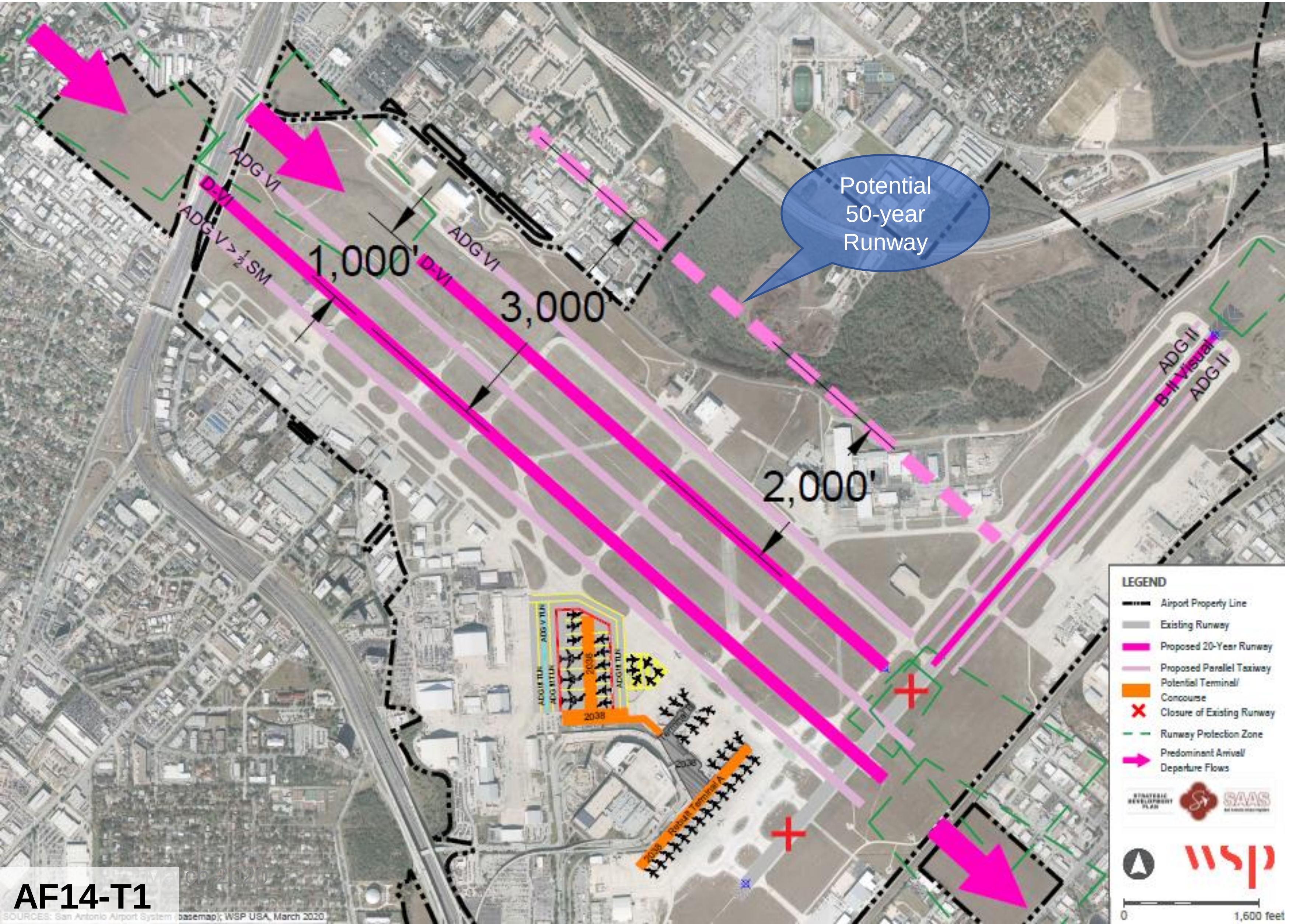
Technically doable, but only extends to the west



Extension to the east and west, Engineered Material Arresting System (EMAS) on the east, bridge over US 281 (road depressed 11')

Preliminary Preferred Airfield Alternative

Preliminary Preferred Airfield/Terminal Alternative



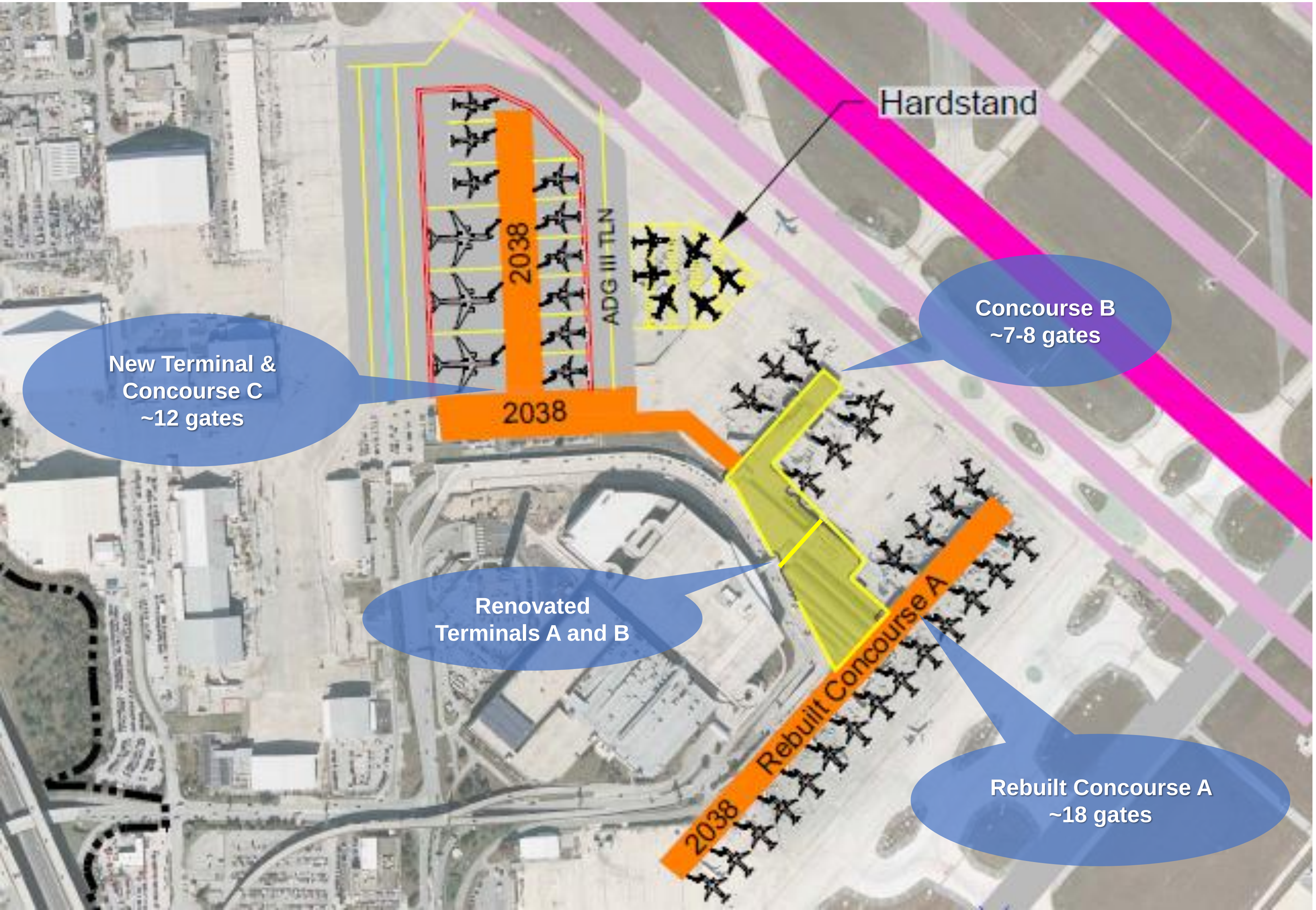
20-Year Airfield Improvements:

- Extend Runway 13R-31L to 10,700' (both to the east and west)
- Upgrade Runway 13L-31R to a 7,300' commercial service runway
- Shorten/close Runway 4-22

20-Year Terminal Improvements:

- Expand existing terminal complex to the west

Preliminary Preferred Terminal Alternative



Total Gates
= up to 38 (2038)

LEGEND

- Airport Property Line
- Existing Runway
- Proposed 20-Year Runway
- Proposed Parallel Taxiway
- Proposed Terminal/ Concourse

Notes:
- Aircraft parking layouts depicted are preliminary
- Hardstand: remote apron parking positions

Next Steps
Round 4

- Noise contours for preferred airfield alternative (CONFIRM)
- Cost estimates for preferred airfield/terminal alternative (CONFIRM)
- Landside (intermodal access and parking)
- Support and tenant facilities

Round 2 Through Final Plan - Overview

Round 2A (Airfield)
Review of airfield capacity, ease of implementation, and operational flexibility.

Round 2B (Terminal)
Review of airfield impacts and constructability/ phasing feasibility.

Round 3A (Airfield)
Review of special purpose environmental laws and 20-year implementability.

Round 3B (Refined Terminal Concepts)
Evaluation of terminal concepts, including airspace penetrations of parked aircraft, walking distances, and passenger convenience and experience

Round 3C (Runway Ends Siting Analysis)
Review of runway end siting impacts to roadways and railroad, achievable runway length, and runway extension timing.

Round 3D (Airfield & Terminal)
Review preliminary preferred alternative for engineering feasibility.

Round 4 (Terminal/Landside/Support)
Prepare noise contours and cost estimates. Refine terminal concepts. Prepare intermodal access and support/tenant alternatives.

Composite Alternatives (Airfield/Terminal/Landside/Support)
Develop overall composite alternatives for all airport functional areas, combining the preferred airfield and terminal alternatives with the preferred access and support alternatives.

Preferred Development Plan
Will illustrate SAT's proposed projects for the 20-year planning period and will depict proposed airfield, terminal, access, support, and tenant facilities, and include high-level phasing for the 6, 10, and 20-year planning periods.

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San Antonio Airport System Strategic Development Plan

2021 AIRPORT MASTER PLAN

MASTER PLAN UPDATE
CHAPTER 5 – ALTERNATIVES DEVELOPMENT AND EVALUATION
APPENDIX 5B – RAILROAD REALIGNMENT MEMORANDUM

wsp

MEMO

TO: Susan St. Cyr, P.E., SAAS

COPY: Syed Mehdi, Debbie Drew, and Chris Anderson (SAAS)

FROM: John van Woensel

SUBJECT: **SAN ANTONIO INTERNATIONAL AIRPORT STRATEGIC DEVELOPMENT PLAN**
Confirmation of Railroad Assumptions in Alternatives Evaluation

DATE: February 6, 2020

Summary of discussion with WSP rail staff:

For the purpose of examining the full range of viable options for extending Runway 13R-31L to the east, the options of relocating or depressing the rail line in its existing alignment were discussed with WSP rail unit staff. They have freight and passenger rail experience in Texas and have experience working with track owner Union Pacific.

The rail line in question runs along Wetmore Road, has dual tracks, accommodates double-stacked container cars, and is a Federal Railroad Administration (FRA) Class IV main freight line (designed for speeds up to 60 mph).

As described below, both relocating or depressing options likely **cannot be achieved by 2038**, because the required right-of-way would need to be in City of San Antonio (City) ownership prior to the conclusion of railroad negotiations. Without the use of eminent domain powers, it is unlikely the City could own all the required property, negotiations would be concluded, design, NEPA, and construction would be completed in time. For the 50-year timeframe, these options appear viable.

General assumptions:

- Railroad companies are not public utilities or agencies, and therefore are generally not interested in undertaking or allowing rail projects that do not benefit their safety or capacity of operations. While they are willing to negotiate with agencies for projects that serve the public good, their foremost concern is about preserving their assets and operations.
- Usually, a memorandum of understanding would be negotiated up front. Negotiations would not conclude until the company was reasonably certain that the project could proceed, meaning that the right-of-way for the track changes would need to be owned by the City. These negotiations tend to take years to complete. In the case of the track lowering adjacent to the Phoenix Sky Harbor International Airport (PHX), PHX already owns the right-of-way and negotiations took two years (Union Pacific also tends to require their involvement in the planning and subsequent design, and that they be reimbursed for their time reviewing the work).
- The FRA Class IV design standards would need to be maintained.

- A maximum slope of 2% theoretically applies for track design purposes, but our rail staff's opinion is that Union Pacific would not want to discuss anything that steep on their existing main line. In their opinion, a practical maximum slope of 1.5% should be assumed. As such, for every 10 feet of track lowering, approximately 3,000 feet of total transition area is needed (1,500 feet for sloping down, and 1,500 feet for sloping back up), plus the length of the flat section.
- Minimum curvature of the track would likely be 2,292 feet, to maintain Class IV (60 mph) through speed (2.5-degree curvature).
- Bridging the railroad tracks requires a minimum track vertical clearance is 23 feet and 4 inches, per UPRR/BNSF *Guidelines for Railroad Grade Separation Projects* (May 2016); this is slightly higher than the FAA's 23 feet required by *14 CFR Part 77*, used to determine obstructions to air navigation.
- During construction, safe track operation would need to be maintained without any speed restrictions.

Regarding relocation of the rail tracks:

Accommodating a potential 10,700-foot runway starting from the western edge of the SAT property would bring the runway east across Wetmore Road (which would need to be tunneled or truncated), and would require an eastward railroad tracks shift, along the runway centerline, of between 800 and 1,600 feet, depending on the runway option safety area/EMAS configuration. No engineering design was completed, but looking at Google Earth, the track would need to start a gradual turn immediately north of the I-410 track underpass, and after clearing the extended runway safety area, start a gradual turn back to the existing realignment. Due to the gradual turn out, straightening, and turn back in, considerable length of track would need to be relocated and significant property, mostly commercial, would need to be acquired. The 1,600-foot railroad track shift option would take the rail line past Broadway Street, and would require the most significant commercial and residential acquisition and relocation. Additionally, Broadway Street would need to be tunneled.

Regarding depression of the tracks:

To maintain unrestricted operation, construction of a lowered railroad track bed first requires the construction of a temporary bypass track, known as a shoofly. This would again require significant right-of-way acquisition prior to the railroad being willing to negotiate the project. One minor benefit to the railroad might be the elimination of the current at-grade crossings at Broadway Street and Bitters Road.

San Antonio Airport System Strategic Development Plan

2021 AIRPORT MASTER PLAN

MASTER PLAN UPDATE
CHAPTER 5 – ALTERNATIVES DEVELOPMENT AND EVALUATION
APPENDIX 5C – RUNWAY 31L END EXTENSION COMPARATIVE SAFETY RISK ASSESSMENT

SAN ANTONIO INTERNATIONAL AIRPORT

San Antonio International Airport requests your presence for the

Runway 13R-31L Southeast Extension & Runway 4-22 Intersection (Strategic Development Plan) Safety Risk Assessment

to be held on **December 2-3, 2020**

8:00am – Noon CST

Agenda
Runway 13R-31L Extension & Runway 4-22 Intersection
Safety Risk Assessment Meeting
San Antonio International Airport

December 2nd, 2020

- 8:00 AM to 8:10 AM – Introduction
- 8:10 AM to 8:30 AM – What is a SRA? (Reminder)
- 8:30 AM to 9:15 AM – Review the existing conditions
- 9:15 AM to 9:30 AM – Findings of the 2011 SRA on the RW 13R-31L / RW 4-22 decoupling
- 9:30 AM to 9:45 AM – Break
- 9:45 AM to 11:00 AM – What has changed since 2011? How? Why?
- 11:00 AM to 11:45 AM – Revision of the 2011 risk assessment
- 11:45AM to Noon – Wrap-up

December 3rd, 2020

- 8:00 AM to 8:20 AM – Introduction
- 8:20 AM to 8:30 AM – Review of the main findings from the day before
- 8:30 AM to 9:30 AM – Review the proposed RW 13R-31L extension to the southeast
- 9:30 AM to 9:45 AM – Break
- 9:45 AM to 10:15 AM – Discuss potential hazards introduced by the proposed configuration
- 10:15 AM to 10:30 AM – Identify the risks
- 10:30 AM to 11:30 AM – Assess and analyze those risks
- 11:30 AM to 11:45 AM – Compare the results to findings from the day before
- 11:45AM to Noon – Review, wrap up, and next steps.

Project Proposal Summary
Runway 13R-31L Extension
& Runway 4-22 Intersection
Comparative Safety Analysis

San Antonio International Airport

December 2-3, 2020

Table of Contents

Section 1 Introduction

The following Project Proposal Summary (PPS) is for a Comparative Safety Analysis (CSA) at San Antonio International Airport (SAT). The CSA will compare the safety aspects of the current master plan to decouple Runway 4-22 and 13R-31L. SAT is currently completing a reassessment and update to the airport's airport layout plan (ALP); the Project is funded using Airport Improvement Program (AIP) monies. As a result, the alternatives change what was planned specifically to improve airfield safety. To ensure the alternatives do not introduce new or additional risk into the SAT system, the FAA's Office of Airports (ARP) requires the conduct of a CSA.

The CSA is part of a Safety Risk Analysis (SRA) that is scheduled to occur on December 2nd and 3rd, 2020. This meeting will review, on the first day, the current system and the results of the first Safety Risk Assessment (SRA) which took place almost ten (10) years ago. The report from this first SRA is attached in **Appendix D** for reference. The results from which drove the plan to ultimately decouple the runways. On the second day the CSA will review the proposed change to the ALP which represents a 340' extension of Runway 13R-31L and 600' of Engineered Material Arresting System (EMAS) on the end to offset a reduction in runway safety area. There is also an extension of Taxiway G to access the new Runway 31L end.

1.1 Current System

SAT is a medium hub, Category 1 airport located in San Antonio, TX. SAT is owned and operated by the City of San Antonio. It is part of the San Antonio Airport System (SAAS) The airport is comprised of three runways. The airfield is configured with two parallel runways generally aligned northwest and southeast, and one runway aligned southwest and northeast. The Runways and their dimensions are:

- Runway 4-22: 8,505' X 150'
- Runway 13R-31L: 8,502' X 150'
- Runway 13L-31R: 5,519' X 100'

Runways 4, 13R and 31L have ILS CAT I approaches. All other runways have visual approach aids.

SAT averaged 454 daily operations in 2019; 97,068 commercial, 20,546 air taxi, 252 local GA, 42,861 itinerant GA, and 4,821 military; there are approximately 225 based aircraft. **Figure** 3**3** contains the Airport Diagram for reference. The complete SAT Master Record 5010 is contained in **Appendix A** for reference.

The current system has not seen a major change for some time. Several improvements to taxiway and commercial ramp areas have been made to meet current design standards. The safety issues associated with the current runway configuration have not changed. The runway intersection of the 31L threshold and Runway 4-22 (approximately 1/3 of the runway length down Runway 4) is a designated hotspot due to the number of incursions which occur there (HS 1). The following diagrams and data represent incursion information taken from a 2018 Runway Incursion Prevention through Situational Awareness (RIPSA) presentation with SAT staff.

Table 1: Runway Incursion Data by Year

2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
7	10	16	14	4	10	9	5	12	22	21	130

Specific incursion information is contained in **Appendix BB** for reference.

Figure 1: Hotspot Locations and % of Incursions

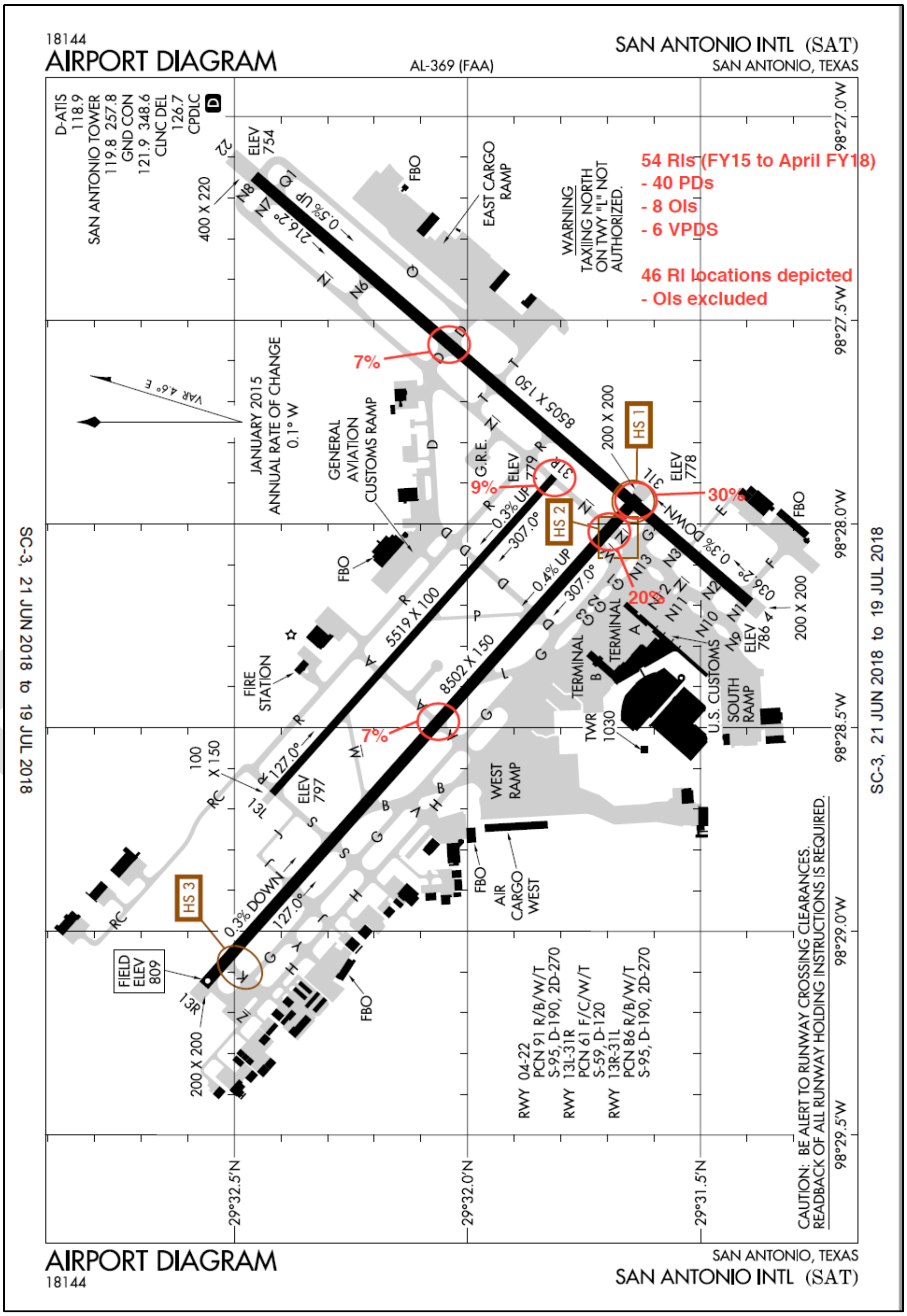


Figure 2: Hotspots 1 and 2

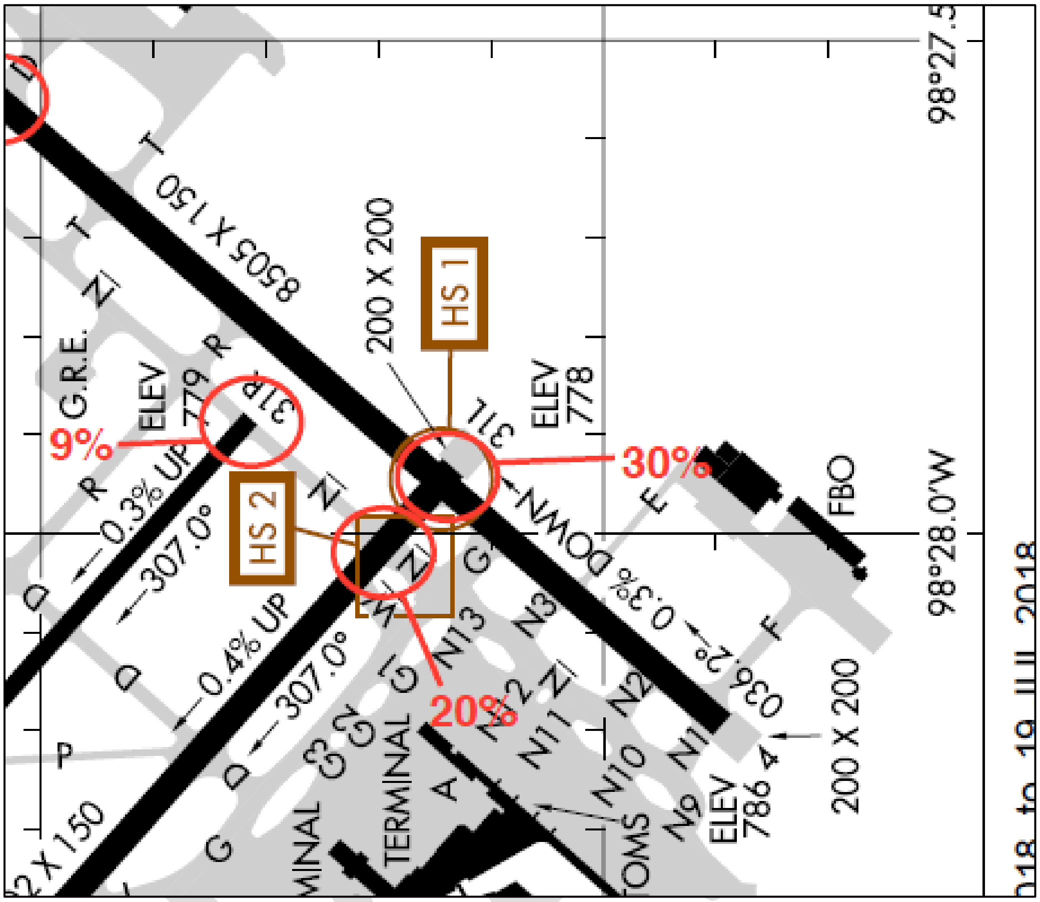
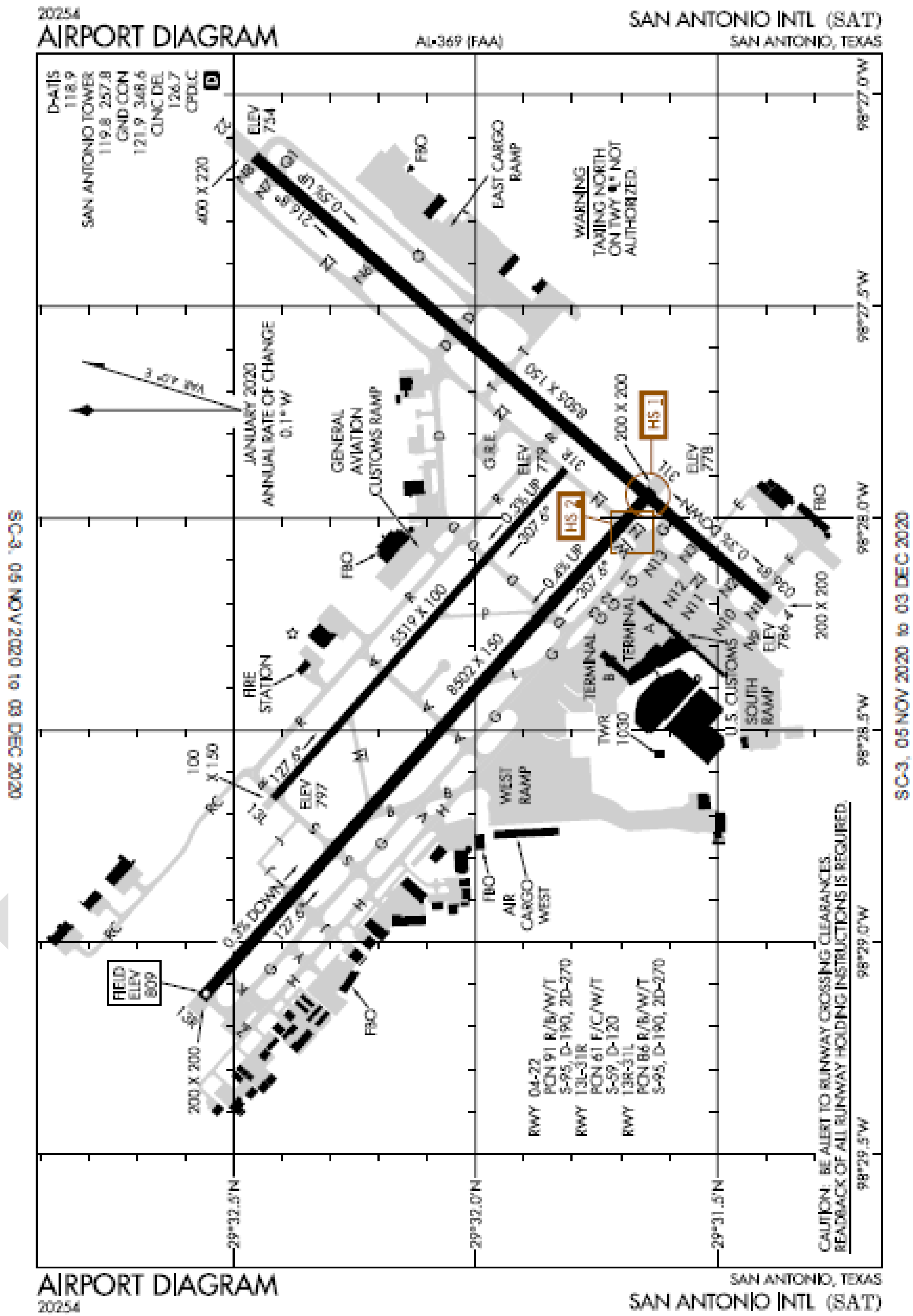


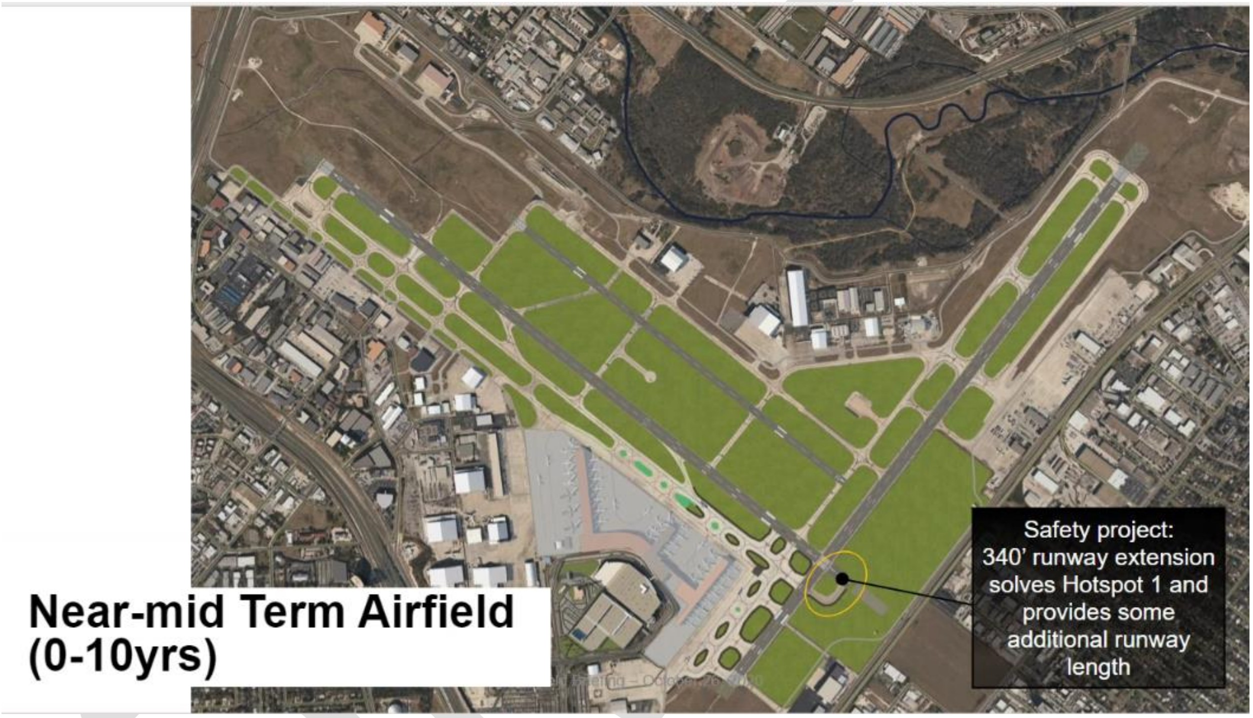
Figure 3: Current Airport Diagram



Section 2 Proposed Change

The proposed change to the ALP essentially adds 340' to the Runway 31L threshold, extends Taxiway G to the end with a new connection. By extending Runway 31L the safety area is reduced and will no longer meet the 1,000' length requirement. This can be mitigated and is proposed with a 600' length EMAS bed which in effect offsets the reduction in Runway safety area. To understand the thoroughness that was employed to arrive at this preferred alternative, in **Appendix C** is the complete alternatives analysis presentation from 2019.

Figure 4: Proposed Alternative



Appendix A 5010 Master Record

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

AIRPORT MASTER RECORD

PRINT DATE: 11/17/2020
AFD EFF 11/05/2020
FORM APPROVED OMB 2120-0015

> 1 ASSOC CITY: SAN ANTONIO | 4 STATE: TX | LOC ID: SAT | FAA SITE NR: 24709.*A
> 2 AIRPORT NAME: SAN ANTONIO INTL | 5 COUNTY: BEXAR, TX
3 CBD TO AIRPORT (NM): 7 N | 6 REGION/ADO: ASW /TEX | 7 SECT AERO CHT: SAN ANTONIO

GENERAL

10 OWNERSHIP: PUBLIC
> 11 OWNER: CITY OF SAN ANTONIO
> 12 ADDRESS: 100 MILITARY PLAZA
SAN ANTONIO, TX 78207
> 13 PHONE NR: 210-207-7253
> 14 MANAGER: JESUS H. SAENZ, JR.
> 15 ADDRESS: 9800 AIRPORT BLVD
SAN ANTONIO, TX 78216
> 16 PHONE NR: 210-207-3444
> 17 ATTENDANCE SCHEDULE:

MONTHS	DAYS	HOURS
ALL	ALL	ALL

18 AIRPORT USE:
19 ARPT LAT: 29-32-2.2488N ESTIMATED
20 ARPT LONG: 98-28-8.6054W
21 ARPT ELEV: 809.1 SURVEYED
22 ACREAGE: 2,305
> 23 RIGHT TRAFFIC: NO
> 24 NON-COMM LANDING: NO
25 NPIAS/FED AGREEMENTS: NGYP3
> 26 FAR 139 INDEX: I C S 05/1973

SERVICES

> 70 FUEL: 100LL A
> 71 AIRFRAME RPRS: MAJOR
> 72 PWR PLANT RPRS: MAJOR
> 73 BOTTLE OXYGEN: HIGH/LOW
> 74 BULK OXYGEN: HIGH/LOW
75 TSNT STORAGE: HGR TIE
76 OTHER SERVICES: AVNCS,CARGO,CHTR, INSTR,RNTL,SALES

FACILITIES

> 80 ARPT BCN: CG
> 81 ARPT LGT SKED: SS-SR
BCN LGT SKED: SS-SR
> 82 UNICOM: 122.950
> 83 WIND INDICATOR:
84 SEGMENTED CIRCLE: NONE
85 CONTROL TWR: YES
86 FSS: SAN ANGELO
87 FSS ON ARPT: NO
88 FSS PHONE NR:
89 TOLL FREE NR: 1-800-WX-BRIEF

BASED AIRCRAFT

90 SINGLE ENG:	67
91 MULTI ENG:	66
92 JET:	76
93 HELICOPTERS:	16
TOTAL:	225
94 GLIDERS:	0
95 MILITARY:	0
96 ULTRA-LIGHT:	0

OPERATIONS

100 AIR CARRIER:	97,068
102 AIR TAXI:	20,546
103 G A LOCAL:	252
104 G A ITNRNT:	42,861
105 MILITARY:	4,821
TOTAL:	165,548

OPERATIONS FOR 12 MONTHS ENDING 09/30/2019

RUNWAY DATA

		13R/31L	13L/31R	04/22
> 30 RUNWAY IDENT:		13R/31L	13L/31R	04/22
> 31 LENGTH:		8,502	5,519	8,505
> 32 WIDTH:		150	100	150
> 33 SURF TYPE-COND:		CONC-G	ASPH-F	CONC-G
> 34 SURF TREATMENT:		GRVD		GRVD
35 GROSS WT:	S	95.0	59.0	95.0
36 (IN THSDS)	D	190.0	120.0	190.0
37	2D	270.0		270.0
38	2D/2DS			
> 39 PCN:		86/R/B/W/T	61/F/C/W/T	91/R/B/W/T
LIGHTING/APCH AIDS				
> 40 EDGE INTENSITY:		HIGH	MED	HIGH
> 42 RWY MARK TYPE-COND:		PIR- G / PIR- G	NPI- G / BSC- G	PIR- G / PIR- G
> 43 VGSI:		P4L / P4L	P4L / P4L	P4R / P4L
44 THR CROSSING HGT:		75 / 82	40 / 60	79 / 85
45 VISUAL GLIDE ANGLE:		3.00 / 3.00	3.00 / 3.00	3.00 / 3.00
> 46 CNTRLN-TDZ:		Y - Y / Y - N	- / -	Y - N / Y - N
> 47 RVR-RVV:		TMR - N / TMR - N	- / -	T - / R -
> 48 REIL:		/	Y / Y	/ Y
> 49 APCH LIGHTS:		ALSF2 / MALSR	/	MALS /
OBSTRUCTION DATA				
50 FAR 77 CATEGORY:		PIR / PIR	B(V) / B(V)	PIR / C
> 51 DISPLACED THR:		/	/	/
> 52 CTLG OBSTN:		/ BLDG	/	POLE /
> 53 OBSTN MARKED/LGTD:		/	/	/
> 54 HGT ABOVE RWY END:		/ 79	/	46 /
> 55 DIST FROM RWY END:		0 / 3,500	0 / 0	2,180 / 0
> 56 CNTRLN OFFSET:		/ 300R	/	225L /
57 OBSTN CLNC SLOPE:		50:1 / 41:1	50:1 / 50:1	43:1 / 50:1
58 CLOSE-IN OBSTN:		N / N	N / N	N / N
DECLARED DISTANCES				
> 60 TAKE OFF RUN AVBL (TORA):		8,502 / 8,502	5,519 / 5,519	8,505 / 8,505
> 61 TAKE OFF DIST AVBL (TODA):		8,502 / 8,502	5,519 / 5,519	8,505 / 8,505
> 62 ACLT STOP DIST AVBL (ASDA):		8,502 / 8,502	5,519 / 5,519	8,505 / 8,505
> 63 LNDG DIST AVBL (LDA):		8,502 / 8,502	5,519 / 5,519	8,505 / 8,505

(>) ARPT MGR PLEASE ADVISE FSS IN ITEM 86 WHEN CHANGES OCCUR TO ITEMS PRECEDED BY >

> 110 REMARKS:

A 110-004 TWY L CLSD NORTHBOUND.
A 110-007 NUMEROUS FLOCKS OF BIRDS INVOF ARPT.
A 110-012 GLIDER/SOARING OPNS APRXLY 17 MILES NW OF ARPT DURG VFR.
A 110-014 TWY D NON-MOVEMENT AREA FM TWY N TO 500 FT W OF TWY N.
A 110-016 NOISE SENSITIVE AREAS EXIST ON ALL SIDES OF ARPT, AT PILOTS DISCRETION CLIMB AS QUICKLY AND QUIETLY AS SAFELY POSSIBLE ON DEPARTURE AND USE CONSIDERATION WHEN FLYING OVER POPULATED AREAS BY MINIMIZING FLT AND HIGH PWR SETTINGS. MILITARY AIRCRAFT: DEPARTING AND ARRIVING AIRCRAFT WILL USE MINIMUM POWER SETTINGS CONSISTENT WITH AIRCRAFT FLIGHT MANUALS, AFTERBURNER TAKEOFF IS PROHIBITED UNLESS REQUIRED FOR SAFETY OF FLIGHT. ENGINE-UPS ARE PERMITTED BTN 0600-2300.
A 110-017 ACFT TAXIING ON RY 04 NE BOUND LOOK FOR HOLD SHORT TO RY 31L.
A 110-018 ACFT TAXIING ON TWY N SW BOUND LOOK FOR HOLD SHORT TO RY 31R.

111 INSPECTOR: (F) | 112 LAST INSP: 01/31/2020 | 113 LAST INFO REQ:

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

AIRPORT MASTER RECORD

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> 11 OWNER: CITY OF SAN ANTONIO
> 12 ADDRESS: 100 MILITARY PLAZA
SAN ANTONIO, TX 78207
> 13 PHONE NR: 210-207-7253
> 14 MANAGER: JESUS H. SAENZ, JR.
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SAN ANTONIO, TX 78216
> 16 PHONE NR: 210-207-3444
> 17 ATTENDANCE SCHEDULE:

MONTHS	DAYS	HOURS
ALL	ALL	ALL

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20 ARPT LONG: 98-28-8.6054W
21 ARPT ELEV: 809.1 SURVEYED
22 ACREAGE: 2,305
> 23 RIGHT TRAFFIC: NO
> 24 NON-COMM LANDING: NO
25 NPIAS/FED AGREEMENTS: NGYP3
> 26 FAR 139 INDEX: I C S 05/1973

SERVICES

> 70 FUEL: 100LL A
> 71 AIRFRAME RPRS: MAJOR
> 72 PWR PLANT RPRS: MAJOR
> 73 BOTTLE OXYGEN: HIGH/LOW
> 74 BULK OXYGEN: HIGH/LOW
75 TSNT STORAGE: HGR TIE
76 OTHER SERVICES: AVNCS,CARGO,CHTR, INSTR,RNTL,SALES

BASED AIRCRAFT

90 SINGLE ENG:	67
91 MULTI ENG:	66
92 JET:	76
93 HELICOPTERS:	16
TOTAL:	225
94 GLIDERS:	0
95 MILITARY:	0
96 ULTRA-LIGHT:	0

FACILITIES

> 80 ARPT BCN: CG
> 81 ARPT LGT SKED: SS-SR
BCN LGT SKED: SS-SR
> 82 UNICOM: 122.950
> 83 WIND INDICATOR:
84 SEGMENTED CIRCLE: NONE
85 CONTROL TWR: YES
86 FSS: SAN ANGELO
87 FSS ON ARPT: NO
88 FSS PHONE NR:
89 TOLL FREE NR: 1-800-WX-BRIEF

OPERATIONS

100 AIR CARRIER:	97,068
102 AIR TAXI:	20,546
103 G A LOCAL:	252
104 G A ITNRNT:	42,861
105 MILITARY:	4,821
TOTAL:	165,548

OPERATIONS FOR 12 MONTHS ENDING 09/30/2019

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> 34 SURF TREATMENT:
35 GROSS WT: S
36 (IN THSDS) D
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LIGHTING/APCH AIDS

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OBSTRUCTION DATA

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(>) ARPT MGR PLEASE ADVISE FSS IN ITEM 86 WHEN CHANGES OCCUR TO ITEMS PRECEDED BY >

> 110 REMARKS:

A 110-019	WORK IN PROGRESS SCHEDULED MAINTENANCE ON & ALONG TWYS AND RAMPS AREAS AT VARIOUS TIMES.
A 110-020	GROUND RUN-UP ENCLOSURE AVBL 24 HRS.
A 110-021	TERMINAL GATES A1, A5, A6, A7 & A8 USE ONLY WITH PPR CALL OPNS 210-207-3433.
A 110-024	RY 13L/31R NOT AVBL FOR PART 121 ACR OPNS.
A 110-025	THE FOLLOWING TWYS ARE NOT AVBL FOR ACFT 59,000 LBS OR OVER: TWY A & TWY J NORTH OF RY 13R-31L, TWY M & TWY P, TWY H NORTHWEST OF TWY Z AND TWY E EAST OF RY 04/22.
A 110-026	TWY Z CLSD TO ACFT WITH WINGSPAN GREATER THAN 118 FT.
A 110-027	C130 AND C17 TYPE ACFT MUST PARK ON WEST RAMP TO CLR CUST.

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> 110 REMARKS:

A 110-031	INNER RAMP TAXILANE NORTH OF TRML A AND B IS CLSD TO ACFT WITH WINGSPAN GTR THAN 135 FT.
A 110-033	PPR WITH ARPT OPNS FOR ACFT POWERING BACK FM TERMINAL GATES.
A 110-034	TWYS L & B CLSD TO ACFT WITH WINGSPANS GREATER THAN 118 FT EXITING RY 31L.
A 110-035	A BARRICADED PAVEMENT ELEVATION CHANGE EXISTS ALONG THE EASTERN SIDE OF THE WEST RAMP.
A 110-036	FREQUENT RUBBER ACCUMULATION NW 2500 RY 13R/31L.
A 110-038	ACFT AT TERMINAL A & B ADVISE GND CTL PRIOR TO PUSH.
A 110-039	COMPASS DEVIATION MAY OCCUR AT THE NW PORTION OF TWY R DUE TO REBAR RE-ENFORCED CONC BRIDGE LCTD UNDER THE TWY.

111 INSPECTOR: (F) | 112 LAST INSP: 01/31/2020 | 113 LAST INFO REQ:

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FEDERAL AVIATION ADMINISTRATION

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> 110 REMARKS:

A 110-045	AERODROME ALL SFC WIP CONST FOR CURRENT INFO CTC OPS. 210-207-3433.
A 110-046	ARPT RSTD TO ACFT WITH WINGSPAN GTR THAN 171 FT, PPR WITH 24HR OPS 210-207-3433. RQRD FOR AUTH.
A 110-049	APRON EAST CARGO RAMP INT OF RWY 04/22 AND TWY DELTA ACFT ARE REQ TO APPLY THE MNM THRUST WHEN XNG THE RWY TO AVOID DMG DUE TO JET BLAST.
A 110-050	ALL INTL GENERAL AVIATION CLEAR U.S. CSTMS AT NORTH FIXED BASE OPERATOR RAMP EAST SIDE, CALL U.S. CSTMS 210-821-6965 UPON ARR.
A 110-051	ALL ACFT AFTER LDG ON RWY 13R/31L EXITING SOUTHWEST BOUND ON TWY DELTA TO MAKE 90 DEG TURN ON TWY GOLF TO AVOID UNUSBL SFC.
A 110-052	FOREIGN MIL ACFT WITH WINGSPAN LESS THAN 100 FT MUST REP TO GA RAMP FED INSPECTION STATION FOR CUST PROCESSING, CTC AP MANAGEMENT AT 210-207-3433.
A 110-053	TWY S BTN APCH END RWY 13L AND RWY 13R/31L CLSD TO ACFT WITH WINGSPAN MORE THAN 100 FT. TWY R BTN APCH END RWY 13L AND TWY D CLSD TO ACFT WINGSPAN MORE THAN 100 FT.

111 INSPECTOR: (F) 112 LAST INSP: 01/31/2020 113 LAST INFO REQ:

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> 110 REMARKS:

A 110-054 SAT TWY R BTN APCH END RWY 13L AND TWY D CLSD TO ACFT MORE THAN 99600 LB.

111 INSPECTOR: (F) 112 LAST INSP: 01/31/2020 113 LAST INFO REQ:

Appendix B Airport Safety Data

EVENT_ID	INCDNT_TYPE_FAA_CODE	EVENT_LCL_DATE	RWY_SFTY_RI_CAT_RNK_CODE	EVENT_ARPT_ID	EVENT_LOC_DESC	ACFT_1_RWY_SFTY_TYPE	ACFT_2_RWY_SFTY_TYPE	ACFT_1_FLTCNDT_CODE	ACFT_2_FLTCNDT_CODE	WX_COND_DESC	EVENT_TKOF_LNDG_DESC
31005	PD	11-Aug-20	D	SAT	SAN ANTONIO INTL	PA32		135	N/A	KSAT 112251Z 15010G17KT 10SM FEW075 FEW250 38/19 A2989 RMK AO2 SLP099 T03780189	RWY 13L
30933	VPD	7-Jul-20	D	SAT	SAN ANTONIO INTL			VEH	N/A	KSAT 071151Z 20006KT 10SM SCT018 OVC025 27/23 A2996 RMK AO2 SLP124 T02720228 10283 20267 53005	RWY13R
30934	VPD	7-Jul-20	D	SAT	SAN ANTONIO INTL			VEH	N/A	KSAT 071151Z 20006KT 10SM SCT018 OVC025 27/23 A2996 RMK AO2 SLP124 T02720228 10283 20267 53005	RWY 4
30880	PD	20-Jun-20	D	SAT	SAN ANTONIO INTL	C172		91	N/A	KSAT 210051Z 14015KT 10SM FEW060 BKN250 32/21 A2991 RMK AO2 SLP110 T03170206	31R
30768	VPD	8-May-20	D	SAT	SAN ANTONIO INTL			PED	N/A	KSAT 090151Z 02013G20KT 350V050 10SM FEW060 BKN250 23/10 A3006 RMK AO2 SLP161 T02280100	TWY D, R, N, RWY13L/31R
30707	PD	1-Apr-20	C	SAT	SAN ANTONIO INTL	SW4	BE20	91	91	KSAT 011451Z 12009KT 10SM BKN250 17/09 A3004 RMK AO2 SLP160 T01670094 51013	RWY 13L
30631	PD	4-Mar-20	C	SAT	SAN ANTONIO INTL	TEX2	B737	MIL	121	KSAT 041751Z 01011KT 10SM BKN019 BKN120 20/13 A2987 RMK AO2 SLP099 60045 T02000133 10200 20172 51018 $	31L
30569	PD	14-Feb-20	C	SAT	SAN ANTONIO INTL	BE90	MU2	135	135	KSAT 141651Z 11008KT 10SM FEW030 08/01 A3044 RMK AO2 SLP302 T00830011	RWY 4
30374	PD	13-Dec-19	C	SAT	SAN ANTONIO INTL	H25B		135	N/A	KSAT 131751Z 24013KT 10SM FEW250 21/07 A2994 RMK AO2 SLP128 T02110072 10211 20056 58019	31L
30323	PD	29-Nov-19	C	SAT	SAN ANTONIO INTL	MD83		121	N/A	KSAT 291537Z 00000KT 1/2SM R13R/P6000FT -DZ BR OVC002 15/14 A3009 RMK AO2 SFC VIS 1 P0001 T01500139	RWY 22
30301	PD	22-Nov-19	C	SAT	SAN ANTONIO INTL	C210		91	N/A	KSAT 221605Z 34012KT 10SM OVC015 13/11 A3006 RMK AO2 SHRA DSNT E T01330106	31L
30040	PD	25-Sep-19	D	SAT	SAN ANTONIO INTL	RV4	C525	91	91	KSAT 251851Z 15006KT 10SM SCT050 SCT250 33/20 A2989 RMK AO2 SLP101 T03280200	RWY 4
29999	PD	18-Sep-19	D	SAT	SAN ANTONIO INTL	CRJ9		121	N/A	KSAT 181751Z 22006KT 10SM SCT047 SCT250 34/21 A2992 RMK AO2 SLP111 T03440206 10344 20233 58008	31L
29857	VPD	18-Aug-19	C	SAT	SAN ANTONIO INTL			VEH	N/A	KSAT 181225Z 18009KT 10SM BKN021 27/23 A2991 RMK AO2 T02670228	RWY 4
29759	VPD	27-Jul-19	D	SAT	SAN ANTONIO INTL	C525		MAI	N/A	KSAT 271951Z 10005G14KT 10SM FEW060 FEW250 33/17 A3011 RMK AO2 SLP175 T03280172	RWY 13L
29690	PD	15-Jul-19	C	SAT	SAN ANTONIO INTL	PC12		91	N/A	KSAT 151551Z VRB04KT 10SM FEW022 FEW250 31/23 A2998 RMK AO2 SLP131 T03060233	31R
29556	PD	20-Jun-19	D	SAT	SAN ANTONIO INTL	SA226	BE20	91	91	KSAT 201451Z 13009KT 8SM OVC011 27/24 A2988 RMK AO2 SLP097 T02670239 53018	RWY 13R
29557	PD	20-Jun-19	D	SAT	SAN ANTONIO INTL	SA226	ZZZZ	91	N/A	KSAT 201451Z 13009KT 8SM OVC011 27/24 A2988 RMK AO2 SLP097 T02670239 53018	RWY 13L
29333	OTH	1-May-19	D	SAT	SAN ANTONIO INTL	B738	C510	121	91	KSAT 012125Z 12012G18KT 8SM -RA BKN024 OVC036 24/21 A2986 RMK AO2 P0001 T02440211	SHORT FINAL RWY 13R
29261	PD	12-Apr-19	D	SAT	SAN ANTONIO INTL	TBM7		91	N/A	KSAT 121751Z 10009KT 10SM FEW026 FEW120 FEW250 22/11 A2983 RMK AO2 SLP088 T02220111 10228 20139 58016	RWY13L AT A
29232	PD	6-Apr-19	D	SAT	SAN ANTONIO INTL	A320		121	N/A	KSAT 062051Z 17006KT 8SM SCT028 BKN046 BKN250 27/21 A2979 RMK AO2 SLP069 T02720206 58026	RWY31L
29156	PD	18-Mar-19	D	SAT	SAN ANTONIO INTL	BE90	C525	129	91	KSAT 181751Z 07007KT 10SM SCT140 BKN250 17/01 A3031 RMK AO2 SLP252 T01720006 10183 20072 50000	RWY 13L
28957	VPD	29-Jan-19	D	SAT	SAN ANTONIO INTL			VEH	N/A	KSAT 290651Z 01016G24KT 10SM FEW075 08/M04 A3019 RMK AO2 PK WND 02029/0640 SLP211 T00781039	RWY13R @ N
28571	PD	27-Oct-18	D	SAT	SAN ANTONIO INTL	C25B		91	N/A	KSAT 271851Z 25010KT 10SM FEW040 27/15 A3009 RMK AO2 SLP174 T02670150	31L
28570	PD	27-Oct-18	D	SAT	SAN ANTONIO INTL	C510		91	N/A	KSAT 271751Z 22012G16KT 10SM FEW030 26/16 A3011 RMK AO2 SLP181 T02560161 10256 20128 58002	31L

28558	OI	25-Oct-18	D	SAT	SAN ANTONIO INTL	B190	E110	135	135	KSAT 251151Z 33005KT 10SM -DZ OVC009 15/14 A2996 RMK AO2 DZB47 SLP132 P0000 60000 70077 T01500139 10161 20150 53005	RWY 4 AND TWY D
28453	PD	4-Oct-18	C	SAT	SAN ANTONIO INTL	C208	C750	135	91	KSAT 042151Z 15009KT 10SM FEW048 31/19 A2996 RMK AO2 SLP127 T03110194	RWY 4
23271	PD	22-Sep-18	D	SAT	SAN ANTONIO INTL, TX	A319		121	N/A	KSAT 221151Z 29005KT 6SM RA BR FEW011 BKN050 OVC120 22/21 A2993	RWY 13R
23270	PD	22-Sep-18	D	SAT	SAN ANTONIO INTL, TX	A319		121	N/A	KSAT 221151Z 29005KT 6SM RA BR FEW011 BKN050 OVC120 22/21 A2993	RWY 13R
23187	PD	6-Sep-18	C	SAT	SAN ANTONIO INTL, TX	C414	A319	91	121	KSAT 061151Z 03003KT 10SM FEW009 SCT037 BKN250 24/23 A3005	
22984	PD	31-Jul-18	D	SAT	SAN ANTONIO INTL, TX	C25A		91	N/A	KSAT 010120Z 19005KT 10SM SCT039 BKN090 BKN250 26/21 A2997	
22418	PD	14-Apr-18	D	SAT	SAN ANTONIO INTL, TX	LJ45		91	N/A	KSAT 142351Z 33018G23KT 10SM FEW080 22/M03 A3002	
22302	PD	21-Mar-18	C	SAT	SAN ANTONIO INTL, TX	A306	B737	121	121	KSAT 211351Z 35003KT 10SM BKN250 12/04 A3017	
22175	PD	20-Feb-18	C	SAT	SAN ANTONIO INTL, TX	LJ35	C550	129	91	METAR KSAT 202251Z 17008KT 10SM OVC011 23/20 A2987	
22155	OI	15-Feb-18	C	SAT	SAN ANTONIO INTL, TX	C525	A319	91	121	KSAT 160151Z 13005KT 10SM SCT250 19/17 A3002	
22152	PD	15-Feb-18	B	SAT	SAN ANTONIO INTL, TX	B763	A319	121	121	KSAT 160151Z 13005KT 10SM SCT250 19/17 A3002	
22148	PD	14-Feb-18	D	SAT	SAN ANTONIO INTL, TX	WW24		91	N/A	141951Z VRB04KT 10SM FEW017 BKN025 18/15 A3024	
22100	PD	1-Feb-18	C	SAT	SAN ANTONIO INTL, TX	C172	A321	91	121	KSAT 020051Z 36013KT 10SM FEW150 BKN250 18/01 A3013	
21911	PD	18-Dec-17	C	SAT	SAN ANTONIO INTL, TX	BE40	C680	91	135	KSAT 181916Z 09009KT 1/2SM R13R/3500V4500FT -RA FG VV003 13/12 A3010	
21888	PD	12-Dec-17	D	SAT	SAN ANTONIO INTL, TX	C182		91	N/A	KSAT 121205Z 01013G18KT 10SM FEW250 12/M03 A3031	
21782	OI	18-Nov-17	D	SAT	SAN ANTONIO INTL, TX	E50P		91	N/A	KSAT 181951Z 34020G31KT 10SM FEW075 FEW250 28/08 A2995	
21634	PD	25-Oct-17	D	SAT	SAN ANTONIO INTL, TX	C152		91	N/A	KSAT 251851Z 24009G14KT 200V300 10SM CLR 26/01 A3019	
21605	VPD	21-Oct-17	D	SAT	SAN ANTONIO INTL, TX			VEH	N/A	KSAT 211951Z 14013KT 10SM SCT044 SCT250 31/19 A2987	
21570	VPD	12-Oct-17	C	SAT	SAN ANTONIO INTL, TX	EA50		VEH	91	KSAT 121451Z 00000KT 10SM FEW044 23/11 A3014	
21547	OI	6-Oct-17	C	SAT	SAN ANTONIO INTL, TX	BE9L	BE9L	135	91	KSAT 061851Z 00000KT 10SM SCT043 28/18 A2994	RWY 13R
21514	PD	1-Oct-17	D	SAT	SAN ANTONIO INTL, TX	C750		91	N/A	KSAT 012151Z 22005KT 10SM SCT055 30/17 A2990	
21482	OI	28-Sep-17	D	SAT	SAN ANTONIO INTL, TX	H25B		91	N/A	KSAT 281929Z 34008KT 7SM -RA BKN012 BKN043 OVC090 25/22 A3001	
21327	PD	7-Sep-17	C	SAT	SAN ANTONIO INTL, TX	C208	C560	135	135	KSAT 071151Z 03003KT 10SM CLR 17/08 A3014	RWY 4
20889	OTH	7-Jul-17	N/A	SAT	SAN ANTONIO INTL, TX	PA32		91	N/A	13006KT 10SM SCT055 SCT250 34/19 A3008	
20758	PD	21-Jun-17	D	SAT	SAN ANTONIO INTL, TX	PILL		91	N/A	32003KT 10SM FEW070 23/19 A2988	
20739	VPD	19-Jun-17	D	SAT	SAN ANTONIO INTL, TX	C550		MAINT TX	N/A	KSAT 191851Z 07008KT 10SM SCT043 BKN250 31/21 A2999	
20704	VPD	14-Jun-17	D	SAT	SAN ANTONIO INTL, TX			VEH	N/A	KSAT 141851Z 15011KT 120V200 10SM SCT041 BKN055 32/21 A2995	
20635	PD	6-Jun-17	D	SAT	SAN ANTONIO INTL, TX	BE36		91	N/A	36012G19KT 10SM FEW046 30/19 A2986	
20533	PD	24-May-17	D	SAT	SAN ANTONIO INTL, TX	PA32		91	N/A	KSAT 241551Z 29009KT 10SM CLR 25/07 A2994	
20532	PD	24-May-17	D	SAT	SAN ANTONIO INTL, TX	SR22		91	N/A	31006KT 10SM CLR 16/09 A2994	
20403	OI	9-May-17	D	SAT	SAN ANTONIO INTL, TX	C650		91	N/A	KSAT 091351Z 13008KT 10SM OVC007 21/19 A2998	
20374	PD	5-May-17	D	SAT	SAN ANTONIO INTL, TX	E50P		91	N/A	KSAT 051951Z VRB04KT 10SM CLR 28/04 A3004	
20346	PD	1-May-17	D	SAT	SAN ANTONIO INTL, TX	PC12		91	N/A	KSAT 011051Z 00000KT 10SM CLR 10/07 A2999	
20341	PD	30-Apr-17	D	SAT	SAN ANTONIO INTL, TX	C152		91	N/A	KSAT 302051Z 29015G21KT 10SM CLR 25/03 A2992	
20144	PD	5-Apr-17	D	SAT	SAN ANTONIO INTL, TX	LJ60		91	N/A	33012G18KT 10SM FEW250 22/02 A3010	
19883	VPD	24-Feb-17	D	SAT	SAN ANTONIO INTL, TX			VEH	N/A	36015G23KT 10SM CLR 28/M03 A2983	
19806	PD	13-Feb-17	D	SAT	SAN ANTONIO INTL, TX	H25B		135	N/A	07013KT 10SM BKN013 OVC035 18/10 A3012	
19796	OI	11-Feb-17	N/A	SAT	SAN ANTONIO INTL, TX	C182		91	VEH	KSAT 110551Z 17007KT 10SM FEW015 FEW250 19/18 A3004	
19798	PD	11-Feb-17	D	SAT	SAN ANTONIO INTL, TX	C182		91	N/A	17007KT 10SM FEW015 FEW250 19/18 A3004	
19727	PD	31-Jan-17	C	SAT	SAN ANTONIO INTL, TX	BE30	C560	91	91	KSAT 312151Z 18009G20KT 10SM FEW250 24/01 A2998	
19374	PD	4-Dec-16	D	SAT	SAN ANTONIO INTL, TX	TBM7		91	N/A	01008KT 8SM -RA BKN010 BKN015 OVC090 11/09 A3002	

19314	PD	23-Nov-16	C	SAT	SAN ANTONIO INTL, TX	PA34	SR22	91	91	33006KT 10SM FEW050 24/07 A3012	RWY30L
19280	PD	18-Nov-16	D	SAT	SAN ANTONIO INTL, TX	C414		91	N/A	36018G25KT 10SM FEW040 FEW250 24/08 A3010	
19246	PD	14-Nov-16	C	SAT	SAN ANTONIO INTL, TX	M20P	C182	91	91	25005KT 10SM FEW050 FEW250 25/14 A3004	
19148	PD	28-Oct-16	C	SAT	SAN ANTONIO INTL, TX	SBR1	MD80	91	121	11005KT 10SM SCT021 24/17 A3024	RWY 12R
18726	OI	27-Aug-16	C	SAT	SAN ANTONIO INTL, TX	SR22	A320	121	91	KSAT 271551Z 15007KT 10SM SCT026 SCT250 29/22 A3003	
18693	VPD	20-Aug-16	N/A	SAT	SAN ANTONIO INTL, TX			PED	N/A	07007KT 10SM FEW015 BKN075 OVC250 27/21 A2983	
18159	PD	6-Jun-16	C	SAT	SAN ANTONIO INTL, TX	C152	B737	91	121	03010G16KT 10SM FEW060 FEW250 32/14 A2986	
17920	PD	27-Apr-16	C	SAT	SAN ANTONIO INTL, TX	SR22	B350	91	91	30006KT 10SM FEW250 22/17 A2975	30L
17775	PD	4-Apr-16	C	SAT	SAN ANTONIO INTL, TX	C207	A319	91	121	16007G16KT 10SM CLR 25/09 A3020	RY 12R
17668	PD	18-Mar-16	C	SAT	SAN ANTONIO INTL, TX	P46T	CRJ9	91	121	10006KT 10SM FEW033 SCT060 27/19 A2973	RWY 12R
17669	PD	18-Mar-16	C	SAT	SAN ANTONIO INTL, TX	P46T	C210	91	91	10006KT 10SM FEW033 SCT060 27/19 A2973	
17532	PD	25-Feb-16	D	SAT	SAN ANTONIO INTL, TX	C210		91	N/A	VRB06KT 10SM FEW250 18/M02 A3031	30L
17197	PD	27-Dec-15	D	SAT	SAN ANTONIO INTL, TX	E170		121	N/A	35015G24KT 9SM -RA SCT014 BKN019 OVC038 10/08 A2960	
17182	VPD	23-Dec-15	D	SAT	SAN ANTONIO INTL, TX			VEH	N/A	00000KT 3SM BCFG FEW003 FEW250 17/16 A2958	
17137	PD	14-Dec-15	D	SAT	SAN ANTONIO INTL, TX	C152		91	N/A	16008KT 10SM CLR 19/05 A2975	RWY 12L
17133	PD	13-Dec-15	D	SAT	SAN ANTONIO INTL, TX	C560		91	N/A	27016G23KT 10SM FEW150 20/M01 A2969	30L
16959	PD	11-Nov-15	C	SAT	SAN ANTONIO INTL, TX	C525	C501	91	91	30003KT 10SM FEW035 FEW050 FEW250 27/19 A2986	30L
16170	PD	23-Jun-15	N/A	SAT	SAN ANTONIO INTL, TX	DA40	N/A		91	12006KT 10SM FEW030 SCT080 SCT250 27/23 A3010	RWY 12R
15932	PD	4-May-15	C	SAT	SAN ANTONIO INTL, TX	SR22	B737	91	121	15013G19KT 10SM BKN017 OVC025 23/18 A3007	RWY 12R
15823	PD	14-Apr-15	C	SAT	SAN ANTONIO INTL, TX	A320	B350	129	91	35011KT 10SM BKN018 OVC250 18/13 A3010	RWY 30L
15373	OI	8-Jan-15	C	SAT	SAN ANTONIO INTL, TX	B190	B737	VEH	121	03012G26KT 10SM FEW110 04/M08 A3072	RWY 4
15289	OI	10-Dec-14	C	SAT	SAN ANTONIO INTL, TX	H25A	B752	91	121	14010KT 10SM SCT031 BKN050 OVC250 20/13 A3013	RWY 12R
15110	PD	2-Nov-14	D	SAT	SAN ANTONIO INTL, TX	C550	N/A		91	17003KT 7SM FEW024 FEW029 OVC045 18/16 A3002	
15109	PD	2-Nov-14	N/A	SAT	SAN ANTONIO INTL, TX	C172	CRJ7	91	121	35003KT 10SM CLR 11/M04 A3014	RWY 30L
14624	OI	20-Jul-14	D	SAT	SAN ANTONIO INTL, TX	COL3	N/A	N/A	91	12009KT 10SM SCT050 SCT250 34/23 A2992	RWY 12R
14483	VPD	25-Jun-14	C	SAT	SAN ANTONIO INTL, TX	N/A	B737	VEH	121	09016KT 1/4SM R12R/3000VP6000FT +TSRA FG SCT008 BKN014CB OVC090 23/21 A3004	RWY 4
14453	PD	19-Jun-14	C	SAT	SAN ANTONIO INTL, TX	CL30	GLF5	91	91	14012KT 10SM SCT045 OVC250 31/19 A3000	RWY 22
14213	PD	4-May-14	D	SAT	SAN ANTONIO INTL, TX	C172	N/A	N/A	91	15015G20KT 10SM CLR 33/03 A2997	RWY 12L
13995	PD	18-Mar-14	C	SAT	SAN ANTONIO INTL, TX	BE35	E170	91	121	19009KT 10SM SCT250 26/07 A2975	RWY 22
13731	PD	6-Jan-14	D	SAT	SAN ANTONIO INTL, TX	PC12	N/A	N/A	91	02013G20KT 10SM SCT100 OVC250 M02/M14	RWY 4
13616	PD	4-Dec-13	D	SAT	SAN ANTONIO INTL, TX	AC11	N/A	N/A	91	16004KT 10SM BKN250 24/17 A2971	RWY 12L
13527	PD	12-Nov-13	D	SAT	SAN ANTONIO INTL, TX	PC12	N/A	N/A	91	02015G25KT 10SM FEW032 SCT250 16/07 A3047	RWY 30L
13433	PD	22-Oct-13	D	SAT	SAN ANTONIO INTL, TX	C152	N/A	N/A	91	01003KT 10SM FEW250 22/04 A3010	RWY 30L
13238	OI	10-Sep-13	C	SAT	SAN ANTONIO INTL, TX	PA46	B737	91	121	11007KT 10SM SCT025 BKN060 BKN250	RWY 12R
13232	PD	7-Sep-13	C	SAT	SAN ANTONIO INTL, TX	C402	CRJ7	91	121	08007KT 10SM SCT040	RWY 12R
13108	VPD	14-Aug-13	D	SAT	SAN ANTONIO INTL, TX	N/A	N/A	N/A	VEH	18007KT 10SM CLR	
12910	PD	2-Jul-13	D	SAT	SAN ANTONIO INTL, TX	BE40	N/A	N/A	91	04006KT 10SM BKN250 28/18 A3004	
12840	PD	19-Jun-13	D	SAT	SAN ANTONIO INTL, TX	B737	N/A	N/A	121	10007KT 10SM FEW065 SCT250 32/20 A2992	RWY 4
12500	PD	5-Apr-13	N/A	SAT	SAN ANTONIO INTL, TX	BE35	B738	91	121	00000KT 10SM BKN250 16/06 A3026	
12464	PD	25-Mar-13	D	SAT	SAN ANTONIO INTL, TX	RV7	N/A	N/A	91	06007KT 10SM CLR 14/M13 A3031	RWY 4
12179	OI	15-Jan-13	D	SAT	SAN ANTONIO INTL, TX	C560	N/A	N/A	91	02009KT 10SM BKN014 OVC028 03/01 A3014	RWY 30L
12063	PD	9-Dec-12	D	SAT	SAN ANTONIO INTL, TX	C501	N/A	N/A	91	00000KT 7SM SCT150 OVC250 22/19 A298	RWY 30L
11994	PD	20-Nov-12	D	SAT	SAN ANTONIO INTL, TX	SR22	N/A	N/A	91	17005KT 10SM FEW040 SCT250 26/16 A3012	RWY 4
11852	PD	14-Oct-12	C	SAT	SAN ANTONIO INTL, TX	SR22	B737	91	121	32003KT 10SM FEW038 SCT060 30/19 A3002	RWY 12R
11542	OI	20-Jul-12	C	SAT	SAN ANTONIO INTL, TX	N/A	SR22	VEH	91	10SM FEW028 29/22 A3013	RWY 12L
11155	PD	26-Apr-12	D	SAT	SAN ANTONIO INTL, TX	C182	N/A	N/A	91	17004KT 10SM BKN250 22/18	N
10807	PD	26-Jan-12	D	SAT	SAN ANTONIO INTL, TX	BE33	N/A	91	N/A	32011KT 10SM CLR	RWY 30L
10687	VPD	9-Dec-11	C	SAT	SAN ANTONIO INTL, TX	BE20	MD80	MAINT TX	121	10 SM FEW030 BKN150 CALM	RWY 12R
10364	PD	8-Sep-11	D	SAT	SAN ANTONIO INTL, TX	BE20	F900	91	135	10 SM CLR 34012G15KT	RWY 30L
10110	VPD	4-Aug-11	C	SAT	SAN ANTONIO INTL, TX	A306	CRJ9	MAINT TX	121	10 SM FEW060 VRB03KT	RWY 12R
10069	VPD	20-Jul-11	N/A	SAT	SAN ANTONIO INTL, TX	N/A	N/A	N/A	VEH	10 SM SCT080 13014KT	UNK
10051	PD	15-Jul-11	D	SAT	SAN ANTONIO INTL, TX	E145	F900	121	91	10 SM FEW040 VRB06KT	RWY 12R

10034	PD	12-Jul-11	C	SAT	SAN ANTONIO INTL, TX	BE9L	MD80	91	121	10 SM BKN021 21011G17KT	RWY 12R
9941	VPD	10-Jun-11	N/A	SAT	SAN ANTONIO INTL, TX	A306	N/A	121	PED	10 SM OVC013 16010G16KT	RWY 12R
9770	PD	16-Apr-11	C	SAT	SAN ANTONIO INTL, TX	C500	C414	91	91	10 SM CLR 12008KT	RWY 12R
9773	PD	16-Apr-11	C	SAT	SAN ANTONIO INTL, TX	C414	C500	91	91	10 SM CLR 12008KT	RWY 12R
9688	PD	24-Mar-11	D	SAT	SAN ANTONIO INTL, TX	C172	MD80	91	121	9 SM BKN021 09005KT	RWY 12R
9691	PD	24-Mar-11	D	SAT	SAN ANTONIO INTL, TX	C172	FA50	91	91	7 SM FEW007 OVC016 07008KT	RWY 12R
9663	OD	15-Mar-11	D	SAT	SAN ANTONIO INTL, TX	C208	N/A	135	N/A	10 SM FEW045 16011KT	RWY 3
9609	OE	25-Feb-11	C	SAT	SAN ANTONIO INTL, TX	SR22	C206	91	91	10 SM CLR 13009KT	RWY 12R
9451	PD	8-Jan-11	D	SAT	SAN ANTONIO INTL, TX	T34P	N/A	MIL	N/A	10 SM BKN023 07012KT	RWY 12R
9438	PD	5-Jan-11	D	SAT	SAN ANTONIO INTL, TX	H25B	N/A	91	N/A	10 SM SCT150 31004KT	RWY 30L
9406	PD	25-Dec-10	D	SAT	SAN ANTONIO INTL, TX	PA34	LJ31	91	91	10 SM CLR 36012G22KT	RWY 30L
9390	PD	16-Dec-10	D	SAT	SAN ANTONIO INTL, TX	B737	N/A	121	N/A	10 SM FEW250 35015KT	RWY 30L
9134	PD	26-Sep-10	C	SAT	SAN ANTONIO INTL, TX	H25B	P32T	91	91	10 SM SCT035 BKN046 01010G17KT	RWY 30L
8684	PD	30-May-10	D	SAT	SAN ANTONIO INTL, TX	P28R	N/A	91	N/A	10 SM FEW050 CALM	RWY 3
8644	PD	20-May-10	D	SAT	SAN ANTONIO INTL, TX	C182	N/A	91	N/A	10 SM CLR CALM	RWY 12L
8559	PD	22-Apr-10	C	SAT	SAN ANTONIO INTL, TX	C208	A320	135	121	7 SM BKN007 OVC015 15013G20KT	RWY 3
8490	PD	8-Apr-10	C	SAT	SAN ANTONIO INTL, TX	BE58	B737	91	121	10 SM CLR 23008G15KT	RWY 30L
8477	PD	1-Apr-10	D	SAT	SAN ANTONIO INTL, TX	PAY2	B752	91	121	10 SM BKN035 BKN250 15018G26KT	RWY 12R
8442	PD	21-Mar-10	D	SAT	SAN ANTONIO INTL, TX	C560	SR22	91	91	10 SM CLR 31016G25KT	RWY 30L
8435	PD	20-Mar-10	C	SAT	SAN ANTONIO INTL, TX	LJ45	B737	91	121	10 SM FEW040 33018G30KT	RWY 30L
8348	PD	21-Feb-10	D	SAT	SAN ANTONIO INTL, TX	CRJ2	N/A	121	N/A	10 SM FEW050 29011G20KT	RWY 3
8338	PD	17-Feb-10	D	SAT	SAN ANTONIO INTL, TX	C206	N/A	91	N/A	10 SM BKN250 21007KT	RWY 12R
8273	PD	25-Jan-10	D	SAT	SAN ANTONIO INTL, TX	C550	N/A	91	N/A	10 SM FEW150 BKN250 31006KT	RWY 30L
8268	PD	24-Jan-10	D	SAT	SAN ANTONIO INTL, TX	BE9T	N/A	91	N/A	10 SM CLR 30015G23KT	RWY 30L
8203	PD	30-Dec-09	C	SAT	SAN ANTONIO INTL, TX	C210	CRJ9	91	121	10 SM CLR 21008KT	RWY 12R
8174	VPD	18-Dec-09	D	SAT	SAN ANTONIO INTL, TX	N/A	N/A	N/A	VEH	10 SM CLR 25003KT	RWY 12L
8078	PD	8-Nov-09	D	SAT	SAN ANTONIO INTL, TX	BE20	N/A	91	N/A	8 SM -RA OVC038 05004KT	RWY 3
7977	PD	1-Oct-09	D	SAT	SAN ANTONIO INTL, TX	C152	B737	91	121	10 SM BKN140 BKN250 17008KT	RWY 12R
7694	PD	13-Jul-09	D	SAT	SAN ANTONIO INTL, TX	PC12	N/A	91	N/A	10 SM CLR 23007KT	RWY 3
7464	PD	3-May-09	C	SAT	SAN ANTONIO INTL, TX	C152	DC10	91	135	10 SM FEW065 BKN250 08010KT	RWY 3
7448	PD	28-Apr-09	D	SAT	SAN ANTONIO INTL, TX	C172	N/A	91	N/A	10 SM FEW043 SCT130 BKN250 13015KT	RWY 12R
7388	PD	9-Apr-09	D	SAT	SAN ANTONIO INTL, TX	F2TH	N/A	91	N/A	10 SM OVC009 16007KT (DAWN)	RWY 30L
7364	PD	28-Mar-09	C	SAT	SAN ANTONIO INTL, TX	BE33	C550	91	91	10 SM FEW250 30015G25KT	RWY 30L
7212	PD	6-Feb-09	C	SAT	SAN ANTONIO INTL, TX	C310	B733	91	121	10 SM FEW037 BKN047 19016G24KT	RWY 12R
7159	PD	14-Jan-09	D	SAT	SAN ANTONIO INTL, TX	C172	N/A	91	N/A	10 SM CLR	RWY 03
7152	PD	13-Jan-09	D	SAT	SAN ANTONIO INTL, TX	MD80	N/A	125	N/A	10 SM CLR 36015G22KT	RWY 30L
7045	PD	29-Nov-08	D	SAT	SAN ANTONIO INTL, TX	C172	N/A	91	N/A	10 SM FEW070 BKN110 BKN250 34011G18KT	RWY 30R
6972	OD	9-Nov-08	D	SAT	SAN ANTONIO INTL, TX	AT43	N/A	121	N/A	10 SM BKN070 BKN130 16014KT	RWY 3
6750	PD	5-Sep-08	D	SAT	SAN ANTONIO INTL, TX	C152	WW24	91	91	N/A	RWY 12R
6751	PD	5-Sep-08	D	SAT	SAN ANTONIO INTL, TX	C152	B737	91	121	N/A	RWY 30L
6735	PD	1-Sep-08	D	SAT	SAN ANTONIO INTL, TX	PC12	C414	91	91	N/A	RWY 30L
6650	PD	11-Aug-08	D	SAT	SAN ANTONIO INTL, TX	BE9L	N/A	91	N/A	N/A	RWY 3
6416	OE	13-Jun-08	C	SAT	SAN ANTONIO INTL, TX	C501	CRJ7	91	121	N/A	RWY 12R
5972	PD	15-Jan-08	C	SAT	SAN ANTONIO INTL, TX	C152	E145	91	121	N/A	RWY 3
5873	PD	7-Dec-07	D	SAT	SAN ANTONIO INTL, TX	C25B	C172	91	91	N/A	RWY 12L
5627	PD	21-Sep-07	N/A	SAT	SAN ANTONIO INTL, TX	C152	N/A	91	N/A	N/A	RWY 12R
5532	PD	19-Aug-07	N/A	SAT	SAN ANTONIO INTL, TX	LJ25	N/A	91	N/A	N/A	RWY 3
4829	PD	5-Jan-07	D	SAT	SAN ANTONIO INTL, TX	E145	B737	129	121	N/A	RWY 12R
4750	PD	27-Nov-06	N/A	SAT	SAN ANTONIO INTL, TX	MD80	B737	129	121	N/A	RWY 12R
4724	PD	16-Nov-06	C	SAT	SAN ANTONIO INTL, TX	C650	BE40	91	135	N/A	RWY 30L
4633	PD	19-Oct-06	D	SAT	SAN ANTONIO INTL, TX	C208	B737	135	121	N/A	RWY 30L
4193	PD	20-May-06	N/A	SAT	SAN ANTONIO INTL, TX	H60 (HELO)	N/A	MIL	N/A	N/A	RWY 12L/R
3918	PD	4-Feb-06	N/A	SAT	SAN ANTONIO INTL, TX	A320	N/A	129	N/A	N/A	RWY 30L
3883	PD	18-Jan-06	D	SAT	SAN ANTONIO INTL, TX	AC95	LJ31	91	91	N/A	RWY 21
3131	OE	30-Mar-05	D	SAT	SAN ANTONIO INTL, TX	C560	C340	91	91	N/A	RWY 12R
2805	PD	3-Nov-04	N/A	SAT	SAN ANTONIO INTL, TX	PA38	N/A	91	N/A	N/A	RWY 30R/L
2738	PD	5-Oct-04	N/A	SAT	SAN ANTONIO INTL, TX	CRJ2	N/A	121	N/A	N/A	RWY 12R/L
2224	PD	7-Mar-04	N/A	SAT	SAN ANTONIO INTL, TX	PA46	B737	91	121	N/A	RWY 30L
2161	PD	5-Feb-04	D	SAT	SAN ANTONIO INTL, TX	MD80	DV20	121	91	N/A	RWY 30L
1791	OE	19-Aug-03	D	SAT	SAN ANTONIO INTL, TX	MD80	B737	121	121	10 SM 012 OVC	RWY 12R/3
1606	PD	8-Jun-03	C	SAT	SAN ANTONIO INTL, TX	B735	DC85	121	135	N/A	RWY 12R
1477	PD	16-Apr-03	N/A	SAT	SAN ANTONIO INTL, TX	WW24	DC9	91	129	N/A	RWY 30L
1309	PD	3-Feb-03	D	SAT	SAN ANTONIO INTL, TX	MD80	C182	121	91	N/A	RWY 30L
1297	PD	29-Jan-03	C	SAT	SAN ANTONIO INTL, TX	FA50	MD80	91	121	N/A	RWY 30L
1100	VPD	4-Nov-02	N/A	SAT	SAN ANTONIO INTL, TX	N/A	N/A	N/A	VEH	6 SM -RA	RWY 3
999	OD	20-Sep-02	N/A	SAT	SAN ANTONIO INTL, TX	C152	N/A	91	N/A	VFR	RWY 30R/L
926	PD	31-Aug-02	N/A	SAT	SAN ANTONIO INTL, TX	C172	N/A	91	N/A	N/A	RWY 21
886	OD	20-Aug-02	N/A	SAT	SAN ANTONIO INTL, TX	MD11	N/A	135	N/A	N/A	RWY 3
714	PD	14-Jun-02	N/A	SAT	SAN ANTONIO INTL, TX	BE58	N/A	91	N/A	N/A	RWY 12L
685	PD	7-Jun-02	D	SAT	SAN ANTONIO INTL, TX	C172	AC11	91	91	N/A	RWY 12R
465	PD	1-Apr-02	N/A	SAT	SAN ANTONIO INTL, TX	PA46	N/A	91	N/A	N/A	TWY G
364	PD	21-Feb-02	N/A	SAT	SAN ANTONIO INTL, TX	C172	N/A	91	N/A	N/A	RWY 30R
74	OE	24-Oct-01	C	SAT	SAN ANTONIO INTL, TX	AEST	C421	91	91	10 SM CLR	RWY 30L
78	PD	24-Oct-01	N/A	SAT	SAN ANTONIO INTL, TX	C150	N/A	91	N/A	N/A	RWY 30R/L

Appendix C Decouple SRA Report

City of San Antonio – Aviation Department
San Antonio Aviation Systems (SAAS)

FAA Part 139 – SMS Implementation Safety Risk Assessment
Safety Risk Assessment #2 -
Runway Intersection of 30L and Runway 3-21

Prepared by:

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February 14, 2011 22, 2010

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1.0 Introduction

1.1 As part of the Federal Aviation Administration's (FAA) Safety Management System (SMS) Implementation Study (Study) project scope of work, a requirement is to conduct at least three Safety Risk Assessments (SRAs) and to provide the FAA with documentation of the processes/procedures and findings from the assessment. The San Antonio Airport System (SAAS) has scheduled a total of five SRAs to be conducted and documented as part of the Study. The topic of the second SRA was an analysis of the Runway 12R-30L and Runway 3-21 intersection at the San Antonio International Airport (SAT). The threshold of Runway 30L is located on Runway 3-21. This configuration has been a contributing factor to several runway incursions over the years and has been identified by the FAA Runway Safety Team (RSAT) as a hotspot and an area in need of changes. This intersection was also identified by the SAAS recent Master Planning efforts as an area in need of change. A project to de-couple the runways is part of the Master Plan CIP.

1.2 This intent of this SRA was to quantify the RSAT and Master Plan findings and determine if the risks associated with this hazardous condition warrant a change in the Master Plan CIP or if other short term options might be possible.

2.0 SRA Contents

2.1 The concept of this process is that of the continuous SMS Cycle (Reference Figure 1). This SMS cycle uses basic safety concepts as the foundation upon which to the SMS at SAAS is being developed. This document provides information regarding the SRA topic background, preparation, facilitation, results, and mitigations that were determined to be appropriate by the Subject Matter Experts (SME) who participated on the SRA panel. The SRA contents include the five basic phases of the SRA process. The SAAS SMS appropriately adds a sixth phase (Monitor Solutions); where the mitigations put in place are actively assigned and monitored for their implementation and effectiveness. Following are the SRA phases as per the SAAS safety manual:

2.1.1 Phase 1. Describe the system

2.1.2 Phase 2. Identify the hazards

2.1.3 Phase 3. Analyze the risk

2.1.4 Phase 4. Assess the risk

2.1.5 Phase 5. Take Action (mitigate or treat the risk)

2.1.6 Phase 6. Monitor Solutions (track)

3.0 Background

3.1 The SAAS has established a SRA process that includes the use of specific documents, processes, and procedures. The SRA documents and process are included in the SAAS SMS Program Manual (SMSPM). The SAAS documents are included later in this report. The SAAS risk forms are located in **Appendix A**.

3.2 Additionally, SAAS has developed a SRA Risk Matrix and associated definitions for likelihood and severity which are presented in section 5.3 of this report. The matrix and associated definitions were used in the determination of risk ranking for all hazards identified as part of the SRA.

3.3 SRA #2 was conducted on January 25 and 26, 2011. The first SRA at SAT was conducted in one day. Some of the feedback received from the panel participants was that a two day session, broken out into two four hour periods would be preferred. SRA #2 was conducted in that format; and was completed in a total of approximately seven hours over the two days.

4.0 Stakeholders

4.1 The Table below provides a list of SRA Attendees/Panelists. In addition to the Consultant and SAAS Safety Team, representatives included members from the Planning and Development (P & D) office, Aircraft Rescue and Fire Fighting (ARFF) team, and Operations. Participants also included representation from the airline industry and the FAA. Based on the proposed topic, the attendees' knowledge and experience assisted in reviewing possible hazards, associated risks, and recommended mitigation strategies.

Table 1 - Attendees/Panelists for SRA #2

Attendee	Representing	Position or Role
Joanne Landry	Landry Consultants	Project Manager
Dave Fleet	Dave Fleet Consulting	SRA Facilitator
Amanda O'Krongley	Kimley-Horn and Associates	SMS and Planning Consultant
Adam Novak	Kimley-Horn and Associates	SMS and Planning Consultant
Tim O'Krongley	SAAS	Assistant Aviation Director – Planning and Development / Accountable Executive
Loyce Clark	SAAS	Assistant Director – Planning and Development and Construction
John Chase	SAAS	SMS Manager
Ray Parrish	SAAS	Safety Specialist
Ryan Rocha	SAAS	Airport Operations Manager
Nathan Polsgroee	SAAS	Airport Operations
Marcus Machemehl	SAAS	Wildlife Manager
Curt Klaerner	SAAS	Safety Auditor
Kao Lin-Chin	SAAS	Senior Engineer
Melvin Keilers	SAAS	Fire Chief
Steve Drew	ALPA	Pilot – Delta Airlines
Bill Mannecke	ALPA	Pilot – FedEx
John Reagan	FAA	Runway Safety Program

5.0 Safety Risk Assessment

5.1 Describe the System

5.1.1 ***Runway Descriptions*** – SAT has three runways; two of which intersect: Runway 12R-30L (8,502' x 150') Runway 12R has a CAT II instrument landing system and Runway 30L has a CAT I instrument landing system, Runway 3-21 (7,505' x 150') Runway 3 has a CAT I landing system and Runway 21 has a GPS approach only. Both runways are designated aircraft Group D-IV, as are the associated parallel taxiways G and N. The identified critical aircraft is the MD-10. Information gathered prior to the SRA and distributed during the introduction included aircraft performance data pertinent to SAT. Specifically, landing runway length requirements for the MD-10 are 8,000' in dry conditions and 9,300' in wet surface conditions. *Note: The information was provided by the SAAS SMS Department and was gleaned from manufacture data available to the industry.*

5.1.2 ***Runway Intersection*** – The threshold of Runway end 30L is located on Runway 3-21 approximately one third of the way down the Runway 3. Both runways serve commercial aircraft. **Figure 1** presents the intersection of the two runways.

5.1.3 ***Runway Markings and Signage*** – Standard marking are in place for both runways, given their category, length and utilization. With the intersection of the two air carrier runways, two sets of hold bars are located on Runway 3-21, depicting the safety area for Runway 12R-30L. The threshold markings for Runway 30L are located on Runway 3-21; Runway 12R-30L is the primary runway. Mandatory hold position signs are located abeam the hold bars.

5.1.4 ***Current System Performance*** – SAAS has recognized the safety concerns with the intersection of these runways. The majority of the safety incidents have occurred when the Airport is in a "Runway 30L flow". There have been 17 documented runway incursions at this intersection between October 2008 and January 2011. *Note: from SAAS records provided prior to the SRA.* This airfield configuration prohibits the use of Runway 3-21 of takeoffs or landing, and therefore Runway 3-21 is used for taxiing aircraft purposes only. One of the contributing factors for these incursions is this configuration which puts aircraft on a runway (much wider than a typical taxiway) with runway position hold signage approximately 270' apart, and holding position markings that are typically obscured by rubber. This configuration does not provide the typical visual queues of a taxiway runway intersection. Data also indicates that out of the 17 documented incursions, 14 involved General Aviation (GA) aircraft. The lack of visual queues and the inexperience of the GA pilots have been identified as key contributing factors.

Figure 1 – Runway Intersection

5.1.5 ***Aircraft Operations*** – Runway 12R-30L serves as the primary runway for commercial aircraft operations. Takeoff operations are split nearly equally between Runways 12R and Runway 3; more landing operations occur on Runway 12R than any other runway end. When operating in a Runway 30L flow configuration all air carrier departures use Runway 3 (or Runway 21 for some cargo operations) to taxi to the departure end of Runway 30L. The Air Traffic Control Tower (ATCT) directs aircraft using Runway 3 as a taxiway to hold short of Runway 30L. Most general aviation (GA) aircraft, including corporate jet operators, may take an "intersection departure" at Taxiway N. All air carrier traffic takes full length Runway 30L departures; forcing them to use Runway 3 for taxi or back taxi on Runway 30L.

5.2 Identify the Hazards

5.2.1 During the SRA, one hazard was identified. The physical configuration of the runway intersection. See the Hazard Summary Table in **Appendix B**. Completed risk forms and hazard outcomes from the SAAS SMSPM are included in **Appendix C.**

5.3 Analyze the Risk

5.3.1 The "most credible outcome" of this hazard is an incursion by an aircraft. Discussion on the "most credible outcome" was related to the number of incursions and that the portion of the runway being assessed (i.e. approximately the first 1,000 feet) presented a lower risk than if the intersection was aligned with the exact touchdown point of Runway 30L. See previous information in Section 5.1.4 of this report. The Panel also discussed potential changes to the airfield configuration or aircraft operational patterns that could potentially enhance safety. Those measures are contained in Section 5.5 of this report.

5.4 Assess the Risk

5.4.1 The risks assessment for the hazard is presented below and included in the Hazard Summary Table located in Appendix B.

5.4.2 SAAS has developed a SRM program that includes a Safety Risk Matrix and definitions of likelihood and severity. These documents were discussed and reviewed with the Panel to use as part of the risk assessment process. **Figure 3** presents the Risk Matrix and Likelihood Definitions.

Figure 3 - SAAS Risk Matrix and Likelihood Definitions

Risk Assessment Matrix										
Likelihood		Consequence				Severity				
		People	Assets	Environment	Reputation	0 Negligible	1 Minor	2 Moderate	3 Major	4 Catastrophic
4	Has happen more than five times at airport	Fatalities	Catastrophic Damage	Catastrophic Effects	Catastrophic Impact	H21	H22	H23	H24	H25
3	Has happen more than once at airport or more than once in industry	Major Injury or *PTD	Major Damage	Major Effects	Major Impact	M15	M16	M17	H19	H20
2	Has happen once at airport or once in industry	Moderate Injury or Health Effects	Moderate Damage	Moderate Effects	Moderate Impact	L9	L10	M13	M14	H18
1	Heard of in Industry	Minor Injury or Health Effects	Minor Damage	Minor Effects	Minor Impact	L5	L6	L7	L8	M12
0	Never Heard of in Industry	No Injry or Health Effects	No Damage	No Effects	No Impact	L1	L2	L3	L4	M11
Green = Continuous Improvement - Low Risk				Yellow = Control to ALARP - Medium Risk			Red = Tolerability to be endorsed by management - High Risk			
*PTD = Permanent Total Disability										

Figure 4 presents the Severity Definitions.

Figure 4 - Severity Definitions Chart Clarification

	Consequence	People	Assets	Environment	Reputation
Severity	**0 = Negligible**	• No Injuries	• No damage • Minor Technical delay	• No Impact	• No loss of public confidence
	1 = Minor	• First Aid Injury or • No disability or lost time	• Technical delay or • Ground Equipments inoperable or • ACFT Grounded causing Operator to incur relatively minimal costs	• Release - Contained	• May be lowered, but public finds situation acceptable
	2 = Moderate	• Lost Time Injury or • Passenger Injured (Broken Bones) • No Disability	• Technical delay or • Ground Equipments inoperable or • Ground Equipment damaged ACFT or • ACFT Grounded causing Operator to incur substantial costs	• Small (< 50 Gallons) release - Uncontained	• Significantly lowered w/high profile media coverage
	3 = Major	• Disability or • Severe Injuries	• Major Technical delay or • Ground Equipments inoperable or • Ground Equipment caused major damage to ACFT causing delays to return ACFT to service or • ACFT Grounded causing Operator to incur substantial costs	• Moderate (> 50 Gallons but < 100 Gallons) release - Uncontained	• Shaken to the point where significant numbers of the public will not fly on a particular aircraft or airline
	4 = Catastrophic	• Fatal Injuries to personnel or passenger • Public exposed to life threatening hazard	• Lost of ACFT • Lost of Equipment	• Large (> 100 Gallons) release - Uncontained	• Shaken to the point where significant numbers of the public not use SAT Airport

5.4.3 Hazard 1 - Runway Configuration

5.4.3.1 Environmental consequences were bounded out.

5.4.3.2 Reputation consequences were deemed moderate to Major.

5.4.3.3 Asset consequences were identified as Major given that the Runway 30L touchdown area is approximately the first 1,500’ of the runway.

5.4.3.4 Consequences to people were determined to be Major.

5.4.3.5 The panel determined the overall severity of Hazard 1 as *Major.* The panel discussed at length the definitions of severity as contained in the SAAS SMSPM. At several points during the analysis the FAA Air Traffic Organization’s (ATO) definitions were referred to. Ultimately, ATO definitions were used.

*Note: following this SRA a change was made to the SAAS risk matrix. See the updated risk matrix in **Appendix D** of this report.*

5.4.3.6 The hazard likelihood was identified as *Frequent, Likely to occur numerous times.*

5.4.3.7 This results in an initial risk of a *High* hazard with maximum amount of points at H24 on the risk matrix.

5.5 Take Action (mitigate or treat the risks)

5.5.1 The following actions were identified as potential mitigation (action) efforts for the identified hazard:

5.5.1.1 Raise Awareness

5.5.1.1.1 Ensure Jeppesen, NOAA, and other charts are updated with the current RSAT Hot Spots. (the runway intersection is Hot Spot number 1).

5.5.1.1.2 FBO, flight school education and outreach – currently ongoing.

5.5.1.1.3 Hot Spot maps to Customs for handout to foreign pilots.

5.5.1.1.4 Add informational sign to the area of Taxiways G and N advising of Hot Spot location. See Airport Diagram in **Appendix E**.

5.5.1.2 FAA ATC Operational Change

5.5.1.2.1 Model ATC operational change using Taxiway N for GA aircraft operations and Runway 3 entry to Runway 30L for commercial operations only. The ATCT staff anticipates completing this modeling within 120 days, and will report the findings to the SAAS staff. The anticipated benefit is an increase in the safety of the aircraft operations by preventing GA aircraft from using Runway 3 as an entry point to Runway 30L. GA aircraft have the majority of runway incursions at this intersection.

5.5.1.3 Change Runway Configuration

5.5.1.3.1 The SAAS has recently completed a Master Plan for SAT. Various airfield projects have been included in the final airport development plan, to include the decoupling of Runway 30L and Runway 3-21. The project is identified in the implementation schedule of the Master Plan to be completed in the 20+ year timeframe. The Panel discussed the importance of this airfield improvement and the potential within the Airport's CIP to complete the project sooner than identified in the Master Plan, given the findings of this SRA. A commitment was made to determine if the project can be pulled forward in the planning period; given the findings of this SRA a commitment was also made to ensure this de-coupling project would be pulled as far forward as reasonably possible. Other potential options previously identified by the Safety Division included:

5.5.1.3.1.1 Shorten Runway End 30L by 150 feet

5.5.1.3.1.2 Shorten Runway End 30L by 330 feet; additional markings with the 330-foot reduction

5.5.1.3.1.3 Shorten Runway End 30L by 450 feet; additional markings with the 450-foot reduction

All previous shortening options would necessitate extension of the Runway 12R end by same amount. Discussion among the panelists and Airport staff confirmed the necessity to maintain a length for Runway 12R-30L at its current length of 8,500'. This is in line with the design aircraft needs.

5.6 Residual Risk

5.6.1 The SRA Panel reviewed the proposed actions and considered the expected residual risk associated with each hazard. The re-assessment of the risk levels are described below.

5.6.1.1 Runway Configuration

5.6.1.1.1 By implementing the runway decoupling action in Section 5.5.1.6, the residual risk resulted in *Low*. This was determined by the following: By physically removing concrete and decoupling the runway intersection, aircraft would enter Runway 30L at Taxiway N. The intersection of Runway 30L and Taxiway N is less likely to create confusion than the present condition today. This new runway end intersection of Taxiway N and Runway 30L would have no more risk associated with it than any other typical runway end in the National Airspace System (NAS). The resultant residual risk severity was reduced to *Negligible* for people, facilities, and reputation.

5.6.1.2 Raise Awareness

5.6.1.2.1 Signage (i.e. "Use Caution / Verify Hold Positions") could be installed immediately to assist in reducing the risk prior to a complete de-coupling project.

5.6.1.2.2 Informational brochures could be placed in the US Customs offices to assist in alerting international pilots of the hazardous configuration on the airfield thus aiding in the human factors and awareness prior to a complete de-coupling project.

5.6.1.2.2.1 The Severity would remain *Major* and the Likelihood would *Frequent*. Using the risk matrix, this assessment still results in a *High* risk, based on the proposed mitigation and staff knowledge. Although the Panel believes these mitigations will help the situation without physically separating the pavement or the aircraft, the opportunity for incursions remains high.

5.6.1.3 FAA ATCT Operational Change

5.6.1.3.1 It is recommended that Airport Operations continue to track incursions, and follow up with ATCT regarding the modeling of shifting GA aircraft to Taxiway N, reducing the frequency of use of Runway 3 as a taxiway. If this operational change can be put in place the Panel felt as though the residual risk would be reduces. Severity would remain *Major* but the Likelihood of incursions would be reduced to once per year (consistent with the number of commercial aircraft incursions at this intersection). This still places it in the *Frequent* category resulting in a *High* risk.

Note: This particular issue is why a decision was made to reevaluate the existing risk matrix and make changes. Reducing the likelihood of incursions from 17 to an anticipated number of 3 over a three year period intuitively improves the margin of safety.

5.7 Monitor the Solutions

5.7.1.1 To ensure the proposed actions effectively reduce the risks for the hazard identified, monitoring of the efforts will include:

5.7.1.1.1 Airport Operations will confirm charts are updated within 60 days.

5.7.1.1.2 ATC – will model separation of GA and commercial traffic within 120 days

5.7.1.1.3 Education of tenants and pilots will continue, especially with regard to foreign pilots is on going and will continue.

5.7.1.1.4 Hot Spot Maps – Airport Operations will have a meeting with US Customs to determine if maps can be made readily available to foreign pilots. This will occur as soon as possible.

5.7.1.1.5 Information Signage – Airport Operations will meet within one month to discuss the viability of installing taxiway informational signs in the vicinity to heighten awareness of the airfield geometry and holding positions.

5.8 Safety Risk Assessment Document Approval

Prepared by _ Joanne M Landry, Landry Consultants
Project Manager

Approved by ______________________________
JOHN C CHASE, SMS Manager

Date Approved ______________________________

Appendix B - Hazard Summary Table

Hazard Summary Table

<table>
<tr><th>Hazards</th><th>Risks</th><th>Risk Assessment</th><th>Mitigation</th><th>Residual Risk</th></tr>
<tr><td rowspan="2">1. Physical configuration of the runway system</td><td rowspan="2">Runway Incursions</td><td rowspan="2">Severity: Major (Reputation damage, major delays, damage to aircraft, severe injuries)

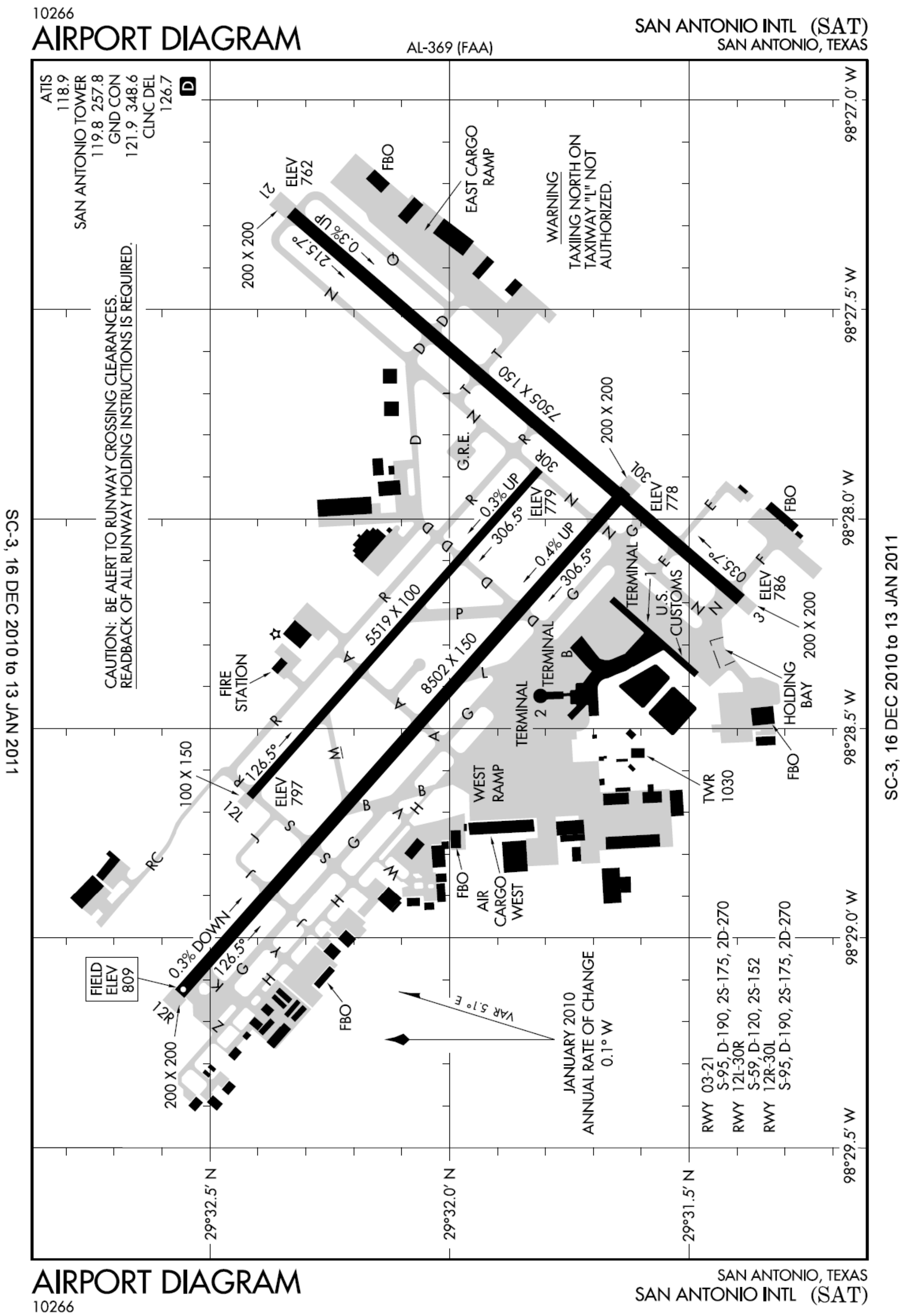
Likelihood: Frequent (Has happened more than five times at airport within a 12 month period.)

High Hazard
See Figure 3</td><td>▪ Ensure Jeppesen, NOAA, and other charts are updated with Hot Spots.
▪ Model ATC operational change (T/W N=GA, R/W 3=commercial).
▪ FBO, flight school education and outreach, ongoing.
▪ Hot Spot maps to Customs for handout to foreign pilots.
▪ Add informational sign to the area of T/W G and N advising of Hot Spot</td><td>Severity: Major
Likelihood: Frequently

HIGH
See Note in Section 5.6.1.3</td></tr>
<tr><td>▪ Decouple runways per Master Plan project (move up in CIP with SRA)</td><td>Severity: Negligible
Likelihood: Negligible (issue goes completely away with a permanent solution in place.

LOW</td></tr>
</table>

Appendix E – Airport Diagram



Decoupling of Runway 12R-30L & 3-21 (4-22) at San Antonio International Airport

Safety Risk Assessment Update

(Reference: FAA Task)

San Antonio International Airport (SAT)

SRMD 2011-02-0 (SRA # 3 – FAA Pilot Study)

25 Feb 2012

This complete SAT ATC Tower Task

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Executive Summary

San Antonio International Airport has two runways 3/21 (Now 4/22) and 12R/30L which intersect. Over the years the airport has experienced numerous safety related Surface Incidents (SI) at this intersection. The Regional Runway Safety Assessment Team, made a recommendation to the City of San Antonio (COSA) Aviation Department, to decouple these two runways as a means to reduce/eliminate the Surface Incidents at this location. Since the Airport was in the process of implementing an SMS program and participated in the third FAA Pilot Study for Airports it was decided that SAT would conduct a Safety Risk Assessment (SRA) as one of the three SRA required by the third pilot study. One of the task from the SRA was that SAT ATC-Tower would conduct a simulation in their simulator with a specific task of "Model ATC operational change to shift all GA to T/W N" after several weeks have gone by then SAT ATC-Tower came back with a verbal stating "this will not work – need more data." SAT ATC-Tower made the recommendation to use the Airport Facilities Terminal Integration Laboratory (AFTIL) within the William J. Hughes Technical Center near Atlantic City New Jersey.

The Modeling was accomplished in May 2012 at AFTIL to thoroughly evaluate the operations of the airport's movement surface areas. COSA had a number of recommendations which they considered would minimize future SI's. The results of the composite of recommendations and improvements proposed by the various participating organizations were evaluated using the full simulation capabilities of the AFTIL. These recommendations were minimally modified and augmented resulting in a series of change proposals which were determined to not introduce hazards (and consequential risk) but would in effect eliminate a number of existing hazards and minimize the existing risk level of the SAT airport's surface operations within the movement areas.

The SME which participated in the modeling concluded there would be no new risks introduced as a result of the proposed changes, developed, enhanced, and evaluated at the AFTIL. Table EX-1: Initial and Residual Risk provides a tabulation of the risk levels.

Table EX-1: Initial and Residual Risk

Seq #	Hazard	Initial Risk	Residual Risk
1	High Risk (Red)	0	0
2	Medium Risk (Yellow)	0	0
3	Low Risk (Green)	0	0
4	**Total**	0	0

The SAAS SRMP concluded the final proposed changes as a result of the modeling should be implemented as soon as possible. Any construction activities to be conducted to implement these changes would be evaluated separately with the appropriate Construction Phasing Plan. Specific changes to the ATCT operations if so required would be evaluated prior to implementation and within a separate Safety Risk Assessment. This action will updated in the SAAS SRMD 2011-02-02, dated 25 Feb 2011, and will be used as to comply with the FAA requirements that an SRA/SRM will be completed as part of construction projects.

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Figures

Signature Page

Title: Decoupling of Runway 12R-30L & 3-21 (4-22) at San Antonio International Airport

Originator: SAT SMS Manager
Originator's Organization: SAT Operations
Originator's Phone Number: (210) 207-1656
Submission Date: 25 Jan 2011
Completion Date of FAA Modeling: June 15, 2012

Document Reviewed by:

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Risk Acceptance Signature(s)

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Tim O'Krongley Assistant Director – Airport Operations	Date

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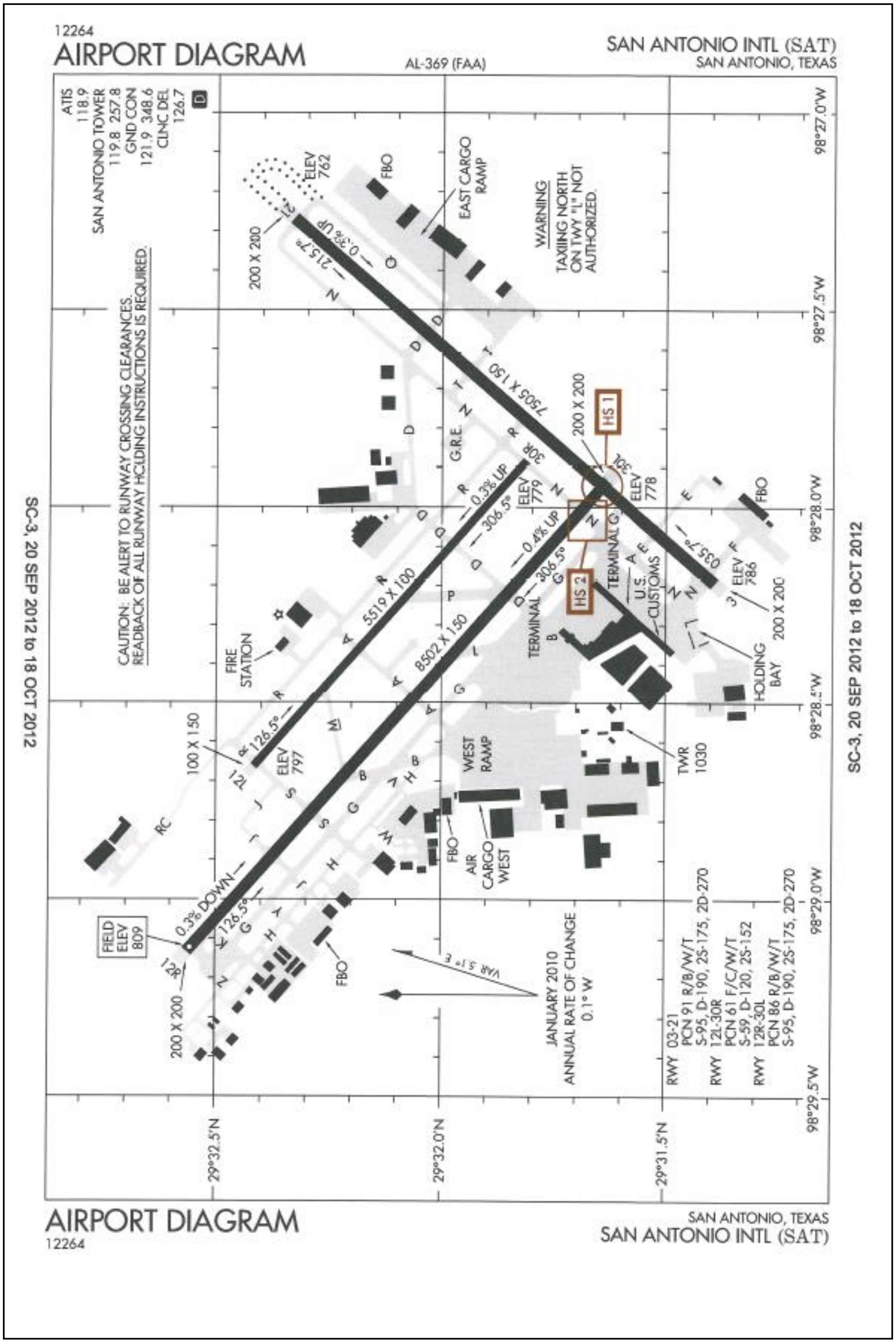
Introduction

Section 1 – Baseline

San Antonio International Airport has two runways 3/21 (4/22) and 12R/30L which intersect. Over the years the airport has experienced numerous safety related Surface Incidents (SI) at this intersection; specifically Runway Incursions (RI) at the intersection. The airport, local air traffic control and regional air traffic control, the runway safety office, and others have been evaluating the situation for many years making various improvements and adjustments to mitigate the situation. Although much credit can be attributed to the Regional Safety Action Team (RSAT) regarding progress through education, better markings and signage, and more diligence by Air Traffic Control to improve upon the situation, there remains continuing incursion incidents.

Figure 1-1: SAT Airport Layout provides a depiction of the airport.

Figure 1-1: SAT Airport Layout



Section 2 – Proposed Changes

The City of San Antonio (COSA) Aviation Department and the San Antonio Airport Traffic Control Tower (SAT – ATCT) perceive the decoupling of the runways 3/21 (4/22) and 12R/30L would eliminate Surface Incidents (SI) at the intersection of RWY 30L and RWY 3/21 (4/22).

While the decoupling will mitigate most if not all of the SI's at the intersection RWY 30L and RWY 03/21 (4/22) it may also introduce issues which need to be addressed:

1. Need for additional intersection and taxiway modifications and
2. the relocation of the landing threshold and Instrument Landing System (ILS) Glide Slope. Possible adjustment of runway approach lights is also anticipated.
3. Air Traffic has indicated it will have to alter their ground movement pattern procedures to accommodate these changes.

The following provides a general overview of the changes and conditions:

- Airport operation is predominantly RWY "12" Flow – approximately 60% of the time; RWY "30" flow is approximately 30% of time; with RWY "3" ("4") flow estimated to be about 10%.
- Operations using RWY 3 (4); there are times it must be used due to prevailing wind changes. These periods do not last long, nearly less than 48 hours and are extremely infrequent – The estimate is placed at approximately 10% with a straight RWY 3 (4) flow. During the RWY 12 flow, RWY 3 (4) is used for departures
- The mix of General Aviation (GA) and Commercial aircraft is nearly equal (55% Commercial, 40% GA, with 5% military). The GA percentage includes a mix of many small and business aircraft including Boeing Business Jets.

  NOTE: The 10/30/2011 Airport Data Form 5010 has: Air Carrier 95,286 operations=52%, Air Taxi 20,720 operations=11.5%, General Aviation 58,965 operations=32.7%, and Military 4,884 operations =2.7%.
- Current configuration has use of TWY N, TWY G, and RWY 3 as the principal means to move aircraft to the approach end of RWY 30L in RWY 30 flow.
- Decoupling eliminates the use of RWY 3 (4) as a principal means for taxi and thus the need for an alternate parallel means to shunt (deliver) traffic perpendicular to RWY 30R and 30L is necessary to minimize congestion at the intersections of RWY 30R an 30L. Taxiway N and TWY G would become a bottle neck during moderate and above traffic causing a backup without this parallel capability.
- The COSA has proposed inclusion of a new TWY I between TWY R; this would intersect through 30L and 30R to TWY G.
- Additionally, a new TWY U would be added mid-section of TWY I and RWY12 east to RWY 3/21 (4/22). This taxiway intercepts existing TWY N.
- TWY I and TWY U would need to be completed prior to decoupling RWY 12/30L and RWY 3/21 (4/22)
- RWY 12R and 30L would be extended at the 12R end by 450ft.
- Relocation of the landing threshold at 30L end, the Medium Intensity Approach Lighting System with Runway Alignment indicator Lights (MALSR), and ILS (Glide Slope) would be required.
- A check by NASWATCH will be needed to ensure the ILS Localizer would not be affected; this will be accomplished through an assessment by the Technical Operations function.
- No impacts are anticipated with air/ground (A/G) communications.

- Decoupling will consist of some actual pavement removal.
- No anticipated changes to Air Traffic Approach and Departure Procedures were indicated. However, during construction transition Air Traffic will most likely have to modify their approach and departure procedures. The TRACON will have to meter the flow and make appropriate adjustments to the STARS and SIDs.

Section 3 – Safety Risk Management Planning and Impacted Organizations

A preliminary assessment and planning meeting was held in San Antonio the week of February 2, 2012 to discuss possible options. This meeting was composed of personnel from COSA; AECOM; SAT ATCT; Central Service Planning and Requirements, Operational Support and Quality Control Groups, AFTIL, and the National Air Traffic Controllers Association (NATCA); participants for this meeting can be found in Table 3-2: SAT Preliminary Safety Evaluation Team Meeting. A determination was made to conduct a simulation per the FAA task of the Safety Risk Assessment; using the William J. Hughes technical Center, Airport Facilities Terminal Integration Laboratory (AFTIL) in New Jersey. SME's was assembled to run this simulation (Reference Table 3-3). Additionally since this facility was available for SAT simulation it was decided for this group to conduct additional evaluation of some add scenarios which would help SAT to adjust their Airport Master Plan.

The SMEs are representatives from the FAA, Technical Operations (Tech Ops) personnel and the Air Traffic Organization (ATO), AECOM and COSA. This group was tasked to evaluate the simulation of the ground operations within SAT, to identify any potential hazards; analyze and assess the associated risks; and make recommendation to the SAAS SRA Panel.

Table 3-2: SAT Preliminary Safety Evaluation Team Meeting

Facility or Company	Name	Phone	E-mail	Area of Specialty
FAA - PRG	Kirk Jorgensen	817-222-4078	kirk.jorgensen@faa.gov	Planning & Requirements
FAA - OSG	Winston Dixon	817-321-7728	winston.dixon@faa.gov	Operations Support
FAA - SAT	Bridget Gee	210-805-5500	bridgetgee@gmail.com	CPC - NATCA
FAA - SAT	Sally Luke	210-805-5500	saluke1@yahoo.com	CPC – NATCA
FAA - SAT	Earl Jackson	210-805-5508	earl.jackson@faa.gov	Operations Manager
FAA – TX ADO	Guillermo Villalobos	817-222-5657	guillermo.villalobos@faa.gov	Airports District Office
FAA – SAT	Henry Beck	210-805-5507	henry.back@faa.gov	SAT Air Traffic Manager
FAA - PRG	Steve Juricek	817-222-4894	steven.f.juricek@faa.gov	Lead Planner
SAT ATCT	Lynn Haney	210-805-5530	lynn.haney@faa.gov	Support Specialist, Plans & Procedures
FAA – FSDO	Gary Stamper	210-308-3300	gary.e.stamper@faa.gov	FAAST Program Manager
FAA – OSG	Gail Kasson	817-321-7721	gail.kasson@faa.gov	Operations Support Team Manager
AFTIL	John Pallante	609-485-4852	john.ctr.pallante@faa.gov	Sr Air Traffic Control Specialist
FAA – AJT	Larry Perkins	817-222-5613	larry.poerkins@faa.gov	Terminal Planning
SAT- OPS	Tim O'Krongley	210-207-3567	tim.okrongley@sanantonio.gov	Assist Director – Airport OPS
SAT- OPS	Ryan Rocha	210-805-3477	ryan.rocha@sanantonio.gov	Manager, Airport Operations
SAT – SMS	John C. Chase	210-207-1656	john.chase@sanantonio.gov	Manager, SMS
FAA QCG	Charles J. Longenecker	817-222-4795	charles.longenecker@faa.gov	SRMP Facilitator

Table 3-3: SME Members

Facility or Company	Name	Phone	E-mail	Area of Specialty
AFTIL	Tony James	609-485-5623	john.ctr.pallante@faa.gov	Sr Air Traffic Control Specialist
COSA Asst Director	Loyce Clark	210-207-3839	loyce.clark@sanantonio.gov	Asst. Airport Director
FAA - QCG	Dennis Hinton	817-222-4566	dennis.hinton@faa.gov	SRM Facilitator
FAA - SAT	Bridget Gee	210-805-5500	bridgetgee@gmail.com	CPC - NATCA
COSA – P&D	Susan St. Cyr	210-207-3559	susan.stcyr@sanantonio.gov	Airport Aviation Engineer
FAA - SAT	Earl Jackson	210-805-5508	earl.jackson@faa.gov	Operations Manager
FAA – TX ADO	Guillermo Villalobos	817-222-5657	guillermo.villalobos@faa.gov	Airports District Office
AECOM	Geoffrey Gindharet	215-399-4349	geoffrey.gindhart@aecom.com	Engineer
AECOM	Elliot Lindgren	215-399-4339	Elliot.lindgren@aecom.com	Engineer
AFTIL	John Pallante	609-485-4852	john.ctr.pallante@faa.gov	Sr Air Traffic Control Specialist
COSA – OPS	Ryan Rocha	210-805-3477	Ryan.rocha@sanantonio.gov	Airport Operations
FAA QCG	Charles J. Longenecker	817-222-4795	charles.longenecker@faa.gov	SRM Facilitator

Section 4 – Assumptions

The following assumptions have been made regarding the changes at SAT:

- Construction will be accomplished in accordance with the airport and contractor construction phasing plans
- NOTAMS and ATIS were updated as necessary
- Construction vehicles and personnel were kept out of active movement surfaces

Section 5 – Phase 1: System Description per Safety Risk Assessment 2011-02-O

<u>DESCRIBING THE SYSTEM</u>

Runway Descriptions – SAT operates with three runways; two of which intersect. Runway 12R-30L is 8,502 feet long and 150 feet wide; Runway 12R has a CAT II instrument landing system and Runway 30L has a CAT I instrument landing system. Runway 3-21 is 7,505 feet long and 150 feet wide; Runway 3 (4) has a CAT I landing system and Runway 21 (22) has a GPS approach only. Both runways are designated aircraft Group D-IV, as are the associated parallel taxiways Golf and November. The identified critical aircraft is the MD-10. Information gathered prior to the SRA and distributed during the introduction included aircraft performance data pertinent to SAT. Specifically, landing runway length requirements for the MD-10 are 6,500 in dry conditions and 7,500 in wet surface conditions.

> ***Note:*** *The information was provided by the SAAS SMS Department and was collected from manufacture data available to the industry. The information was used for general discussion purposes only, not recognizing load factors, temperatures, or other conditions which may result in a different runway length requirement.*

Runway Intersection – The threshold of Runway end 30L is located on Runway 3-21 (4/22) approximately one third of the way on Runway 3 (4). Both runways serve commercial aircraft. Attachment 1 reflects the intersection of the two runways and relevant conditions.

Runway Markings and Signage – Standard marking are in place for both runways, given their category, length, and utilization. With the intersection of the two air carrier runways, two sets of hold bars are located on Runway 3-21 (4/22), depicting the safety area for Runway 12R-30L. The threshold markings for Runway 30L are located on Runway 3-21 (4/22); Runway 12R-30L is the primary runway. Mandatory hold position signs are located abeam the hold bars.

Current System Performance – SAAS has recognized the safety concerns with the intersection of these runways and has collected data regarding incidents. The majority of the safety incidents have occurred when the Airport is in a “Runway 30L flow”. This flow prohibits the use of Runway 3-21 (4/22) of takeoffs or landing, and therefore Runway 3-21(4/22) is used for taxiing aircraft purposes only, and remains under the control of Air Traffic Control Tower (ATCT) Ground Control.

There have been seventeen (17) documented runway incursions at this intersection between October 2008 and January 2011.

Note 1 – From SAAS records provided prior to the SRA. One of the contributing factors for these incursions is this configuration which allows aircraft on a runway (much wider than a typical taxiway) with runway position hold signage approximately 270 feet apart, and holding position markings that are oftentimes obscured by rubber.

Note 2 – From FAA Runway Safety Hot Spot report. This configuration does not provide the typical visual cues of a taxiway/runway intersection. Data also indicates that of the 17 documented incursions, 14 involved General Aviation (GA) aircraft. The lack of visual cues and the inexperience of the GA pilots have been identified as key contributing factors.

Aircraft Operations – Runway 12R-30L serves as the primary runway for commercial aircraft operations. Takeoff operations are divided nearly equally between Runways 12R and Runway 3 (4); more landing operations occur on Runway 12R than any other runway end. When operating in a Runway 30L flow configuration, all air carrier departures use Runway 3 (4) (or Runway 21 (22) for some cargo operations) to taxi to the departure end of Runway 30L. The ATCT directs aircraft using Runway 3 (4) as a taxiway to hold short of Runway 30L. Most general aviation (GA) aircraft, including corporate jet operators, may take an “intersection departure” at Taxiway November. All air carrier operations take full length Runway 30L departures; forcing them to use Runway 3 (4) for taxi to Runway 30L.

Section 6 – Phase 2: Identified Hazards per Safety Risk Assessment 2011-02-O

Hazard Identification: During the SRA session, a single hazard was identified and described as: physical configuration of the runway intersection with the ultimate risk of runway incursions. The Hazard Summary Table (Reference Table 6-1) presents the details of the hazard, risk, assessment, mitigation, and resulting residual risk.

Table 6-1 Hazard Summary Table

Hazards	Risks	Risk Assessment	Mitigation	Residual Risk
1. Physical configuration of the runway system	Runway Incursions	H24 Severity: **Major** (Reputation damage, major delays, damage to aircraft, severe injuries) Likelihood: **Frequent** (Has happened more than five times at airport within a 12 month period.) See Attachment 4	▪ Ensure Jeppesen, NOAA, and other charts are updated with Hot Spots. ▪ Model ATC operational change (T/W N=GA, R/W 3 (4) =commercial). ▪ Continue FBO, flight school education and outreach, ongoing. ▪ Deliver Hot Spot maps to Customs for handout to foreign pilots. ▪ Add informational sign to the area of T/W G and N advising of Hot Spot	**H24** **Severity**: Major **Likelihood**: Frequently
			▪ Decouple runways per Master Plan project (move up in CIP with SRA findings)	**L** **Severity**: Negligible **Likelihood**: Negligible (issue goes completely away with a permanent solution in place.

Prior to the modeling simulation of the potential Hazard; the group of SME did a brainstorming session for identification of potential hazards was accomplished by the collaborative effort of the SMEs. All aspects and predicted impacts of the proposed change were discussed, analyzed, and assessed. The "worst credible outcome" during the "worst credible system state" was evaluated, in addition to less severe outcomes and system states. The following areas were considered:

- The causes
- The corresponding system states
- The possible effects
- The existing controls

Existing controls listed in Appendix D – Existing Controls, Table D-7: Existing Controls were integrated within the simulations efforts and considered as part of the deliberations and evaluations. The proposed changes along with these existing controls will minimize the existing risk level of the surface movement at the airport.

Initial findings

Air Traffic evaluation consisted of two separate program runs.

1. The first "A" Template was with the current configuration and the decoupling of RWY 12R/30L from RWY 3/21 (4/22). Proposed TWY's I and U were introduced as part of the operation and extension of RWY 3 (4) and RWY 12R were introduced. Operation of the RWY 3 (4) only was not investigated during this Template (A). Operation in a "12" flow indicated relatively no operational impact. All runways were used to simulate normal "12" flow. The scenario loaded the two controllers Ground and Local with a mix of aircraft (mostly commercial). The scenario revealed little impact with a "12" flow due to the inclusion of the proposed changes. However, on a "30" the controllers discovered significant congestion if the proposed taxiways, I and U, are not in place prior to the decoupling of the runways (specifically the taxiways at the RWY 30 ends), the controllers found this to potentially have serious implications - probable significant congestion of ground operations at the RWY 30 approach end would be the most problematic. In short order, aircraft could become stacked up on TWY G and N: this would create significant controller workload, possible delays, and add confusion. All of these factors which have safety implications.

The impact to the airport other than the above was not affected. Air Traffic Local was able to manage the arrival and departure flow without issue. Air Traffic Ground was successful in managing operations, but the increased situational awareness at the RWY 30 approach end dictated by traffic congestion, frequency congestion, and an inability to access the inner ramp caused concern; all of the previously mentioned factors have safety implications.

2. Evaluation of Template "B" included all of the above and the extension of RWY 12L; additionally the paving of the ramp areas near the ramp, TWY G, and TWY N was included in this scenario. The running of this scenario indicated these proposed changes would relieve the congestion, improve efficiency, and equalize (level) the amount of traffic flow.

There were issues with traffic transitioning to and from the terminal A & B ramps to TWY G. The airport plans to place concrete between the ramp and TWY G, but this would not be hardened for aircraft use. The possibility of a taxiway that connected alley between terminals A & B to taxiway G was also discussed as an alternative. This would be a significant relief to congestion in that area if all of the grassy could not be hardened/stressed for aircraft use. The airport authority (COSA) would take this under advisement and the need for hardening of the concrete may need to be altered. Construction methods may require full strength.

<u>Concerns:</u>

Template A – "12" Flow Operations:

- Minimal Impact - movement of the runway is the biggest change and does not really effect Air Traffic operations

Template A – "30" Flow Operations:

- Congestion on TWY's G and N – queued up in the corner due to no access to RWY 30R
- When A/C returning to gate – limited options with taxiways; especially with B757 and larger aircraft

Template B – RWY 3 (4) Only:

- Need for TWY C otherwise most air carrier arrivals will need to go to the new end of runway thus increasing runway occupancy time

- Need for new proposed TWY U (General Aviation - GA predominantly) because it replaced an exit removed as a result of decoupling
- The use of Back Taxi is often required to access the southeast facilities
- TWY E needs to be replaced – preference is within 500ft of approach end of RWY 3 (4) to meet new airports division requirements and eliminate wake turbulence issues. Other use is for in/out access to southeast side of the field

Template B – "12" Operations:

- Will introduce changes to Air Traffic approach operations due to new ILS
- Operations were capable of meeting current GA needs with minimal delay
- Existing Safety Risk level is diminished or eliminated – able to side step alternate direction aircraft

Template B – 12L Operations:

- Turn off from 12L: missing TWY D and not able to use TWY P due to the taxiway not being stressed for larger aircraft would significantly increase runway occupancy time
- Introduced more Hearback/Readback issues due to length of and detail of taxi instructions
- TWY's P, M, A have weight (Group) limit restrictions
- All "Heavy's" are mandated to cross TWY's N, D, S to reach approach end of RWY 12L – generally, TWY S is the preferred taxiway to avoid multiple runway crossings

Template B – "30" Operations:

- Can cross from 30L to 30R for departure using TWY's I and N
- Landing 30R (Heavy) to reach east cargo has to make left turn and cross RWY 30L at TWY S.
- Dual taxiways provide more efficient operations at/near Terminal area (see the dark blue areas, Appendix F: SAT Airport Change Templates, Figure F-6: Plan 3). Need connector between the taxi lane; taxiway eliminates to congestion on TWYs N and G.

Scenarios indicated the need for additional high speed exit. When commercial A/C require rapid exit off of RWY 30R, 1000ft west of TWY M, this would improve efficiency – minimize runway occupancy time. This proposed high speed exit would intercept TWY S – Airport Master-Plan for year 2050.

- Missing TWY S (RWY 30R) would increase runway occupancy time – commercial and larger GA
- TWY I provides the controller an out (alternative) should abort be necessary, cancel takeoff, or need to get A/C off runway.

The threshold for RWY 30R is 260 feet from TWY M, therefore the three-minute wake turbulence hold time for thresholds more than 500 feet from a taxiway, as stipulated in JO 7110.65 Para 3-9-7 A-2, is unnecessary for General Aviation (GA) users.

As a consequence of the SME's evaluations there were no hazards identified – see Appendix C – Preliminary Hazard Analysis Worksheets, Table C-6: Preliminary Hazard Analysis Worksheets.

Section 7 – Phase 3 - Risks Analyzed and Assessed

AFITL used the combined experience of the SMEs to analyze and assess the risks associated with the identified hazards. Risk was determined using the guidance within the ATO SMS Manual Version 2.1, dated May 2008.

Existing Safety Controls

No potential hazards were identified by the SME's; all potential hazards have been evaluated with reference to the existing safety controls in place at SAT associated with this change. These existing safety controls are:

- Vehicle operator's situational awareness
- Airfield operations monitoring
- ATC intervention
- Operational supervision
- Pilot intervention
- Traffic Management/Traffic Management Initiatives (TMI)
- SAT Order 7210.1 – *Local Facility Administration and Operational Procedures*
- Radios – frequency monitoring
- Scanning/ATC training
- Contractor training/driver's training
- Vehicle markings/lighting
- Jeppeson Charts
- Transition plans
- Periodic briefings

Risk Assessment and Analysis

Initially, each hazard was assigned a pre-mitigation (with existing controls considered) severity classification as per the Severity Definitions from the ATO SMS Manual, as well as a likelihood determination from the Likelihood Definitions also from the ATO SMS Manual. The assessment process followed by the SME's for each hazard can be found in Appendix C: Preliminary Hazard Analysis Worksheets (PHA), Table C-1: PHA. The results of this effort are found in the following Table 7-4: Risk Adjustment Analysis; these were derived from Appendix E: Risk Matrix, Figure E-2: Risk Matrix.

Table 7-4: Risk Adjustment Analysis

Hazard	Severity	Likelihood	Initial Risk
SAT-001	N/A	N/A	**N/A**

Section 8 – Phase 4: Treatment of Risks and Mitigation of Hazards

No hazards were identified by the SME's because of the safety assessment of the runway construction at SAT. No mitigations were necessary.

Hazard conclusions

The PHA worksheets (included in Appendix C: Preliminary Hazard Analysis Worksheets) defines and lists the hazards and existing controls.

Table 8-5: Initial and Residual Risk is used to tabulate the results of the initial and mitigated residual risk levels associated with implementing the various safety mitigations.

Table 8-5: Initial and Residual Risk

Sequence Number	Hazard	Initial Risk	Residual Risk
1	High Risk (Red)	**0**	**0**
2	Medium Risk (Yellow)	**0**	**0**
3	Low Risk (Green)	**0**	**0**
4	**Total**	**0**	**0**

Note: The SAAS SMS Manual and the ATO SMS Manual (Version 2.1) stipulates risk is the composite of predicted severity and likelihood of the potential effect of a hazard in the worst credible system state.

Based on the efforts of the SME's and subsequent review and discussions related to changes at SAT, the SME's concluded these change can be safely implemented into the NAS with an acceptable level of risk.

Section 9 – Tracking and Monitoring of Hazards

No hazards were identified by the SME's, and no further tracking or monitoring is necessary. The SAT Quality Control function will monitor the facility operations through the normal course of daily functional activity; should any safety issues or events surface, the facility will take immediate action and will reconvene the SME's to assess the implications. This action will updated in the SAAS SRMD 2011-02-02, dated 25 Feb 2011

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Appendices

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Appendix A - References

The following documents (orders, directives, regulations, handbooks, and manuals) address the safety management assessment. These documents were consulted in the development of the SRM assessment process. In some cases the documents listed below may have been updated since this list was compiled. lease refer to the appropriate facility for the most recent version of the documents.

Air Traffic Control:

- JO 7110.65 – *Air Traffic Control*
- SAT Order 7210.1 – *Local Facility Administration and Operational Procedures*
- JO 7210.56 – *Air Traffic Quality Assurance*
- FAR Part 139 – *Airport Certification*
- JO 6000.15 – *General Maintenance Handbook for NAS Facilities*

Safety Risk Management:

- JO 8040.4 – *Safety Risk Management*
- SAAS SMS Manual, Version 1, dated Nov 2011
- FAA SMS Manual, Version 2.1, May 5, 2008

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Appendix B – Acronyms and Abbreviations

A/G	Air Ground Communication
ASDA	Accelerate Stop Distance Available
ATC	Air Traffic Control
ATCT	Air Traffic Control Tower
ATM	Air Traffic Manager
ATO	Air Traffic Organization
BBJ	Boeing Business Je
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FAAST	FAA Safety Team
GA	General Aviation
ILS	Instrument Landing System
JO	Joint Order
LDA	Landing Directional Aid
MALSR	Medium Intensity Approach Lighting System with Runway Alignment indicator Lights
NAS	National Airspace System
NASWATCH	
ODALS	Omni-directional Approach Lighting System
PAPI	Precision Approach Path Indicator Lights
PHA	Preliminary Hazard Analysis
REIL	Runway End Identification Lights
RWY	Runway
SAT	San Antonio International Airport
SME	Subject Matter Expert
SMS	Safety Management System
SOP	Standard Operating Procedure
SAAS	San Antonio Airport System
SRA	Safety Risk Assessment
SRM	Safety Risk Management
SRMD	Safety Risk Management Document
SRMP	Safety Risk Management Panel
Tech Ops	Technical Operations
TMI	Traffic Management/Traffic Management Initiatives
TODA	Take-off Distance Available
TORA	Take-off Run Available
TWY	Taxiway
VFR	Visual Flight Rules

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Appendix C – Preliminary Hazard Analysis Worksheets

Table C-6: Preliminary Hazard Analysis Worksheets

Hazard # (1)	Hazard Descriptio n (2)	Cause(s) (3)	System State (4(	Existing Controls (5)	Possible Effect(s) (6)	Severity / Rationale (7)	Likelihood / Rationale (8)	Current / Initial Risks (9)	Recommended Safety Requirements (10)	Predicted Residual Risks (11)	Responsibilities (12)
ELP-001	N/A										
ELP-002	N/A										
ELP-003	N/A										-

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Appendix D: Existing Controls

Table D-7: Existing Controls

Existing Controls		Hazards		
		1	2	3
1	Design Standard AC/150-5300-13			
2	Debris Hazards AC/150-5380-5b			
3	Emergency Plans AC/150 150-5200-31c			
4	Lighting Fixtures AC/150-5345-46d			
5	Markings AC/150-5340-1j			
6	Master Plans AC/150 150-5070-6b			
7	Notams AC/150-5200-28d			
8	Safety During Construction AC/150-5370-2e			
9	Self Inspection AC/150-5200-18c			
10	Signs AC/150-5340-18c			
11	Vehicle Operations AC/150-5210-20			
12	Vehicle Marking Painting AC/150-5210-5c			
13	Vehicle operator's situational awareness			
14	Airfield Operations Monitoring			
15	Air Traffic Controller (ATC) Intervention			
16	Operational supervision			
17	Pilot intervention			
18	Traffic Management/Traffic Management Initiatives (TMI)			
19	JO 7110.65 - Air Traffic Control			
20	7110.1 SOP			
21	Airport Surveillance Radar (ASR)-9/Beacon			
22	Air Route Surveillance Radar (ARSR)			
23	Airport Surface Detection Equipment (ASDE)-X			
24	Airport Movement Area Safety System (AMASS)			
25	Airport Terminal Information System (ATIS)			
26	Traffic Alert and Collision Avoidance System (TCAS)			
27	Construction Phasing SOPs (review and updates)			
28	Order 8260.55 - Special Area Navigation Visual Flight Procedures			
29	Letter of Agreement (LOA)			
30	JO 7210.3 - Facility Operation and Administration			
31	Standard Terminal Automation Replacement System (STARS)			
32	Radios - Frequency monitoring			
33	Conflict Alert/Minimum Safe Altitude Warning (CA/MSAW)			
34	Scanning, ATC Training			
35	Contractor Training, Drivers Training			
36	Federal Aviation Regulations (FAR) Part 139			
37	Airport Rules and Regulations			
38	Daily Briefings			
39	Access Control Training			
40	Physical Barriers			
41	Vehicle Marking /Lighting			
42	Additional Communication (monitoring of frequency)			
43	Crew resource Management (CRM)			
44	Notice to Airmen (NOTAM)			
45	JO 6000.15 -General Maintenance Handbook For NAS Facilities			
46	Jeppeson Charts (phased construction depictions)			
47	Personnel/team Briefings			
48	Transistion plans			
49	Dry-run testing			
50	Periodic briefings			
51	ACM			

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Appendix E: Risk Matrix

Figure E-2: Risk MatrixError! Bookmark not defined.

SAAS Risk Matrix

Risk Assessment Matrix

Consequence				Likelihood		Severity				
People	Assets	Environment	Reputation			5 Negligible	4 Minor	3 Moderate	2 Major	1 Catastrophic
No Injury or Health Effects	No Damage	No Effects	No Impact	A	**Frequent** (Has happened more than five times at airport)	L5	M13	H20	H22	H25
Minor Inquiry or Health Effects	Minor Damage	Minor Effects	Minor Impact	B	**Probable** (Has happened more than once at airport or in industry)	L4	M12	M15	H21	H24
Moderate Injury or Health Effects	Moderate Damage	Moderate Effects	Moderate Impact	C	**Remote** (Has happened once at airport or once in industry)	L3	L8	M14	M17	H23
Major Injury or *PTD	Major Damage	Major Effects	Major Impact	D	**Extremely Remote** (Heard of in industry)	L2	L7	L10	M16	M19
Fatalities	Catastrophic Damage	Catastrophic Effects	Catastrophic Impact	E	**Extremely Improbable** (Never heard of in industry)	L1	L6	L9	L11	M18

*PTD = Permanent Total Disability

Low Risk: Acceptable Risk | **Medium Risk: Acceptable Risk** | **High Risk: Unacceptable Risk**

SAAS Risk Matrix

LOW RISK

LOW RISK: ACCEPTABLE RISK
- Acceptable without restriction or limitation
- Hazards must be documented

MEDIUM RISK

MEDIUM RISK: ACCEPTABLE RISK
- Minimum acceptable safety objective
- Change may be implemented, but tracking, monitoring, and management required

HIGH RISK

HIGH RISK: UNACCEPTABLE RISK
- Change cannot be implemented unless the hazards' associated risks are mitigated so that the risks are reduced to medium or low levels
- Tracking, monitoring, and management required

Initial Risk

Initial and Residual Risk (no change in likelihood)

Predicted residual risk

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Appendix F: SAT Airport Change Templates

Figure F-3: Baseline

Figure F-4: Plan 1

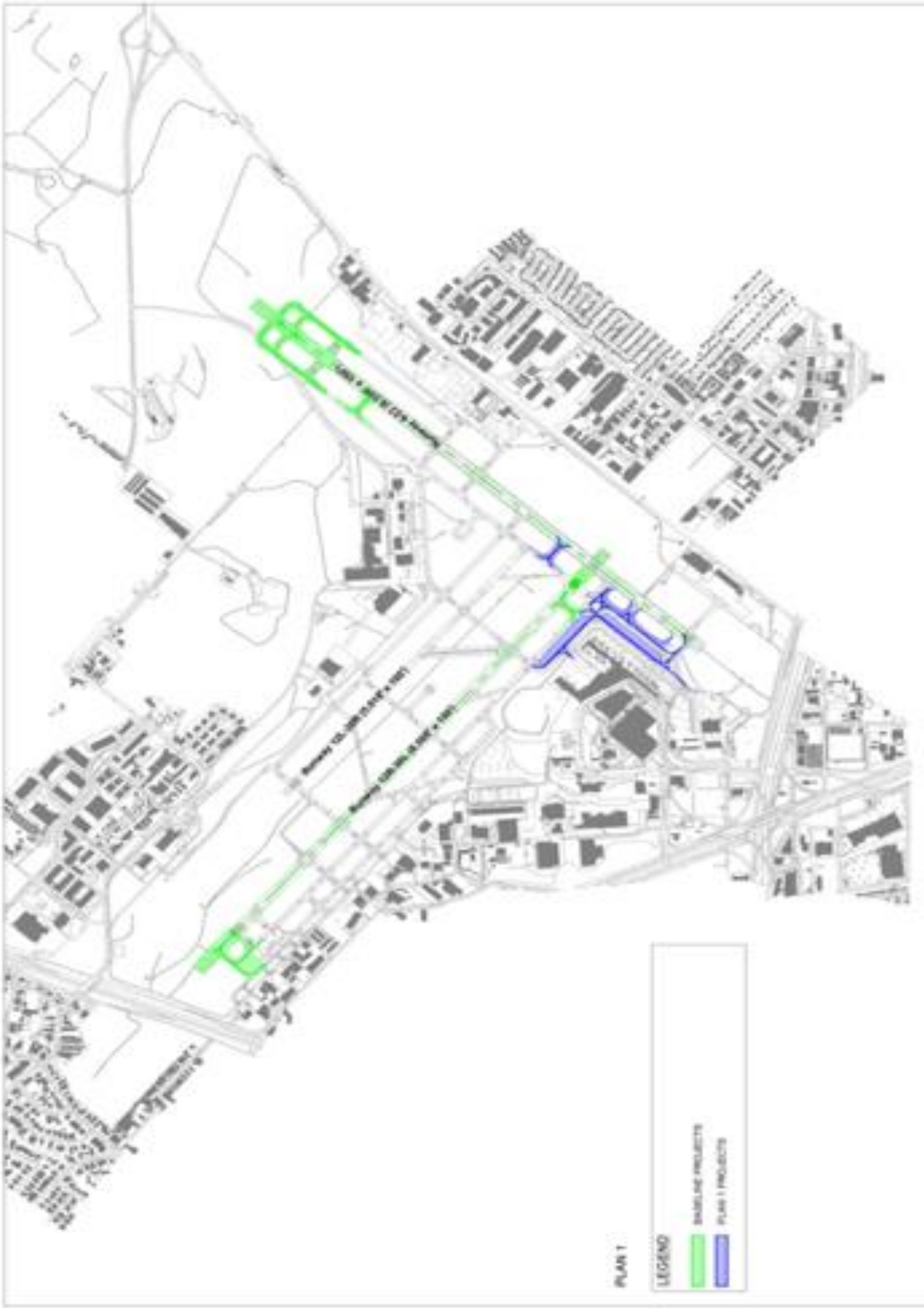


Figure F-5: Plan 2

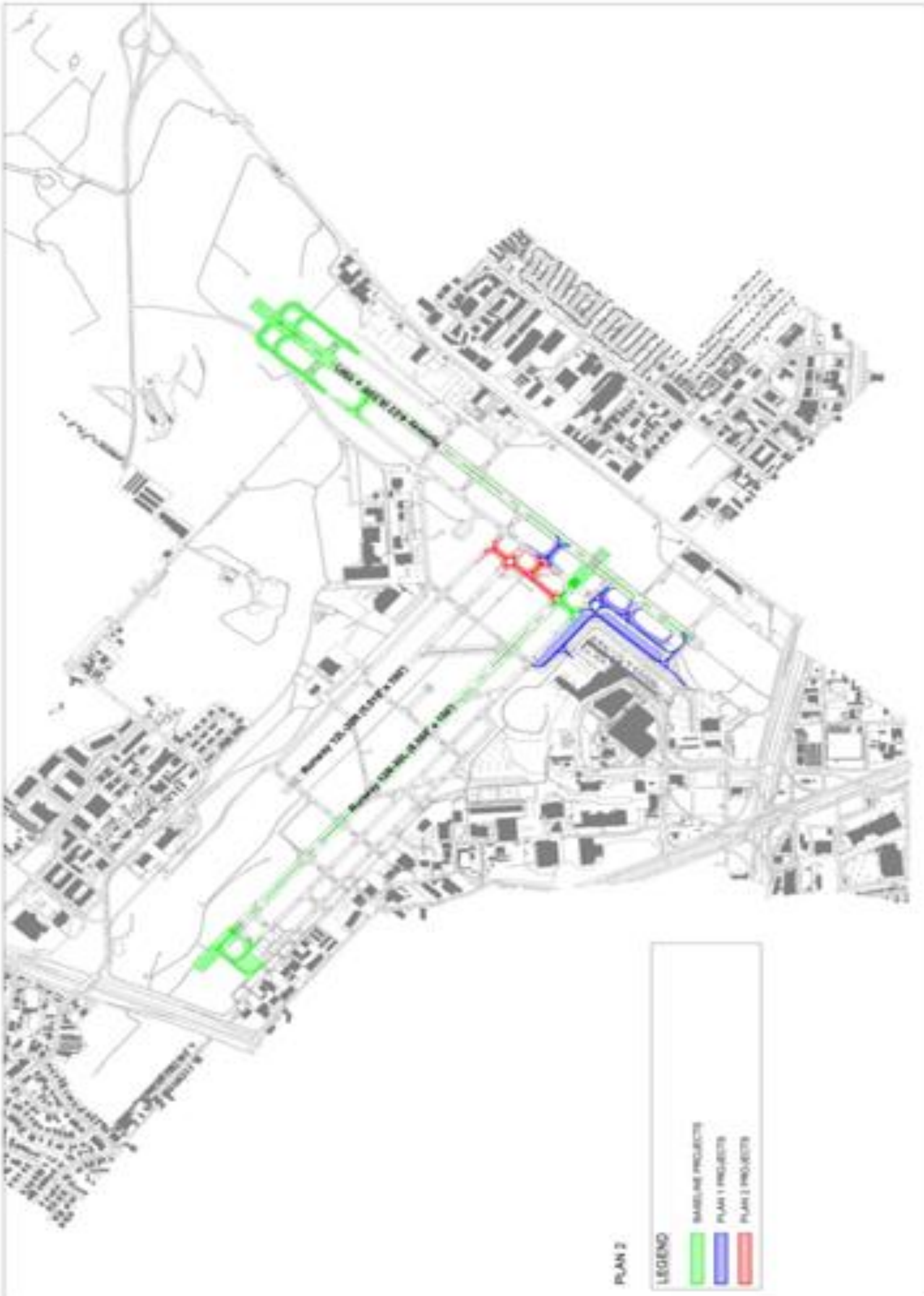
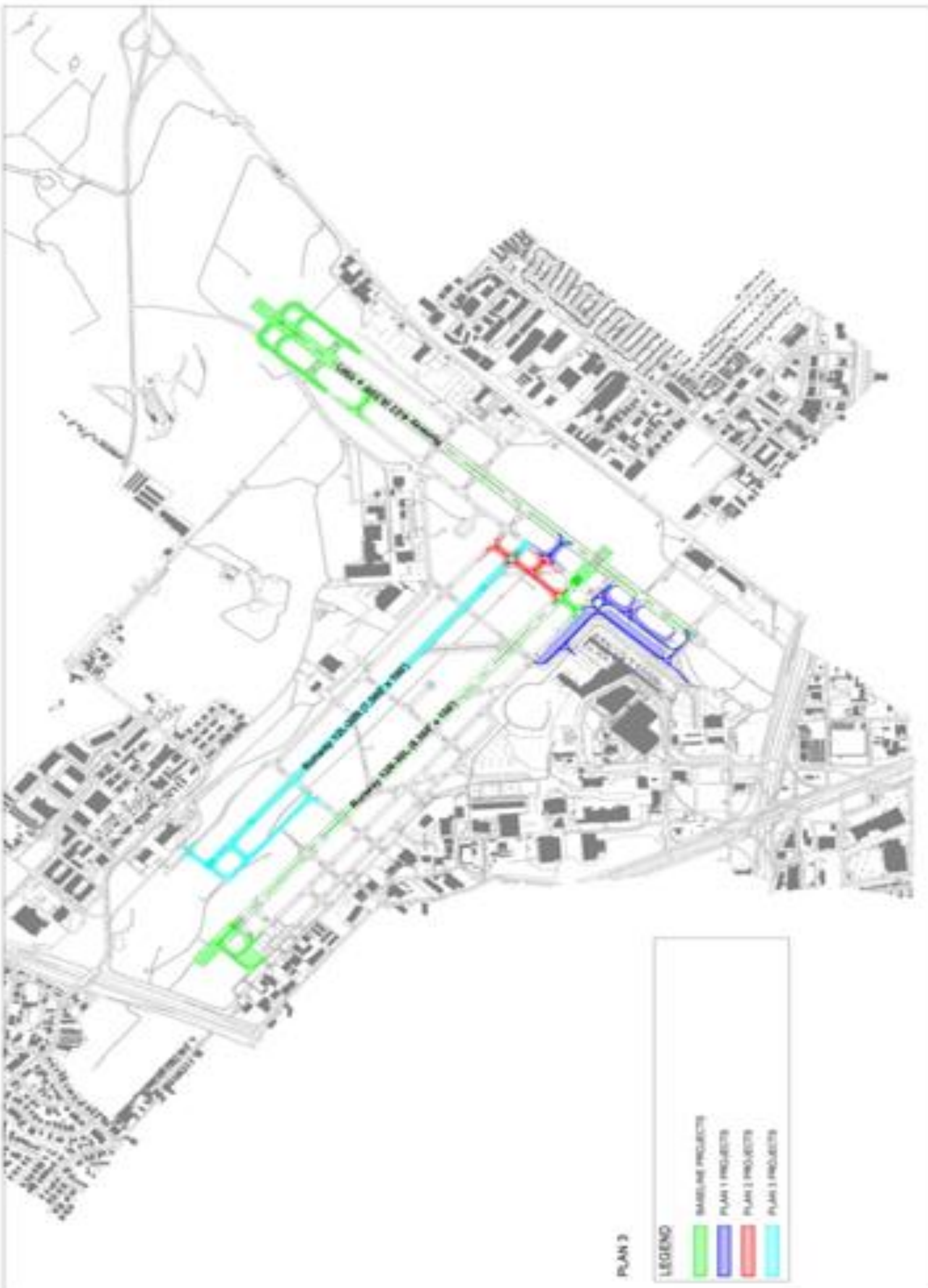


Figure F-6: Plan 3



Appendix G: SAT Airport Information

Location

FAA Identifier:	SAT
Lat/Long:	N 29º32´ 02" / W 098º28´19"
Elevation:	809 ft. / 246.6 m (surveyed)
Variation:	08E (1980)
From city:	7 miles N of SAN ANTONIO, TX
Time zone:	UTC -5 (UTC -6 during Standard Time)
Zip code:	78216

Airport Operations

Airport use:	Open to the public
Activation date:	07/1942
Status:	Operational
Control tower:	Yes
Segmented circle:	No
Beacon:	white-green (lighted land airport) Operates sunset to sunrise.
Wind indicator:	Yes Lighted
Lights:	SS-SR
ARTCC:	HOUSTON CENTER
FSS:	SAN ANGELO FLIGHT SERVICE STATION
NOTAMs facility:	SAT (NOTAM-D service available)
Sectional chart:	SAN ANTONIO
ARFF Cert:	ICS 05/1973
Customs (International Operations):	Customs Landing Rights
Attendance:	CONTINUOUS

Airport Communications

D-ATIS:	118.9
ASOS:	PHONE 210-805-5583
SAN ANTONIO TOWER:	119.8 257.8
SAN ANTONIO GROUND:	121.9 348.6
SAN ANTONIO APPROACH:	118.05(141-270) 124.45(360-090) 125.1(271-359) 128.05(091-140) 307.0(271-359) 318.1(091-140) 335.625 360-090 353.5(141-270) 125.7 127.1 251.125 290.225
SAN ANTONIO DEPARTURE:	118.05(141-270) 124.45(360-090) 125.1(271-359) 128.05(091-140) 307.0(271-359) 318.1(091-140) 335.625 360-090 353.5(141-270) 125.7 127.1 251.125 290.225
CLEARANCE DELIVERY:	126.7
EMERG:	121.5 / 243.0
AS ASGND:	120.3 121.2 239.025 269.1 285.45 317.5
CLASS C:	118.05(141-270) 124.45(360-090) 128.05(091-140) 318.1(091-140) 335.625 360-090 353.5(141-270)
CLASS C IC:	125.1(271-359) 307.0(271-359)
UNICOM:	122.95
AWOS-3 at SPN (5.9 NM West)	119.575
WX ASOS at SSF (12 NM South)	Phone 210-927-9391
ATIS at RND (10.0 NM East)	327.8 Hangover
ATIS at SKF (10.7 NM Southwest)	120.45

Remarks:

- 128.05 397.0 348.4 289.2 TRACON PIT/UPT CAT VI TRAINING AREA (DO NOT ADVERTISE.
- CTN: DUE CONST UFN; ATCT UNABLE TO OBSERVE TFC ON SE PORTION OF ARPT. TWR INSTRUCTIONS ON TWYS & RAMPS IN THIS AREA WILL BE ADZY ONLY. SMALL ACFT DEPARTING RWY 3 ANTICIPATE TKOF FM INT TWY G.
- ASR-9 ELEV 865 FT. CPME JUDSON 29-32-39.3342N 098-21-19.3004W. CPME QNA 30-05-06.0069N 100-21-51.9579W. CPME RSG 29-21-40.5476N 097-03-59.7940W. CPME SAT 29-31-37.2354N 098-28-33.0040W.

Nearby radio navigation aids

VOR	VOR name	Freq	Radial/Range	Magnetic Variation
SAT	SAN ANTONIO VORTAC	116.80	R175/6.6	08E
RND	RANDOLPH VORTAC	112.30	R270/9.7	05E
SKY	Kelly	112.00	R027/10.3	08E
SSF	STINSON VOR	108.40	R346/16.6	09E
HDO	HONDO VOR/DME	109.40	R065/38.6	08E

Airport Services

Fuel available:	100LL JET-A
Parking:	Hangars and tie downs
Airframe service:	MAJOR
Powerplant service:	MAJOR
Bottled oxygen:	HIGH/LOW
Bulk oxygen:	HIGH/LOW
Other Services	Avionics, Cargo Handling Services, Charter Services, Pilot instruction, Aircraft Rental, Aircraft Sales

Runway Information

Runway 12R/30L

Dimensions:	8502 x 150 ft. / 2591 x 46 m	
Surface:	Concrete/grooved, in good condition	
Weight bearing capacity:	Single Wheel	95.0
	Double wheel	190.0
	Double Tandem	270.0
Runway edge lights	High intensity	
	RUNWAY 12R	**RUNWAY 30L**
Latitude:	N29º32.56´	N29º31.63´
Longitude:	W098º29.13´	W098º27.93´
Elevation:	809.1 ft.	778.4 ft.
Gradient:	0.4%	0.4%
Traffic pattern:	left	left
Runway heading:	124 magnetic, 132 true	304 magnetic, 312 true
Declared distances:	TORA:8502 TODA:8502 ASDA:8502 LDA:8502	TORA:8502 TODA:8502 ASDA:8502 LDA:8502
Markings	Precision Instrument, in good condition	Precision Instrument, in good condition
Visual Glide slope indicator	P4L (3.00 degrees glide angle)	P4L (3.00 degrees glide angle)
RVR equipment:	Touchdown, midfield, rollout	Touchdown, midfield, rollout
Approach lights:	ALSF2: standard 2,400 foot high intensity approach lighting system with centerline sequenced flashers (category II or III)	MALSR: 1,400 foot medium intensity approach lighting system with runway alignment indicator lights
Centerline lights:	yes	yes
Touchdown point:	yes, lighted	yes, no lights
Instrument approach:	ILS/DME	ILS/DME
Obstructions:	none	79 ft. bldg, 3500 ft. from runway, 300 ft. right of centerline, 41:1 slope to clear

Runway 3/21 (To become RWY 4/22, effective November 2012)

Dimensions:	7505 (8,505) x 150 ft. / 2288 x 46 m	
Surface:	Concrete/grooved, in good condition	
Weight bearing capacity:	Single Wheel	95.0
	Double wheel	190.0
	Double Tandem	270.0
Runway edge lights	High intensity RWY 3	
	RUNWAY 3	**RUNWAY 21**
Latitude:	N29º31.39´	N29º32.33´
Longitude:	W098º28.19	W098º27.27´
Elevation:	786.0 ft.	761.7 ft.
Gradient:	0.3%	0.3%
Traffic pattern:	left	left
Runway heading:	033 magnetic, 041 true	213 magnetic, 221 true
Declared distances:	TORA:7505 TODA:7505 ASDA:7505 LDA:7505	TORA:7505 TODA:7505 ASDA:7505 LDA:7505
Markings	Precision Instrument, in good condition	Precision Instrument, in good condition
Visual slope indicator	P4L (3.00 degrees glide angle)	P4L(3.00 degrees glide angle)
RVR equipment:	Touchdown	
Approach lights:	MALS: 1,400 foot medium intensity approach lighting system	
REIL		Yes
Centerline lights:	yes	yes
Instrument approach:	ILS	ILS/
Obstructions:	46 ft. pole, lighted, 2180 ft. from runway, 225 ft. left of centerline,	none

Runway 12L/30R

Dimensions:	5519 x 100 ft. / 1682 x 30 m	
Surface:	asphalt, in fair condition	
Weight bearing capacity:	Single Wheel	59
	Double wheel	112
Runway edge lights	medium intensity 12L	
	RUNWAY 12L	**RUNWAY 30R**
Latitude:	N29º32.42´	N29º31.81´
Longitude:	W098º28.66´	W098º27.88´
Elevation:	797.2 ft.	779.2 ft.
Gradient:	0.4%	0.4%
Traffic pattern:	left	left
Runway heading:	124 magnetic, 132 true	304 magnetic, 312 true
Declared distances:	TORA:5519 TODA:5519 ASDA:5519 LDA:5519	TORA:5519 TODA:5519 ASDA:5519 LDA:5519
Markings	Non-precision, in good condition	basic, in good condition
Visual slope indicator	P4L (3.00 degrees glide angle)	P4L
Runway end identifier lights:	yes	yes

Airport Ownership and Management from official FAA records

Ownership: Publicly-owned

Owner: CITY OF SAN ANTONIO
100 MILITARY PLAZA
SAN ANTONIO, TX 78207
Phone 210-207-7253

Aviation Director: FRANK R. MILLER
9800 AIRPORT BLVD
SAN ANTONIO, TX 78216
Phone 210-207-3450

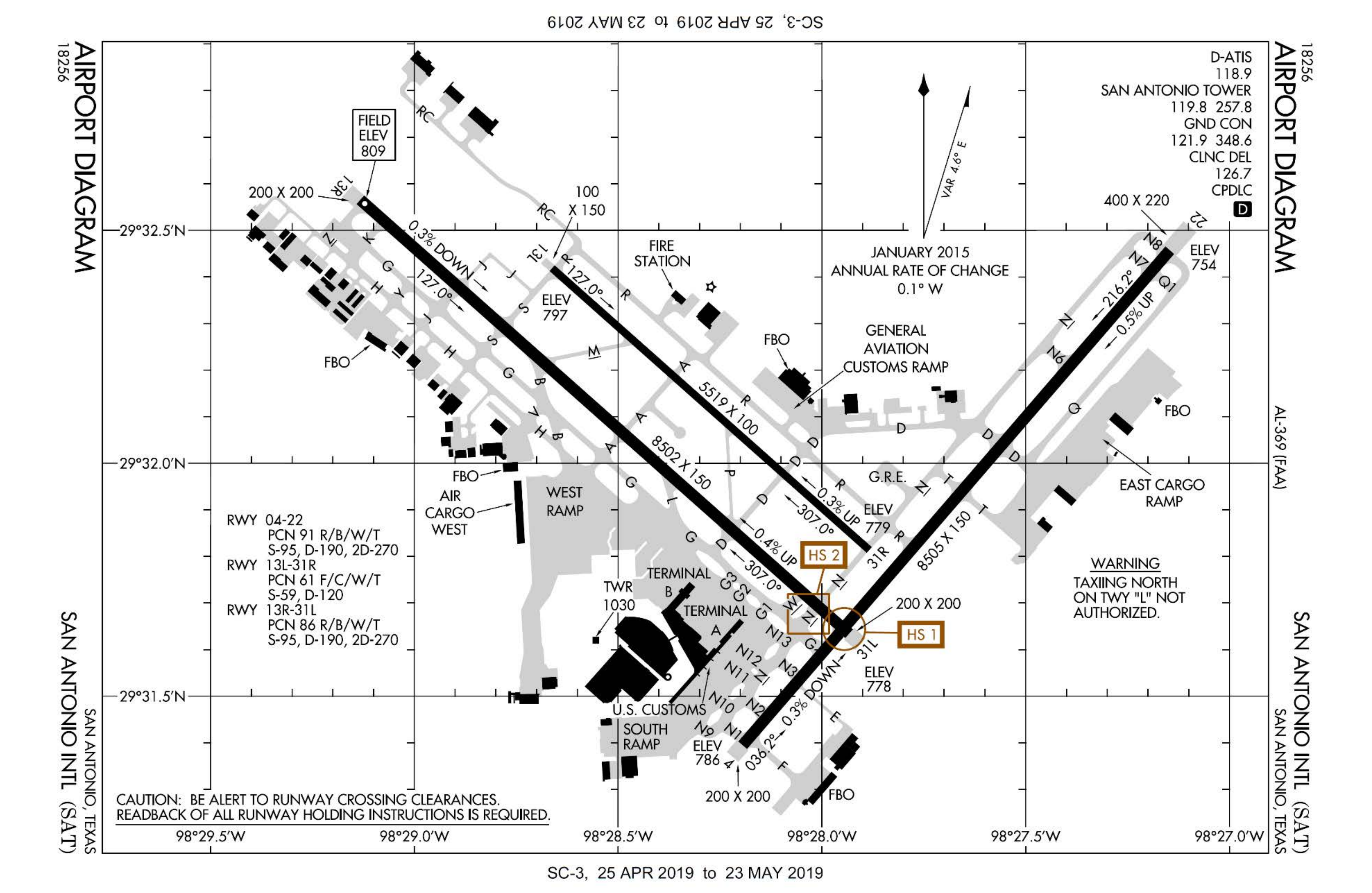
Airport Operational Statistics

Aircraft based on the field	206	Aircraft operations: avg 492/day *
Single engine airplanes	87	53% commercial
Multi engine airplanes	39	33% transient general aviation
Jet airplanes	71	12% air taxi
Helicopters	9	3% military
* for 12-month period ending 30 October 2011		

Appendix D Alternatives Analysis

Hot Spot Mitigation Options

Existing Hot Spots



STRATEGIC DEVELOPMENT PLAN

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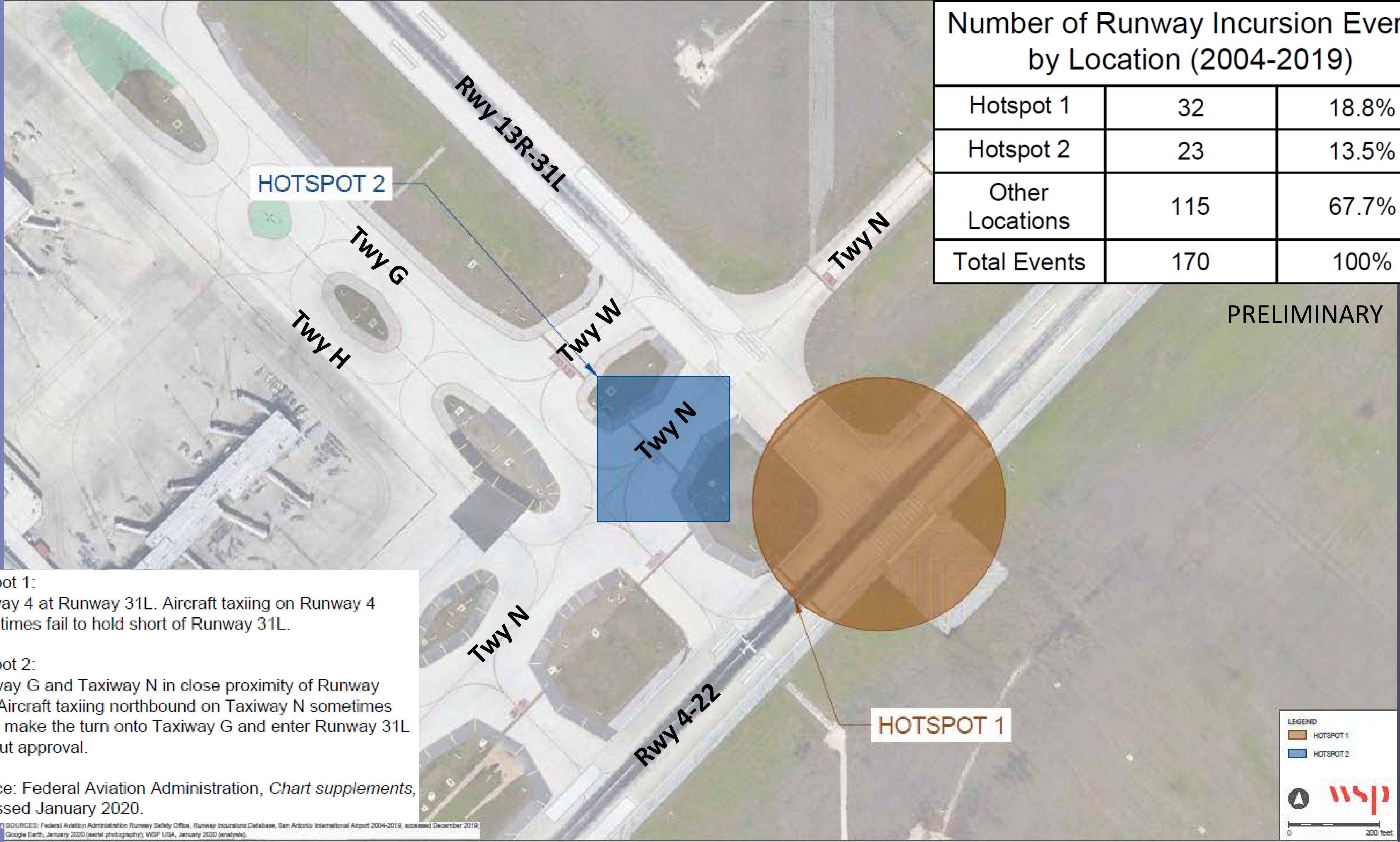


Number of Runway Incursion Events by Location (2004-2019)		
Hotspot 1	32	18.8%
Hotspot 2	23	13.5%
Other Locations	115	67.7%
Total Events	170	100%

Hotspot 1:
Runway 4 at Runway 31L. Aircraft taxiing on Runway 4 sometimes fail to hold short of Runway 31L.

Hotspot 2:
Taxiway G and Taxiway N in close proximity of Runway 31L. Aircraft taxiing northbound on Taxiway N sometimes fail to make the turn onto Taxiway G and enter Runway 31L without approval.

Source: Federal Aviation Administration, *Chart supplements*, accessed January 2020.

SOURCES: Federal Aviation Administration Runway Safety Office, Runway Incursions Database, San Antonio International Airport 2004-2019, accessed December 2019. Google Earth, January 2020 (aerial photography); WSP USA, January 2020 (analysis).

Analysis

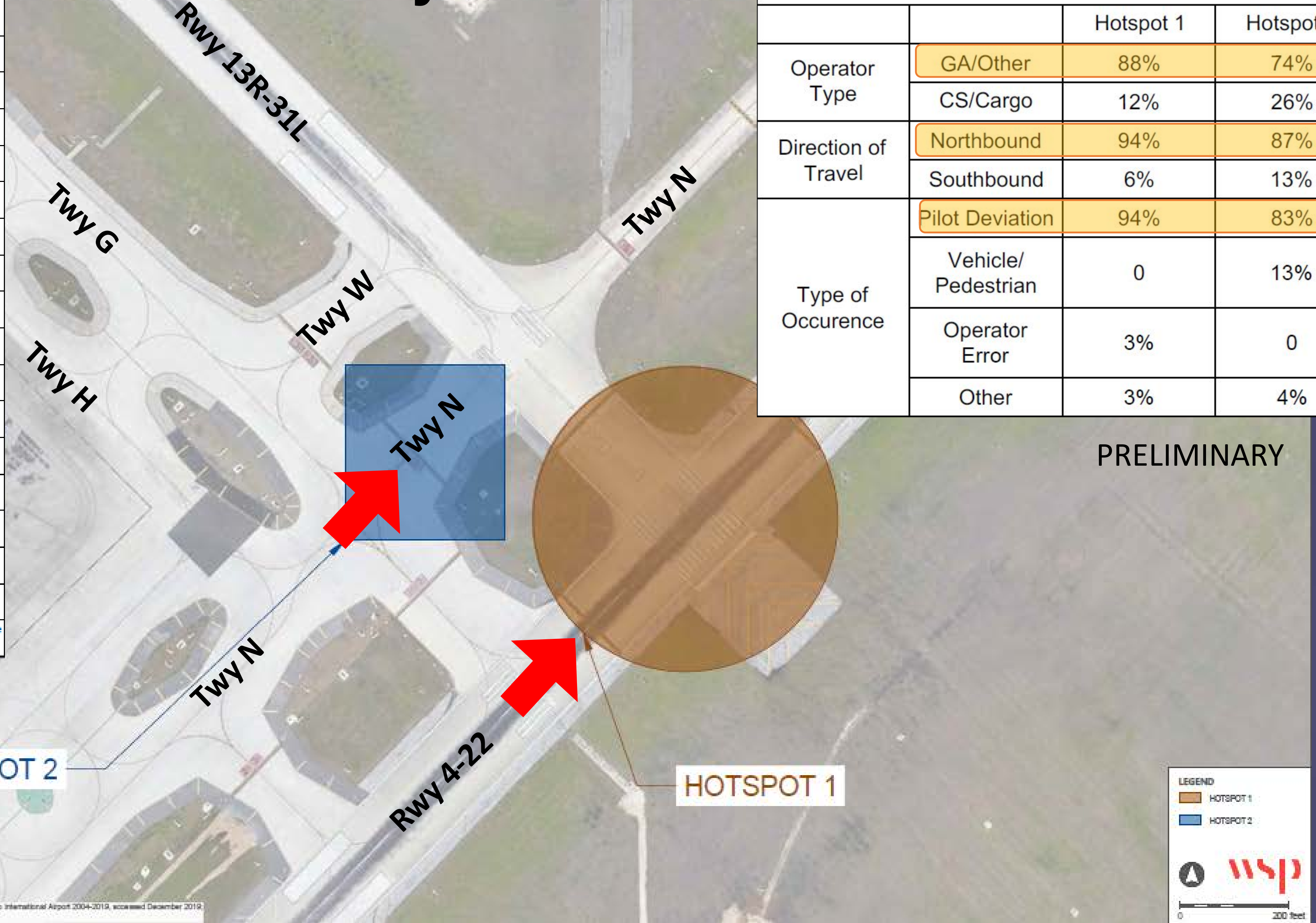
Number of Runway Incursion Events by Year

	Hotspot 1	Hotspot 2
2004	0	3
2005	1	0
2006	1	2
2007	0	0
2008	3	0
2009	1	3
2010	6	3
2011	2	2
2012	0	1
2013	2	0
2014	0	0
2015	3	1
2016	1	2
2017	7	4
2018	3	1
2019	2	1

Note: Taxiway centerline realignments were implemented in 2018 to mitigate runway incursions at Hotspot 2.

Analysis of Events 2004-2019

		Hotspot 1	Hotspot 2
Operator Type	GA/Other	88%	74%
	CS/Cargo	12%	26%
Direction of Travel	Northbound	94%	87%
	Southbound	6%	13%
Type of Occurence	Pilot Deviation	94%	83%
	Vehicle/ Pedestrian	0	13%
	Operator Error	3%	0
	Other	3%	4%



PRELIMINARY

SOURCES: Federal Aviation Administration Runway Safety Office, Runway Incursions Database, San Antonio International Airport 2004-2019, accessed December 2019; Google Earth, January 2020 (aerial photography); WSP USA, January 2020 (analysis).

Potential Hot Spot Mitigations

1. Decouple Rwys 13R-31L and 4-22
2. Extend Rwy 31L end east and add a parallel taxiway to Rwy 4-22
3. Extend Rwy 31L end east and extend short partial parallel Twy G to connect to the extension

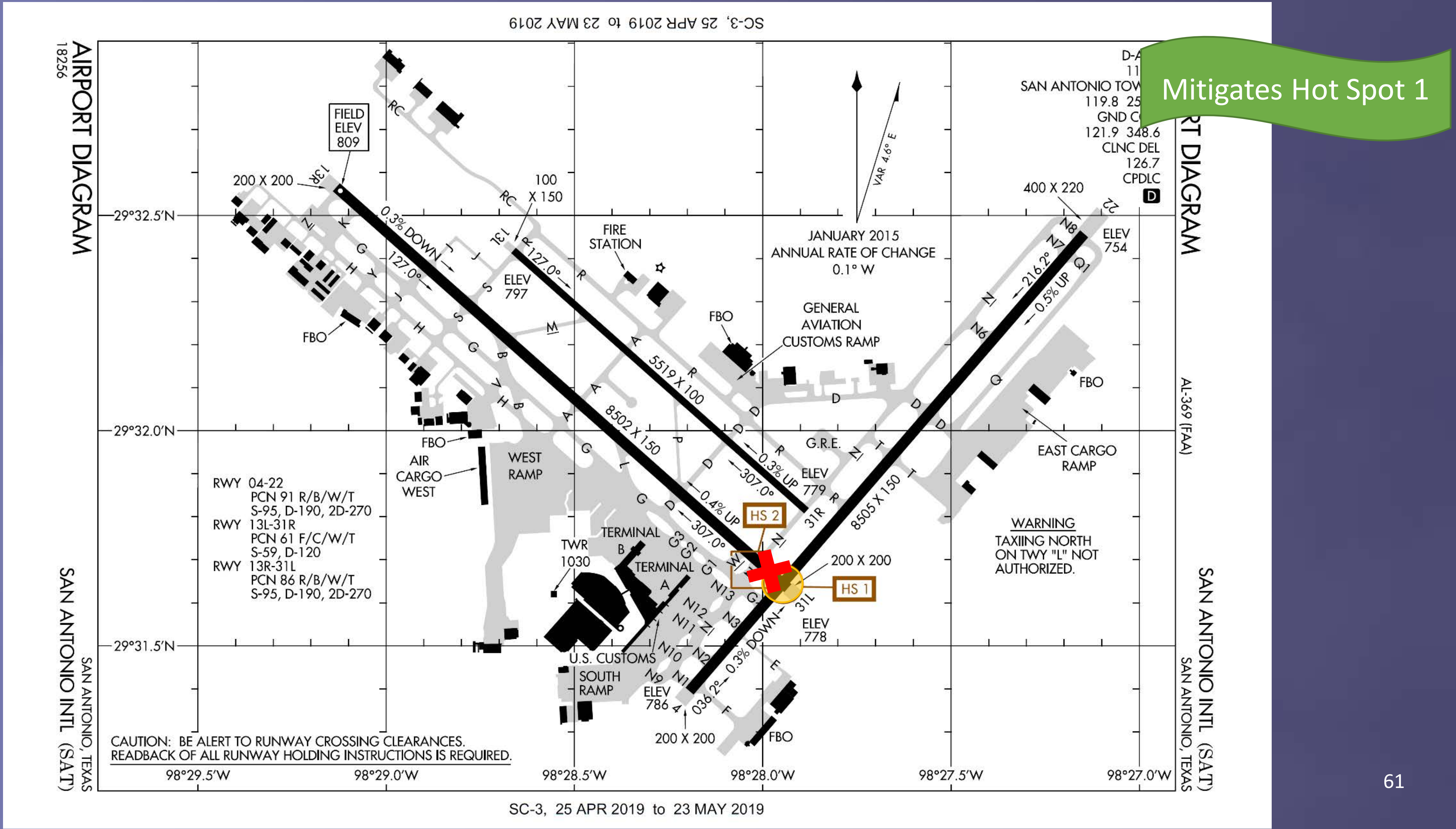
3A. Extend Rwy 31L end east and extend partial parallel taxiway from Twy G to connect to Twy Q

4. Extend Twy W across Rwy 31R-31L and build a dogleg to Twy N, close Twy N west of Rwy 13R-31L
5. Other?

Mitigation Option #1

Decouple Runways

PRELIMINARY



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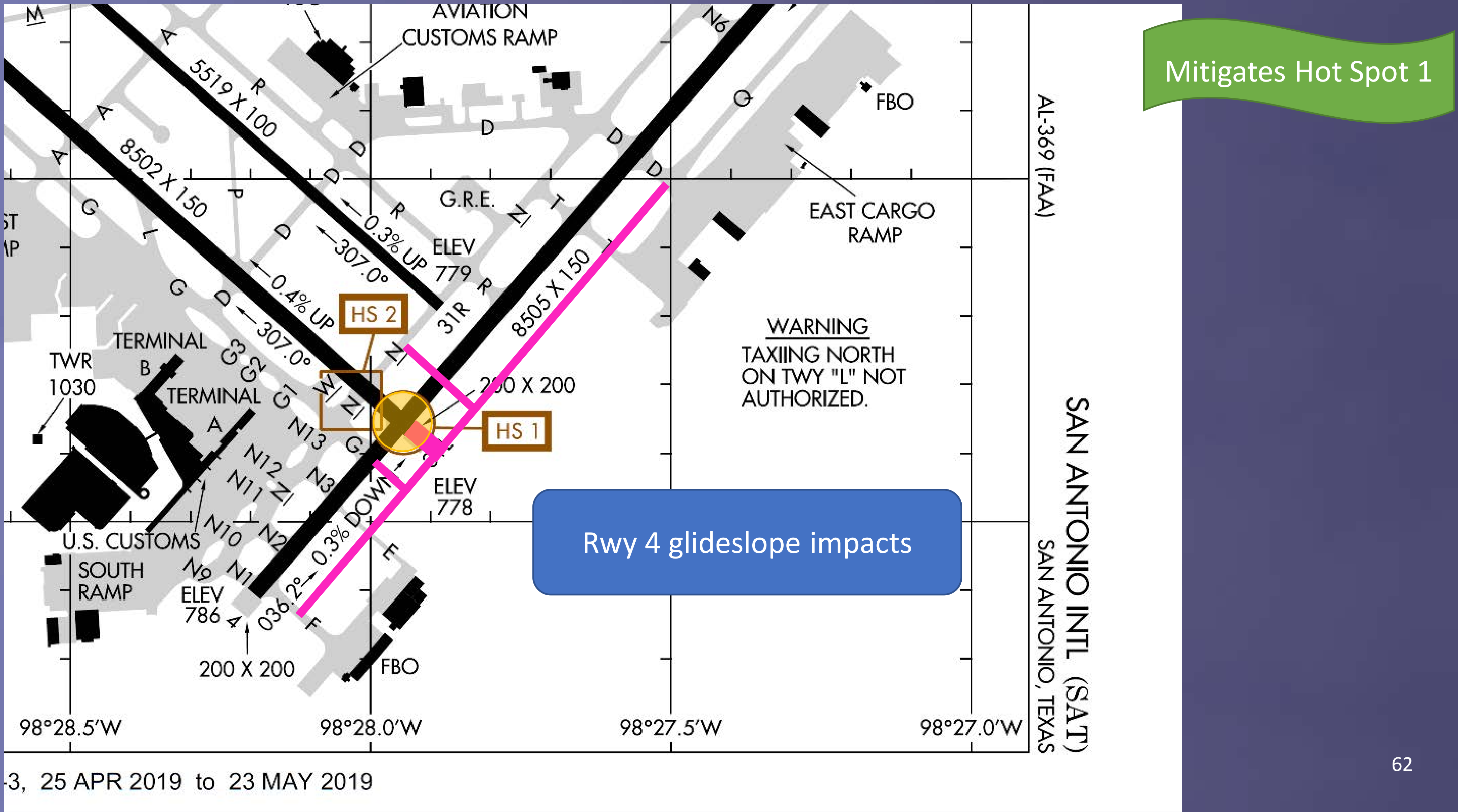
Mitigation Option #2

Extend Rwy 31L East, Rwy 4-22 Parallel Taxiway

PRELIMINARY



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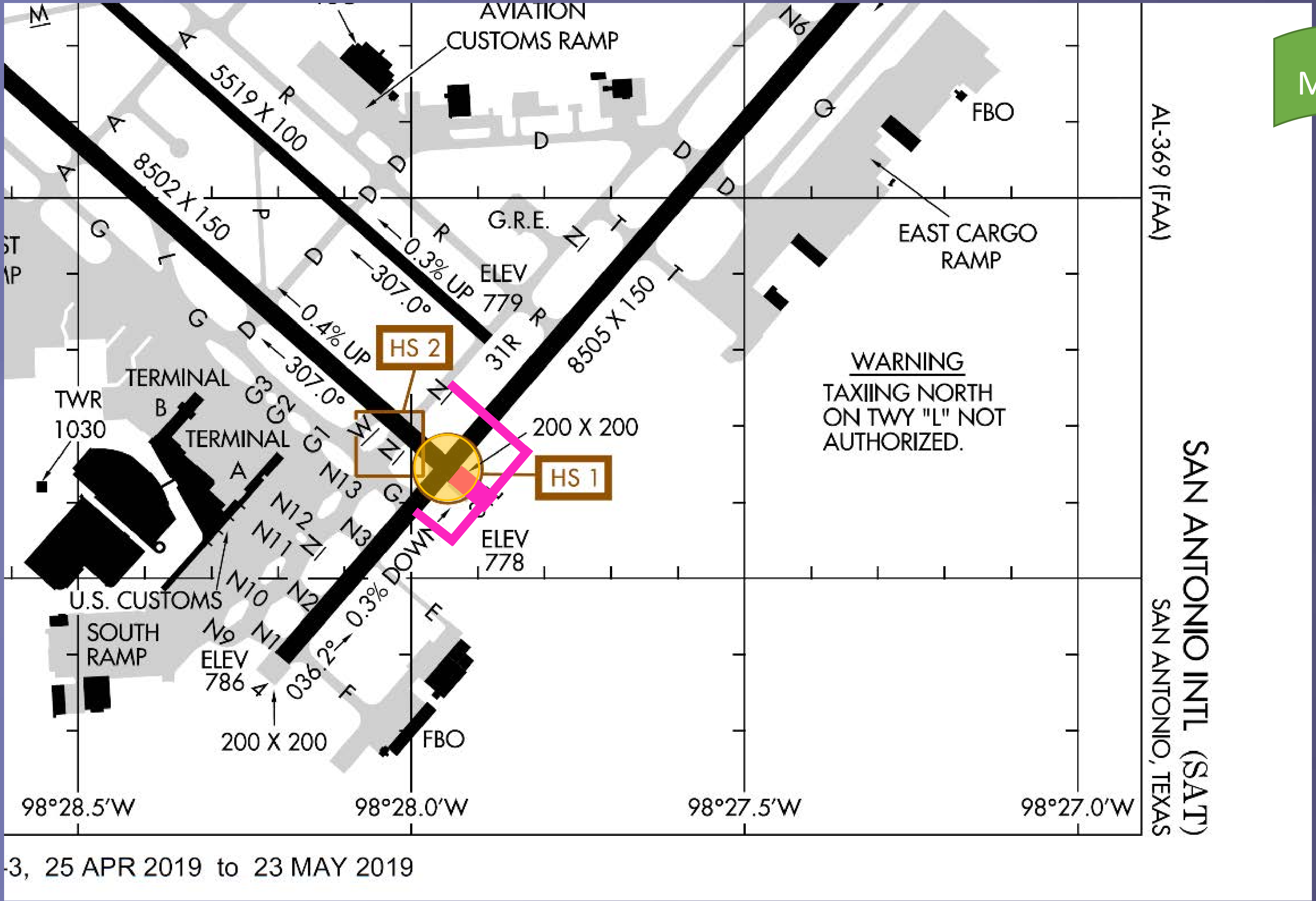
Mitigation Option #3

Extend Rwy 31L East, New Access Taxiways

PRELIMINARY



Mitigates Hot Spot 1

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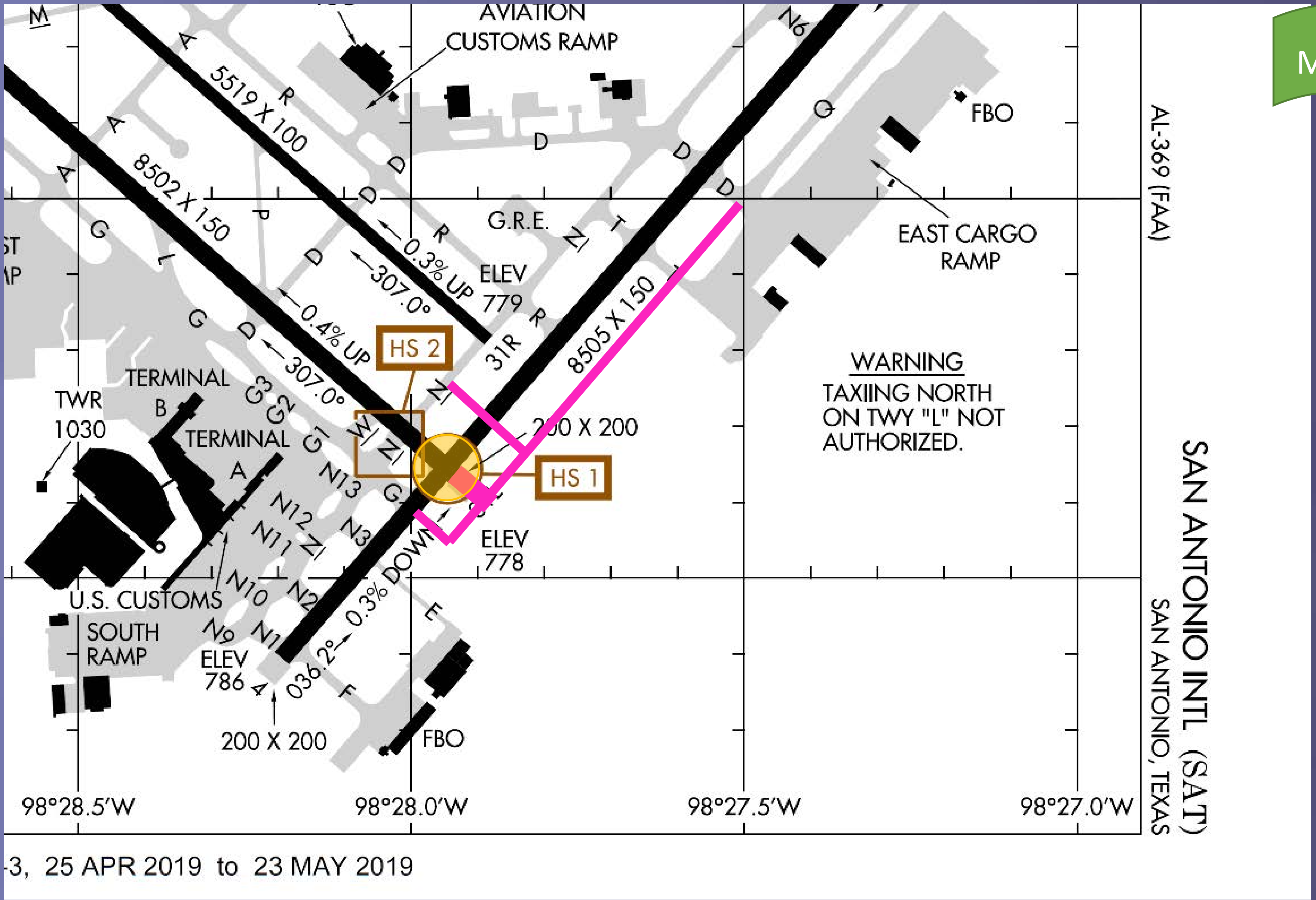
Mitigation Option #3A

Extend Rwy 31L East, Rwy 4-22 Partial Parallel Taxiway

PRELIMINARY

Mitigates Hot Spot 1



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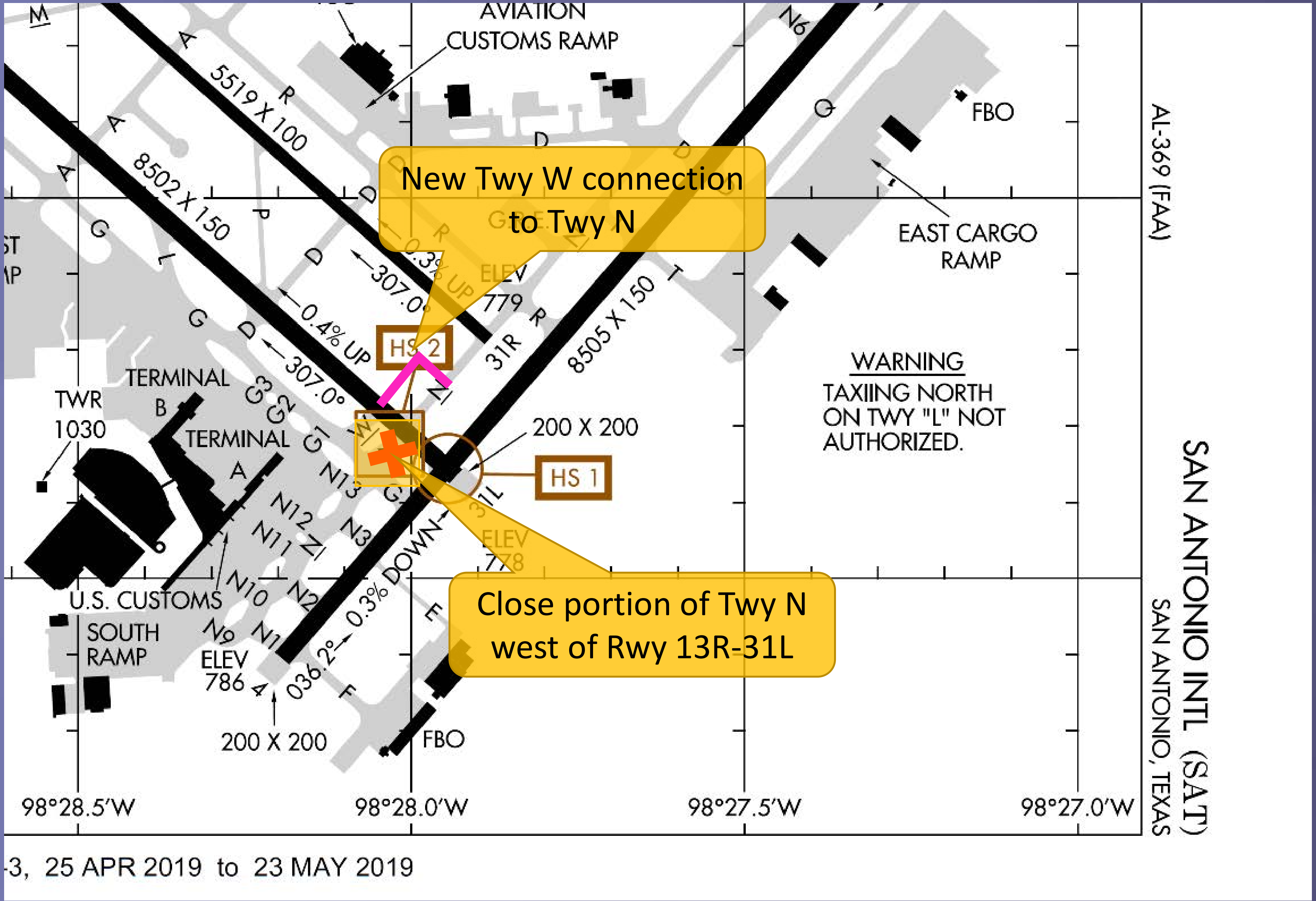
Mitigation Option #4

Extend Twy W , Close Portion of Twy N

PRELIMINARY

Mitigates Hot Spot 2



STRATEGIC DEVELOPMENT PLAN

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Thank You!

STRATEGIC DEVELOPMENT PLAN

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San Antonio Airport System Strategic Development Plan

2021 AIRPORT MASTER PLAN

MASTER PLAN UPDATE
CHAPTER 5 – ALTERNATIVES DEVELOPMENT AND EVALUATION
APPENDIX 5D – HIGH-SPEED EXIT SITING ANALYSIS

STRATEGIC DEVELOPMENT PLAN

San Antonio Airport System

San Antonio International Airport
Strategic Development Plan
Alternatives Development

Round 4
Airfield Workshop #9 – Runway 13R-31L Exits Optimization

August 28, 2020 (Revised September 21, 2020)

Meeting Agenda

- Task and REDIM Overview:
  - Background
  - Assumptions
- Analysis Results
- Next Steps

Task and REDIM Overview

STRATEGIC DEVELOPMENT PLAN

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Runway 13R-31L Exits
Background

ROT – Runway Occupancy Time (time from crossing the runway threshold to nose crossing the hold bar)

- Field observations/ATC/ops personnel reported that exits were in the wrong location, resulting in potential high ROTs:
  - Twy L is in the right location, but it is not a true high-speed exit, potentially resulting in aircraft missing the exit
  - Pilots deliberately get off at Twy D or N for convenience
  - ATC anticipates aircraft not exiting at right location, thus increases in-trail separation

➢ Use REDIM to:
  - Verify assumptions made in SDP Facility Requirements (artificial high ROTs)
  - Determine optimal high-speed exit location (component of an optimized airfield from 207,000 to 230,000 annual operations)

➢ Objective: get ROT down to 50 seconds or less to allow typical in-trail separation

REDIM Limitations

- How does REDIM work?
  - Based on actual observations and distributions from the 37 US airports equipped with ASDE-X (SAT is not one of them)

- Cannot input local conditions:
  - REDIM assumes optimized use of the runway and taxiways, ie landing in the touchdown zone and exiting at first available taxiway
    - REDIM cannot simulate long landings or delayed runway exit (such as long rollout for Terminal A)
  - ➢ WSP calibrated the model to tailor to SAT exit usage
    - Manual inputs into Excel spreadsheet

Runway 13R-31L Runway Exits Analysis
Scenarios

HSE = high-speed exit

- Runway Exits:
  - Existing Exits
  - Existing Exits + 1 new HSE in optimal location (30° exit angle with proper pavement geometry)
- Aircraft Fleet Mix:
  - 2019, 2023, 2028, 2038
- Runway 13R-31L Length:
  - 8,500’: 2019/2023
  - 10,089’ (Rwy 13R end stays on Airport): 2028, with 31L and 13R ends extensions
  - 10,700’ (Rwy 13R end over U.S. 281): 2038, with 31L and 13R ends extensions

Exit Use Assumptions

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Runway 13R-31L Runway Exits Analysis
Inputs - Aircraft Fleet Mix from the Forecast

- Narrowbody Passenger: B737 (≈ 55%)
  - Also includes A319, A320, B738, B739, ~~MD82, MD88, MD90~~
- Regional Jet: CRJ9 (≈ 12%)
  - Also includes B712, CRJ7, E170, E175, E190, SU95
- Widebody Passenger: B789 (≈ 0.2%)

- Large Cargo: A306 (≈ 4%)
  - Also includes B763, B752, B753, DC10, MD11
- Small Cargo: BE30 (≈ 2%)
  - Also includes: BE19, C208

Based on 2019 ANOMS and Fleet Mix Forecast

- GA Jet: C560 (≈ 19%)
- GA Prop/Turbo Prop: PA44 (≈ 6%)

Based on 2019 ANOMS and FAA Aerospace Forecast

ROT = Runway Occupancy Times

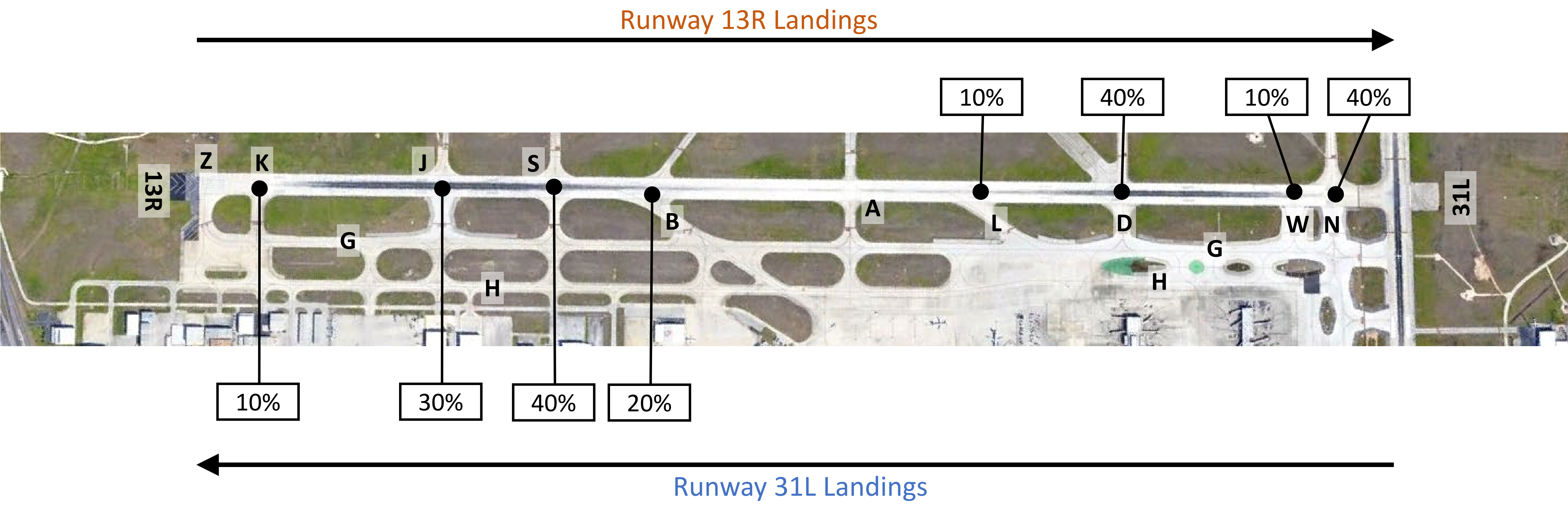
Runway Exit Use Assumptions

- GA prop/turboprop: use HIRO (High Intensity Runway Operations) - ATC requests expeditious exit after landing to minimize ROTs

- Runway extensions would have a displaced threshold

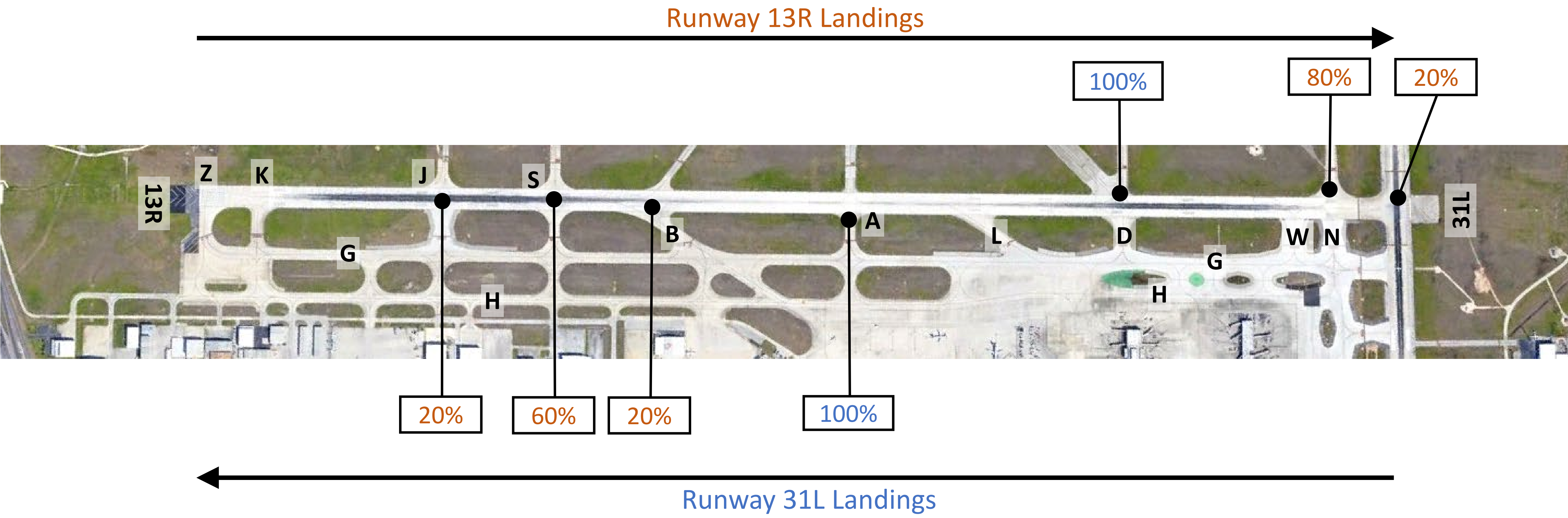
- ATC/WSP input for exit estimates

Commercial Aircraft Exit Use Assumptions



Per SAT ATC Input

Cargo Aircraft Exit Use Assumptions



Legend:
XX% Large Cargo Aircraft
XX% Small/Medium Cargo Aircraft

Per WSP Input – Comments?

REDIM Results

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PLAN

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Runway 13R-31L Landings

2019 Runway Exit Use

ROT = Runway Occupancy Times

- **Challenge:** REDIM cannot simulate long landings or delayed runway exit based on convenience
  - Received ATC input of estimated exit use
    - Does not match REDIM exit distributions
    - REDIM cannot be modified to account for this
  - Through spreadsheet weighted average calculations based on ATC/WSP exit estimates and REDIM data, we "calibrated" the REDIM model to fit SAT's exit use patterns:
    - 2019 Rwy 13R landings ROT = 53.9 sec
    - 2019 Rwy 31L landings ROT = 48.5 sec

- ROT **Results**:
  - Rwy 13R: ROT > 50 sec → try to improve
  - Rwy 31L: ROT < 50 sec, leave as is

Runway 13R Occupancy Time
Existing Exits - 2019 Fleet Mix (Spreadsheet Method)

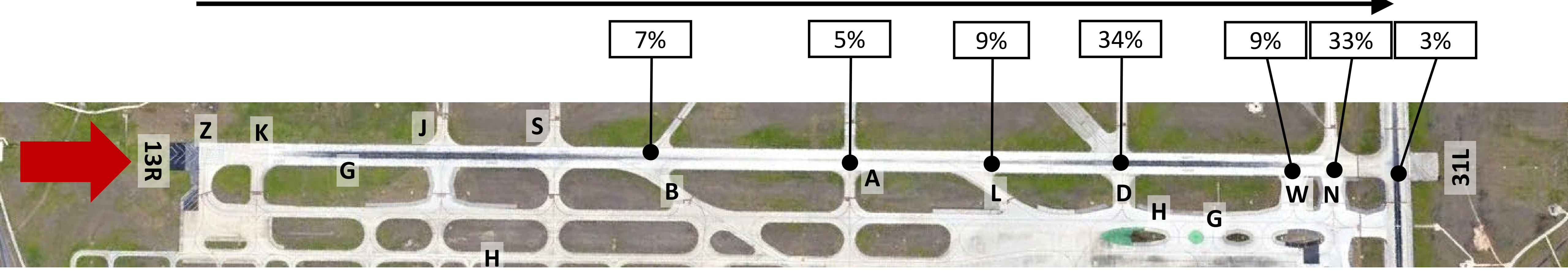
Sample spreadsheet calculations

Aircraft / Exit		K	J	S	B	A	L	D	W	N	Rwy 4-22	Aircraft Mix
Distance from Landing Threshold (ft)		400	1,575	2,353	2,823	4,456	5,238	6,250	7,588	7,824	8,248	
Narrowbody Pax	Exit %						10.0%	40.0%	10.0%	40.0%		54.9%
	ROT (sec)						42.5	49.1	60.6	56.6		
Regional Jet	Exit %						10.0%	40.0%	10.0%	40.0%		11.9%
	ROT (sec)						42.3	49.3	60.4	56.9		
Large Cargo	Exit %									80.0%	20.0%	4.2%
	ROT (sec)									63.5	67.2	
Small Cargo	Exit %							100.0%				4.4%
	ROT (sec)							60.1				
GA Jet	Exit %				30.0%	20.0%	10.0%	10.0%	10.0%	10.0%	10%	18.0%
	ROT (sec)				32.4	46	52.1	59.9	71.3	68.2	72	
GA Prop/TP	Exit %				30.0%	20.0%	10.0%	10.0%	10.0%	10.0%	10%	6.6%
	ROT (sec)				38.5	57.4	63.2	74.9	91.1	82.1	91.3	
Exit Mix			**0.0%**	**0.0%**	**7.4%**	**4.9%**	**9.1%**	**33.6%**	**9.1%**	**32.5%**	**3.3%**	

ROT = 53.9 sec

Sources:
Exit %: ATCT/WSP input
ROTs: REDIM

Runway 13R Landings



Runway 31L Occupancy Time
Existing Exits - 2019 Fleet Mix (Spreadsheet Method)

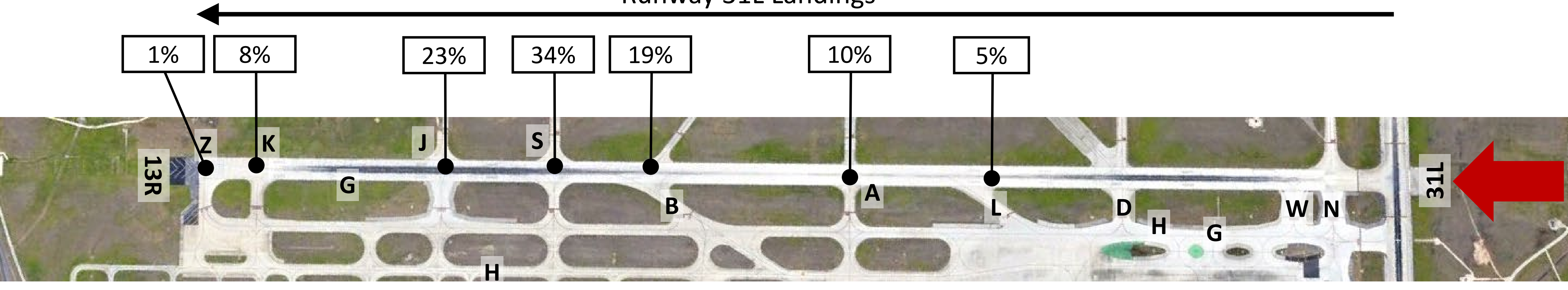
Sample spreadsheet calculations

Aircraft / Exit		N	W	D	L	A	B	S	J	K	Z	Aircraft Mix
Distance from Landing Threshold (ft)		427	723	1907	2895	3825	5168	5879	6663	7650	8313	
Narrowbody Pax	Exit %						20.0%	40.0%	30.0%	10.0%		53.2%
	ROT (sec)						41.4	46	51.6	59.6		
Regional Jet	Exit %						20.0%	40.0%	30.0%	10.0%		11.4%
	ROT (sec)						43	46.8	52.36	59.6	62.9	
Large Cargo	Exit %						20.0%	60.0%	20.0%			3.9%
	ROT (sec)						48.4	53	58.4	65.7	75.5	
Small Cargo	Exit %					100.0%						4.8%
	ROT (sec)					40.1	53.9	56.8	64.8	71.9		
GA Jet	Exit %				20.0%	20.0%	20.0%	20.0%	10.0%	5.0%	5.0%	19.4%
	ROT (sec)				33	40.4	53.3	56.5	62.2	69.6	73.6	
GA Prop/TP	Exit %				20.0%	20.0%	20.0%	20.0%	10.0%	10.0%		7.1%
	ROT (sec)				38.2	48.1	63.2	66.8	75.8	85.8		
Exit Mix		**0.0%**	**0.0%**	**0.0%**	**5.3%**	**10.1%**	**19.0%**	**33.5%**	**22.8%**	**8.2%**	**1.0%**	

ROT = 48.5 sec

Sources:
Exit %: ATCT/WSP input
ROTs: REDIM

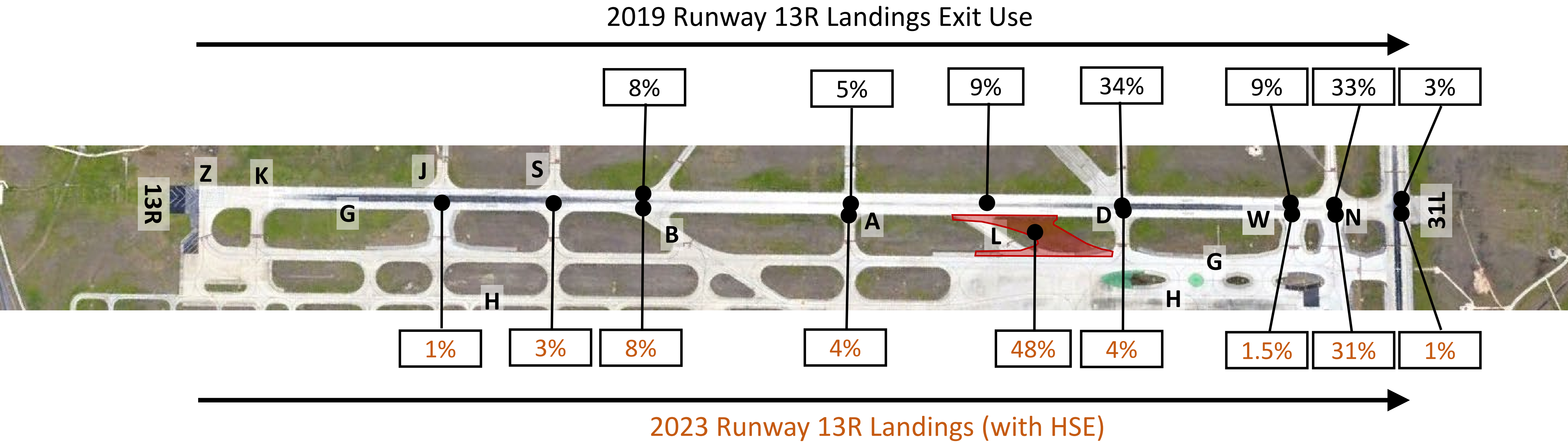
Runway 31L Landings



Comparison of Runway 13R Exit Use

Without a HSE (2019) and With a HSE (2023)

HSE = High-Speed Exit



HSE as depicted is the optimal location per REDIM. The curve starts 5,495' from the Rwy 13R end.

HIRO for GA prop/turboprop on 13R

Runway 13R-31L Occupancy Times

2023 Fleet Mix - Rwy 31L End Extension

ROT = Runway Occupancy Times

Runway 13R Landings – ROT (no HSE) = 52.0 sec

Runway 13R Landings – ROT (with HSE) = 50.0 sec

Runway 31L Landings – ROT = 48.5 sec

HIRO for GA prop/turboprop on 13R

Runway 13R-31L Landings

2028 Fleet Mix - Runway Extensions on Both Ends

ROT = Runway Occupancy Times

Rwy 13R Displaced Threshold

Runway 13R Landings – ROT (no HSE) = 52.0 sec

Runway 13R Landings – ROT (with HSE) = 50.0 sec

Rwy 31L Displaced Threshold

Runway 31L Landing – ROT = 48.4 sec

HIRO for GA prop/turboprop on 13R

Runway 13R-31L Landings

2038 Fleet Mix - Runway Extensions on Both Ends

ROT = Runway Occupancy Times

Rwy 13R Displaced Threshold

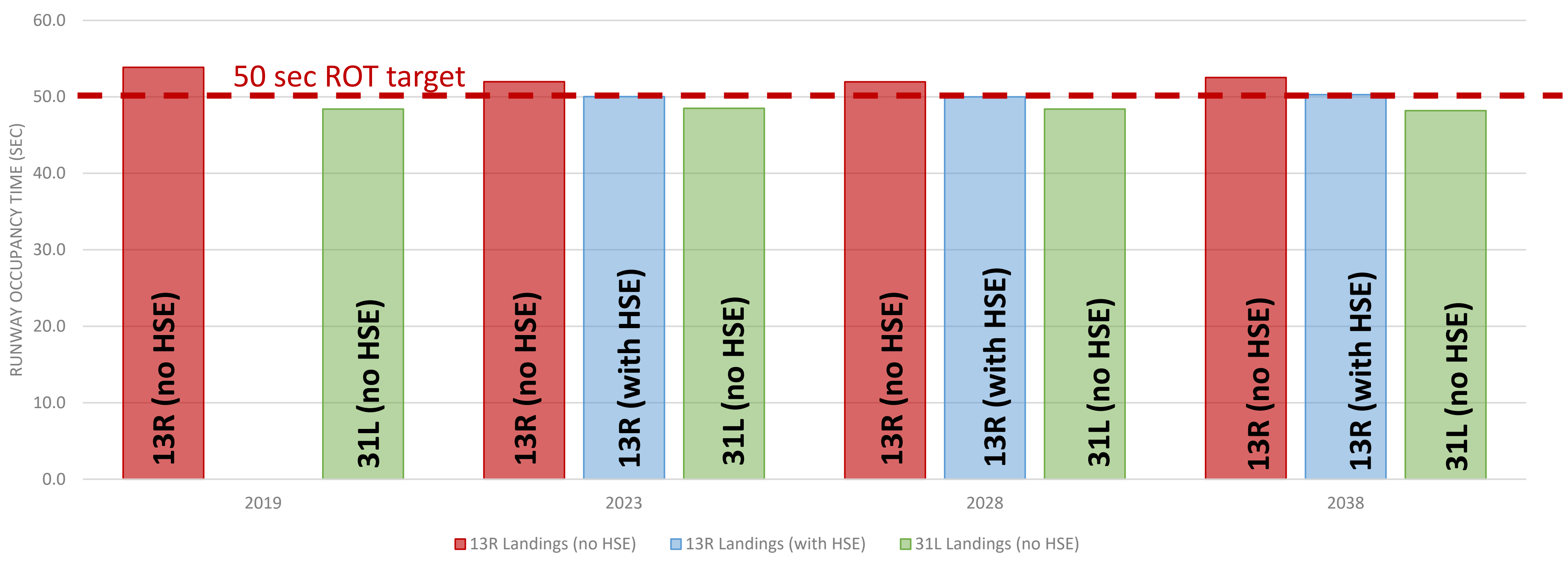
Runway 13R Landings – ROT (with HSE) = 52.5 sec

Runway 13R Landings – ROT (with HSE) = 50.3 sec

Runway 31L Landing – ROT = 48.2 sec

HIRO for GA prop/turboprop on 13R

Runway Exits Analysis Results



Notes:

1. ROTs based on ATC/WSP input, REDIM data and spreadsheet calculations.
2. HIRO for prop/turboprop on 13R from 2023 on.

➢ Recommend replacing existing Twy L with a high-speed exit for Rwy 13R arrivals, located 5,495’ from the Rwy 13R end.

High-Speed Exit Location

- ➢ Recommend replacing existing Twy L with a high-speed exit located 5,495’ from the Rwy 13R end.

5,495’ is measured to start of taxiway centerline curvature

Note: for illustration purposes only.

Next Steps

STRATEGIC DEVELOPMENT PLAN

SAAS
San Antonio Airport System

Next Steps

- SRA-light #2
  - High-level phasing and AviPlan
- ADO/ATCT discussion:
  - ADG VI hold bars/MOS
  - ADG VI runway-taxiway separation/MOS
  - Rwys 31 ends alignment/taxiflows
- Finalize airfield decisions

THANK YOU!

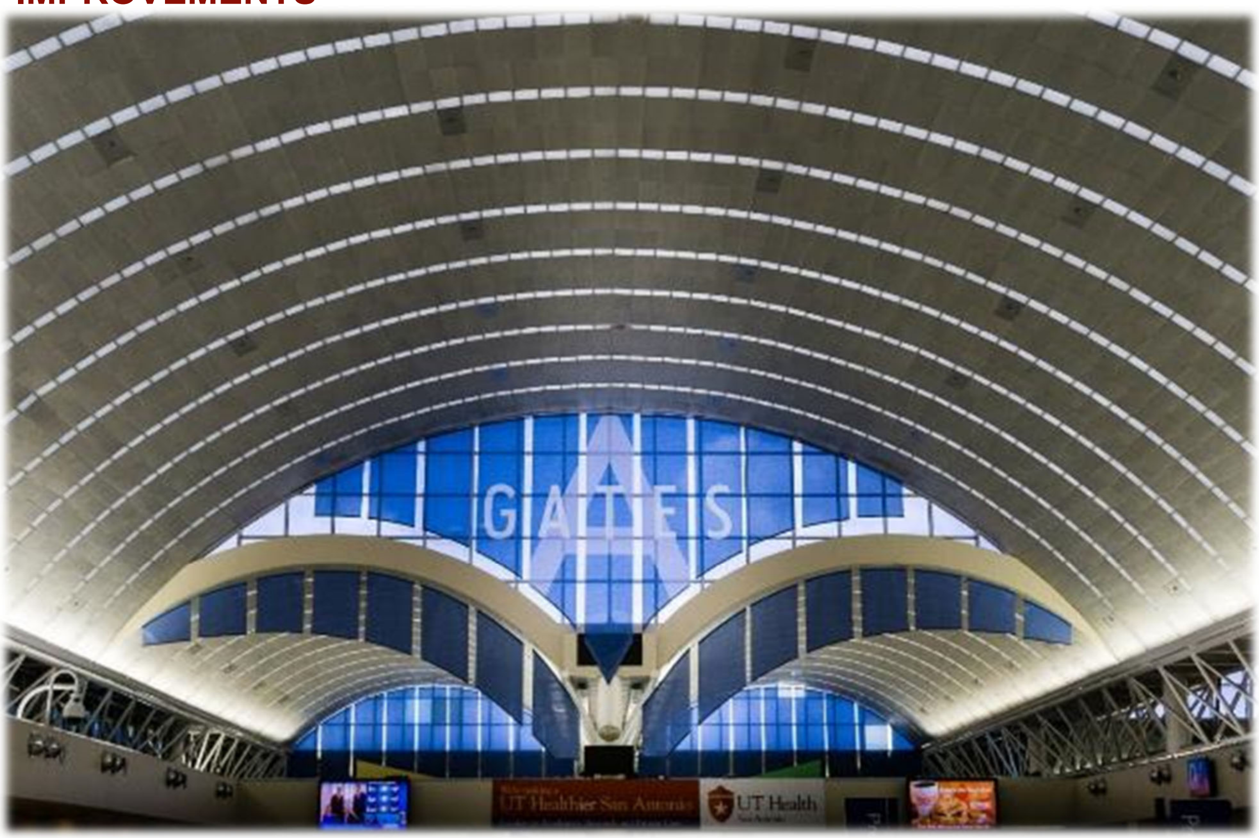
STRATEGIC DEVELOPMENT PLAN

SAAS
San Antonio Airport System

San Antonio Airport System
Strategic Development Plan

2021 AIRPORT MASTER PLAN

MASTER PLAN UPDATE
CHAPTER 5 – ALTERNATIVES DEVELOPMENT AND EVALUATION
APPENDIX 5E – NON-STANDARD AIRFIELD GEOMETRY IMPROVEMENTS



STRATEGIC DEVELOPMENT PLAN

SAAS

San Antonio Airport System

San Antonio International Airport

Strategic Development Plan

Airfield Non-Standard Geometry Mitigation Alternatives

March 18, 2021

Meeting Agenda

- Purpose and Outcome
- Areas of Non-Compliance
- Mitigation Alternatives and Recommendations
- Next Steps

Purpose & Outcome of this Meeting

Purpose

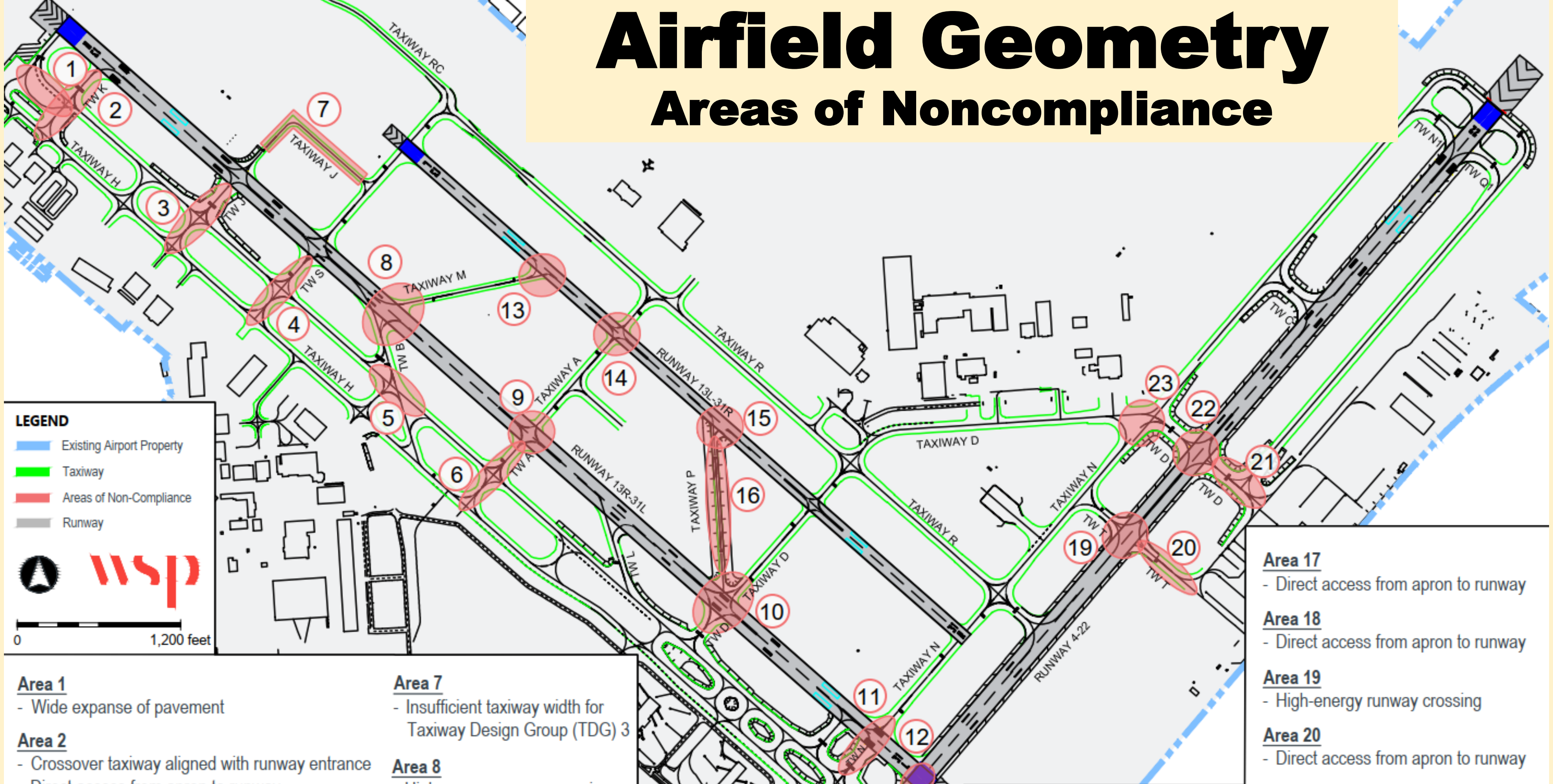
- Review areas of airfield geometry non-compliance and mitigation alternatives

Outcome

- Select preferred mitigation alternatives

Non-Standard Airfield Geometry

Airfield Geometry
Areas of Noncompliance



Area 1
- Wide expanse of pavement

Area 2
- Crossover taxiway aligned with runway entrance
- Direct access from apron to runway

Area 3
- Crossover taxiway aligned with runway entrance
- Direct access from apron to runway

Area 4
- Crossover taxiway aligned with runway entrance
- Direct access from apron to runway

Area 5
- More than three nodes
- Wide expanse of pavement

Area 6
- Crossover taxiway aligned with runway entrance
- Direct access from apron to runway

Area 7
- Insufficient taxiway width for Taxiway Design Group (TDG) 3

Area 8
- High-energy runway crossing
- Non perpendicular runway crossings

Area 9
- High-energy runway crossing

Area 10
- More than three nodes
- Non-perpendicular runway crossing

Area 11
- Hot spot

Area 12
- Hot spot

Area 13
- Non-perpendicular runway entrance/exit

Area 14
- High-energy runway crossing

Area 15
- Non-perpendicular runway entrance/exit

Area 16
- Insufficient taxiway width for TDG 3

Area 17
- Direct access from apron to runway

Area 18
- Direct access from apron to runway

Area 19
- High-energy runway crossing

Area 20
- Direct access from apron to runway

Area 21
- Direct access from apron to runway
- Crossover taxiway aligned with runway entrance

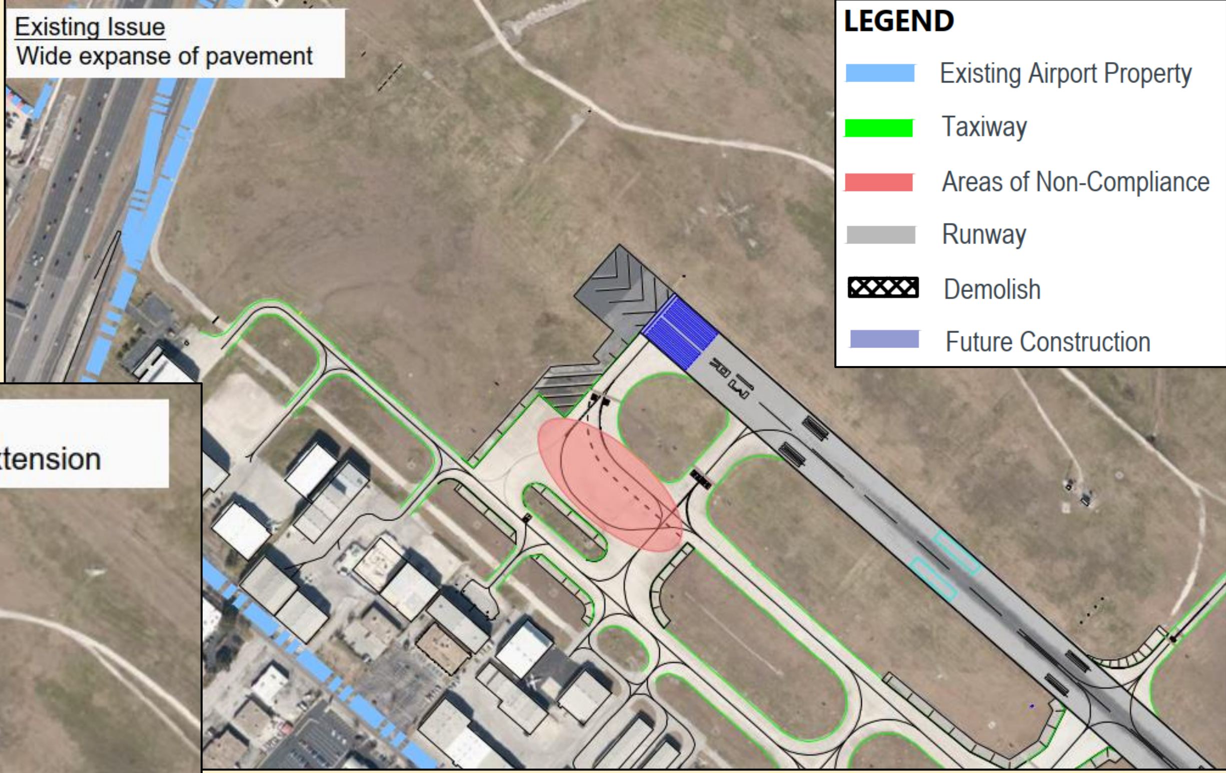
Area 22
- High-energy runway crossing

Area 23
- Wide expanse of pavement

Area 24 (Airfield-wide)
- No runway shoulders for Runway 13R-31L and Runway 13L-31R
- Insufficient taxiway shoulders and fillets to meet Taxiway Design Groups

Mitigation Alternatives

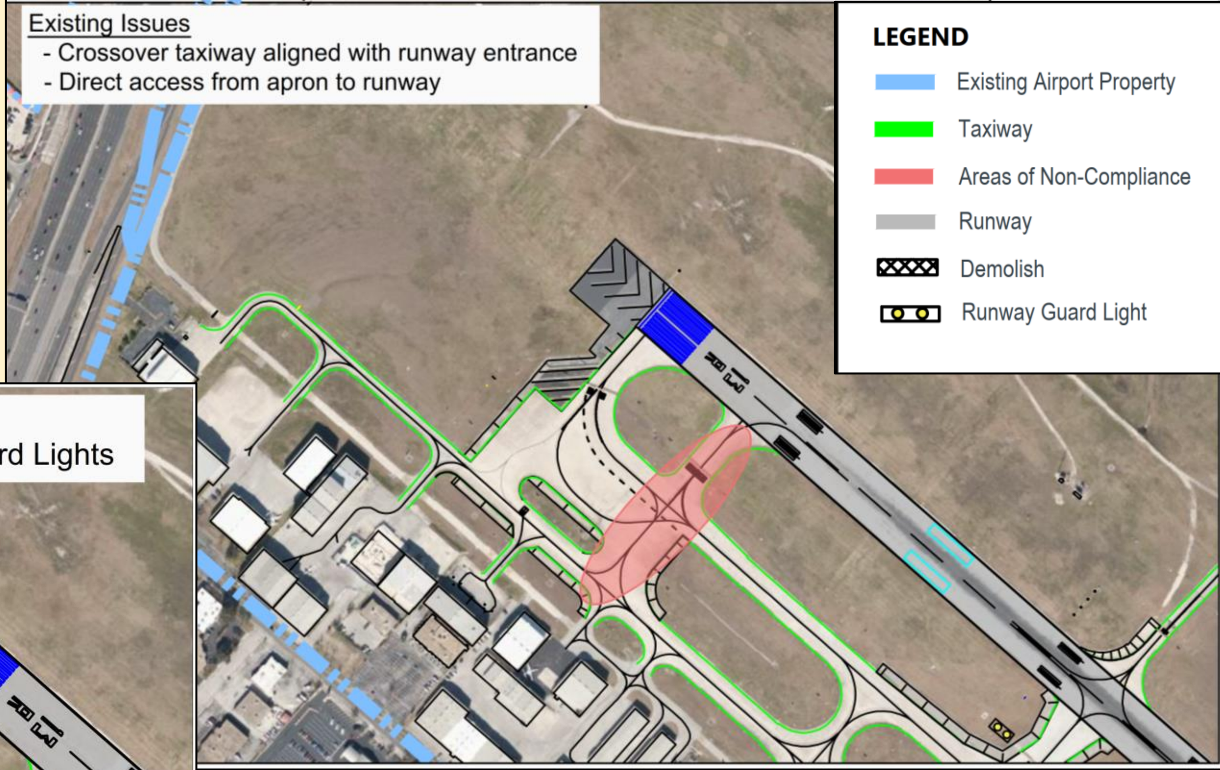
Area 1
Mitigation Alternatives

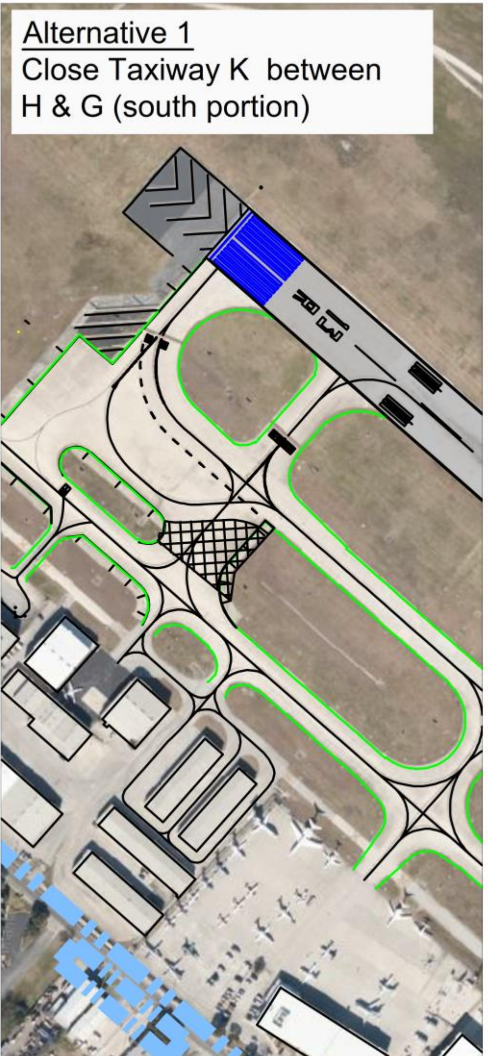


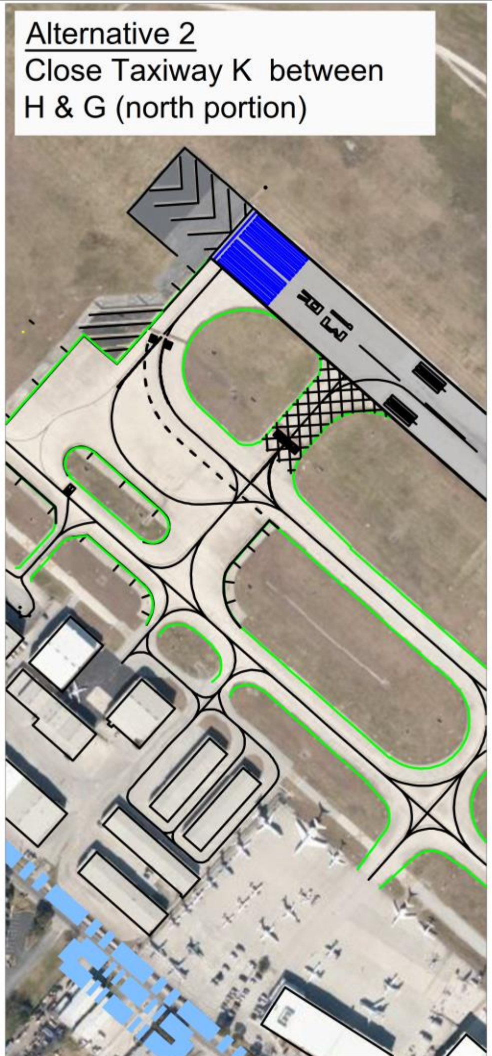
Recommendation:

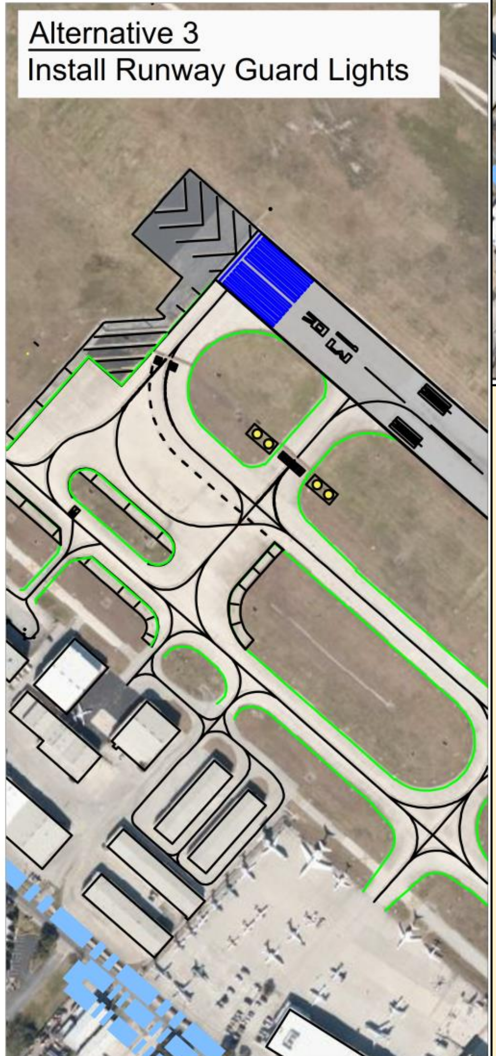
- Short-term: Alternative 1
  - Include in Rwy 13R-31L keel Replacement project
- Long-term: Alternative 2

Area 2
Mitigation Alternatives





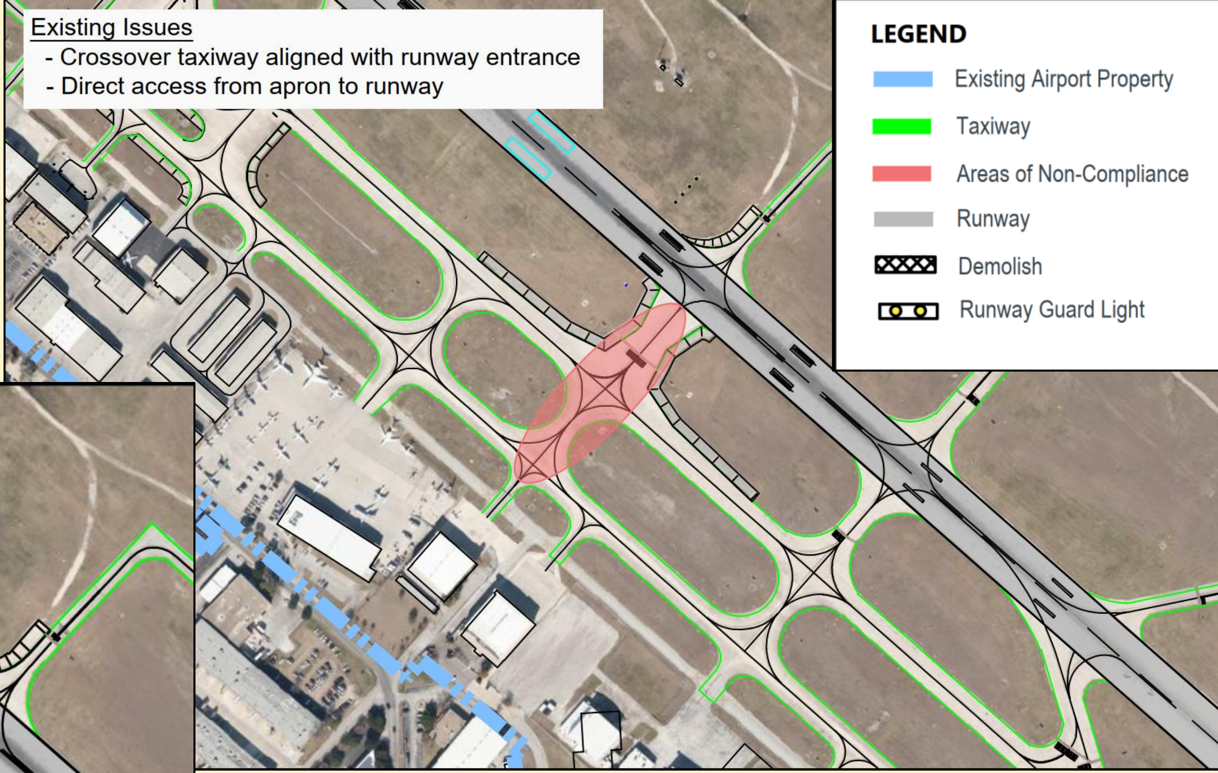


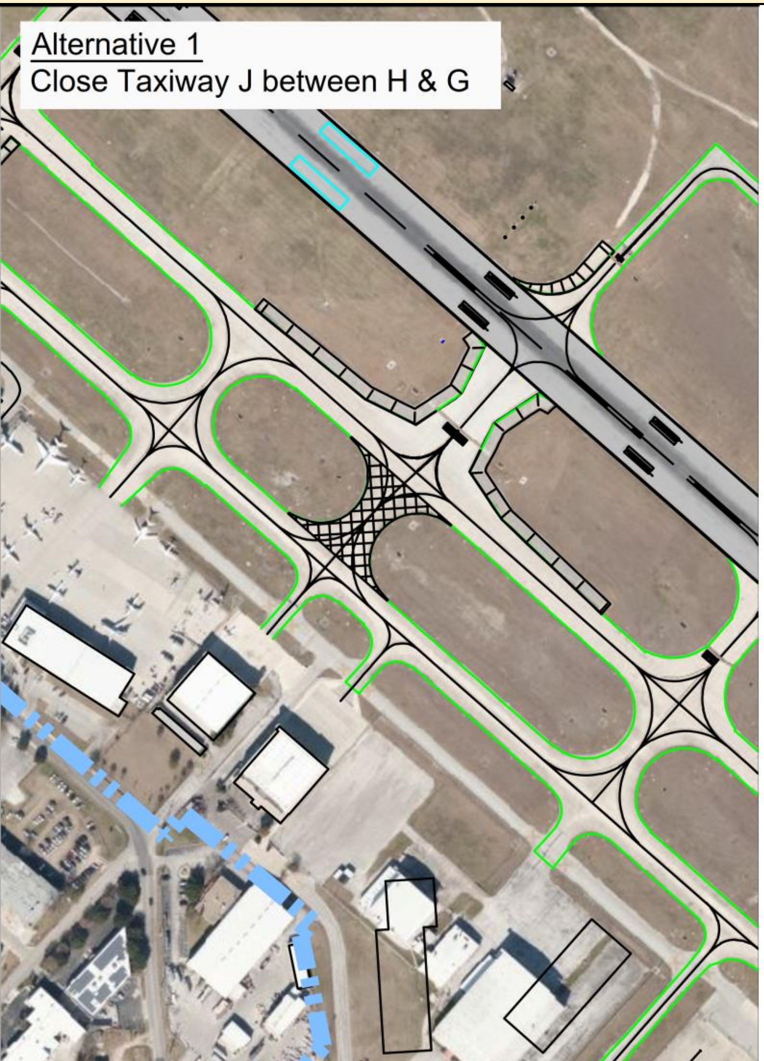


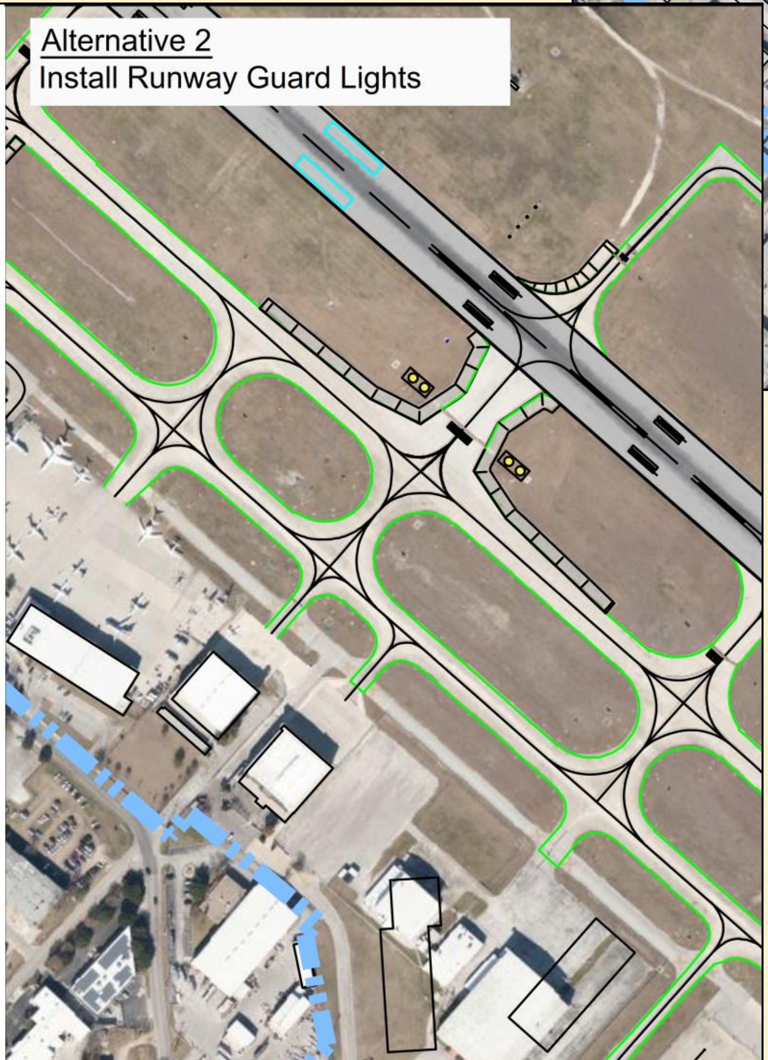
Recommendation:

- Alternative 3 (already have RGLs)
- No action needed

Area 3
Mitigation Alternatives

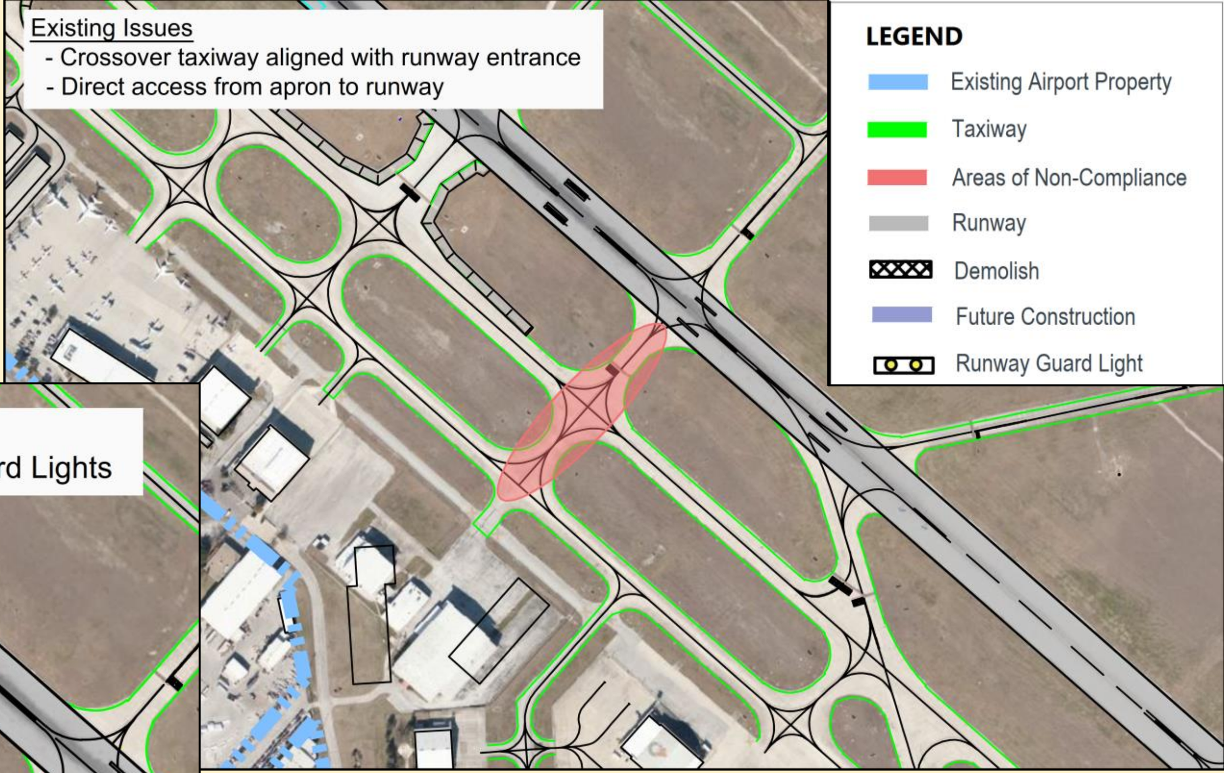


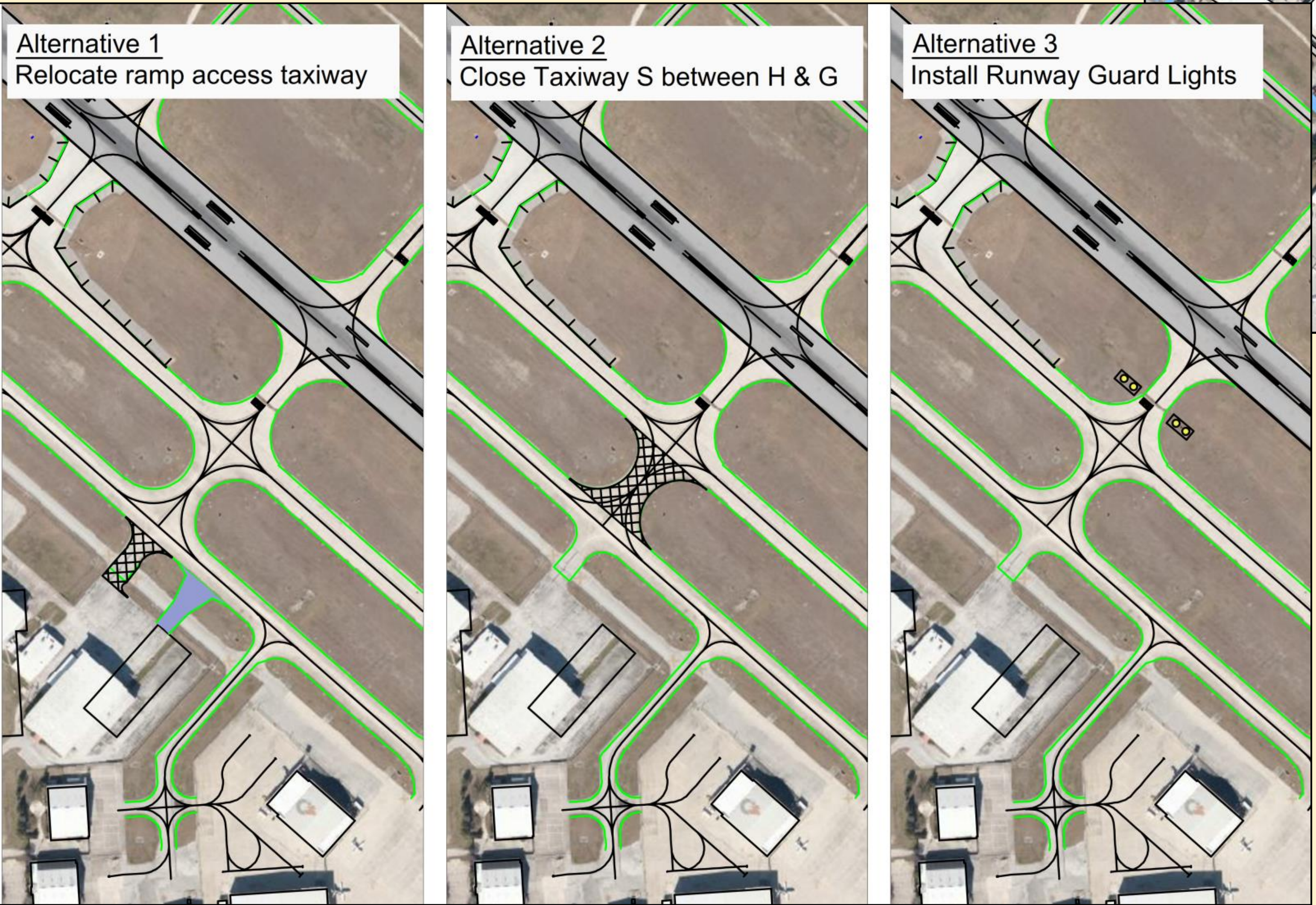




Recommendation:
- Alternative 2 (install RGLs)
- Defer after 6-year CIPs

Area 4
Mitigation Alternatives

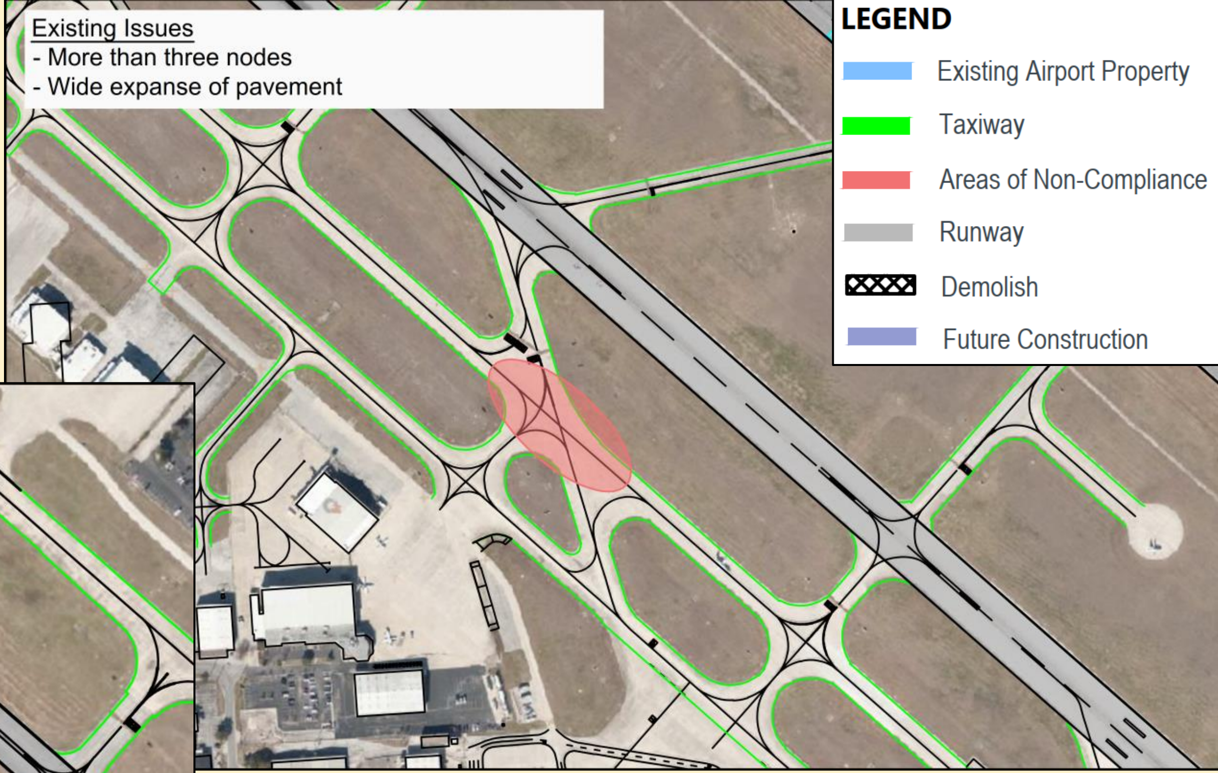


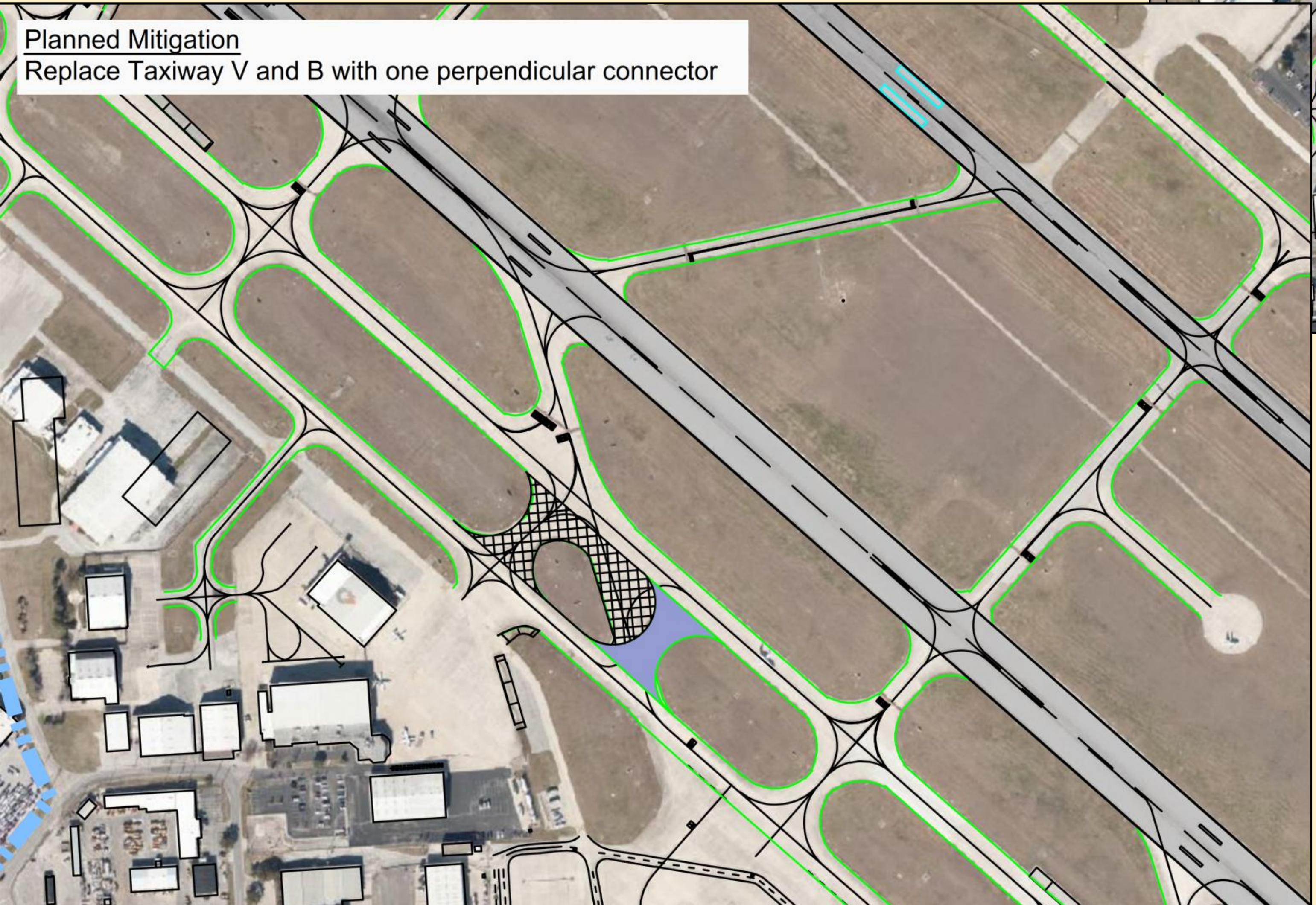


Recommendation:

- No action needed (tenant access will be relocated west)

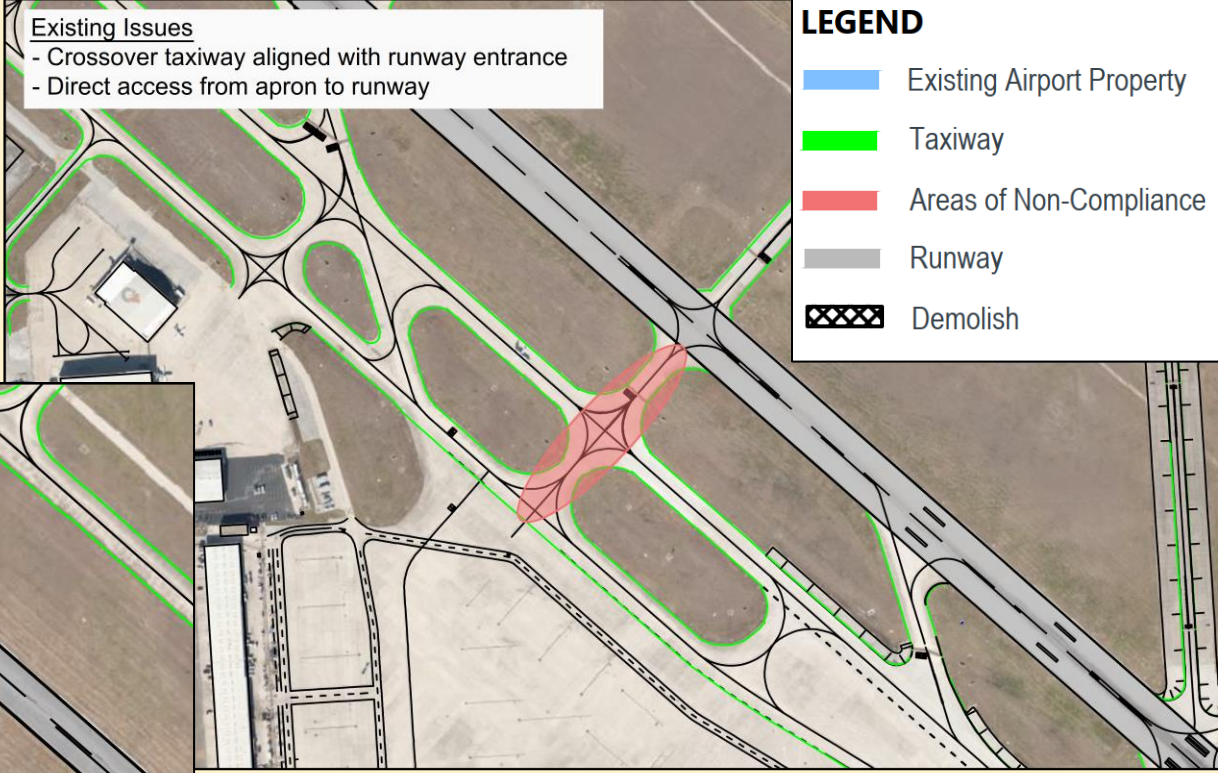
Area 5
Mitigation Alternatives

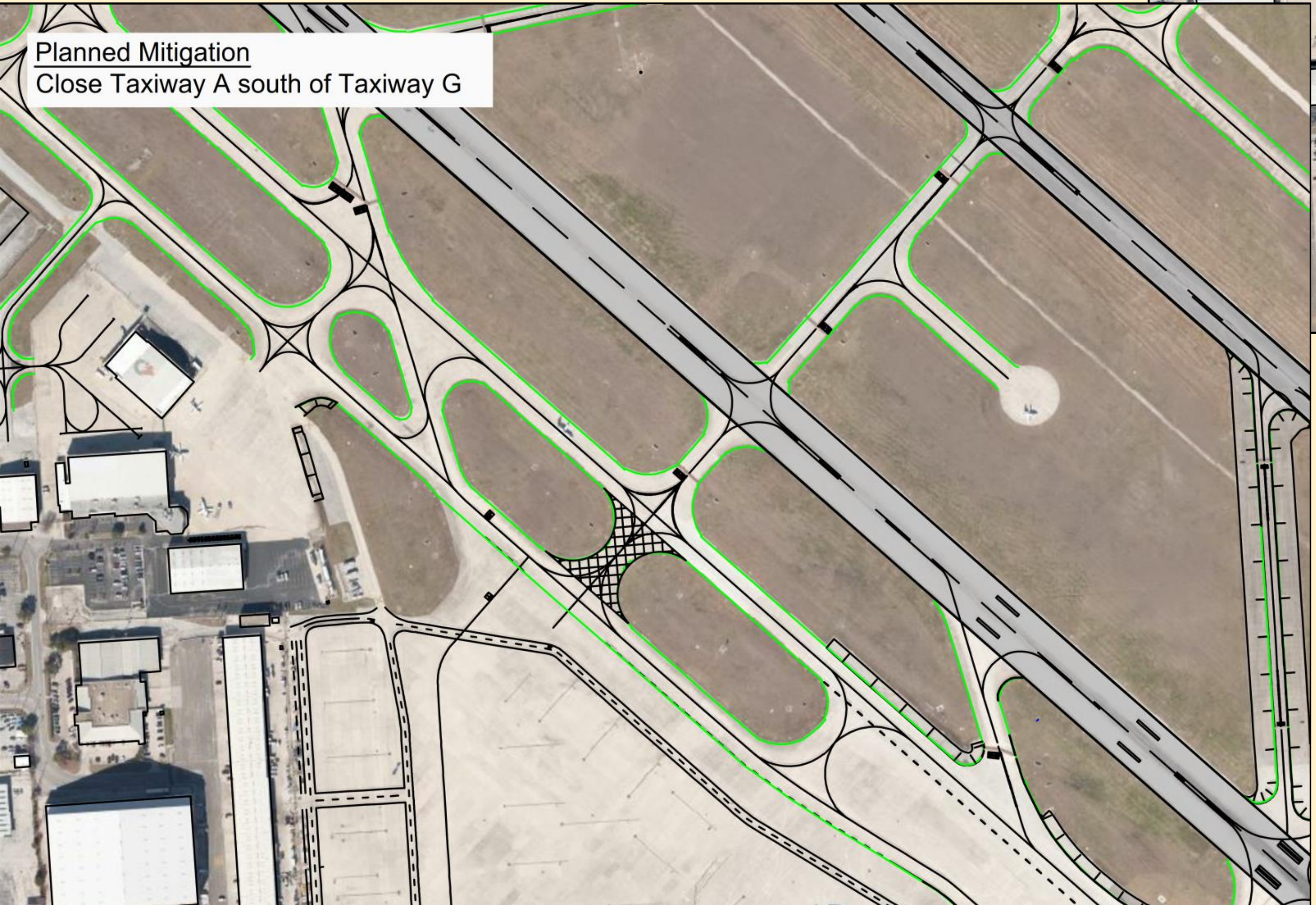




Recommendation:
- Planned mitigation

Area 6
Mitigation Alternatives

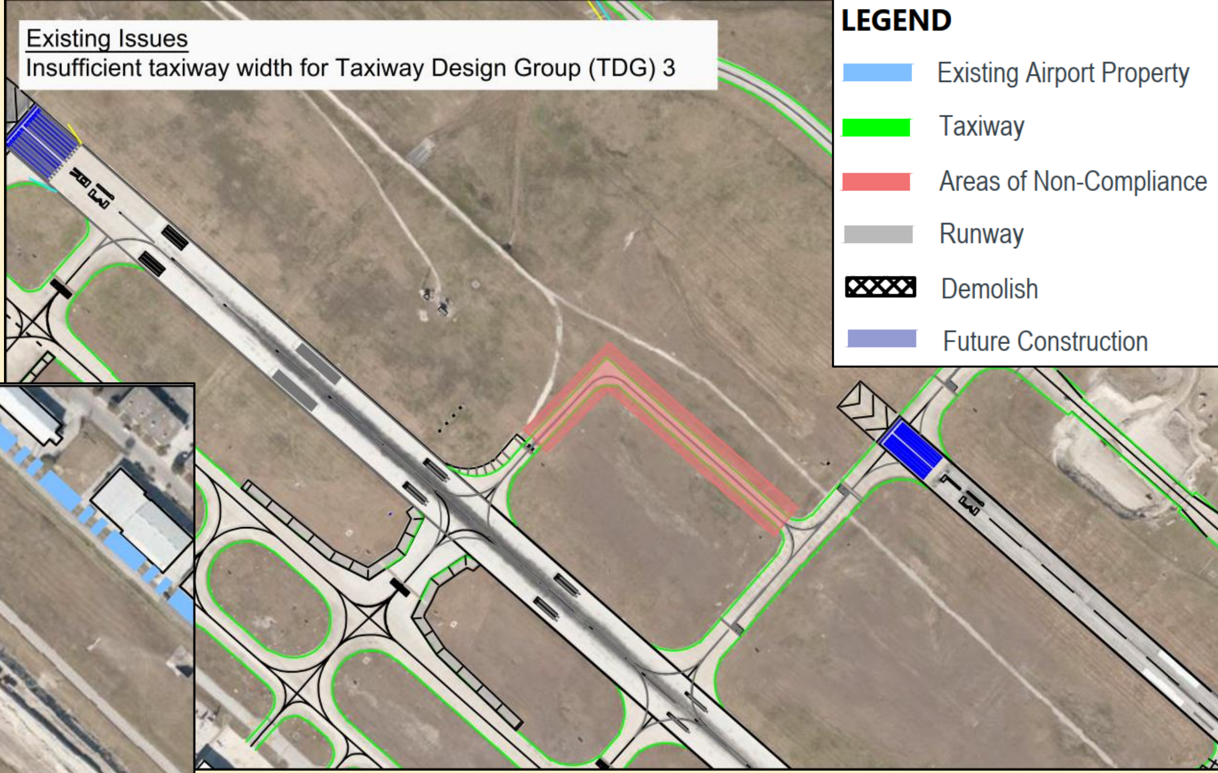


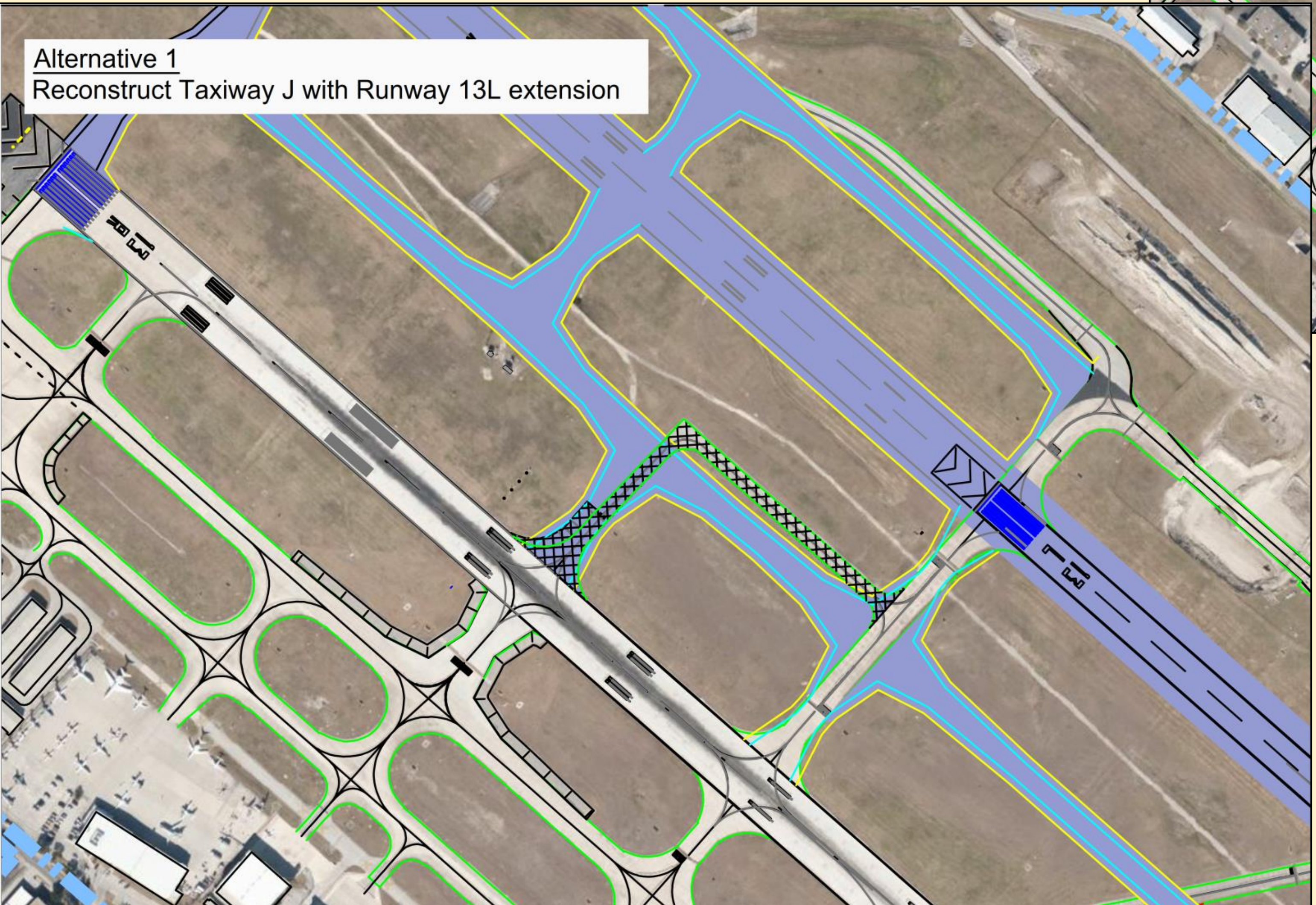


Recommendation:

- Planned mitigation
- Combined with Area 5 mitigation

Area 7
Mitigation Alternatives

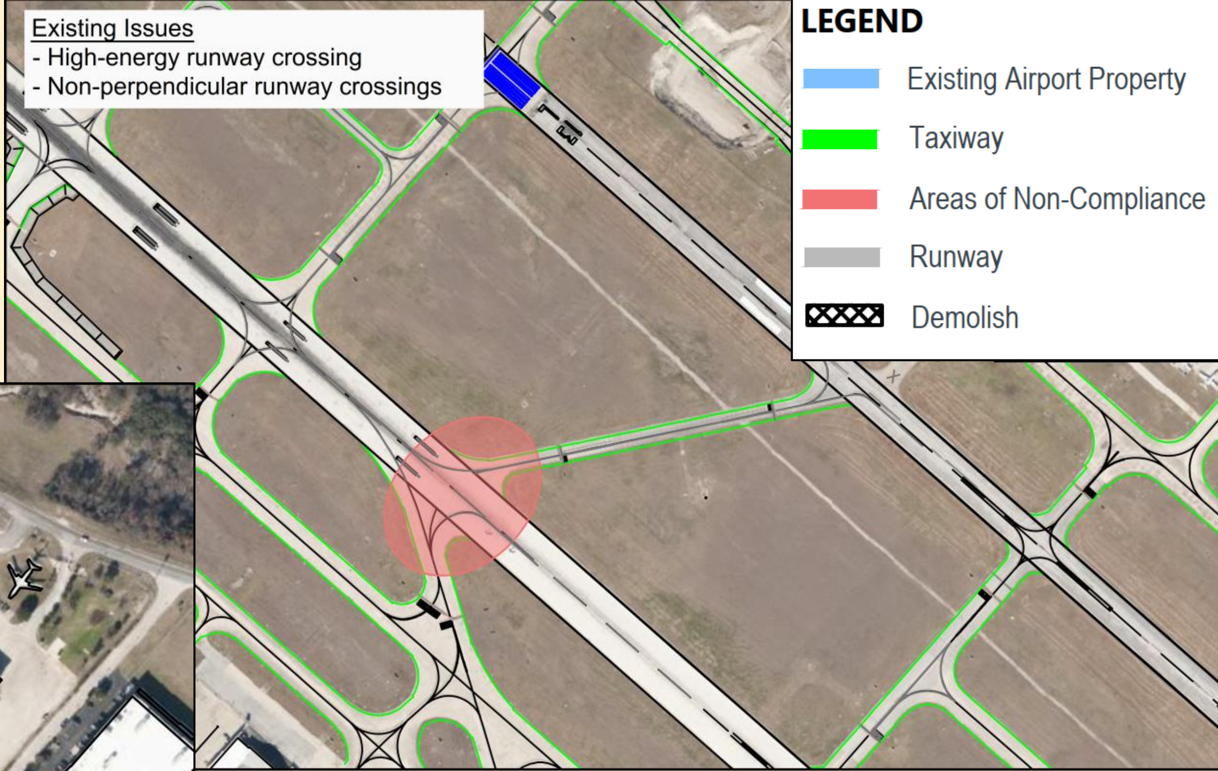


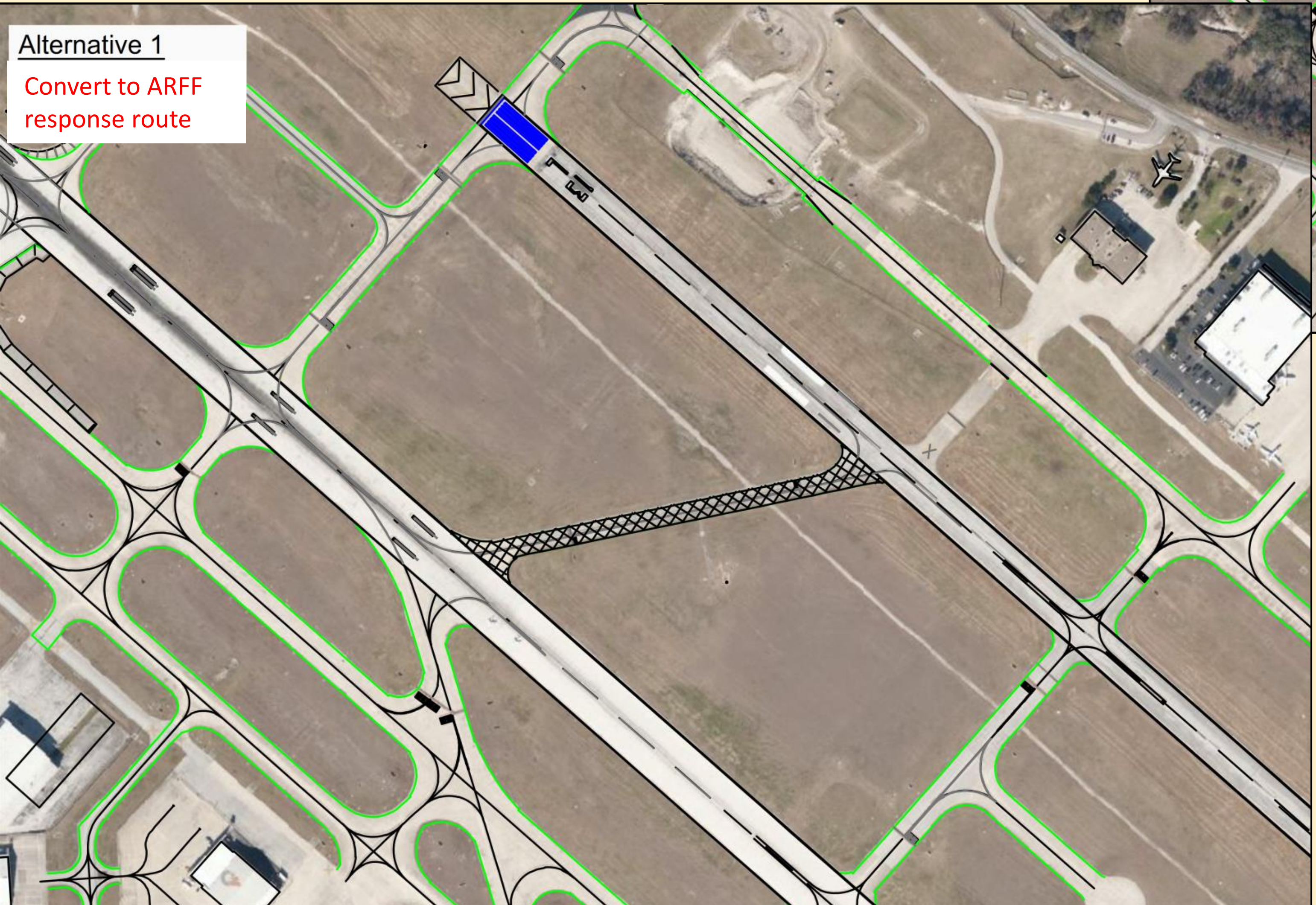


Recommendation:

- Alternative 1
- Defer to after CIP

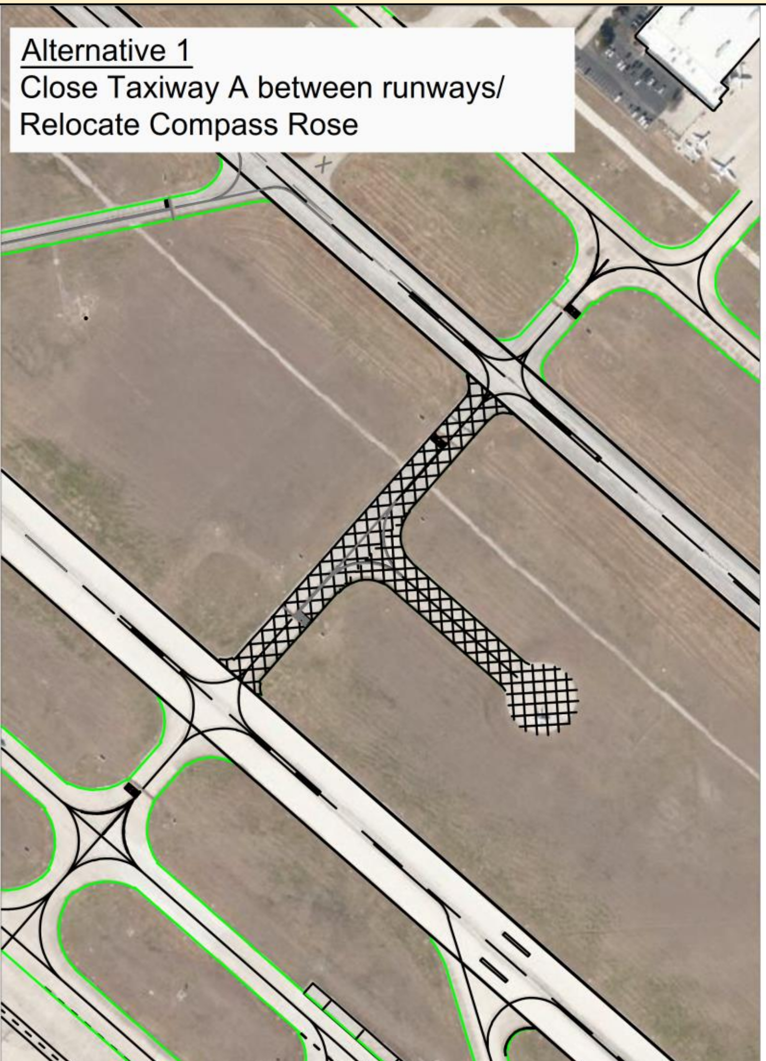
Area 8
Mitigation Alternatives

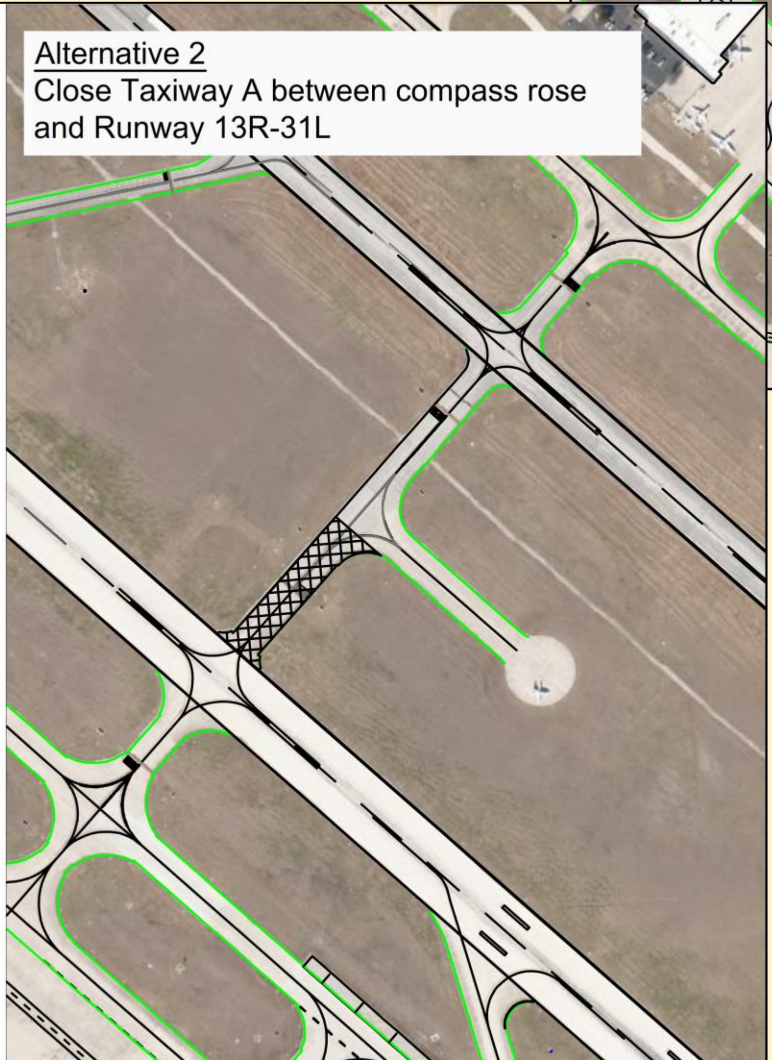


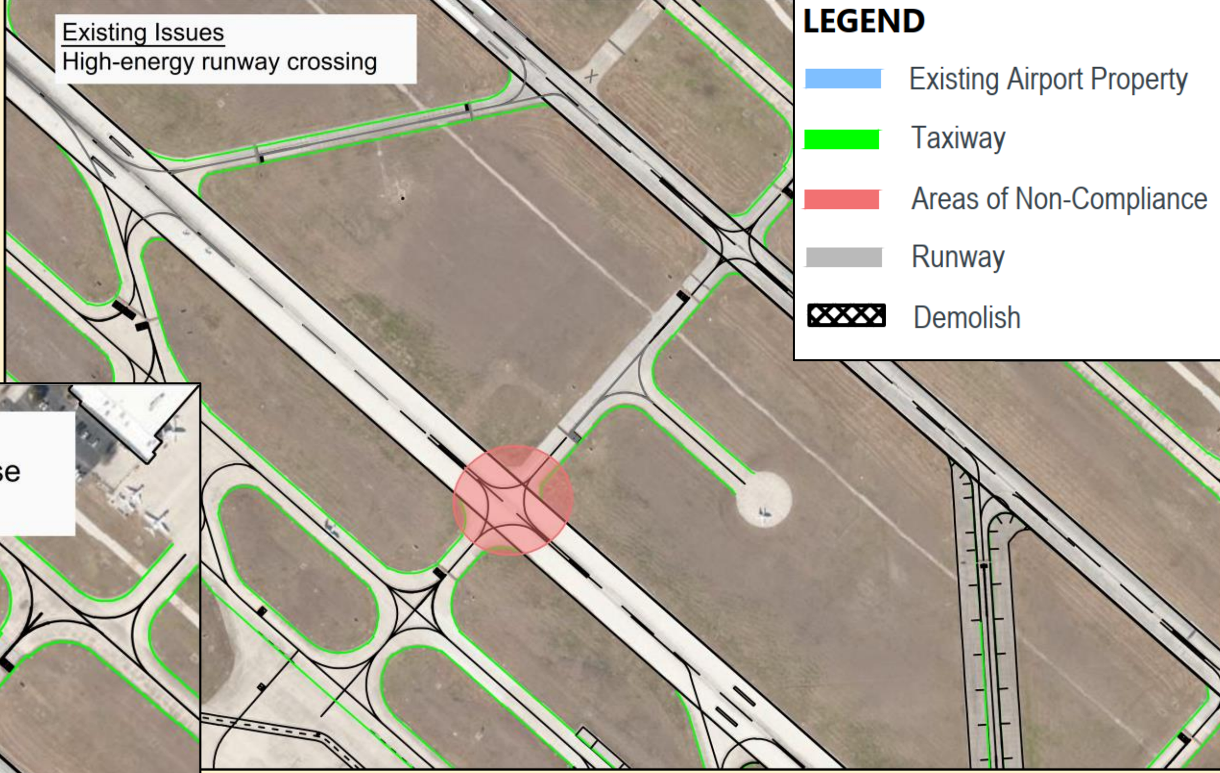


Recommendation:
- Alternative 1 (per ACIP)
- Revise to “convert to service road” for ARFF response (markings/signs change)
- Defer to after 6-year CIP

Area 9
Mitigation Alternatives



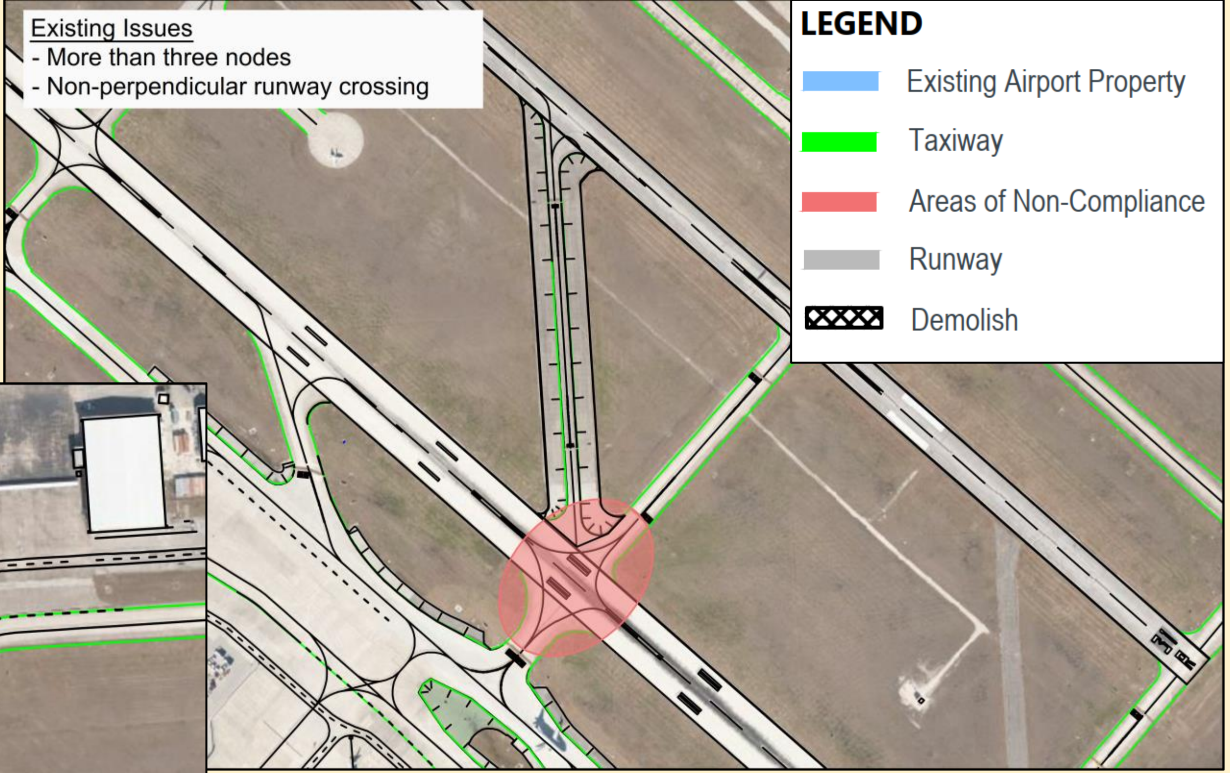


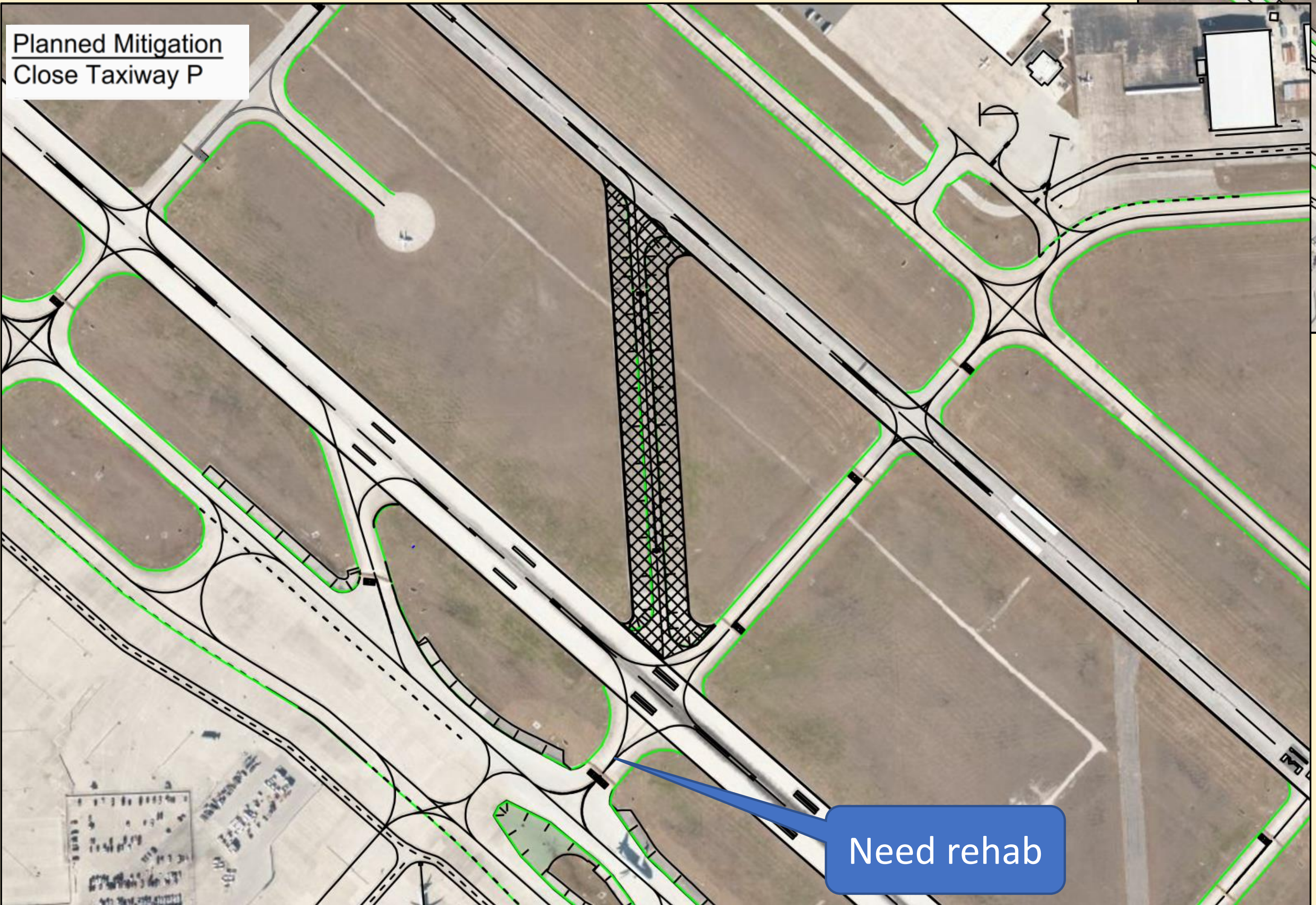


Recommendation:

- Will be used as rwy crossing when close D (with HSE)
- TBD

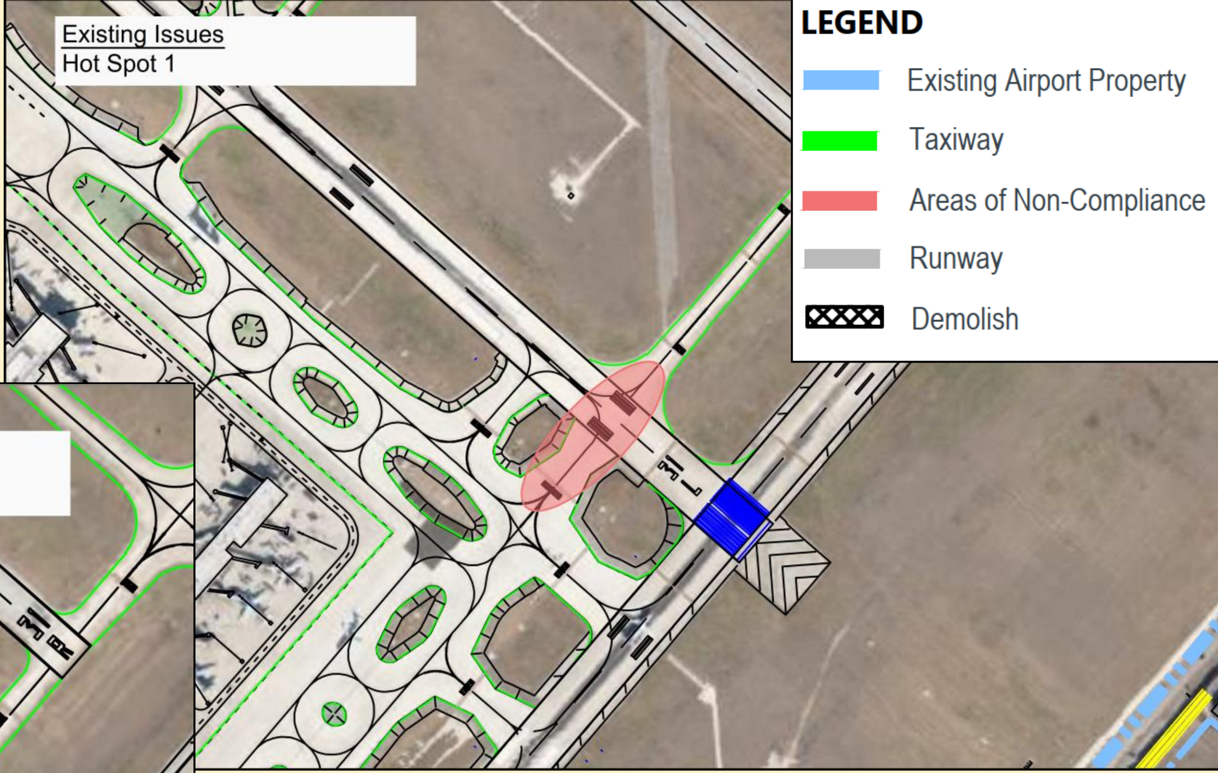
Area 10
Mitigation Alternatives

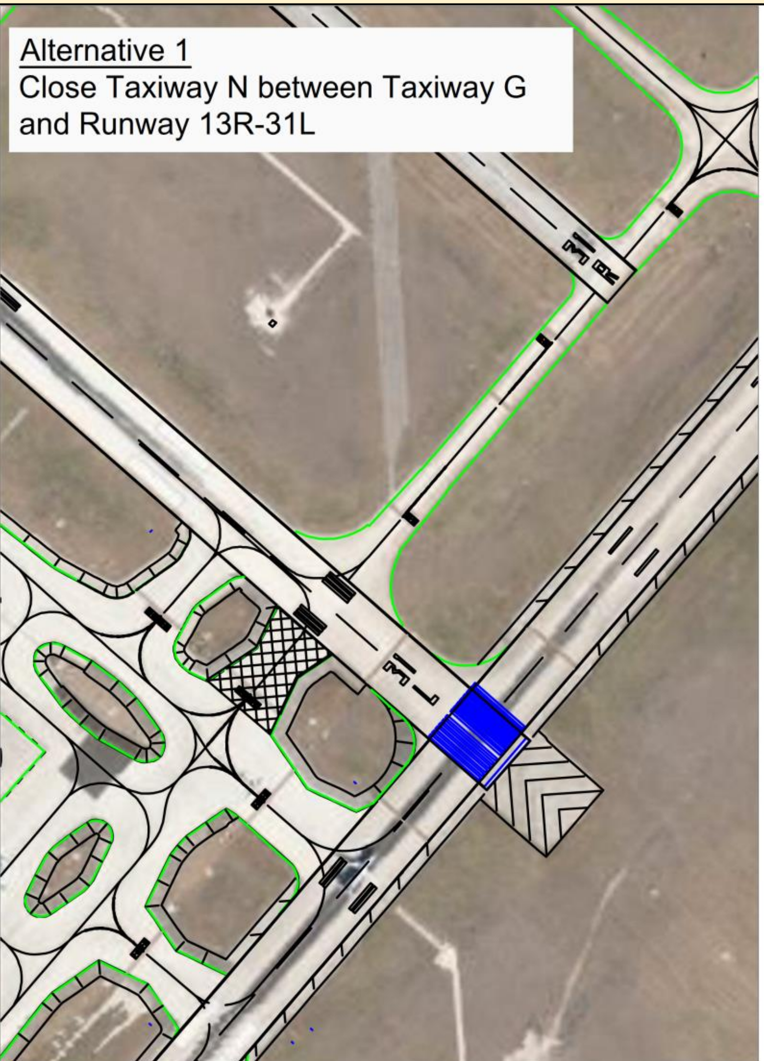


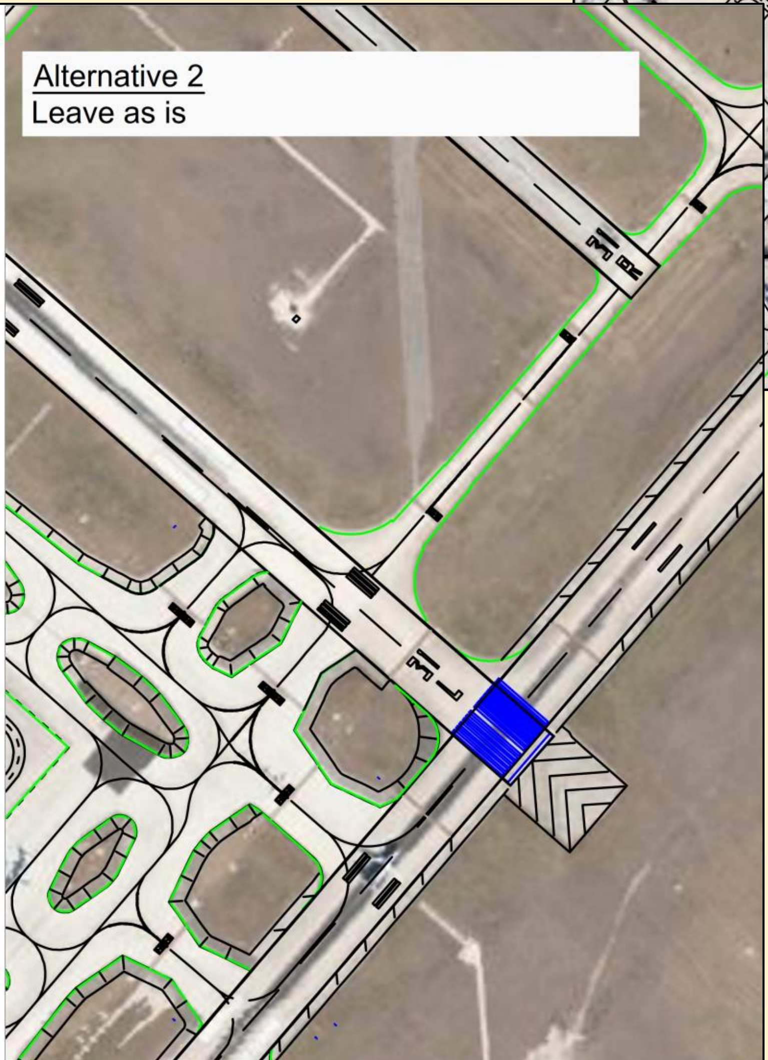


Recommendation:
- Planned mitigation (per ACIP)
- Combine with Areas 15 & 16 mitigation

Area 11
Mitigation Alternatives



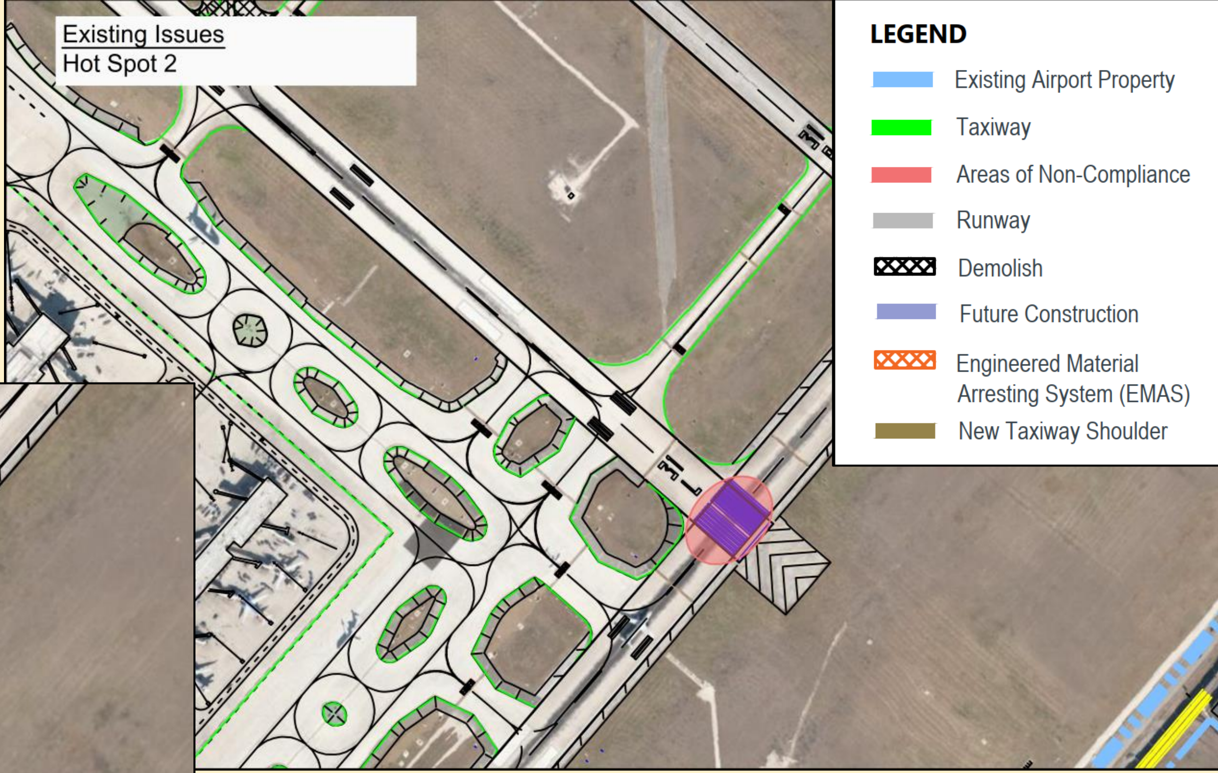


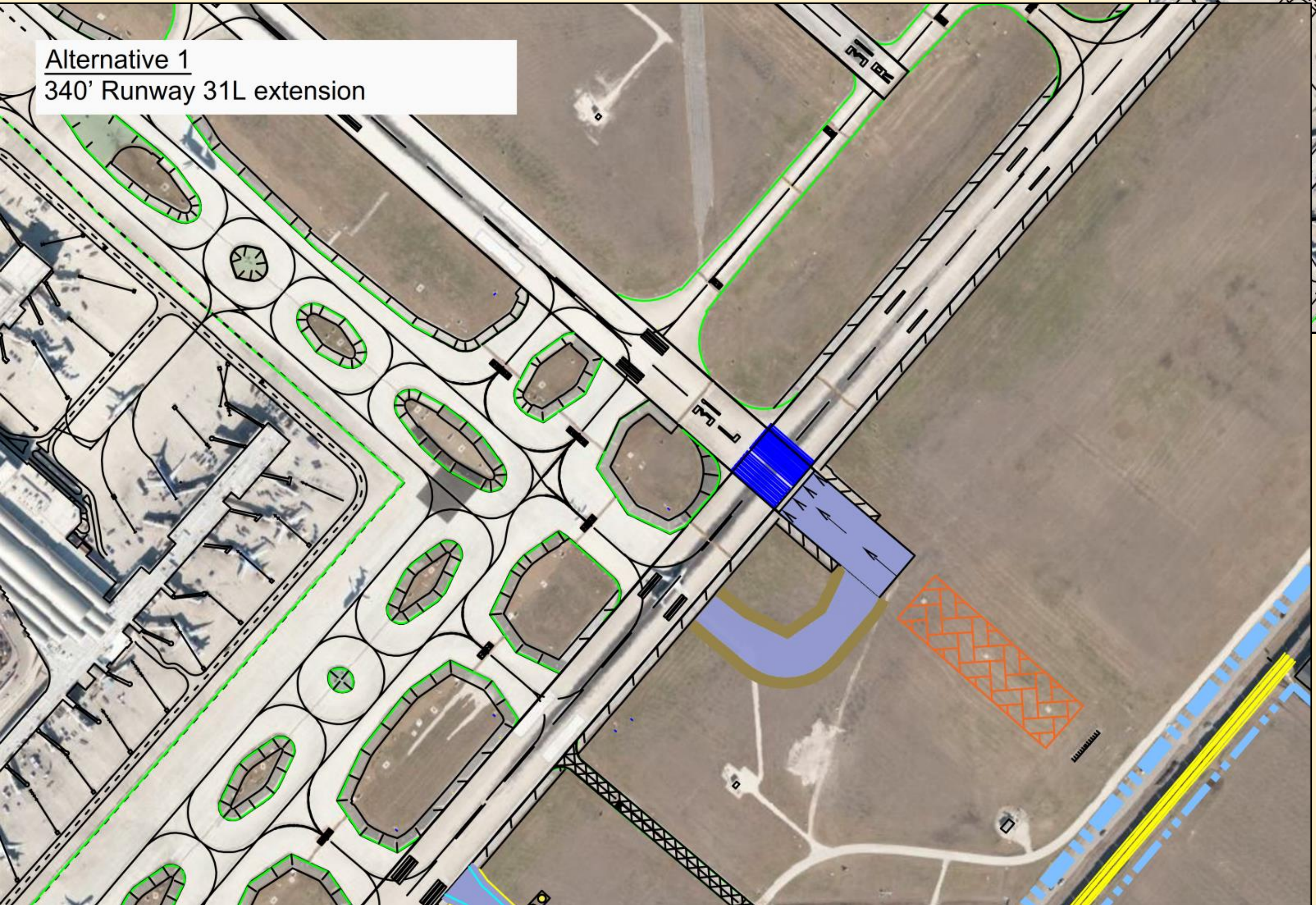


Recommendation:

- Alternative 2 (per Airfield SRA/SAT ATCT)
- No action, may not be designated as a Hot Spot anymore if RGLs are effective

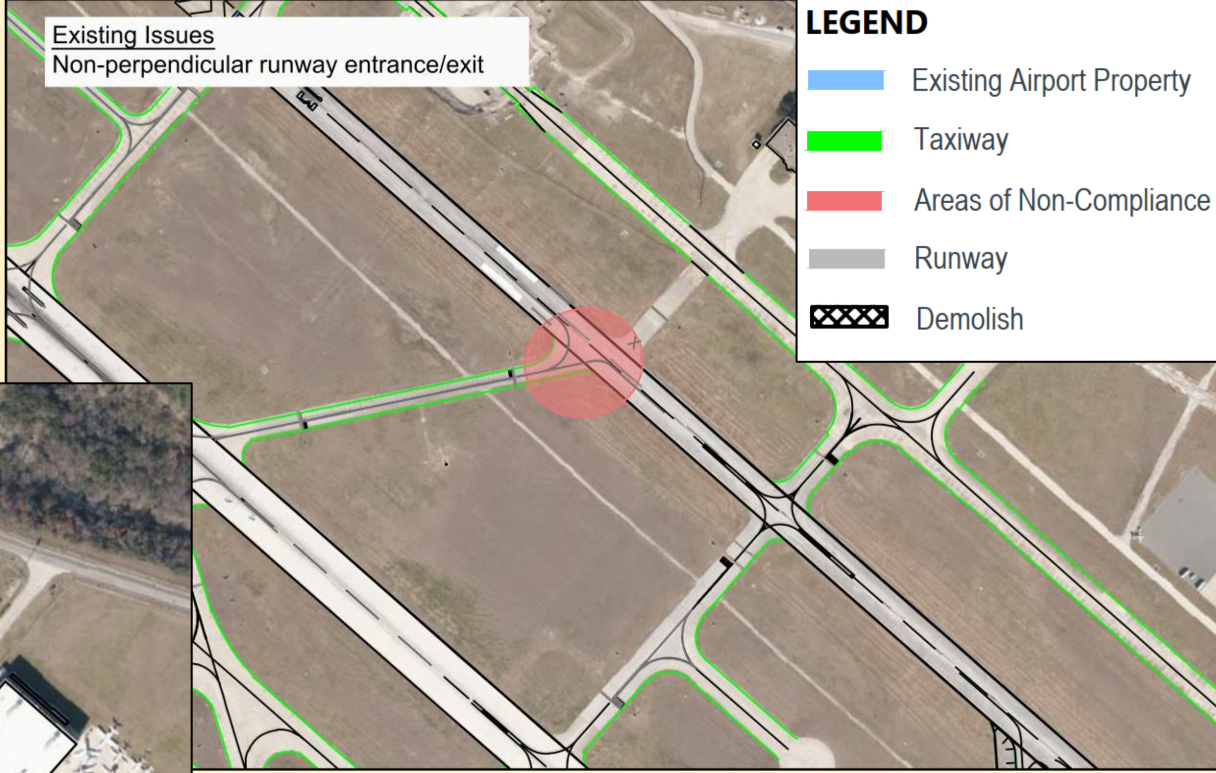
Area 12
Mitigation Alternatives

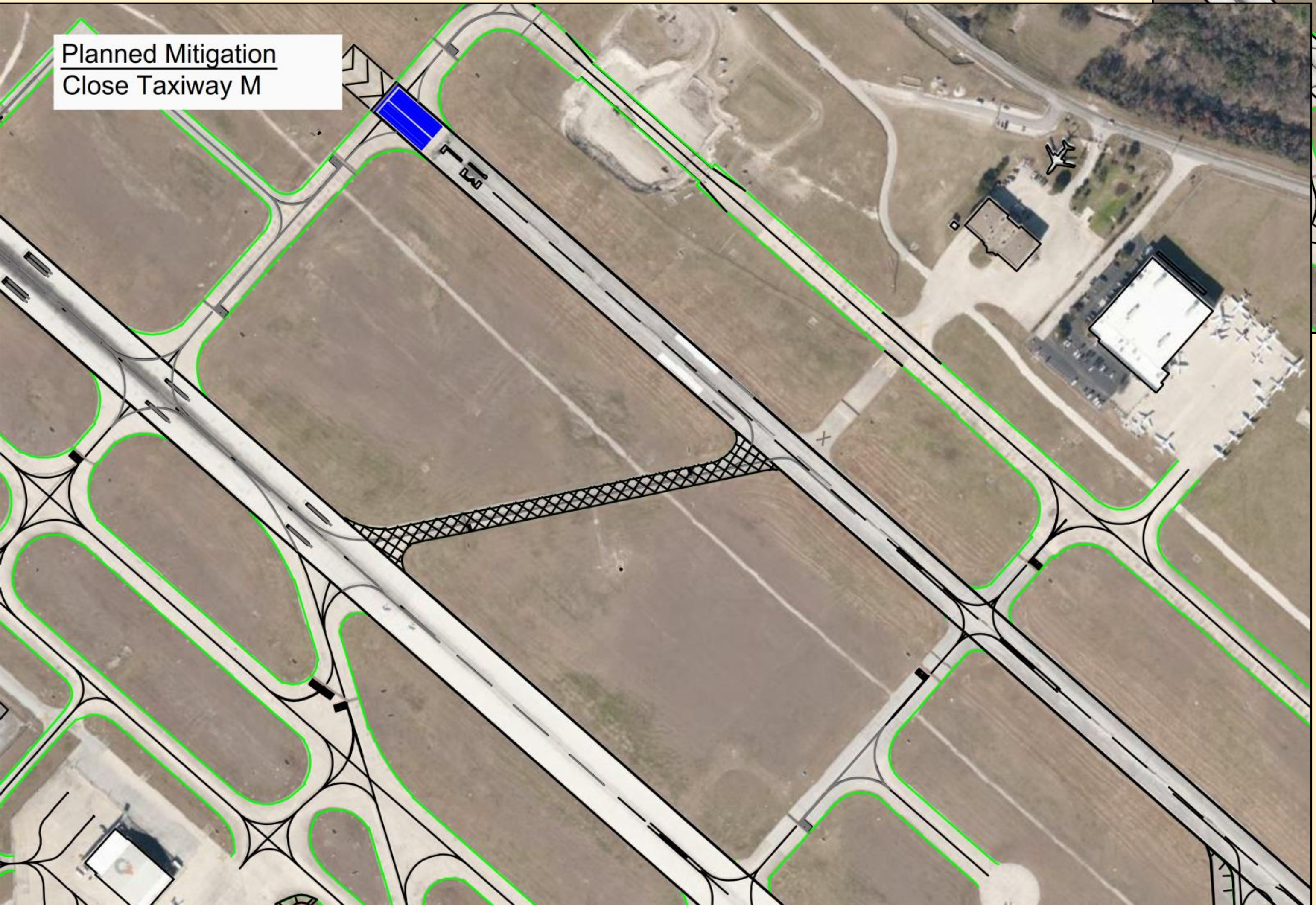




Recommendation:
- Alternative 1

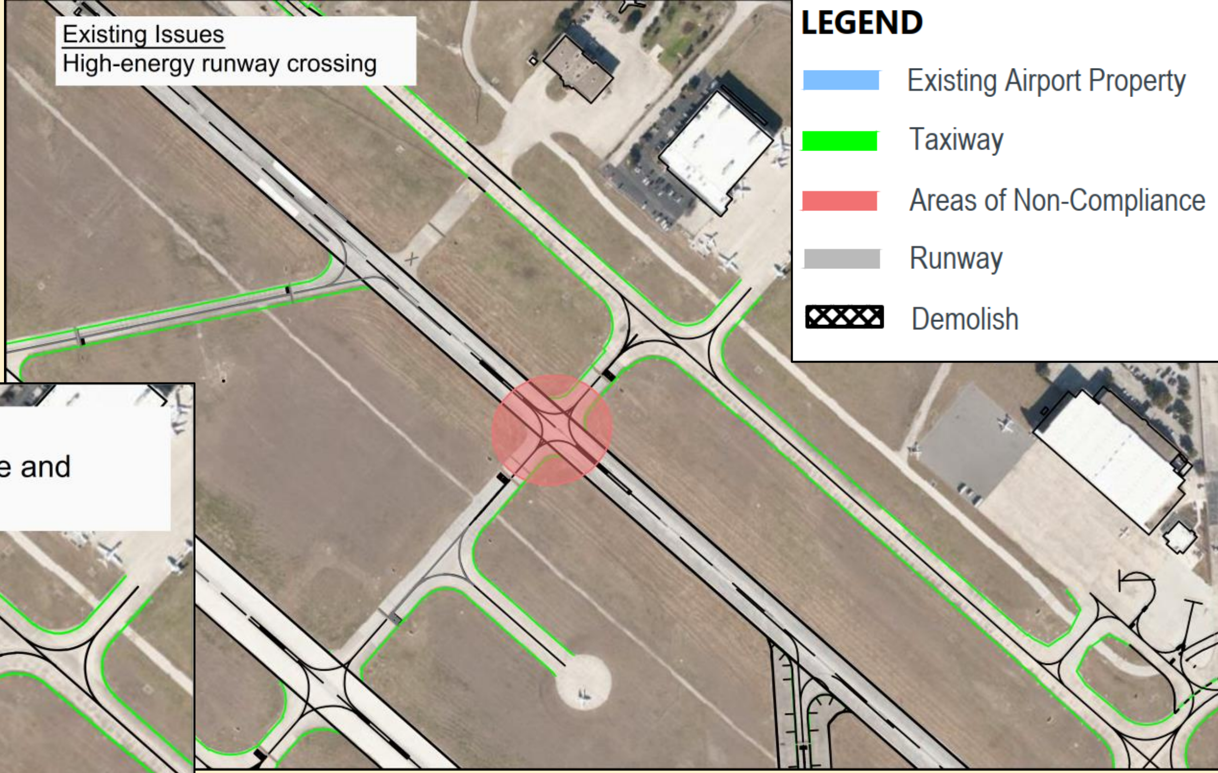
Area 13
Mitigation Alternatives

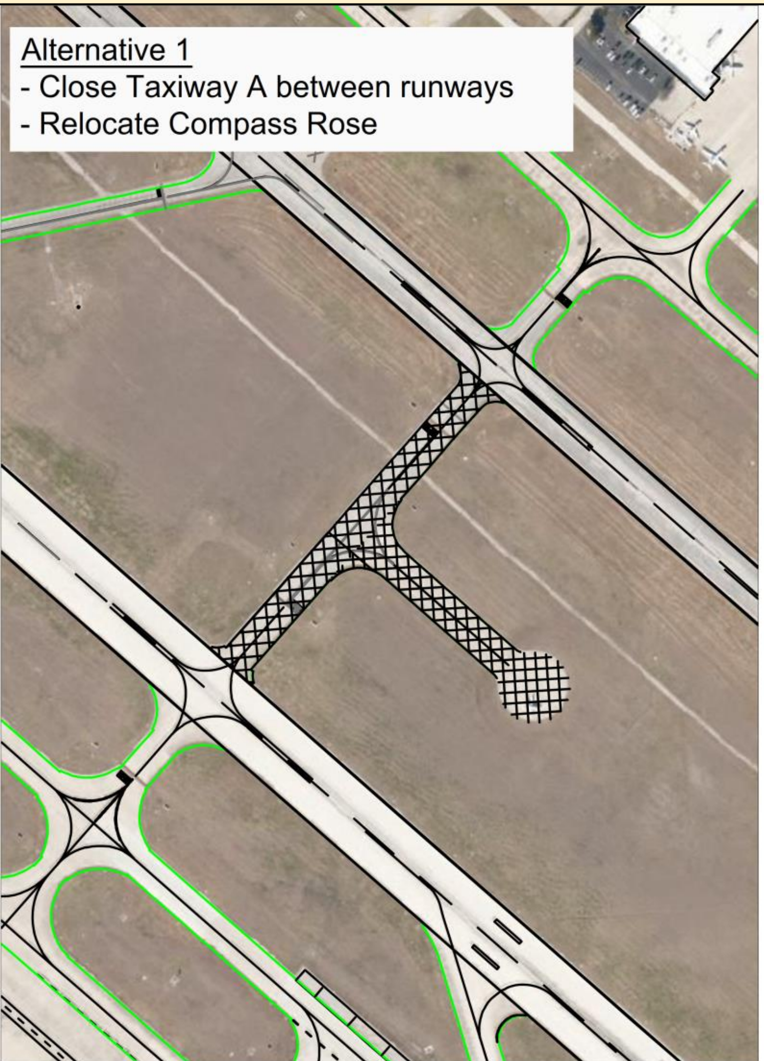


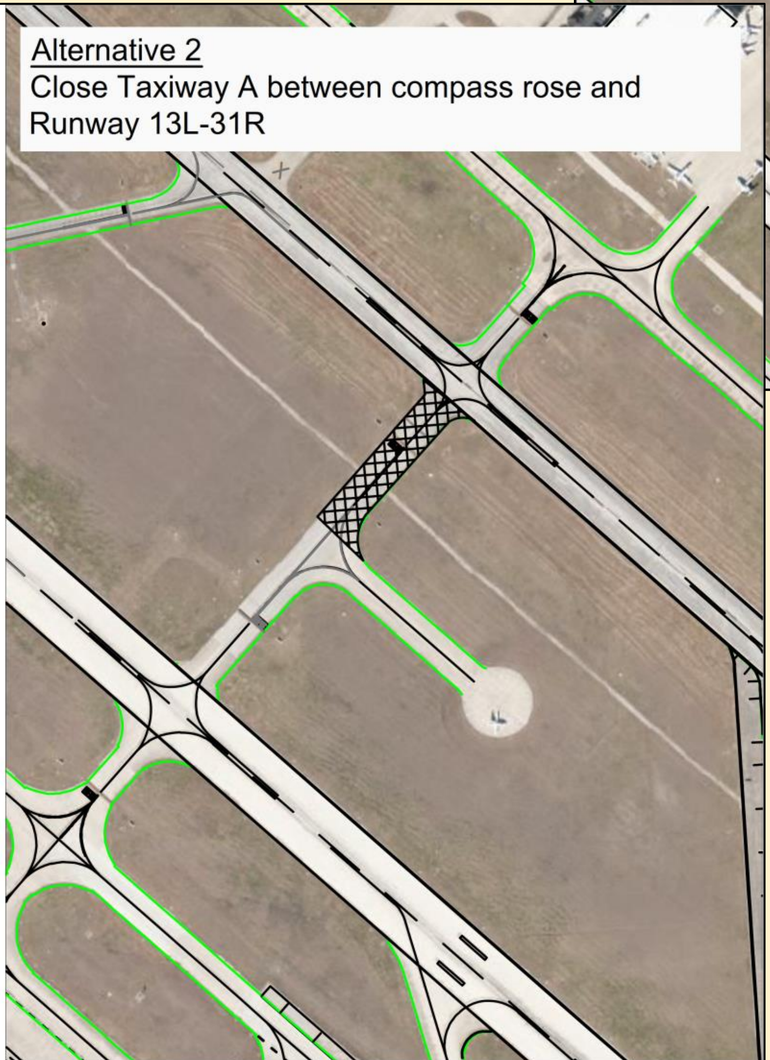


Recommendation:
- Planned mitigation (per ACIP)
- Combined with Area 8 mitigation

Area 14
Mitigation Alternatives

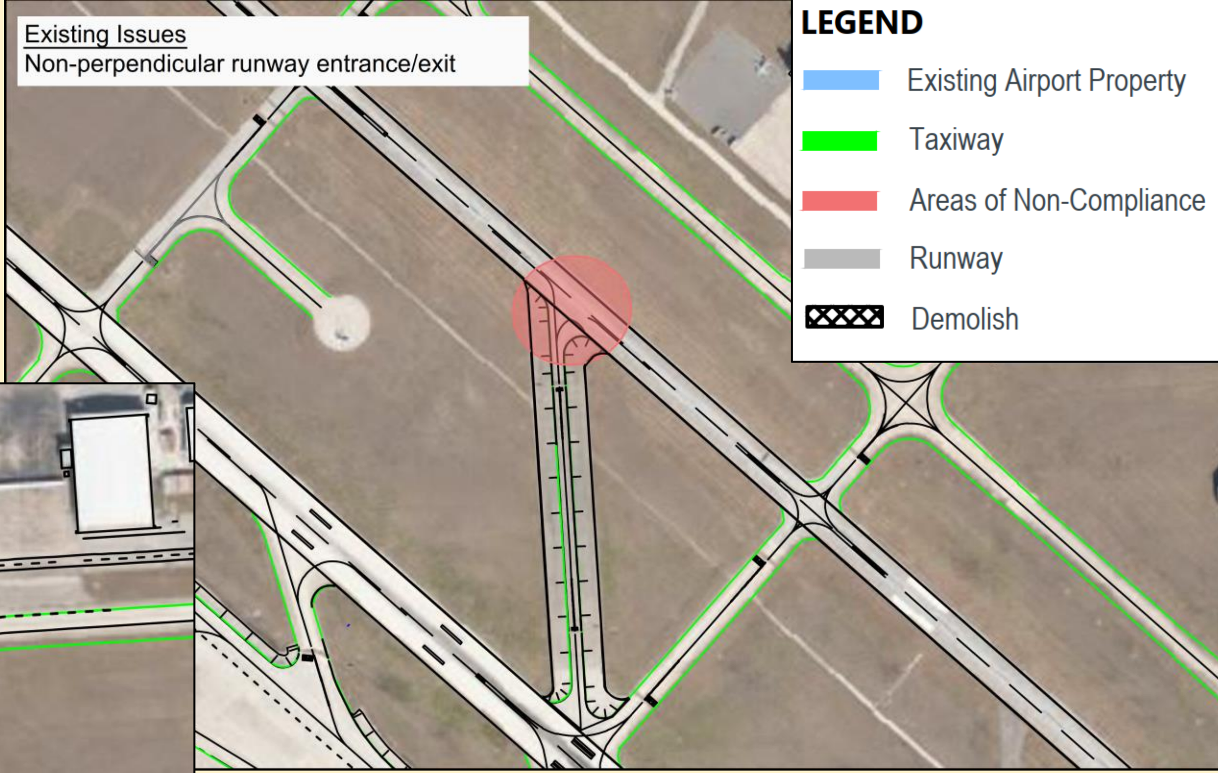


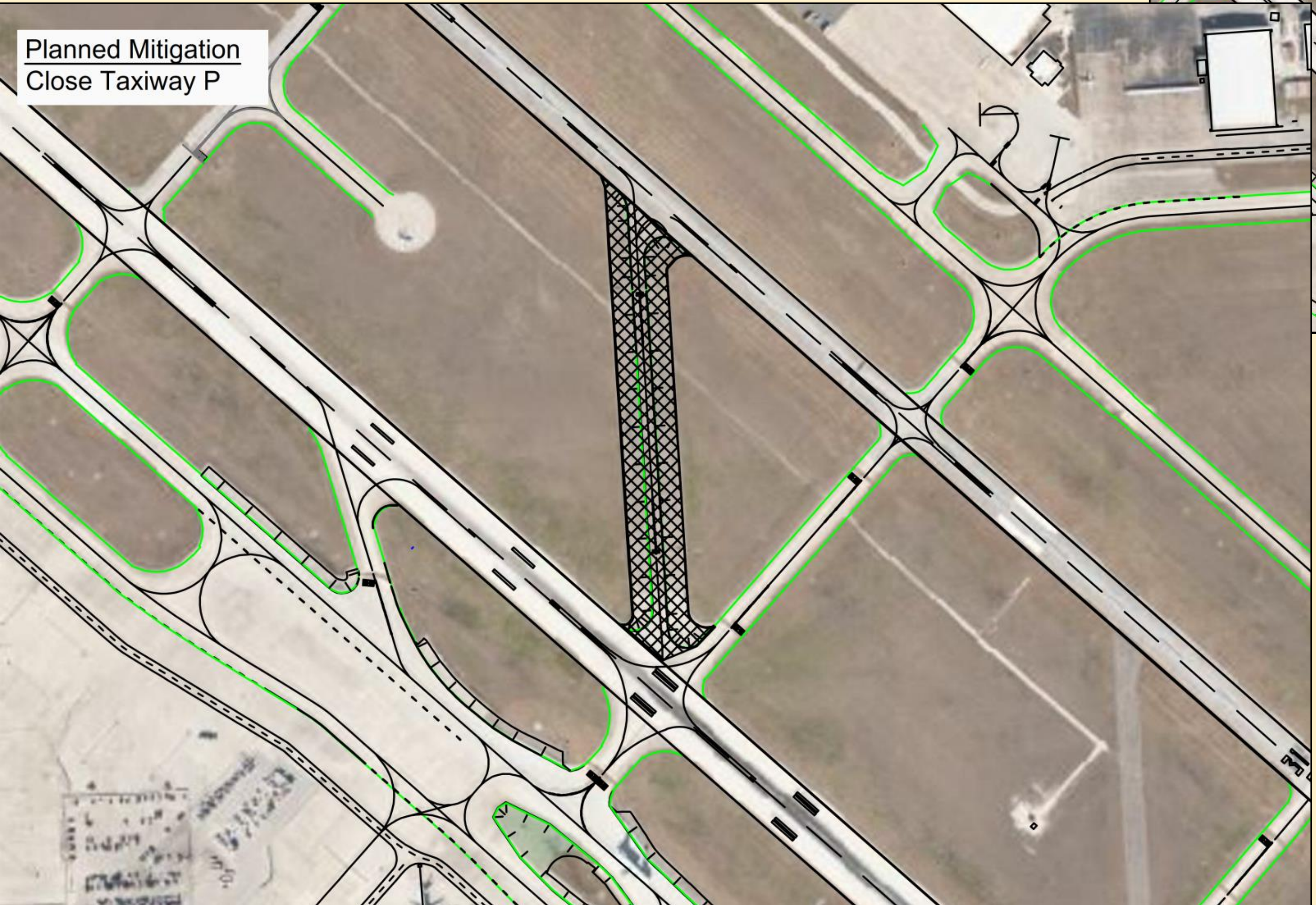




Recommendation:
- Already recommend closing portion of Twy A between compass rose and Rwy 13R-31L (Area 9 mitigation)
- Do nothing
- TBD

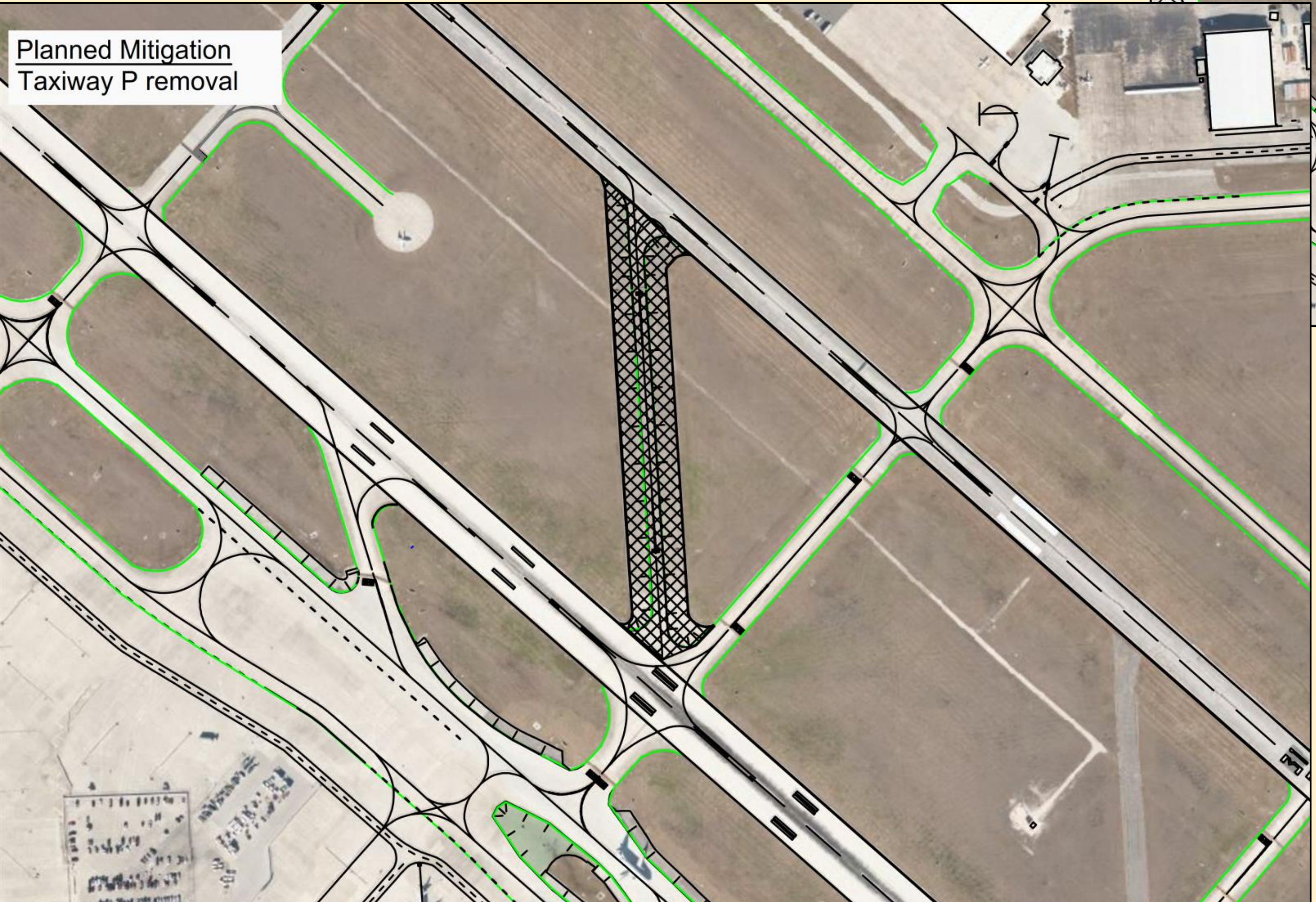
Area 15
Mitigation Alternatives

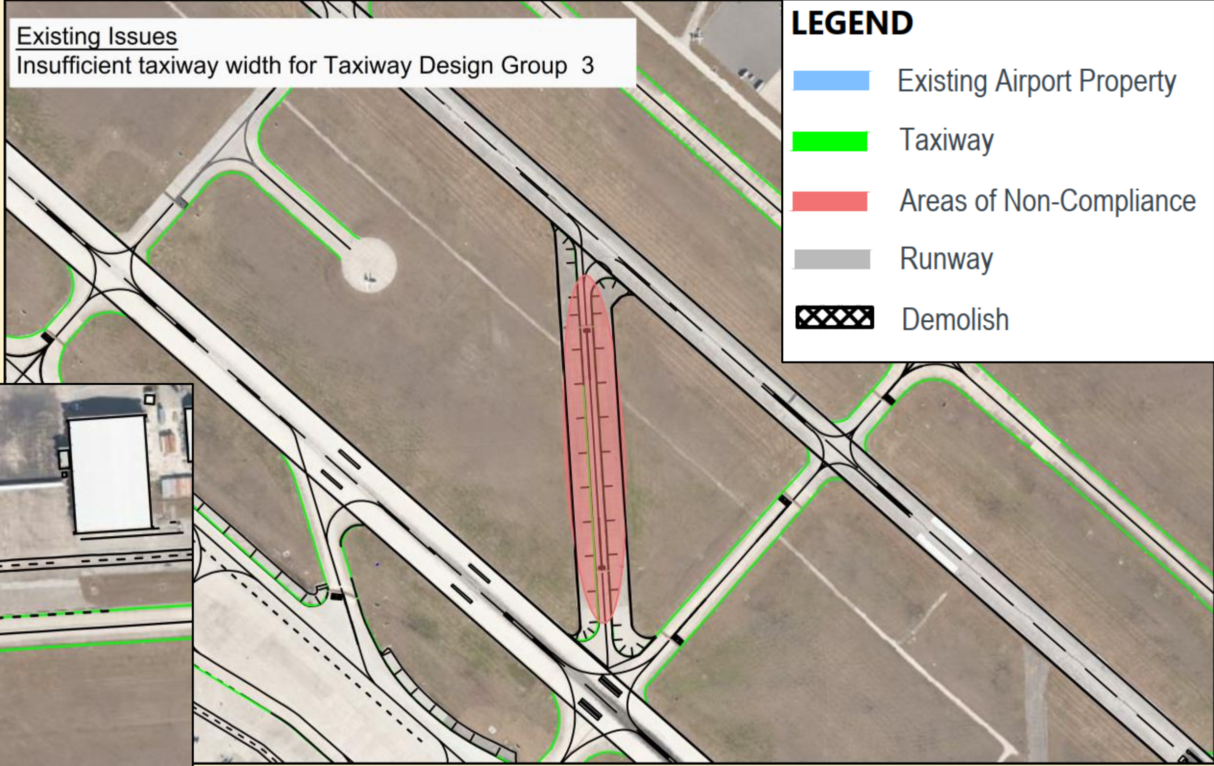




Recommendation:
- Planned mitigation (per ACIP)
- Combine with Areas 10 & 16 mitigation

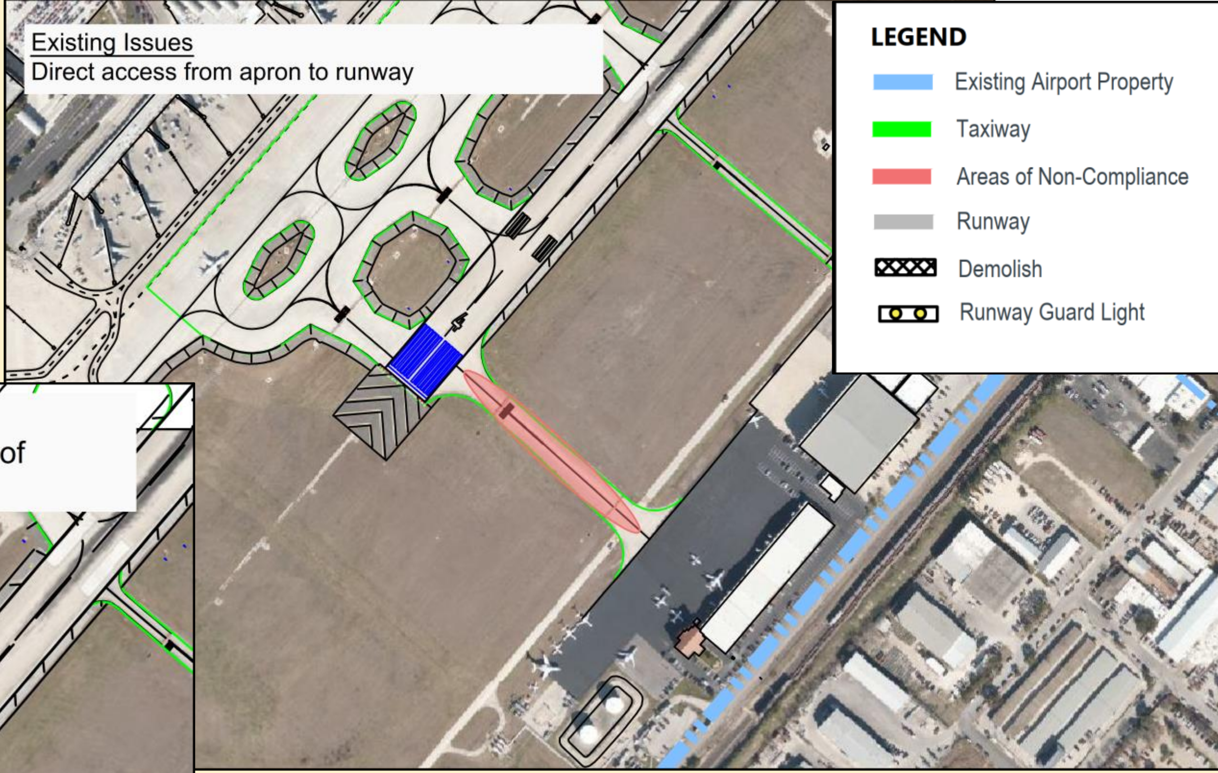
Area 16
Mitigation Alternatives

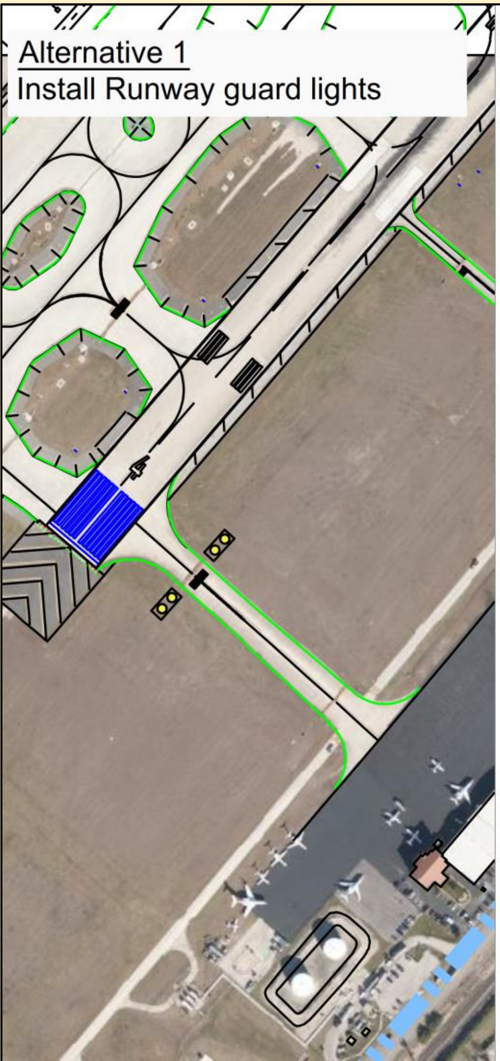


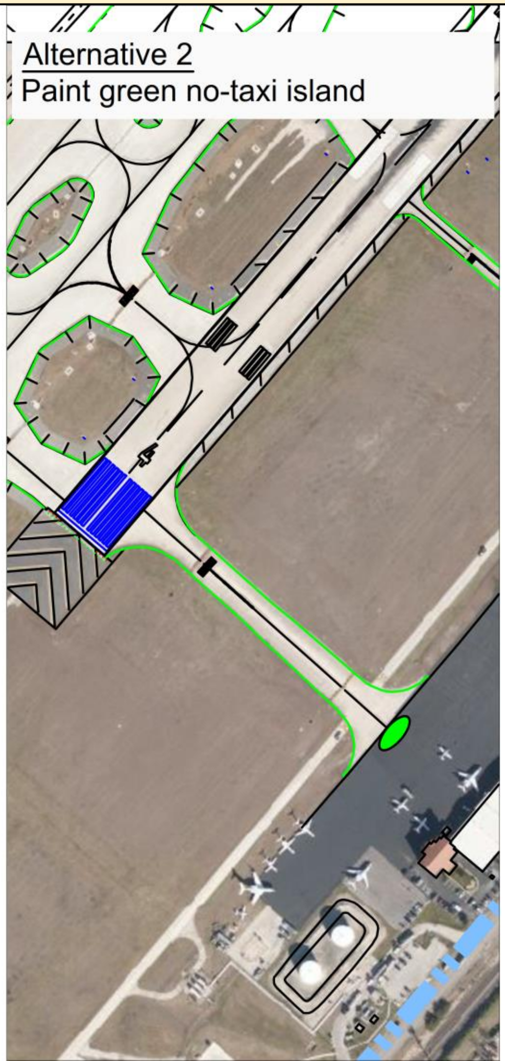


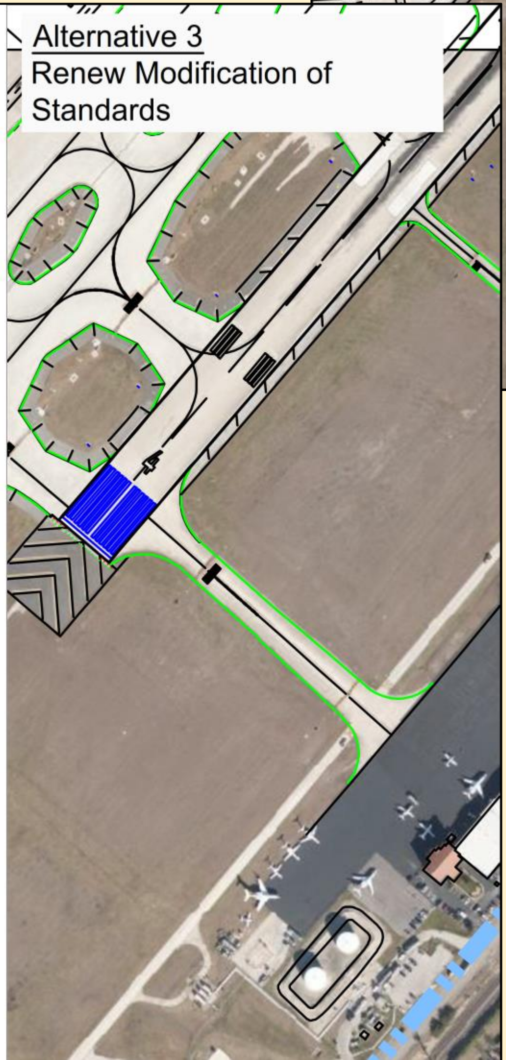
Recommendation:
- Planned mitigation (per ACIP)
- Combine with Areas 10 & 15 mitigation

Area 17
Mitigation Alternatives





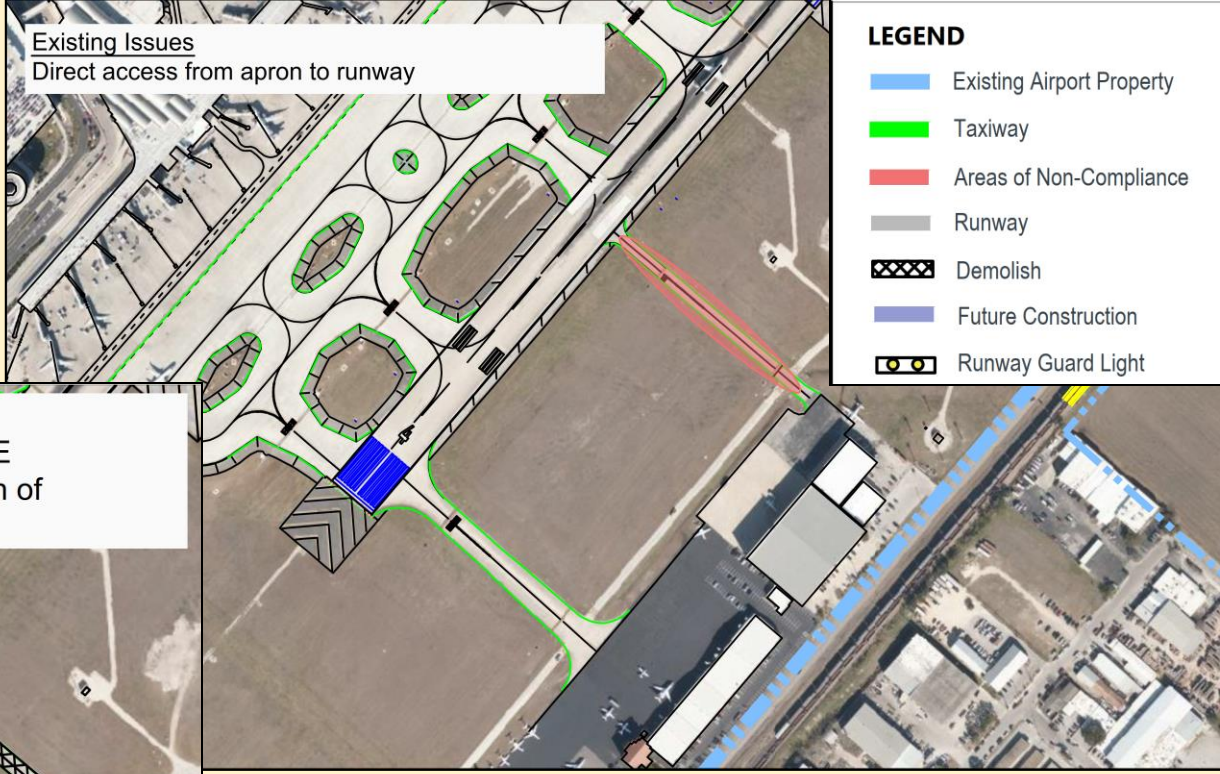


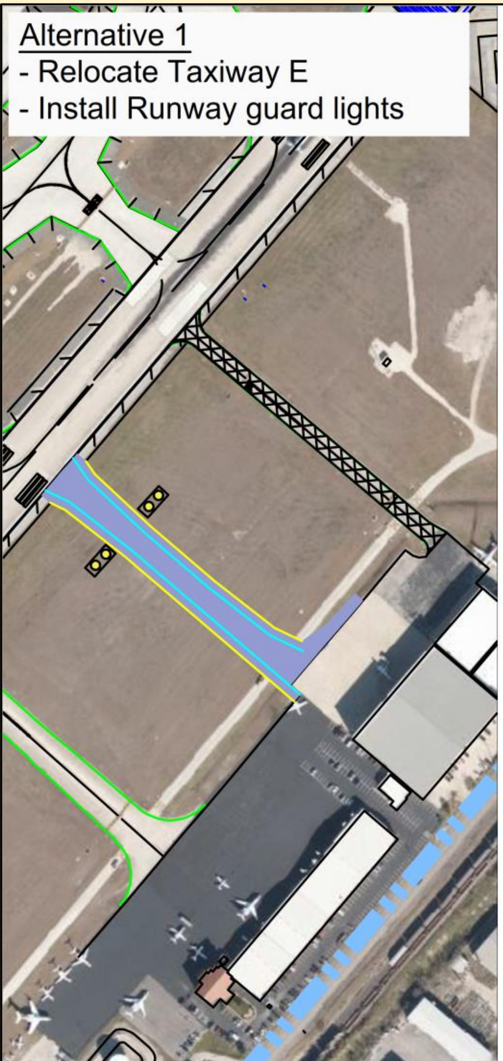


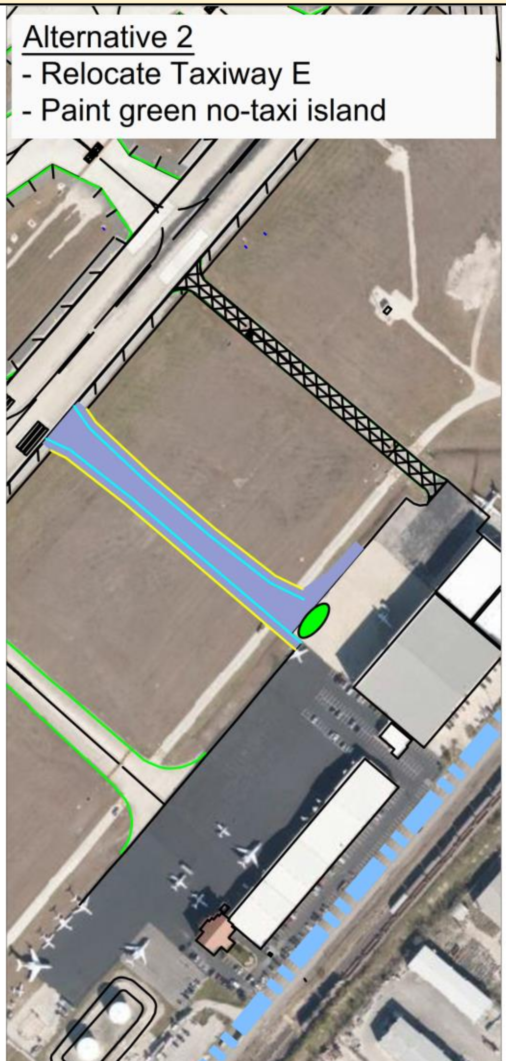
Recommendation:

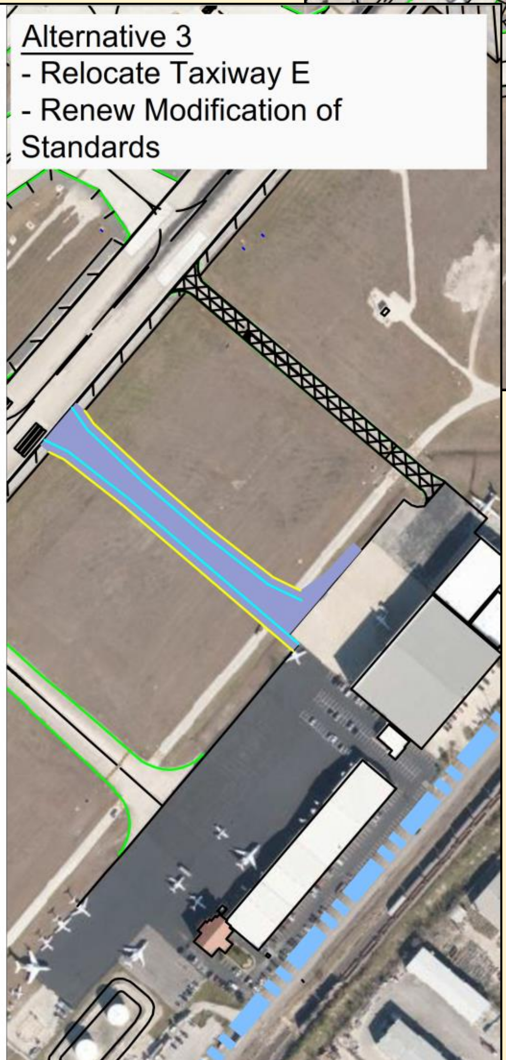
- Not an issue (operational procedure - call ATC 3 times – apron, ILS, RSA)
- No action needed

Area 18
Mitigation Alternatives





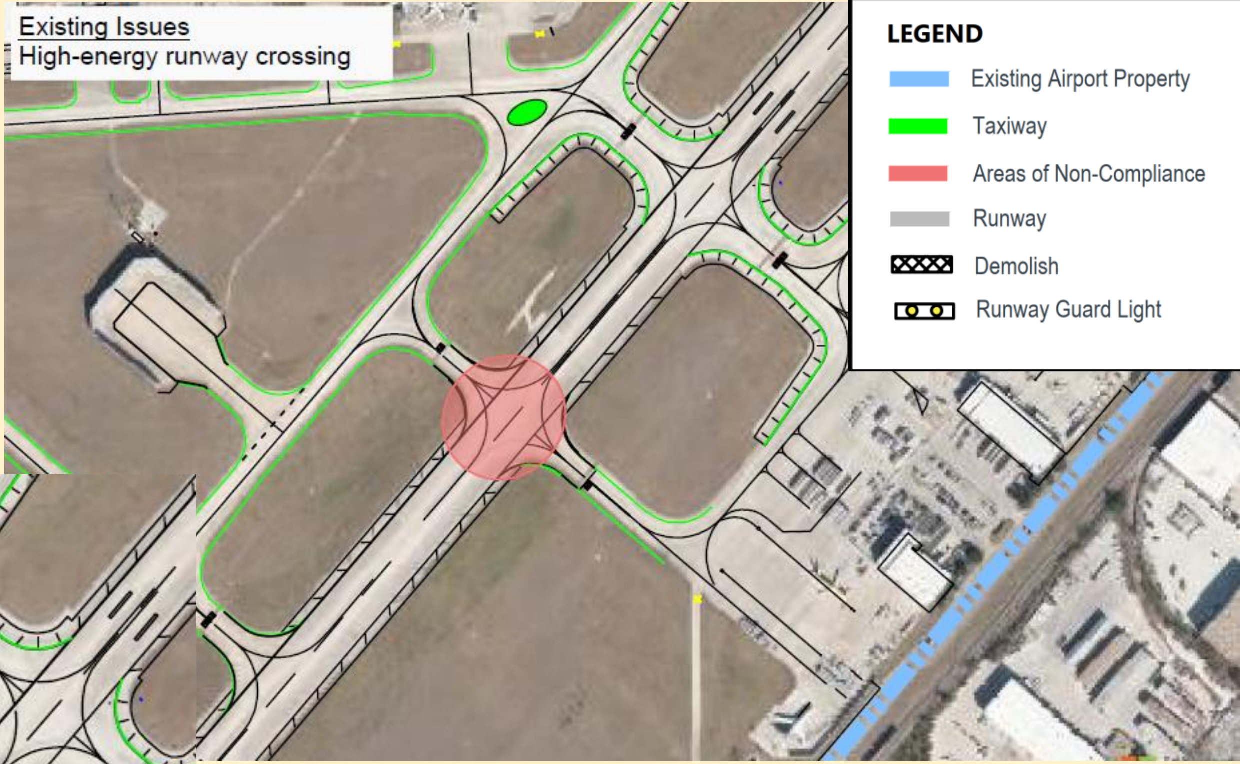


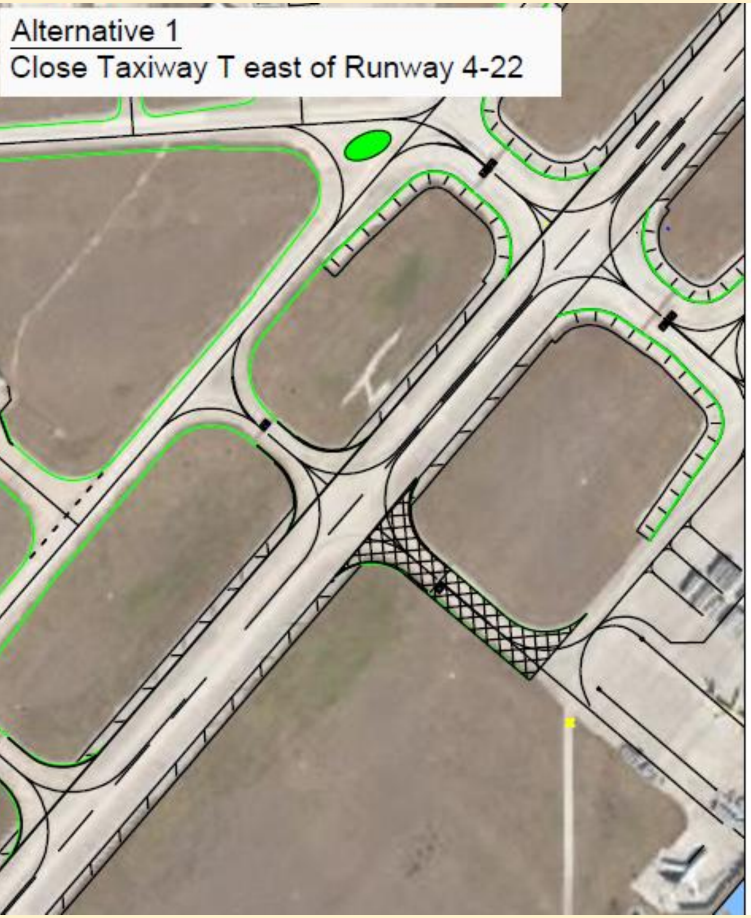


Recommendation:

- Not an issue (operational procedure - call ATC 3 times – apron, ILS, RSA)
- No action needed

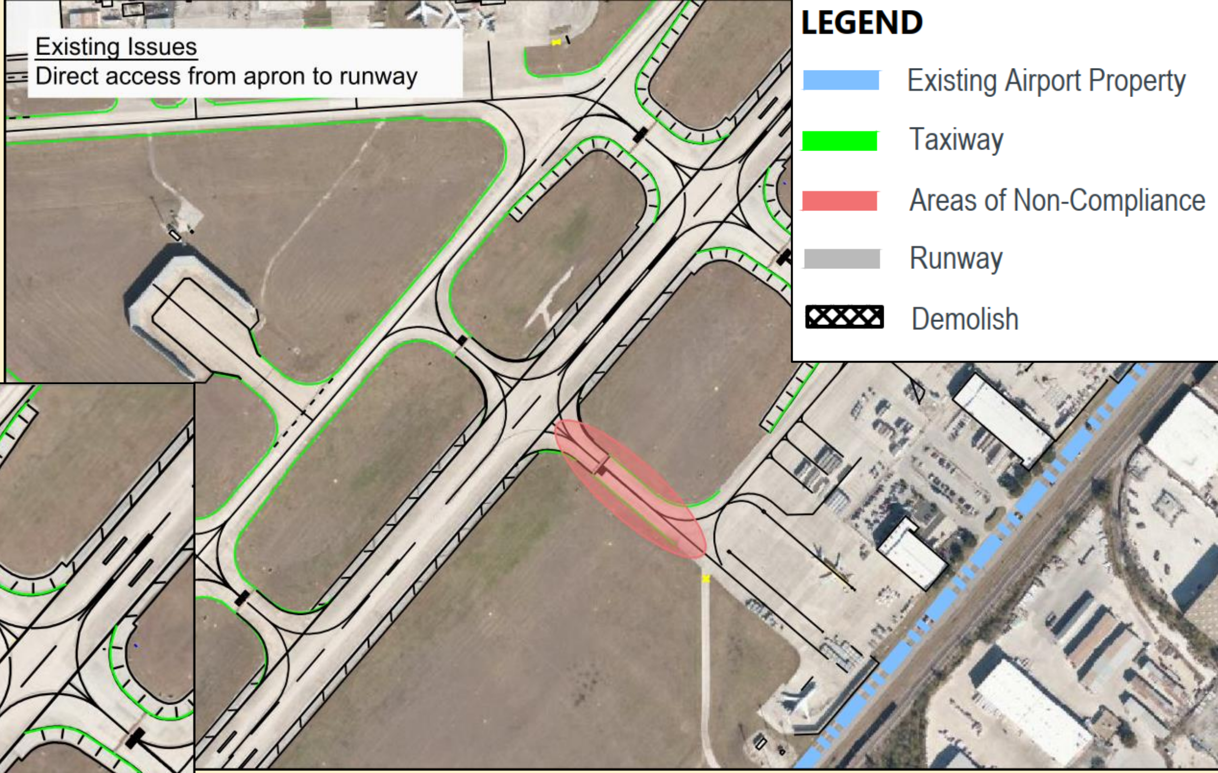
Area 19
Mitigation Alternatives

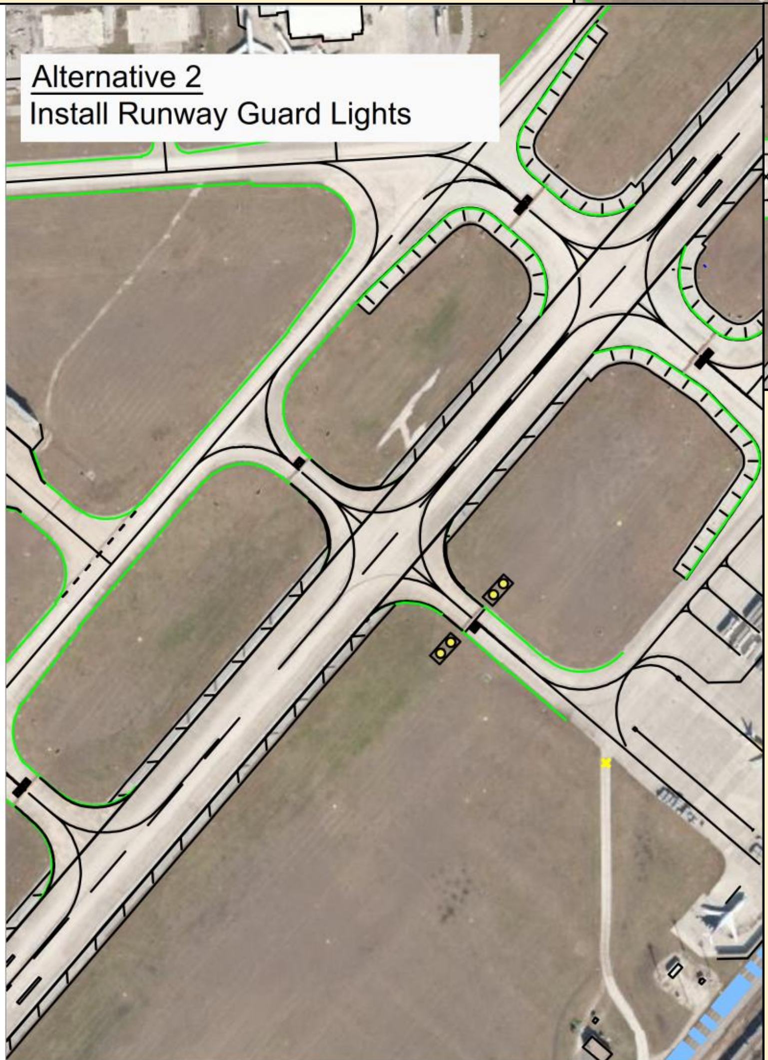




Recommendation:
- Alternative 1 (per 2017 ALP)
- Combine with Area 20 mitigation
- TBD, beyond 6-y CIP

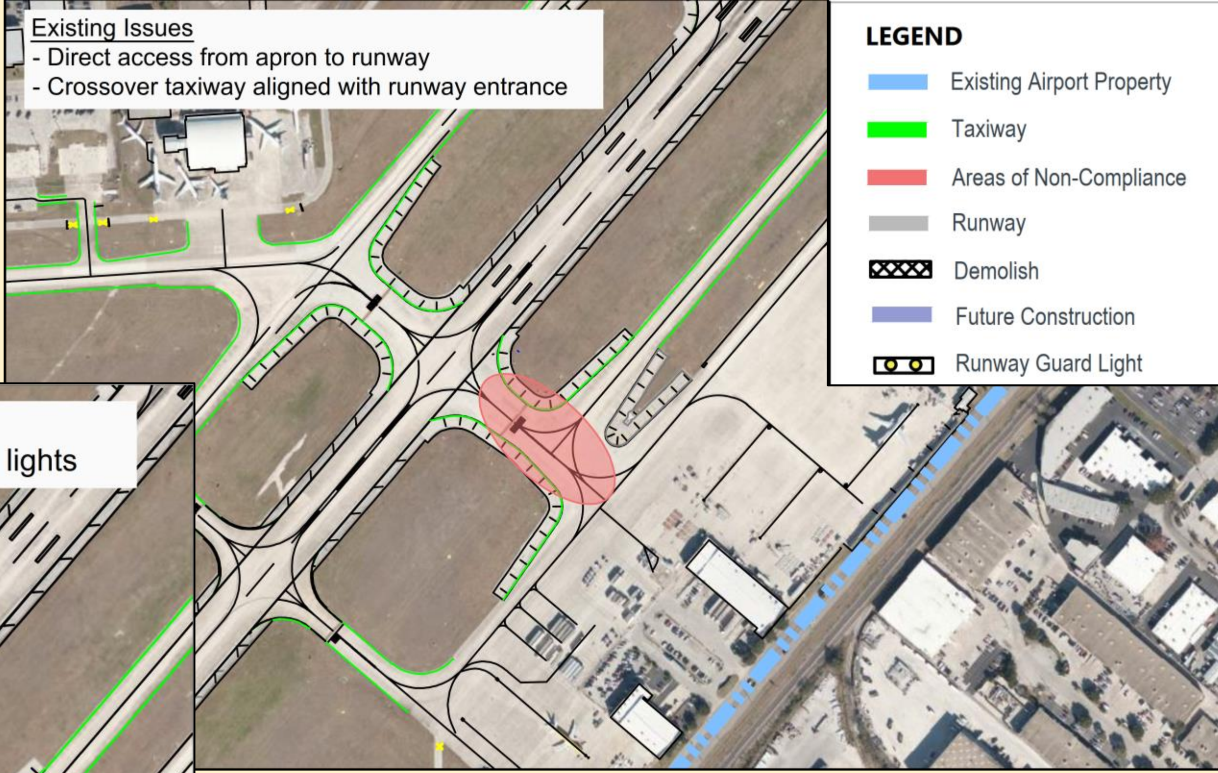
Area 20
Mitigation Alternatives

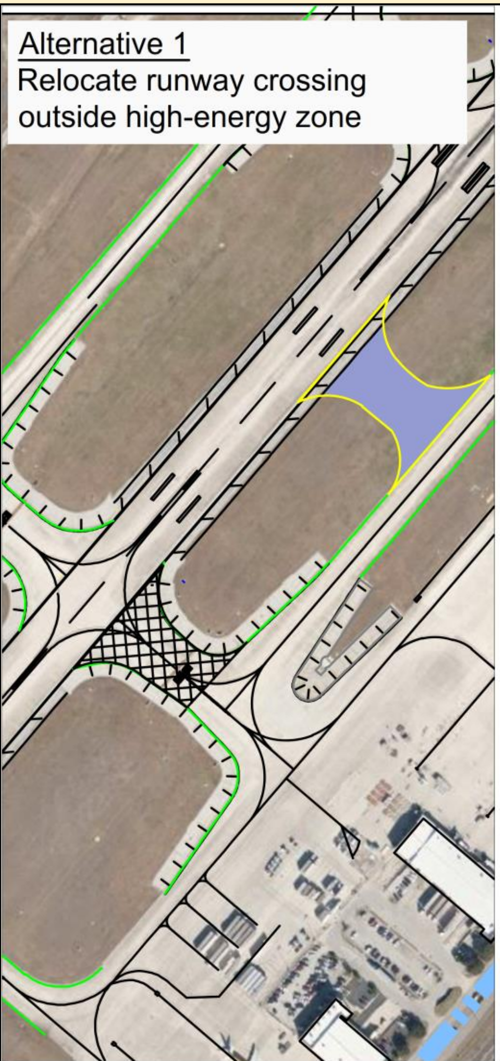


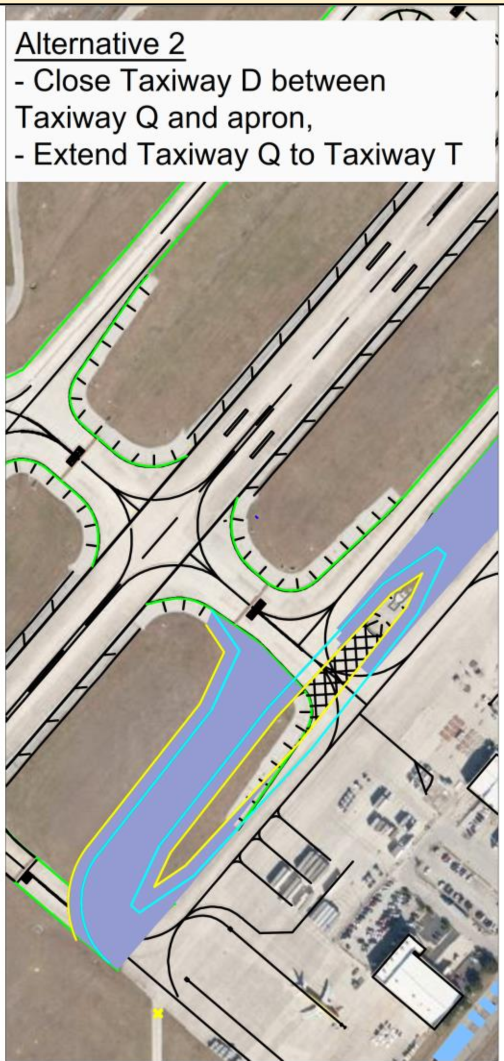


Recommendation:
- Alternative 1 (per 2017 ALP)
- Combine with Area 19 mitigation
- TBD, beyond 6-y CIP

Area 21
Mitigation Alternatives

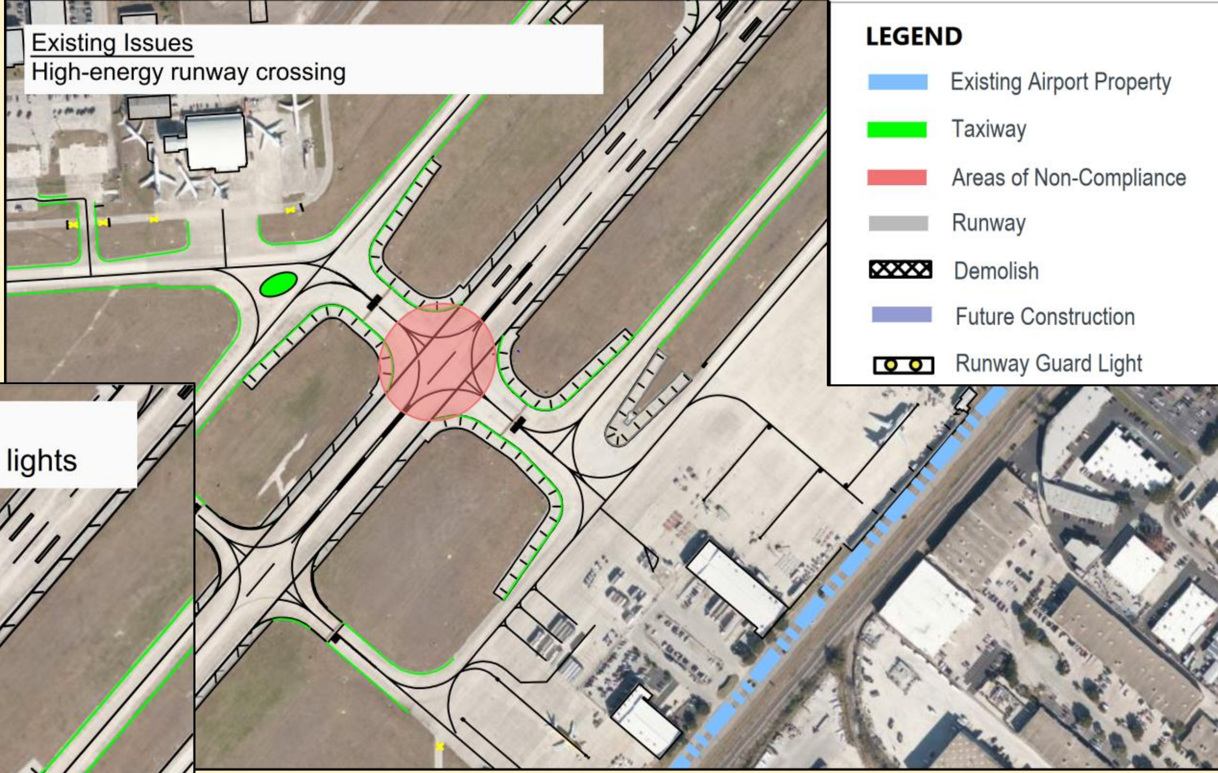


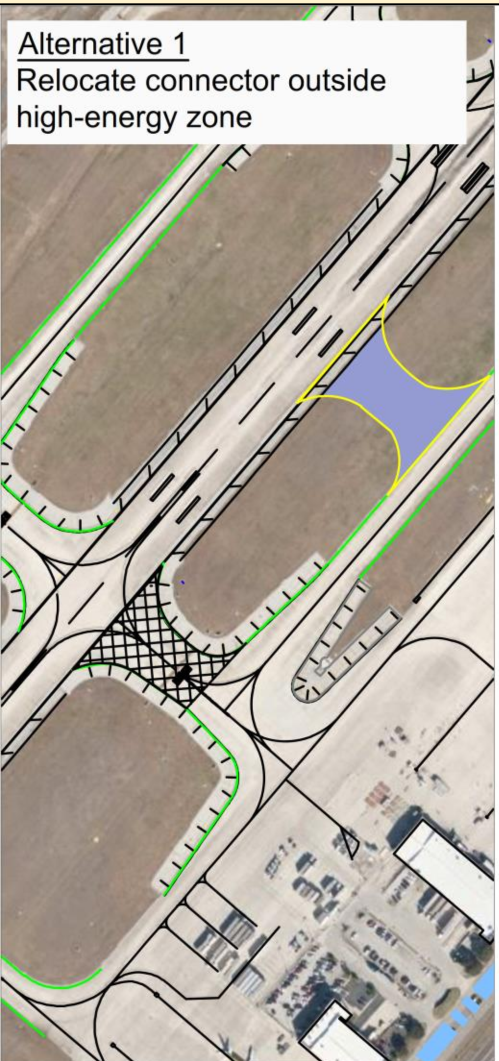


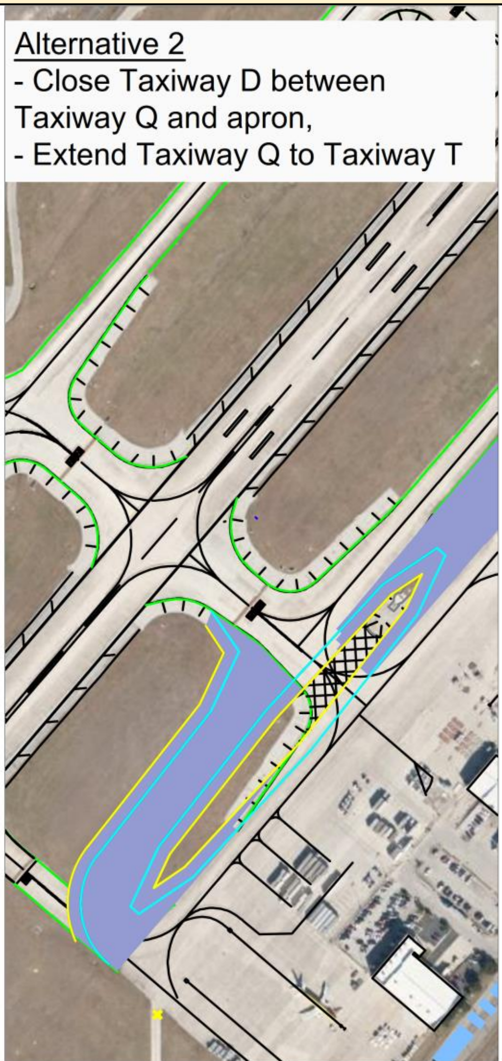


Recommendation:
- Alternative 2 (per 2017 ALP)
- Combine with Area 22 mitigation
- TBD, beyond 6-y CIP

Area 22
Mitigation Alternatives



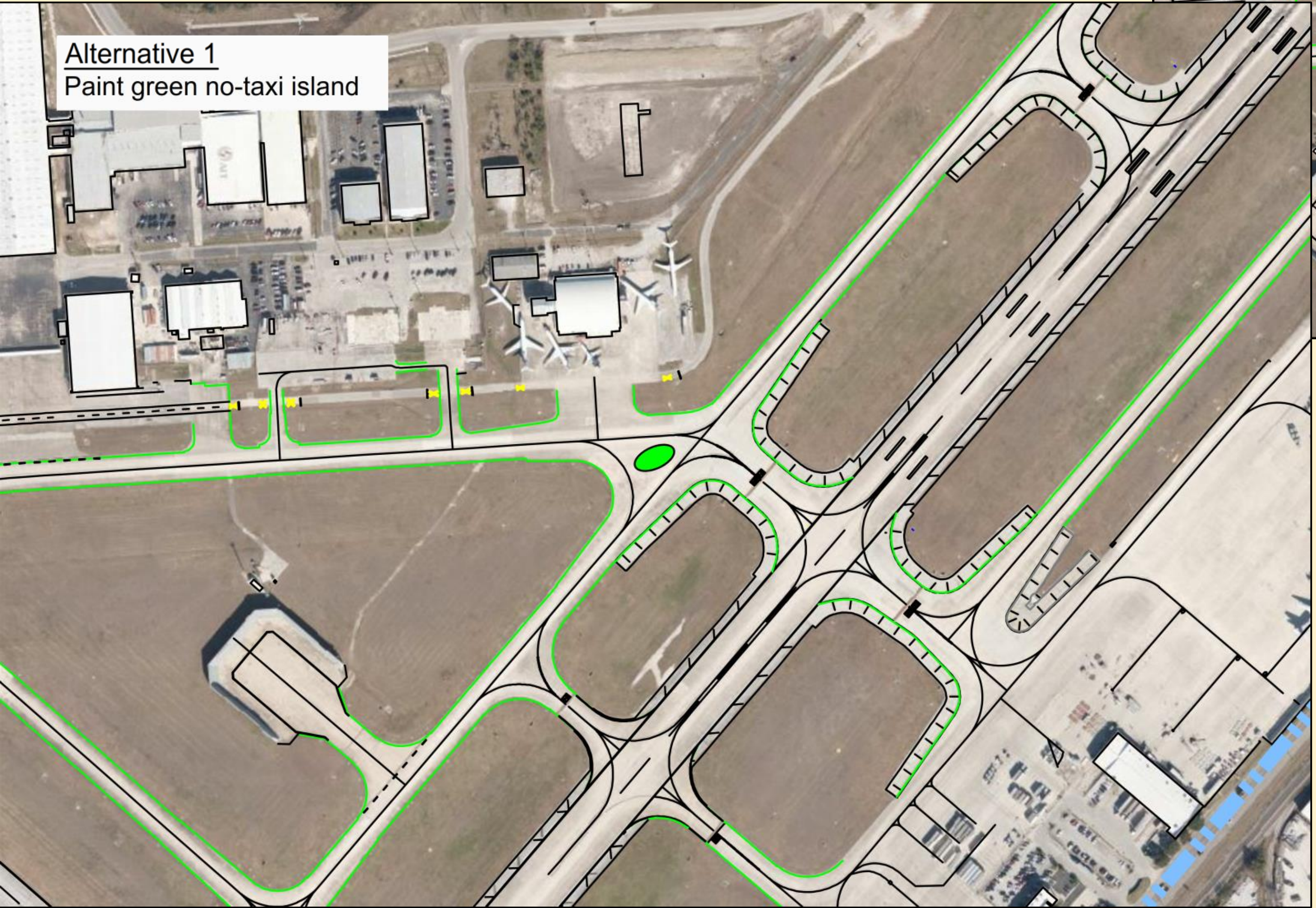


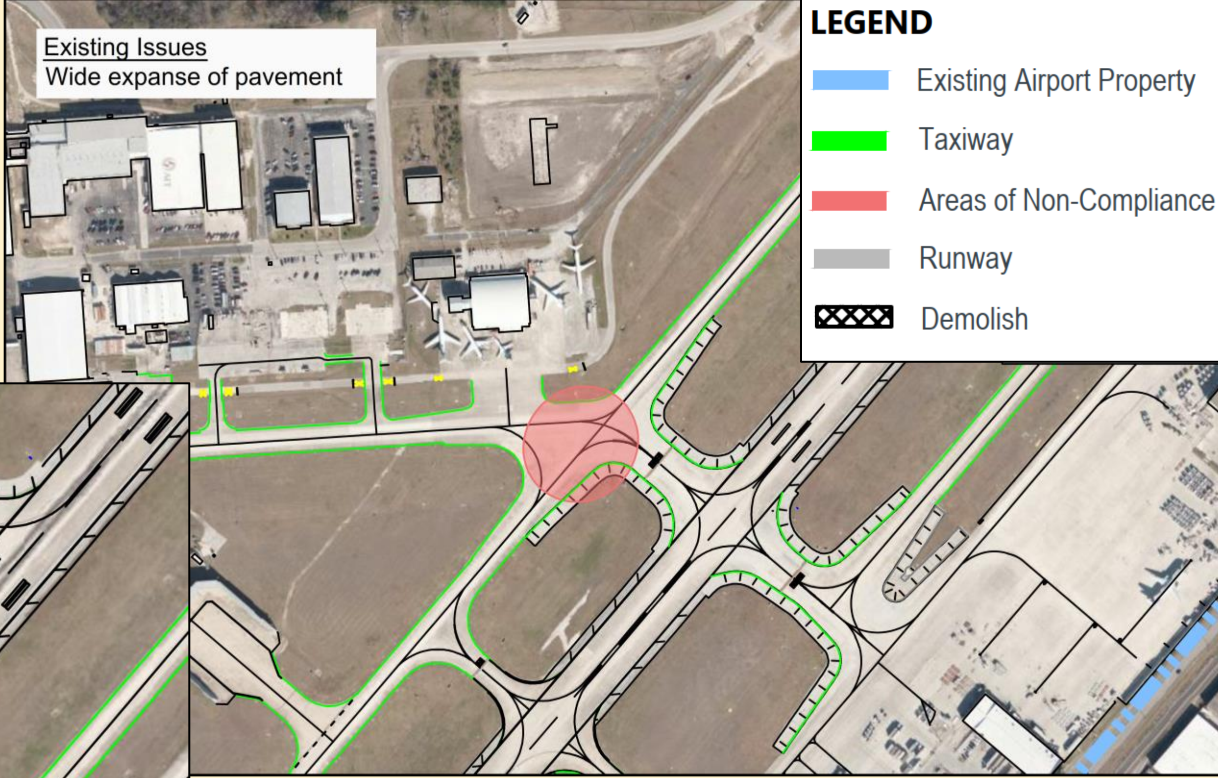


Recommendation:

- Alternative 2 (per 2017 ALP)
- Combine with Area 21 mitigation
- TBD, beyond 6-y CIP

Area 23
Mitigation Alternatives





Recommendation:
- Alternative 1 (per 2017 ALP)
- Include in Twy N project (in CIP)

Next Steps in SDP

Next Steps

- Incorporate selected mitigations into proposed airfield layout

THANK YOU

San Antonio International Airport

Strategic Development Plan

Airfield Non-Standard Geometry Mitigation Alternatives

Summary of Preferred Alternatives from March 18, 2021 Meeting

April 22, 2021

Meeting Agenda

Areas of Non-Compliance

Recap Preferred Mitigation Alternatives

- In 6-Year CIP
- Beyond 6-Year CIP
- Included in Other Projects
- No Action Needed

Select Preferred Alternatives for Remaining Areas

Next Steps

Purpose & Outcome of this Meeting

Purpose

- Recap preferred mitigation alternatives selected at March 18, 2021 meeting
- Select preferred alternatives for outstanding areas

Outcome

- Decision on all areas for inclusion in ALP

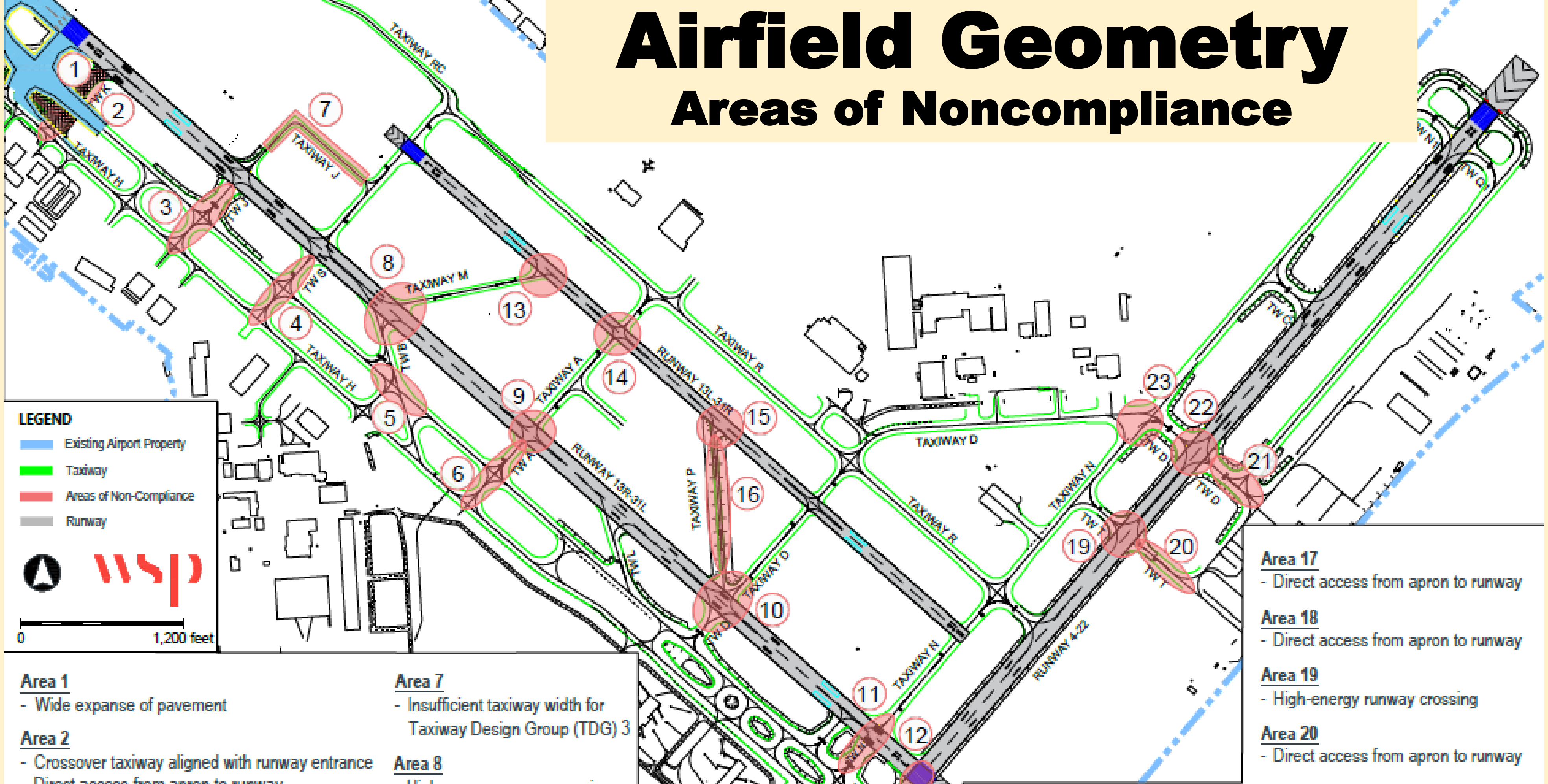
Non-Standard Airfield Geometry

Airfield Geometry
What are Areas of Noncompliance?

- Runway incursion prevention
- Taxiway design principles per FAA AC 150/5300-13A (*Airport Design*):
  - More than 3 nodes
  - High-energy runway crossing
  - Wide expanse of pavement
  - Direct runway access from apron
  - …
- FAA-designated airfield hot spots
- Airfield pavement geometry standards (taxiway widths)

Airfield Geometry

Areas of Noncompliance



Area 1
- Wide expanse of pavement

Area 2
- Crossover taxiway aligned with runway entrance
- Direct access from apron to runway

Area 3
- Crossover taxiway aligned with runway entrance
- Direct access from apron to runway

Area 4
- Crossover taxiway aligned with runway entrance
- Direct access from apron to runway

Area 5
- More than three nodes
- Wide expanse of pavement

Area 6
- Crossover taxiway aligned with runway entrance
- Direct access from apron to runway

Area 7
- Insufficient taxiway width for Taxiway Design Group (TDG) 3

Area 8
- High-energy runway crossing
- Non perpendicular runway crossings

Area 9
- High-energy runway crossing

Area 10
- More than three nodes
- Non-perpendicular runway crossing

Area 11
- Hot spot

Area 12
- Hot spot

Area 13
- Non-perpendicular runway entrance/exit

Area 14
- High-energy runway crossing

Area 15
- Non-perpendicular runway entrance/exit

Area 16
- Insufficient taxiway width for TDG 3

Area 17
- Direct access from apron to runway

Area 18
- Direct access from apron to runway

Area 19
- High-energy runway crossing

Area 20
- Direct access from apron to runway

Area 21
- Direct access from apron to runway
- Crossover taxiway aligned with runway entrance

Area 22
- High-energy runway crossing

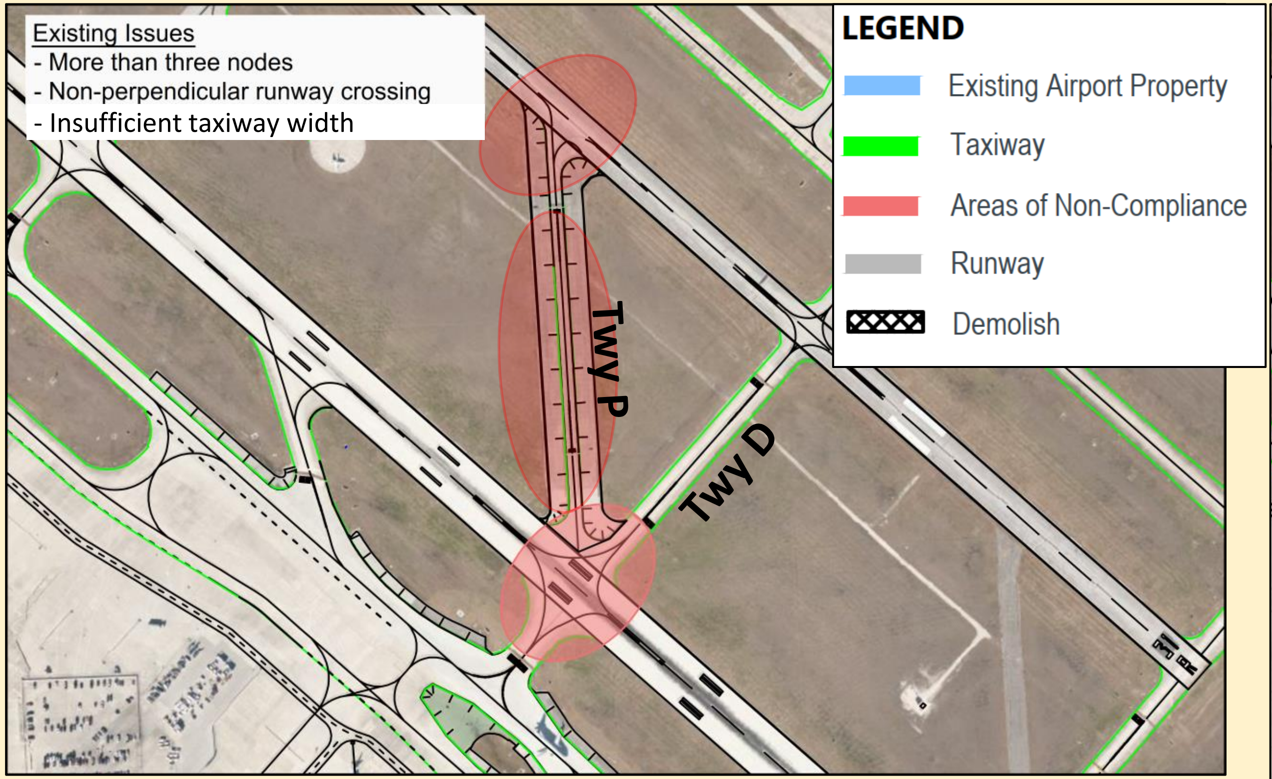
Area 23
- Wide expanse of pavement

Area 24 (Airfield-wide)
- No runway shoulders for Runway 13R-31L and Runway 13L-31R
- Insufficient taxiway shoulders and fillets to meet Taxiway Design Groups

Summary of Preferred Mitigation Alternatives In 6-Year CIP

Recap
Areas 10, 15 & 16 Preferred Alternative

Selected at 3/18/21 meeting



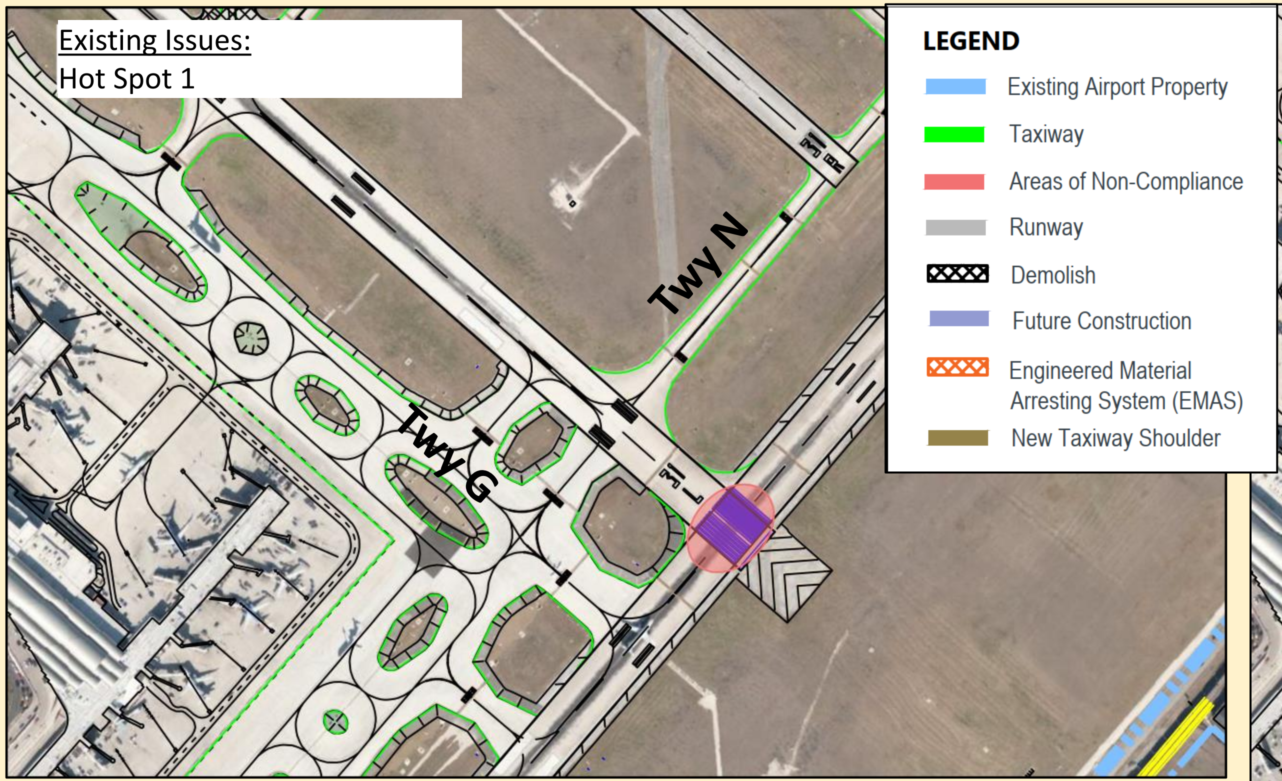
Proposed Improvement:

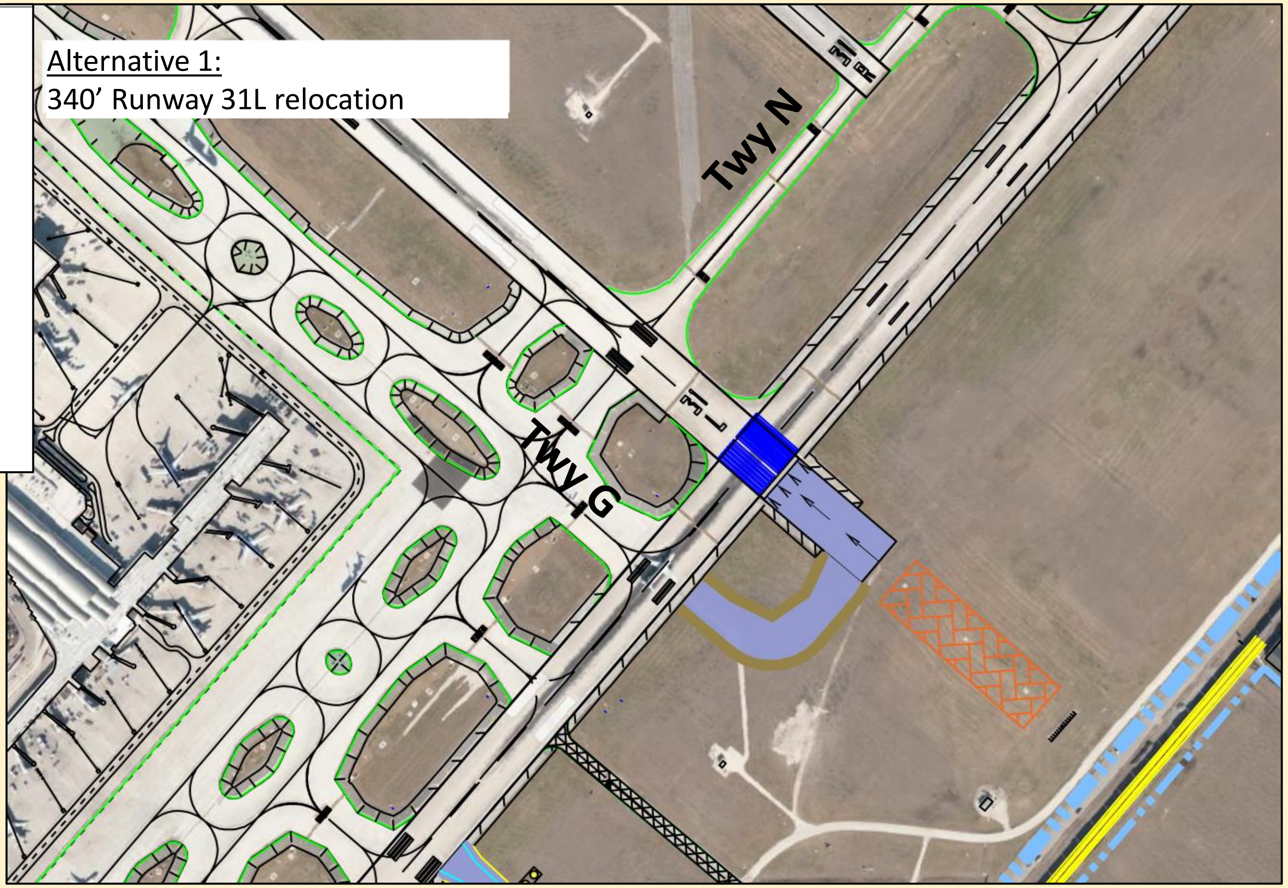
- Planned mitigation (per ACIP)
- Close Twy P

4/22/2021 Meeting:
- Close Twy P before reopen Rwy 13L

Recap
Area 12 Preferred Alternative

Selected at 3/18/21 meeting



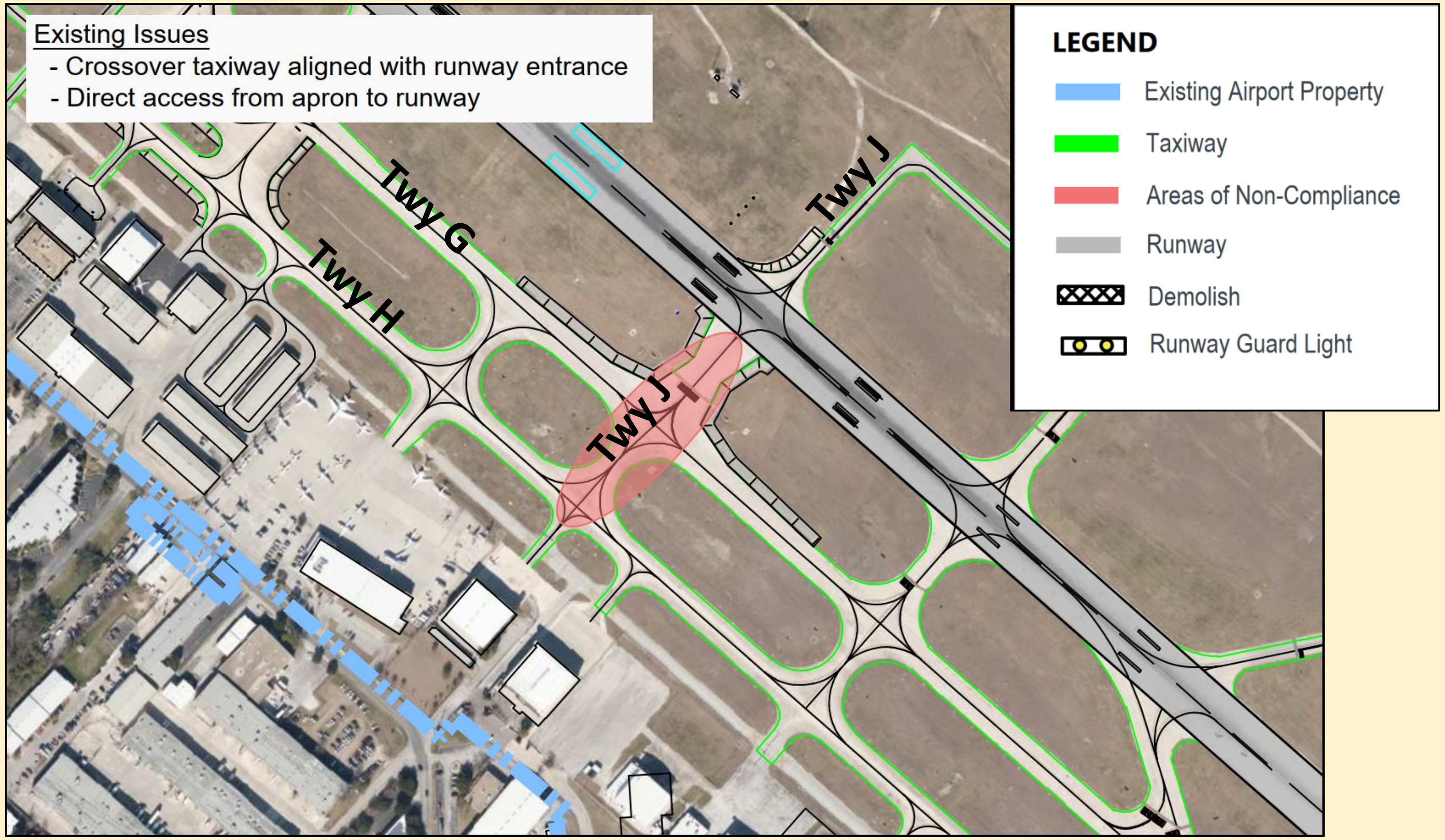


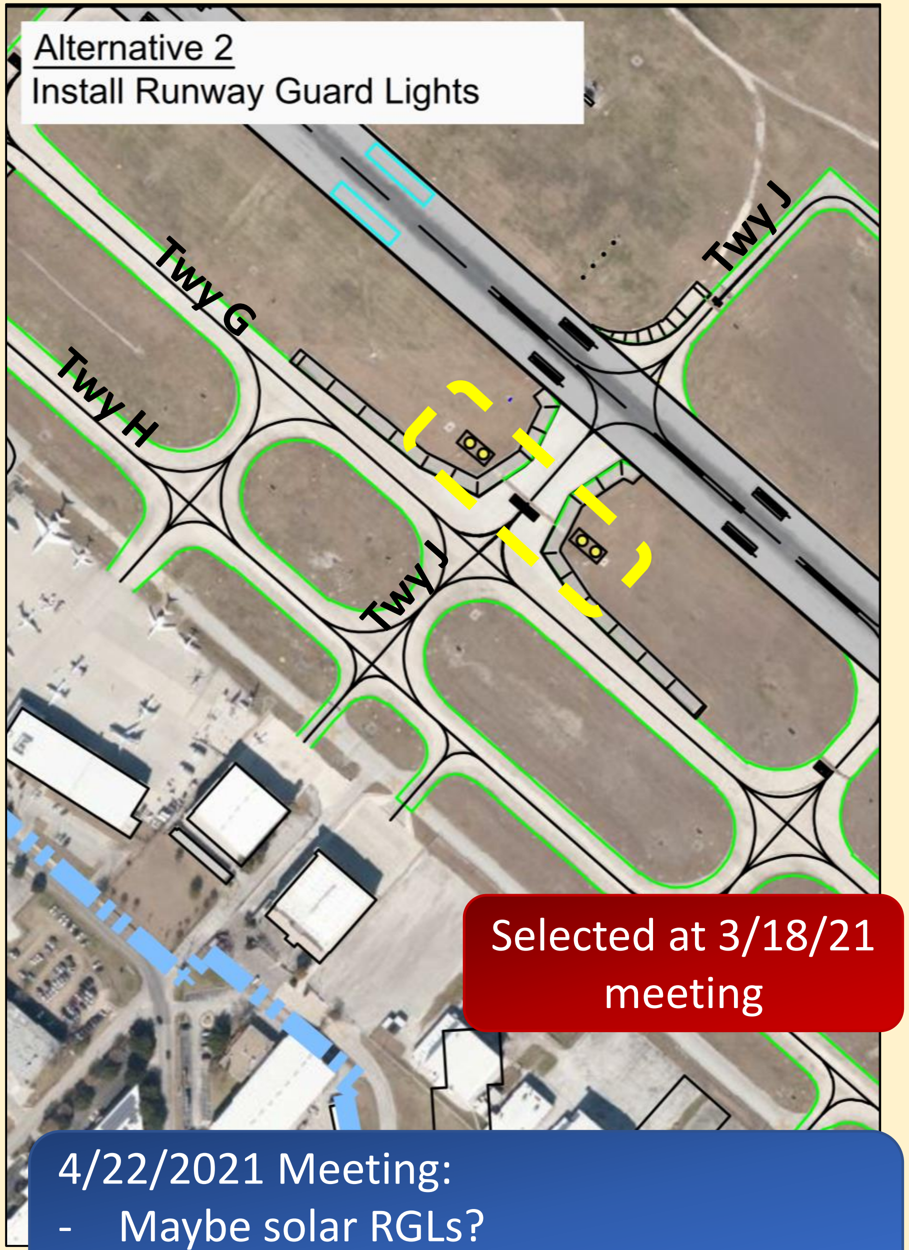
Proposed Improvement:

- Alternative 1 (340’ runway end relocation)

Summary of Preferred Mitigation Alternatives Beyond 6-Year CIP

Recap
Area 3 Preferred Alternative





Selected at 3/18/21 meeting

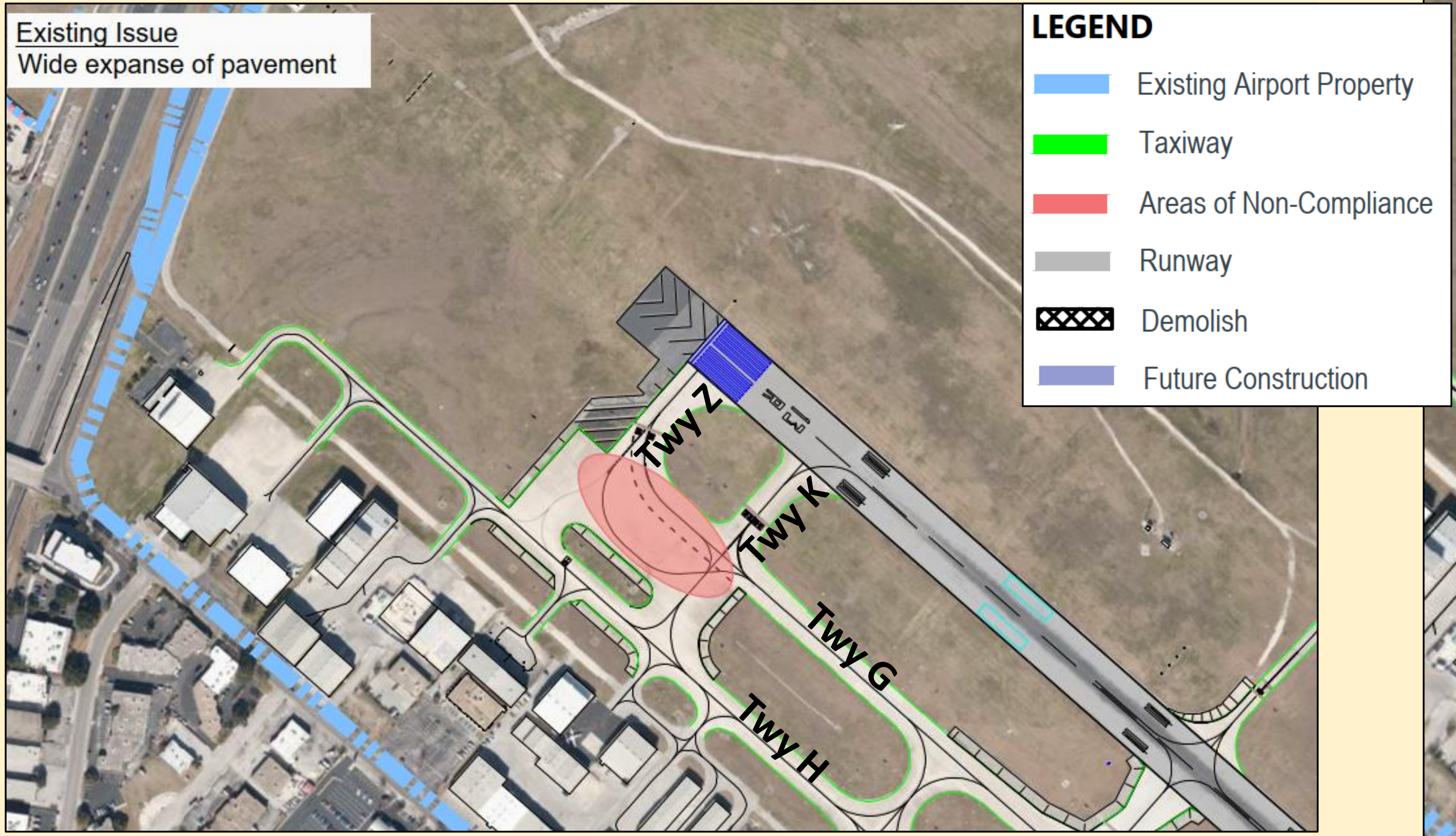
Proposed Improvement:

- Alternative 2 (install RGLs)

4/22/2021 Meeting:
- Maybe solar RGLs?
- RGL circuits already in vicinity of Twy J

Recap
Area 1 Preferred Alternative

Selected at 3/18/21 meeting



4/22/2021 Meeting:
- Show as mid-term project

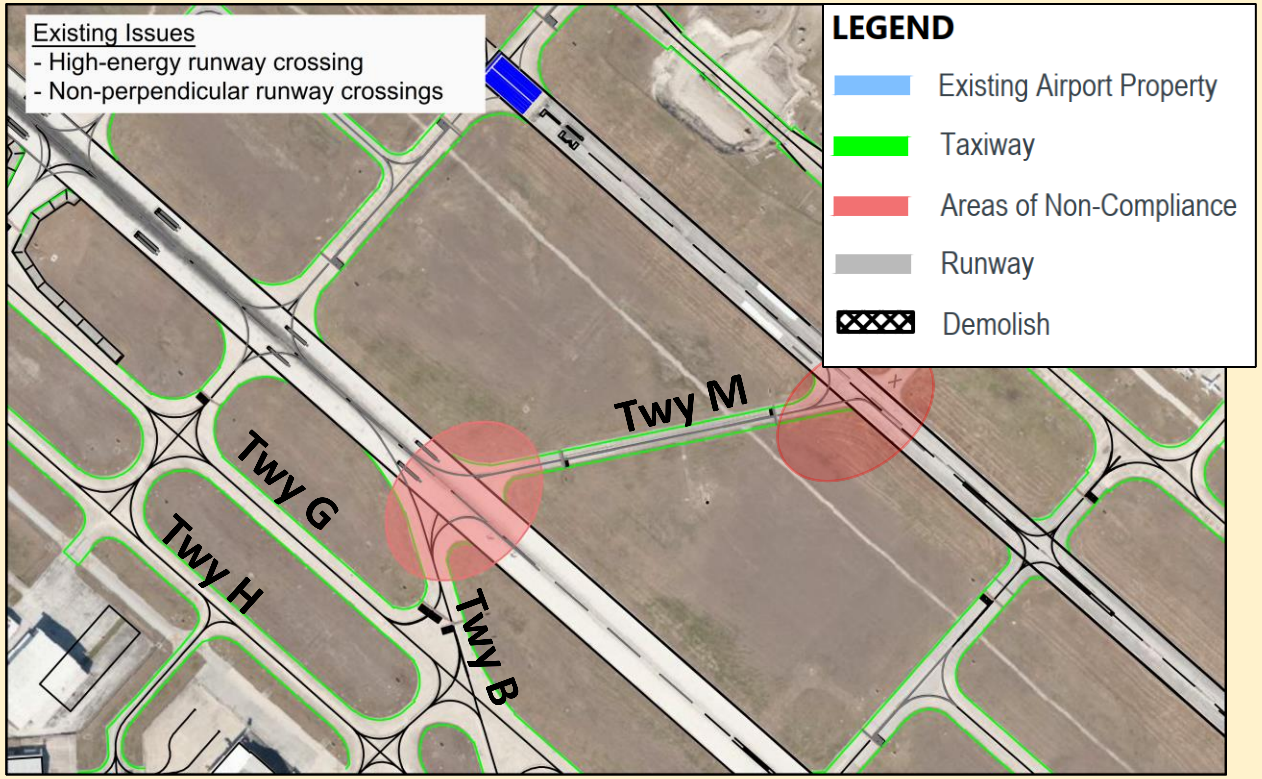
Preferred Alternative:

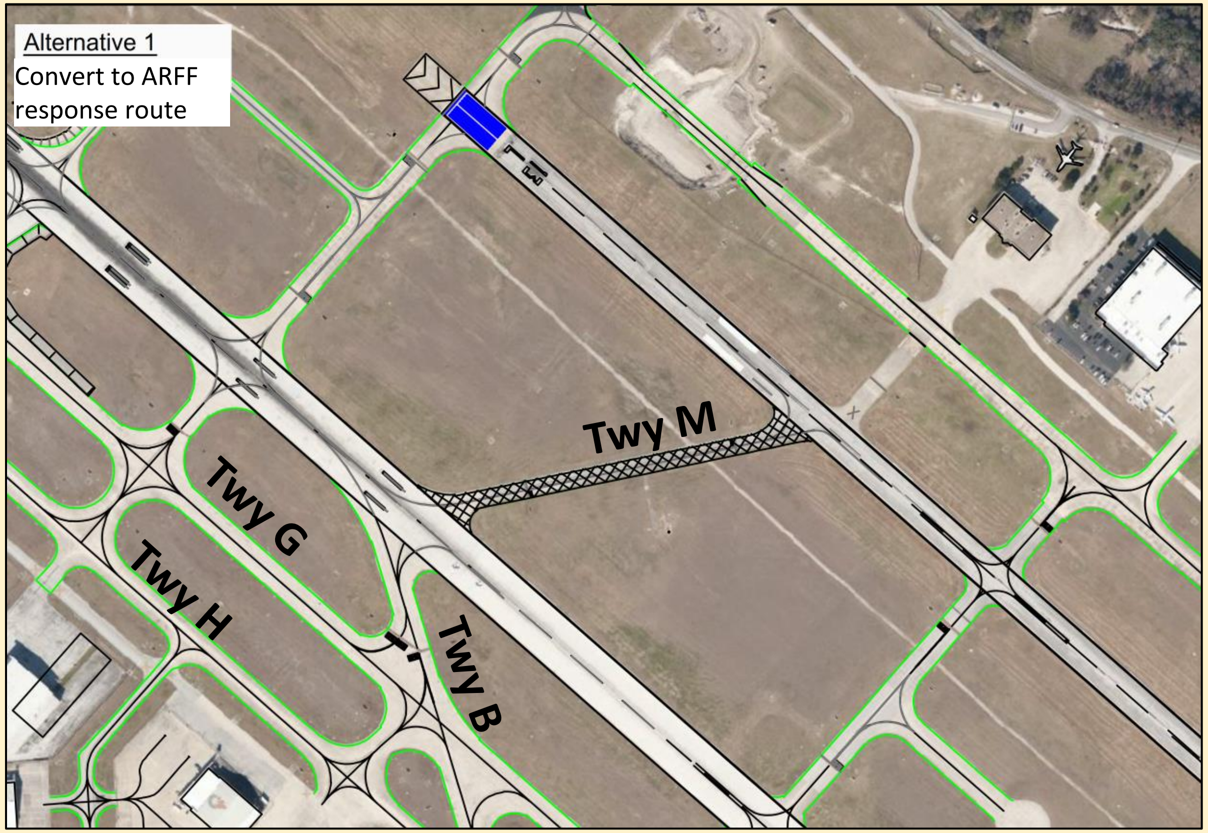
- Alternative 1 (green no-taxi island [paint, astroturf or grass])

Summary of Preferred Mitigation Alternatives To Be Included in Other Projects

Recap
Areas 8 & 13 Preferred Alternative

Selected at 3/18/21 meeting





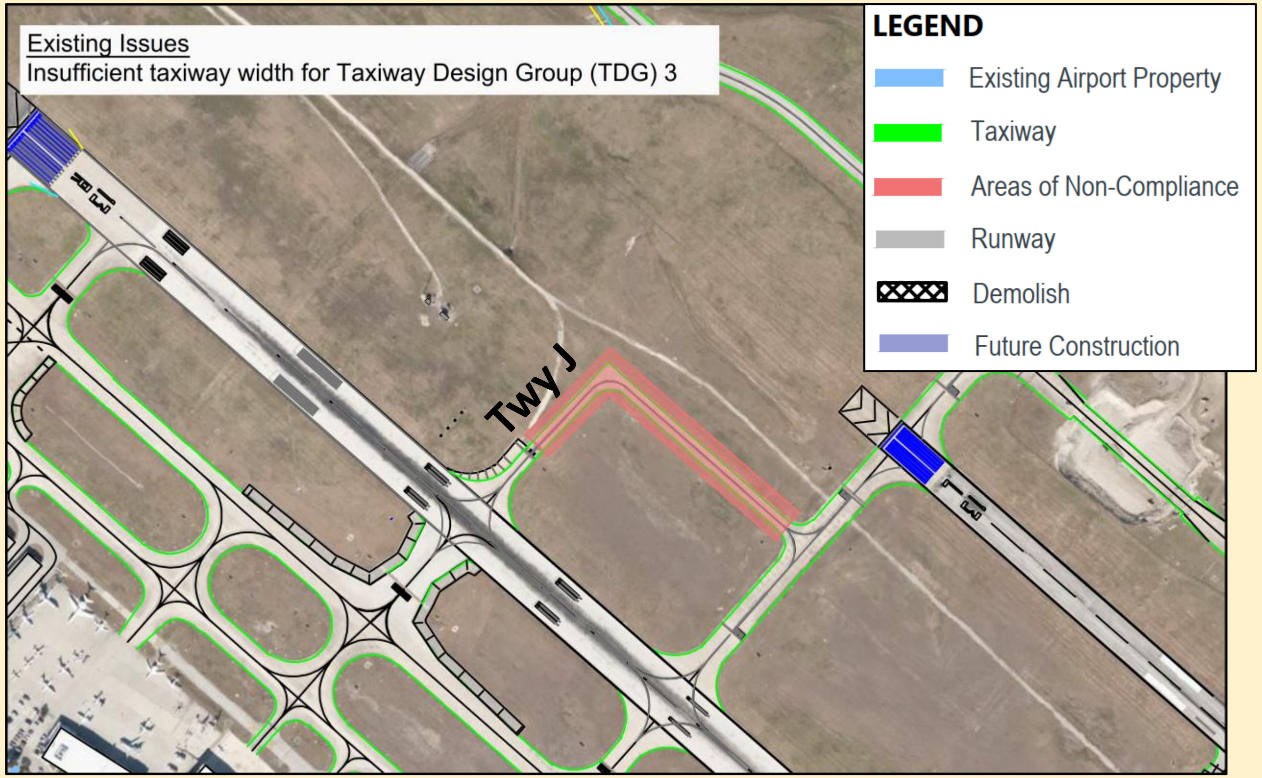
Proposed Improvement:

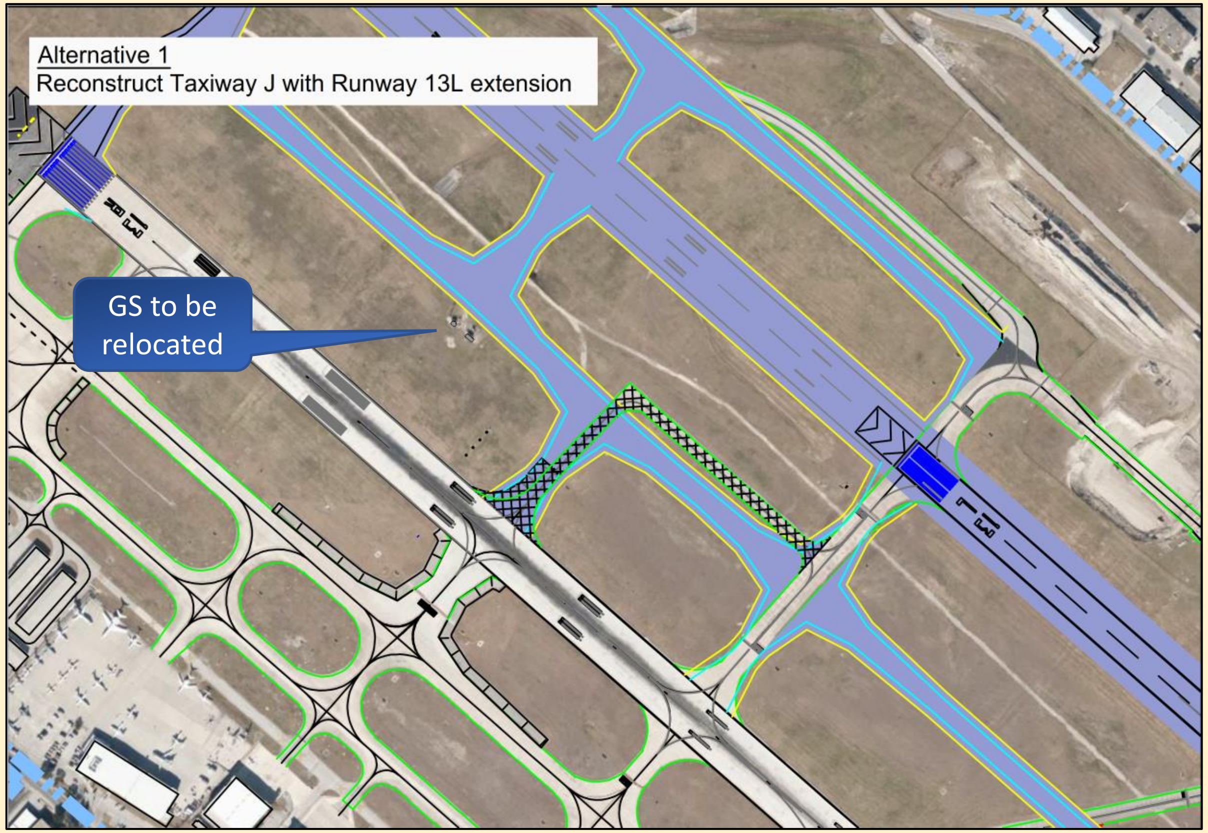
- Alternative 1 (convert to service road for ARFF response)
- Signs/markings only
- Included in Package 7

4/22/2021 Meeting:
- Included in Package 7

Recap
Area 7 Preferred Alternative

Selected at 3/18/21 meeting



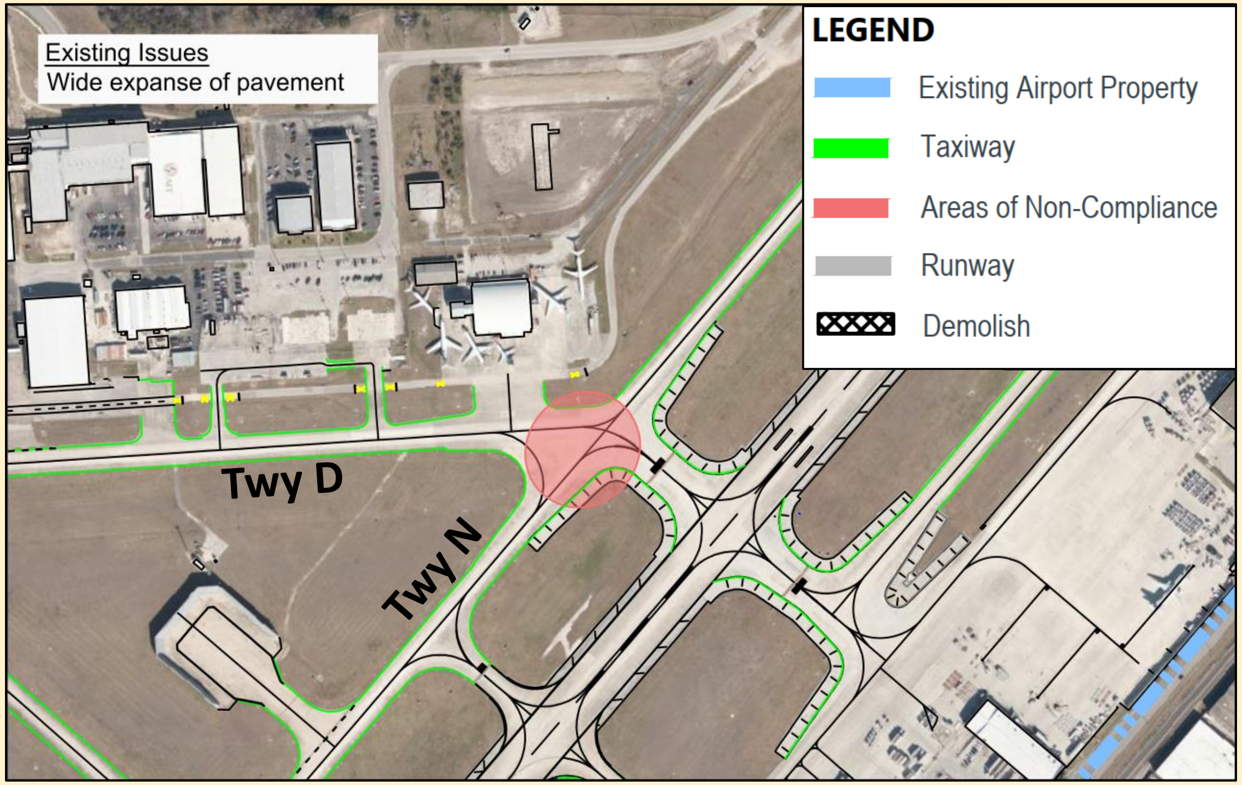


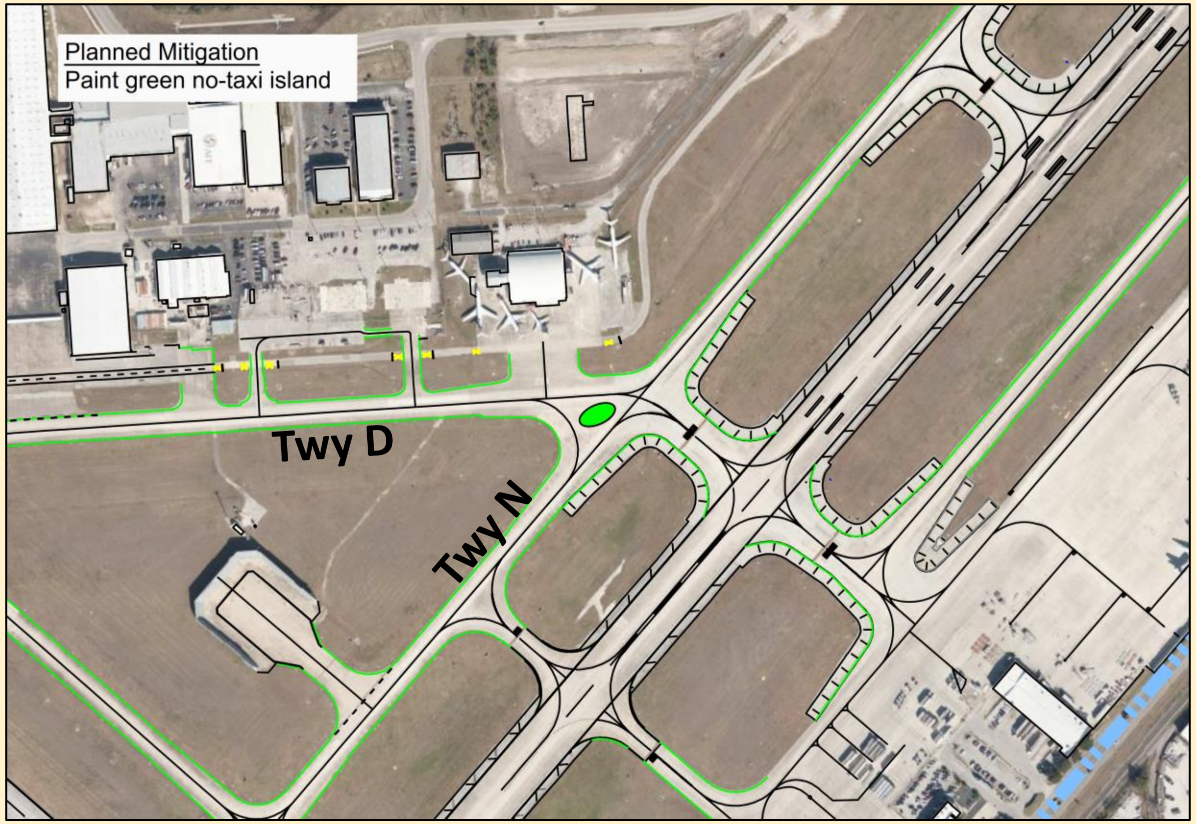
Proposed Improvement:

- Alternative 1
- Include in the *Rwy 13L Upgrade/ADG VI Midfield Taxiway* project

Recap
Area 23 Preferred Alternative

Selected at 3/18/21 meeting



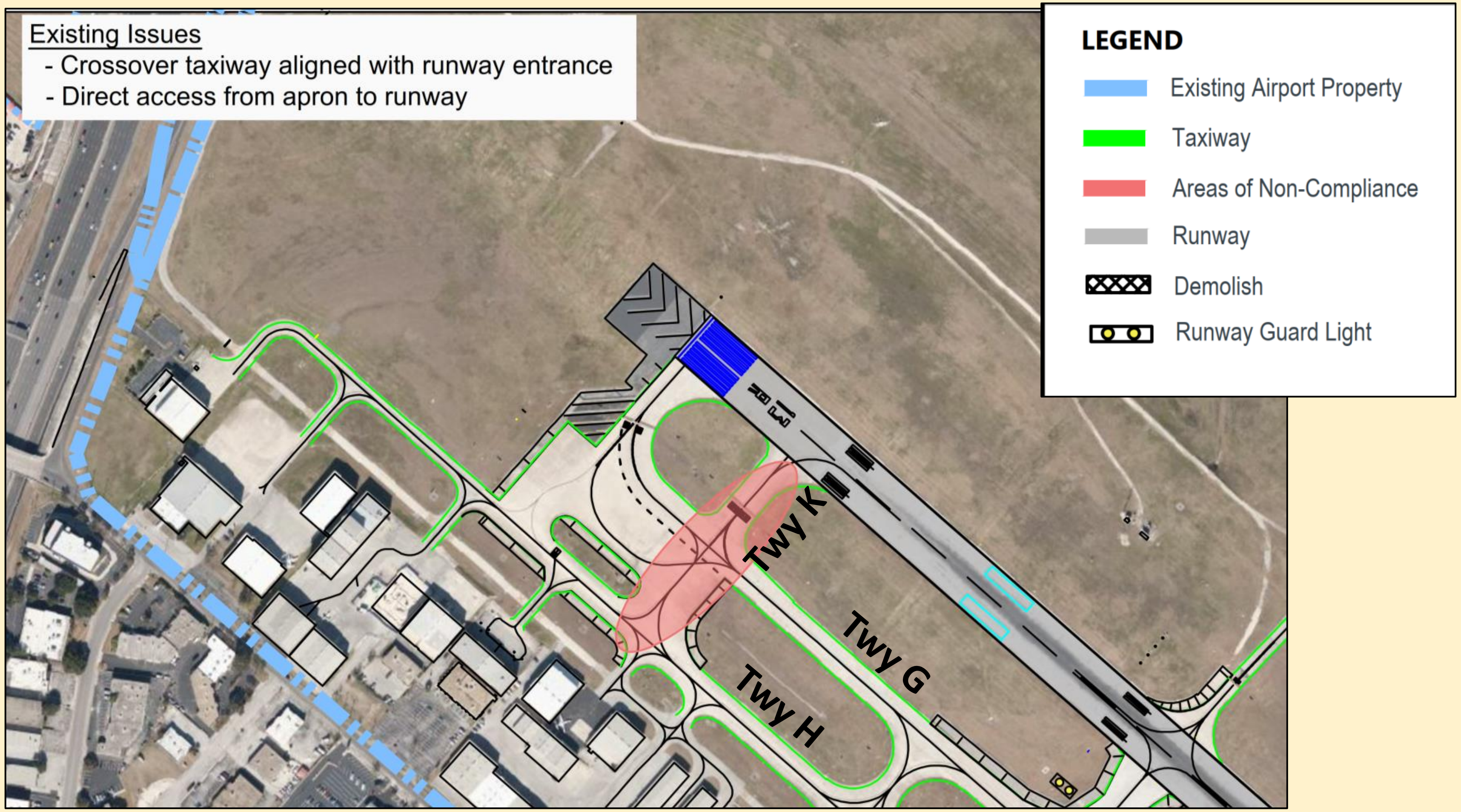


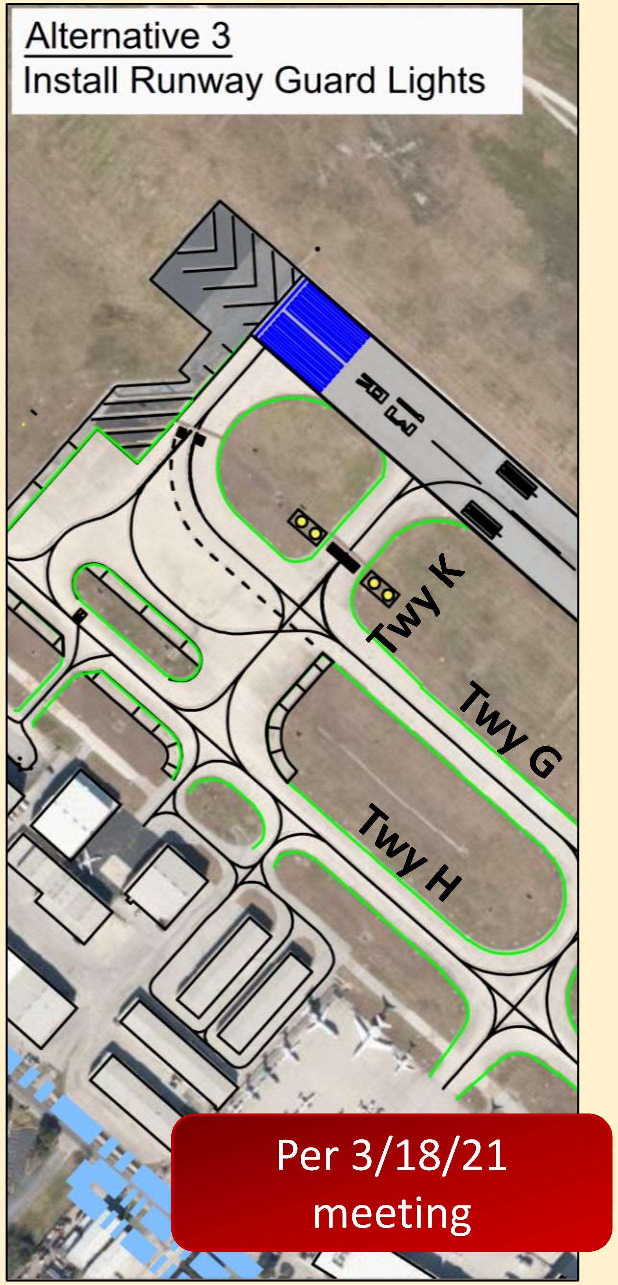
Proposed Improvement:

- Green no-taxi island
- Include in *Twy N Rehab* project (already in CIP)

Summary of Preferred Mitigation Alternatives
No Action Needed

Recap
Area 2 Preferred Alternative



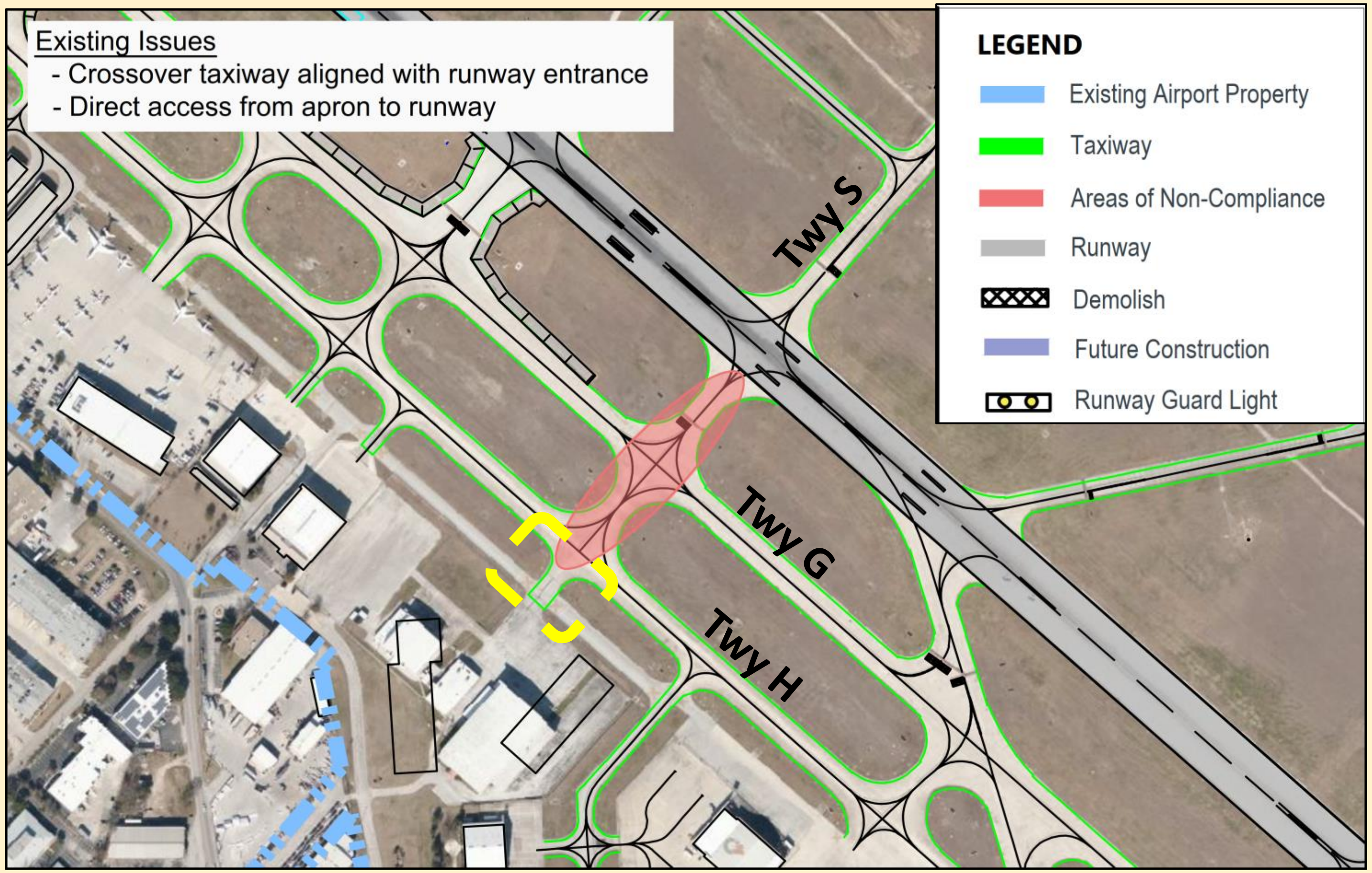


Proposed Improvement:

- No action needed
- Alternative 3 (RGLs) is the existing condition

Recap
Area 4 Preferred Alternative

Per 3/18/21 meeting



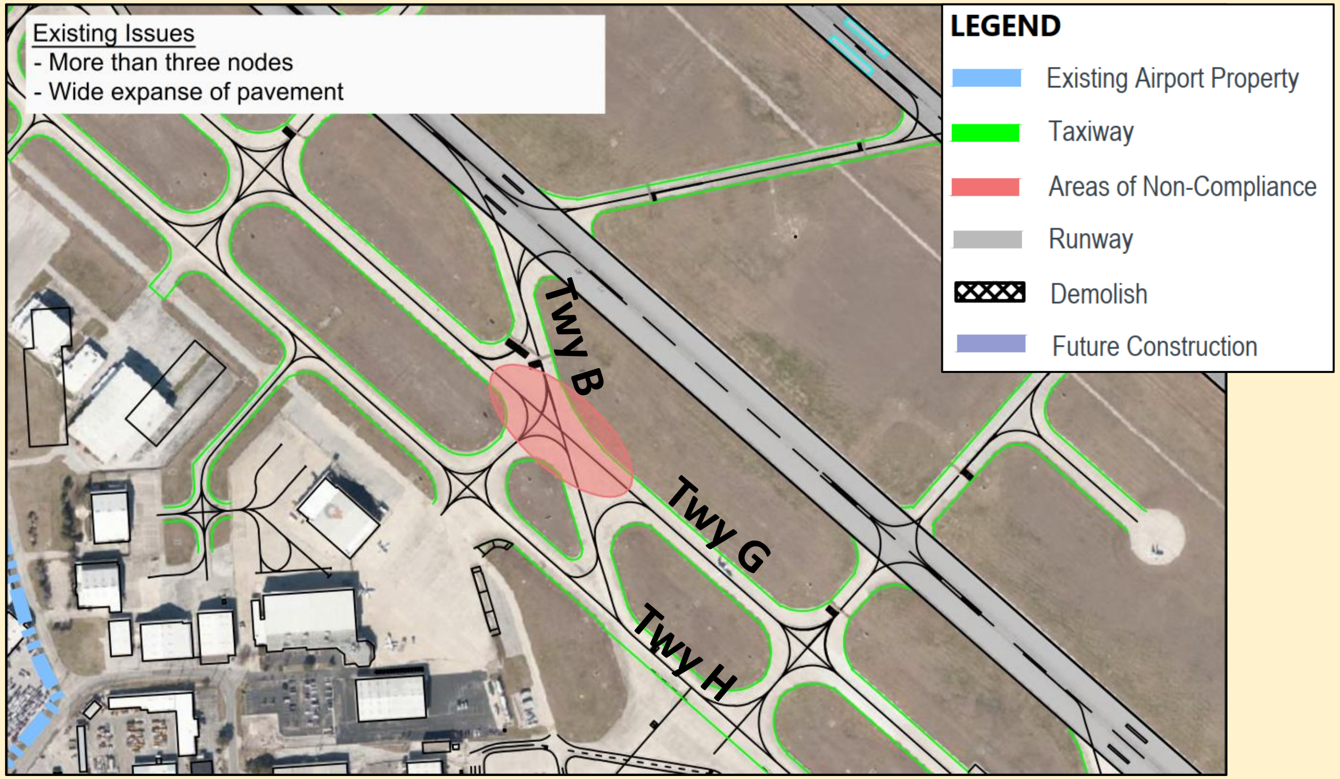
Proposed Improvement:

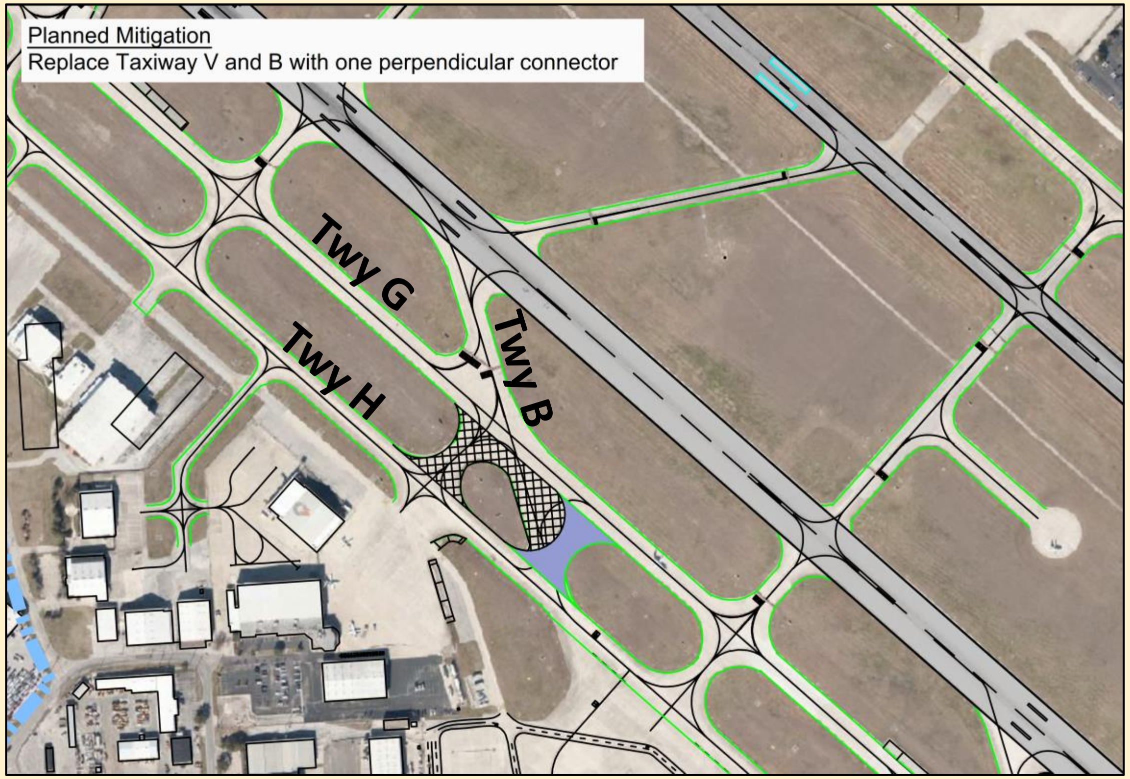
- No action needed
- Tenant access will be shifted west as part of another tenant project

4/22/2021 Meeting:
- To be completed by tenant

Recap
Area 5 Preferred Alternative

Per 3/18/21 meeting





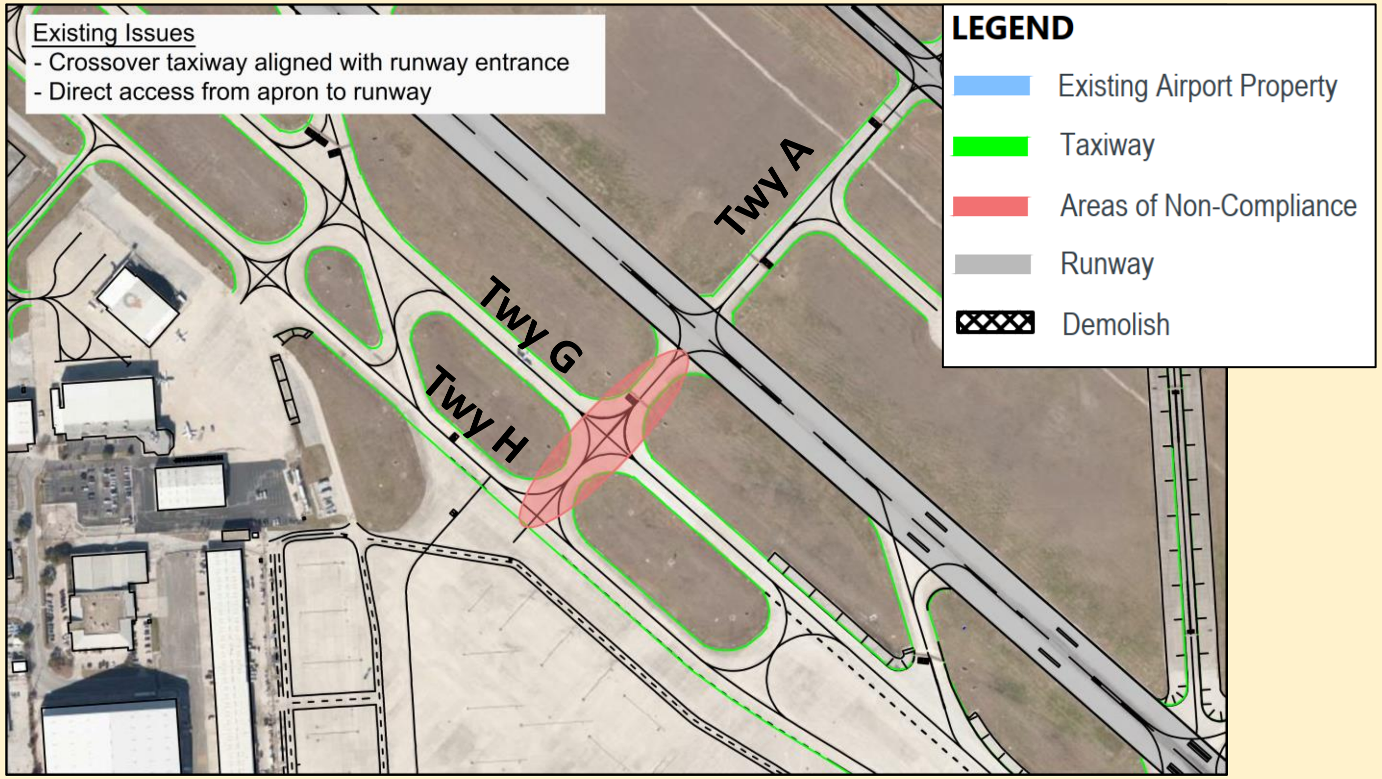
4/22/2021 Meeting:
- Included in *Twy H Reconstruction* project

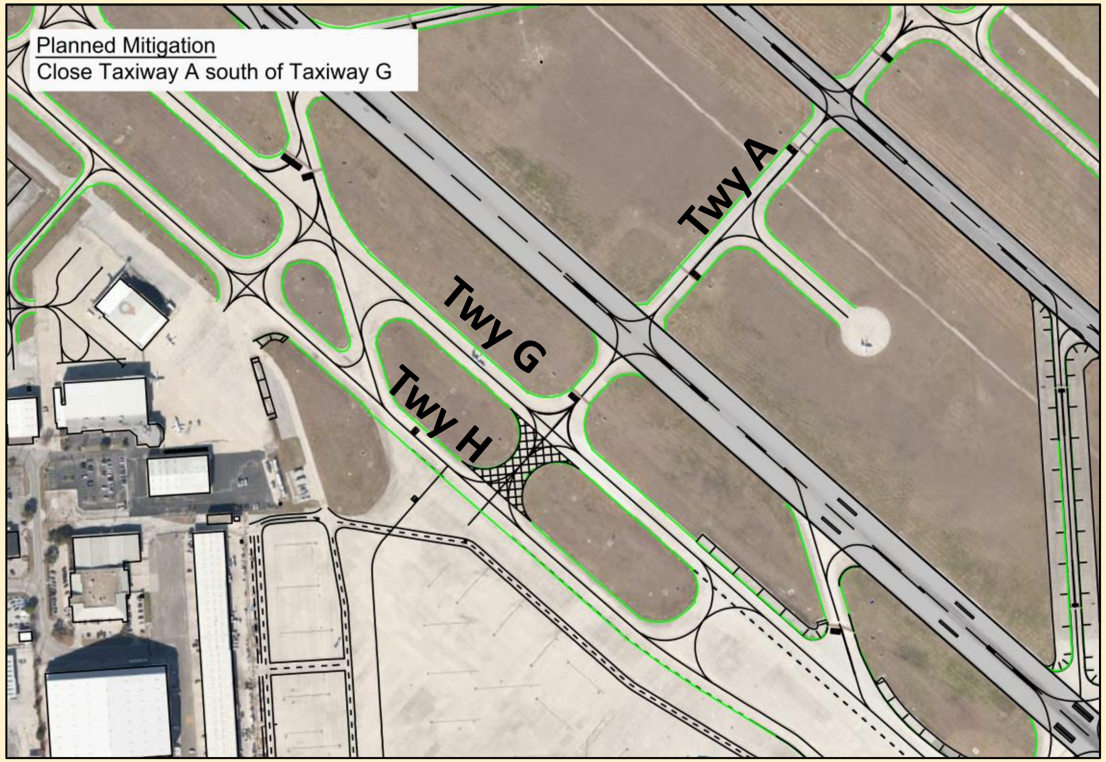
Proposed Improvement:

- No action needed
- Proposed improvement is already included in *Twy H Reconstruction* project

Recap
Area 6 Preferred Alternative

Per 3/18/21 meeting



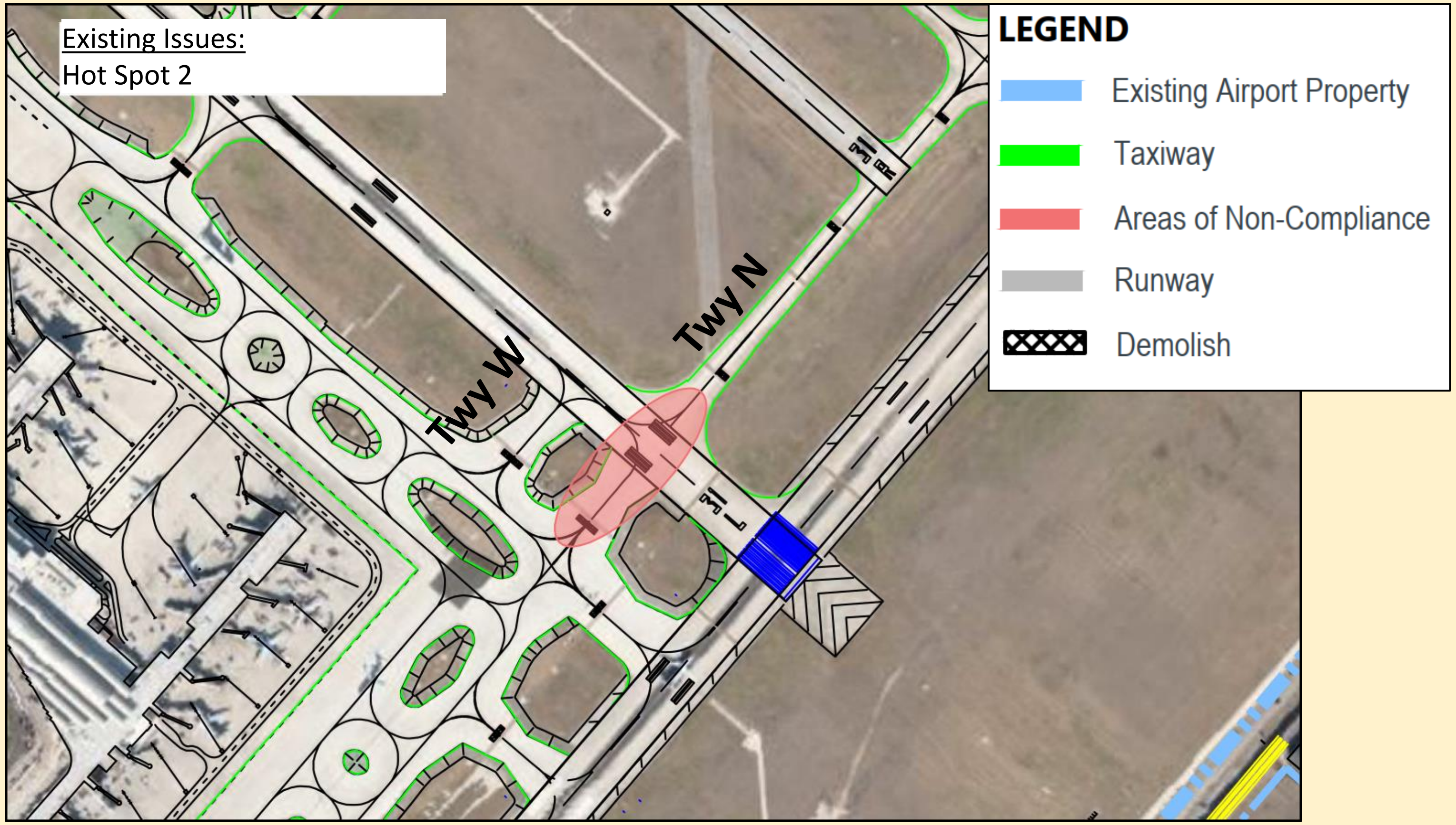


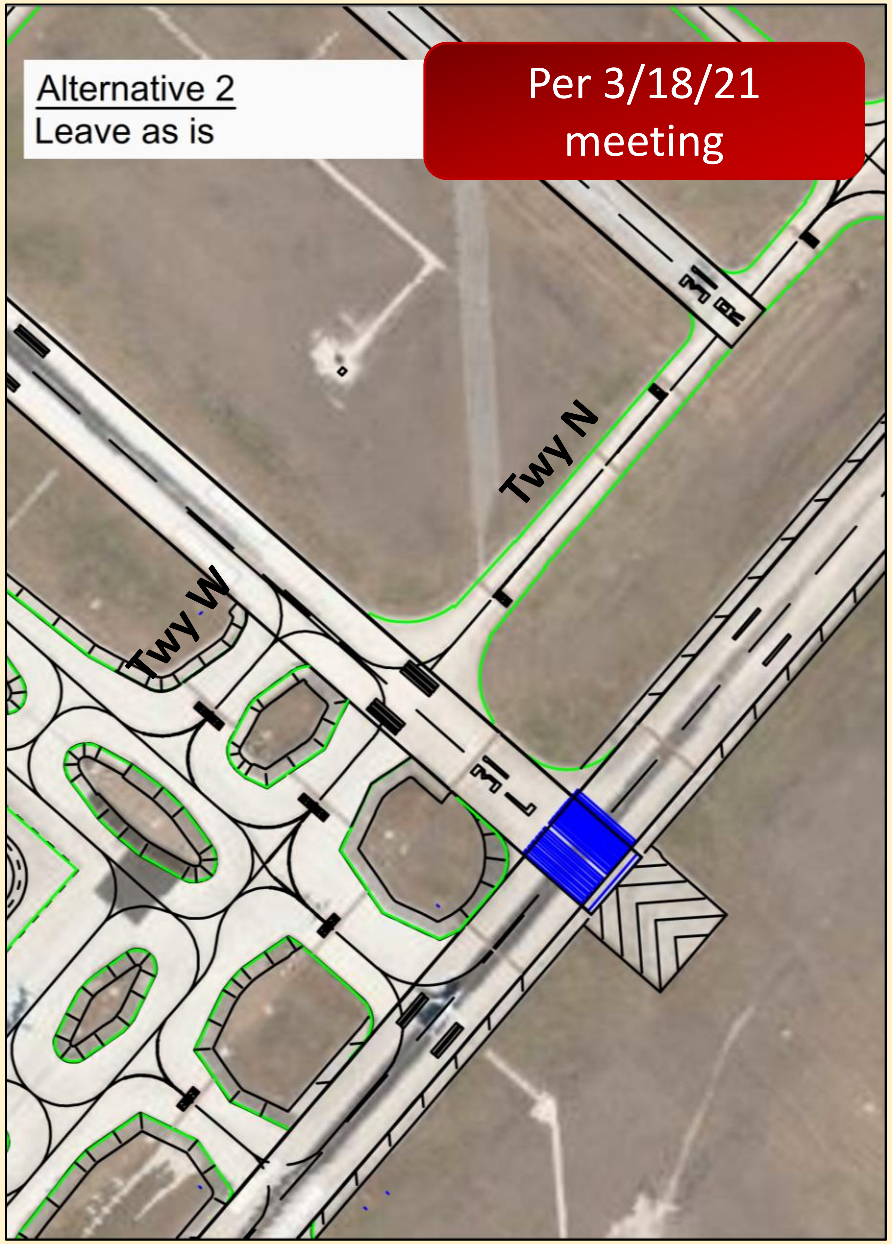
Proposed Improvement:

- No action needed
- Proposed improvement is already included in *Twy H Reconstruction* project

4/22/2021 Meeting:
- Included in *Twy H Reconstruction* project

Recap
Area 11 Preferred Alternative



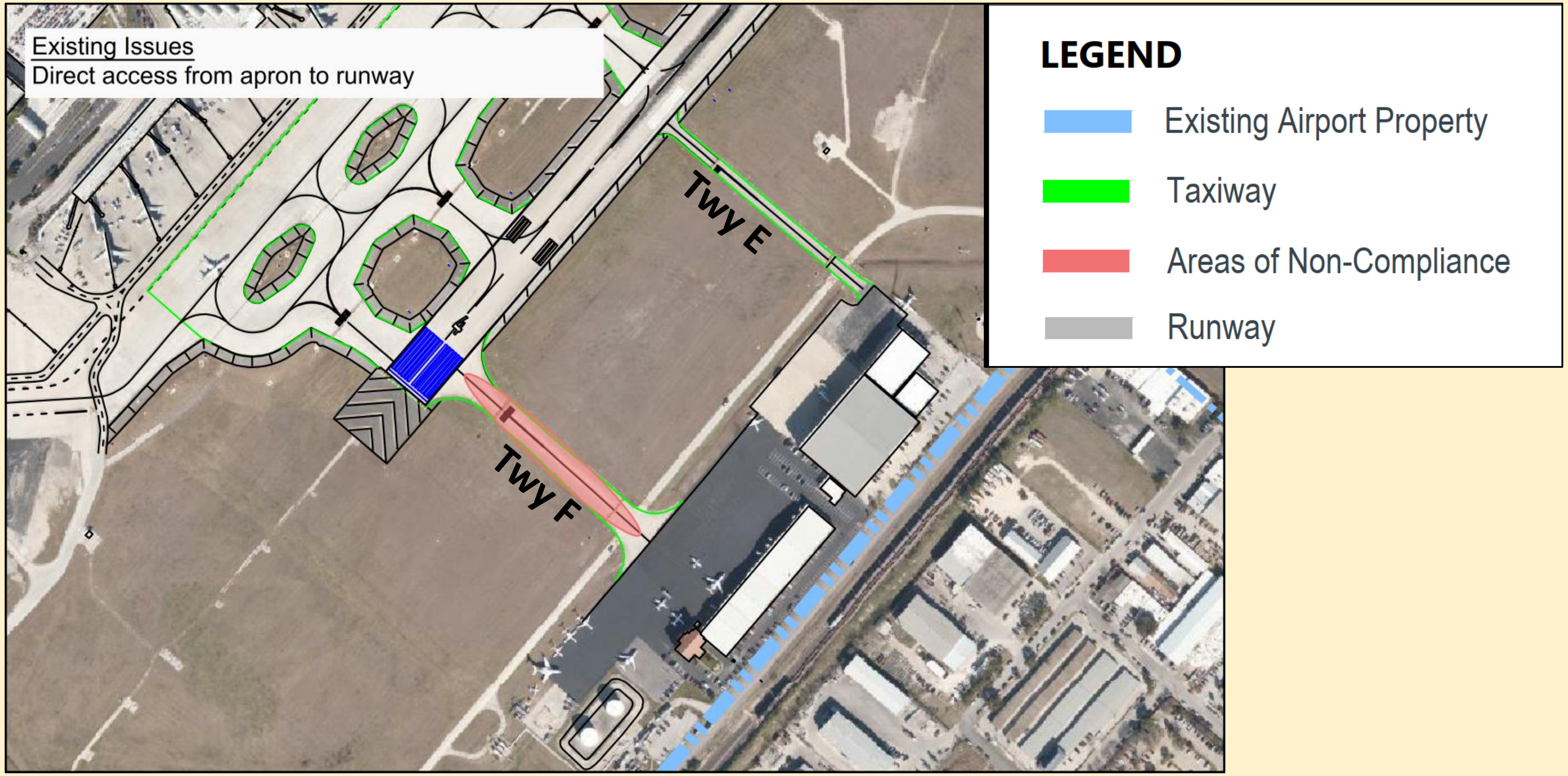


Proposed Improvement:

- Alternative 2
- No action, may not be designated as a Hot Spot anymore if RGLs are effective

Recap
Area 17 Preferred Alternative

Per 3/18/21 meeting

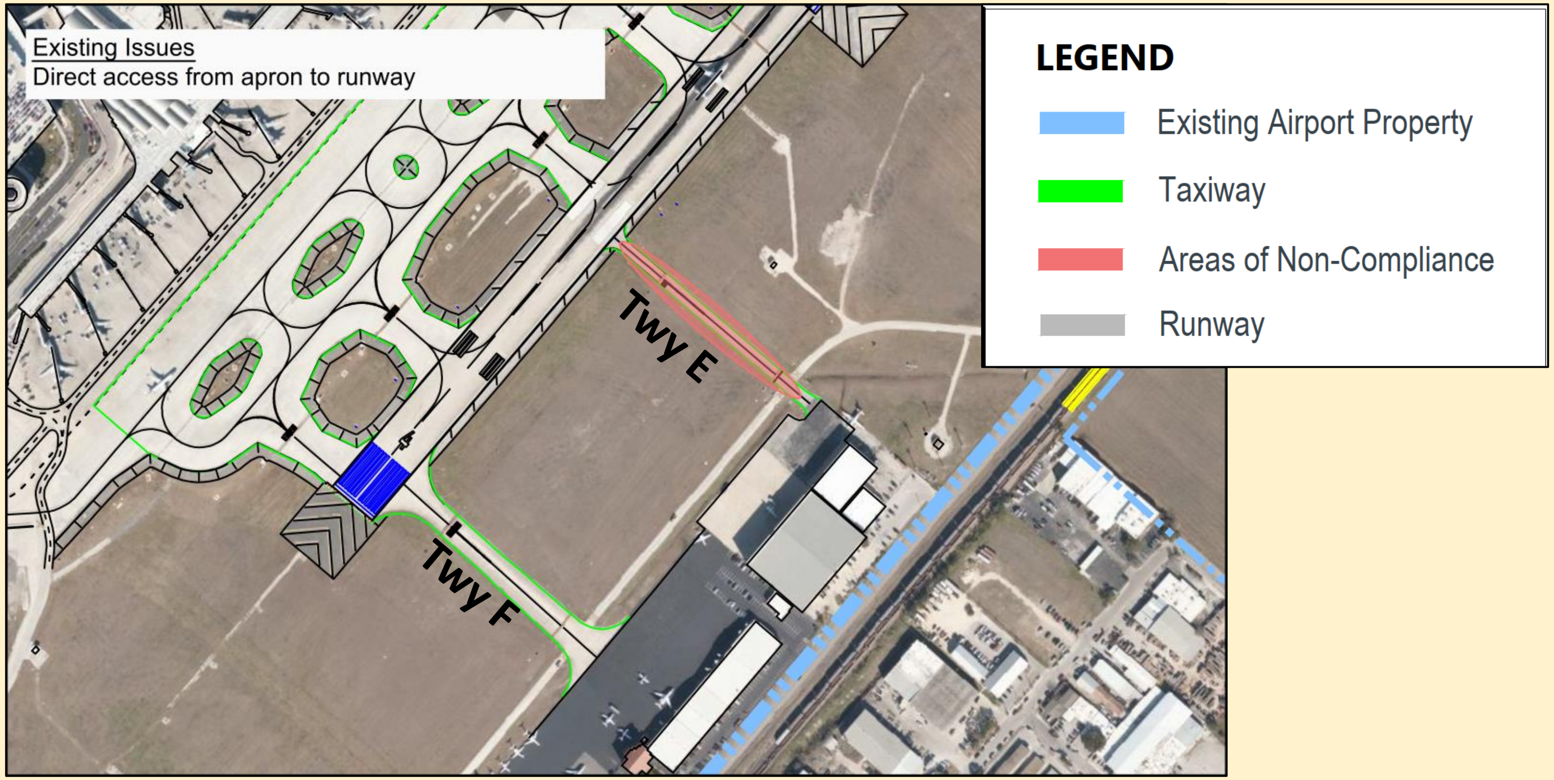


Proposed Improvement:

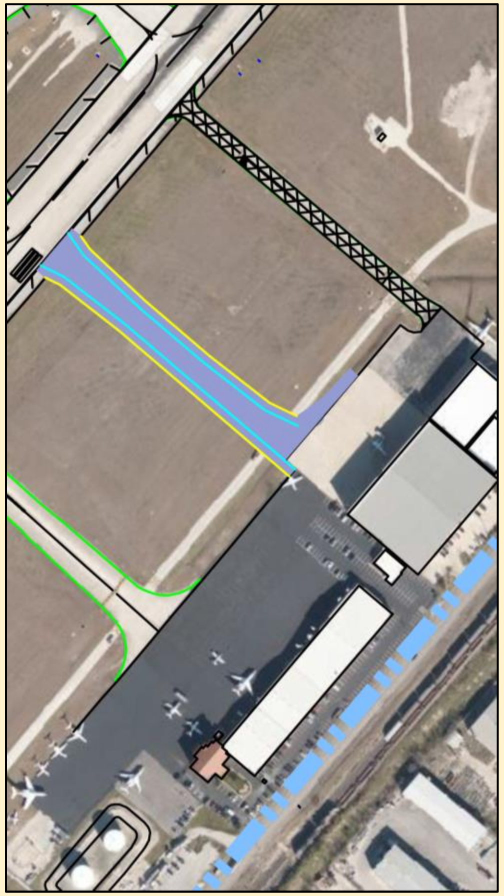
- No action
- Operational procedure/signs/markings already in place, with no issues

Recap
Area 18 Preferred Alternative

Per 3/18/21 meeting



Planned Taxiway E Relocation:

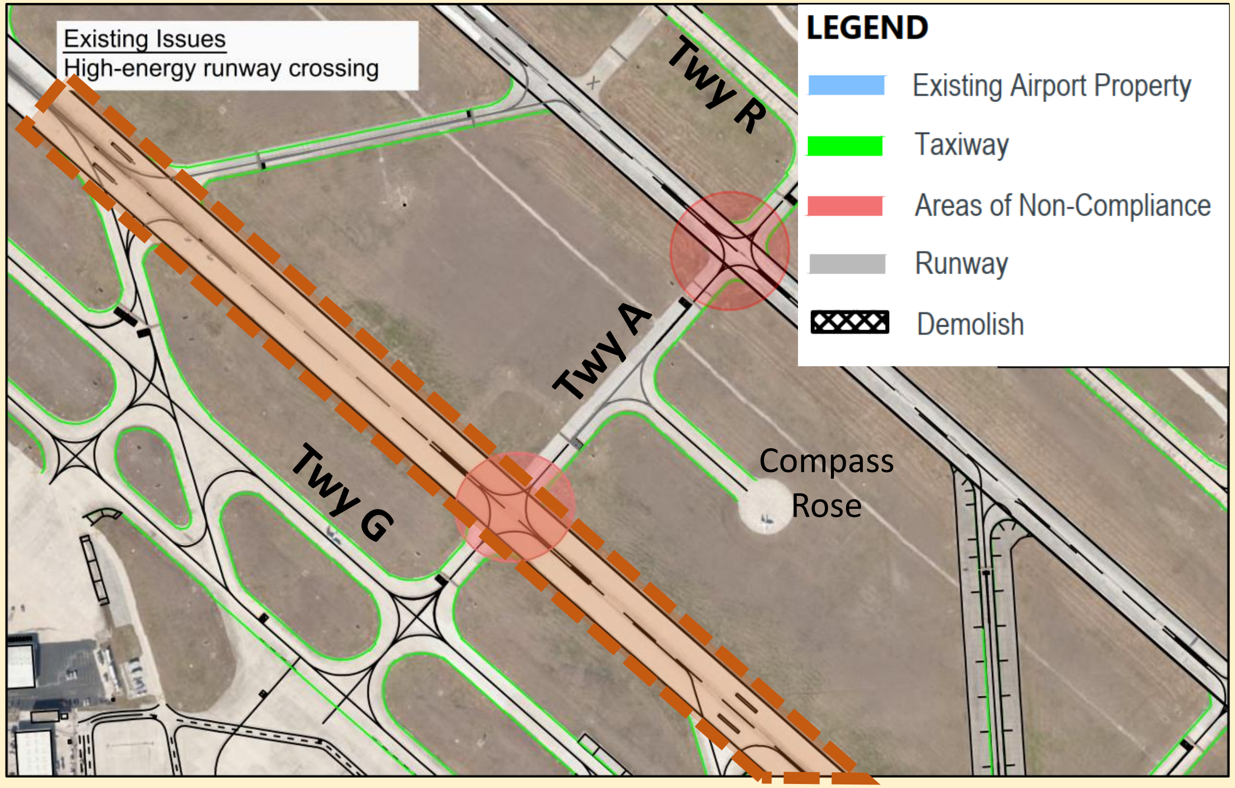


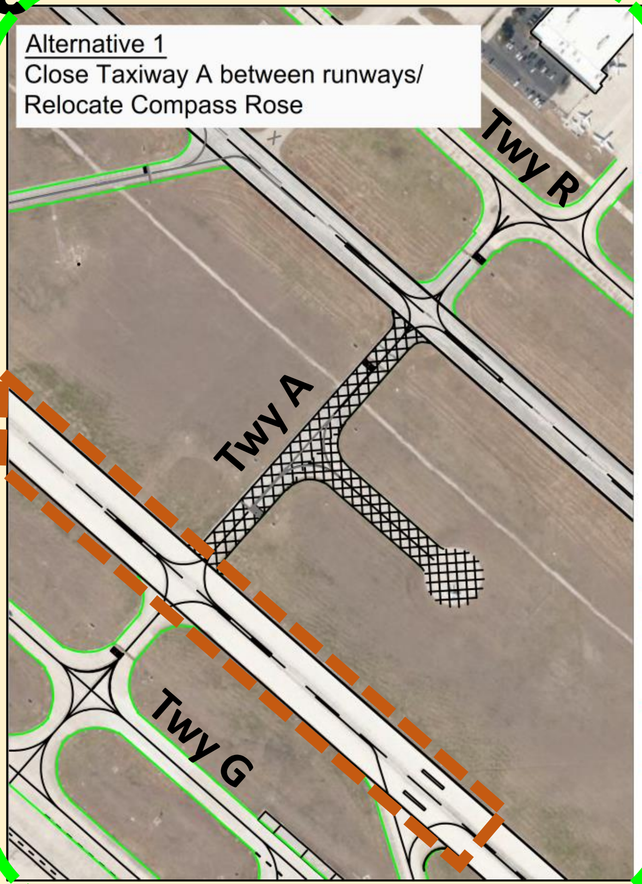
Proposed Improvement:

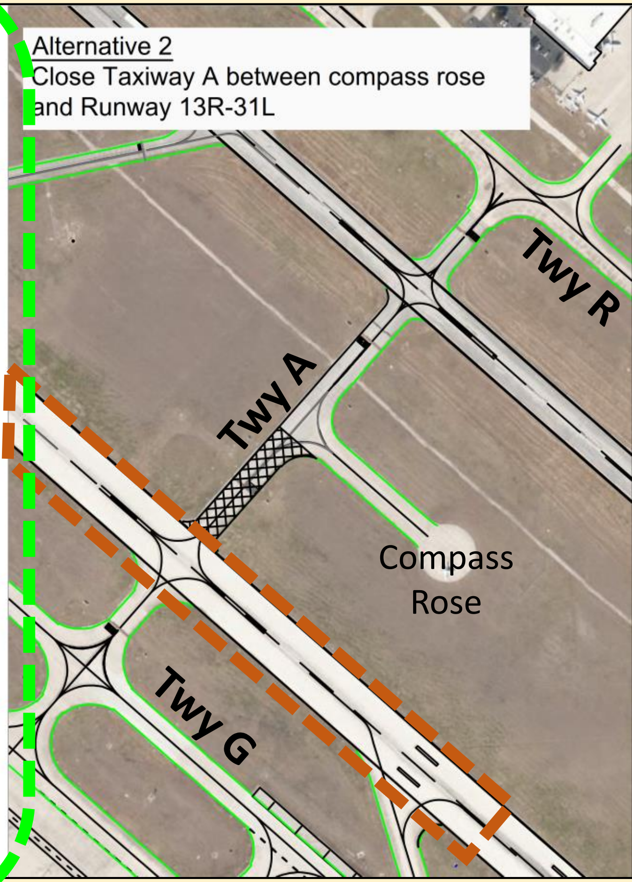
- Taxiway E planned to be relocated south
- No action
- Operational procedure already in place will also be used with the relocated Taxiway E: call ATC 3 times (apron, ILS, RSA) with no issues

Summary of Preferred Mitigation Alternatives To Be Determined

Decision Needed
Areas 9 & 14 Preferred Alternative







Considerations:

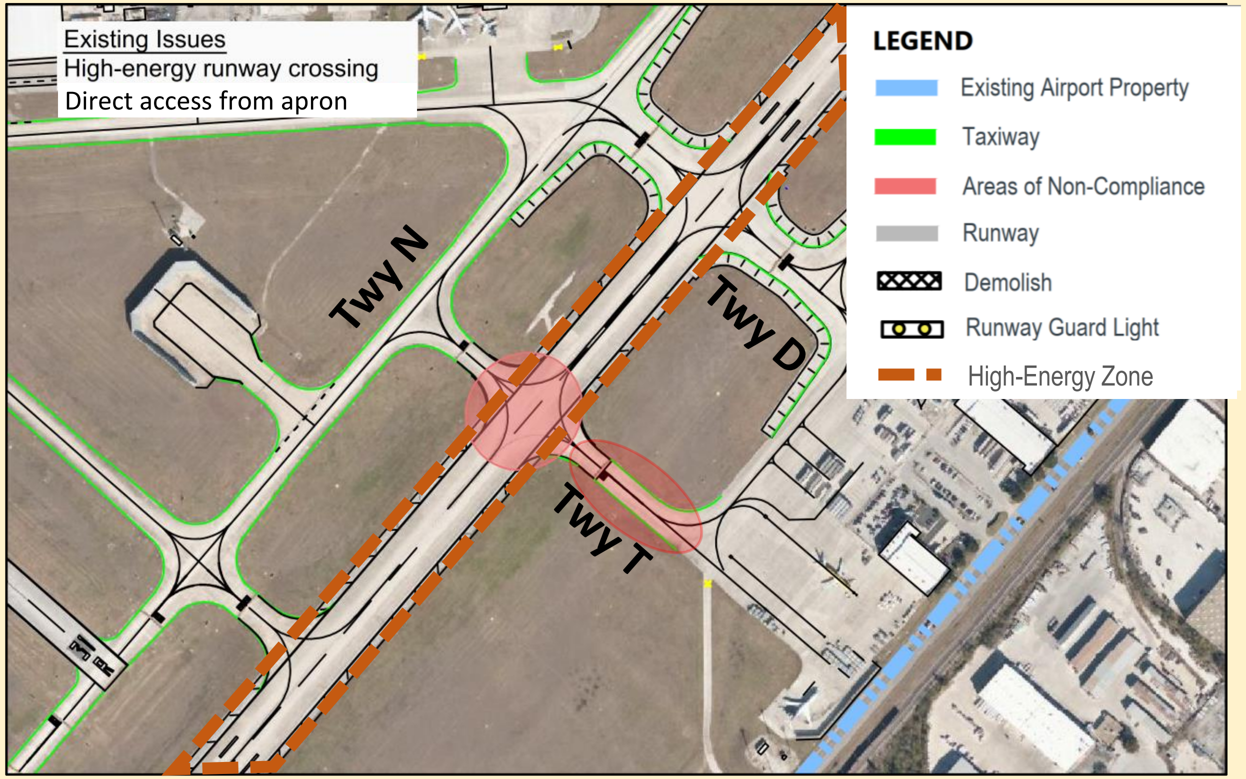
- Currently, air carriers cross at Twy N & D, small aircraft use Twy A for compass rose and Cessna access
- Use Twys S and N for runway crossings (Twy D closed as runway crossing)

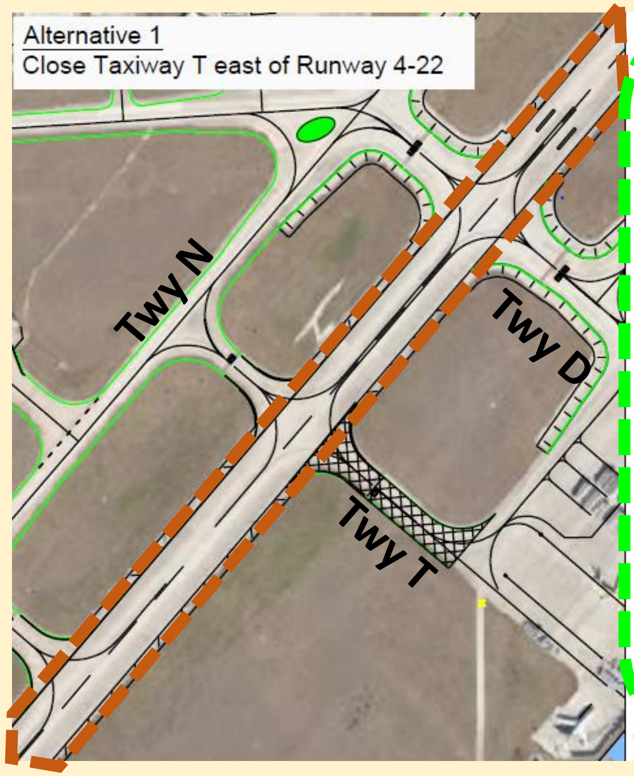
Recommended Improvement:

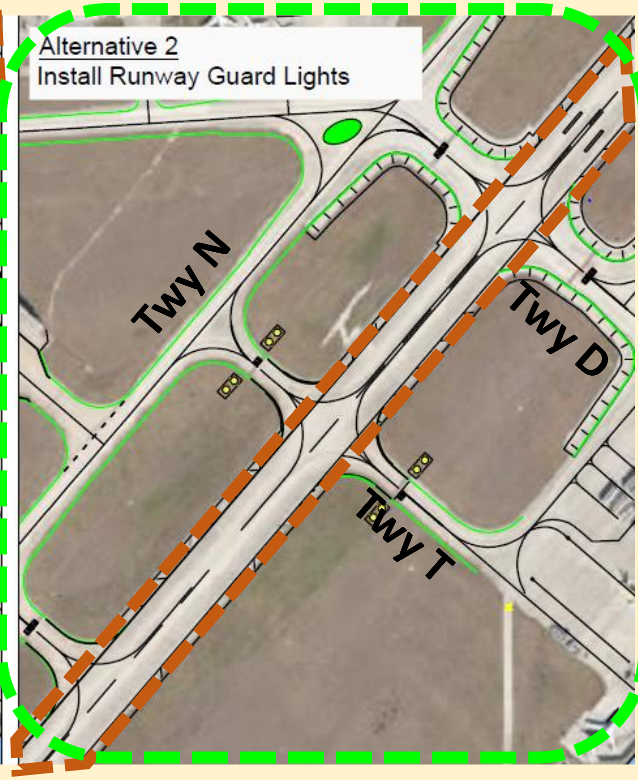
- Alternative 2 (requires compass rose relocation)
- Beyond 6-y CIP

4/22/2021 Meeting:
- Close Twy A, convert to ARFF route

Decision Needed
Areas 19 & 20 Preferred Alternative





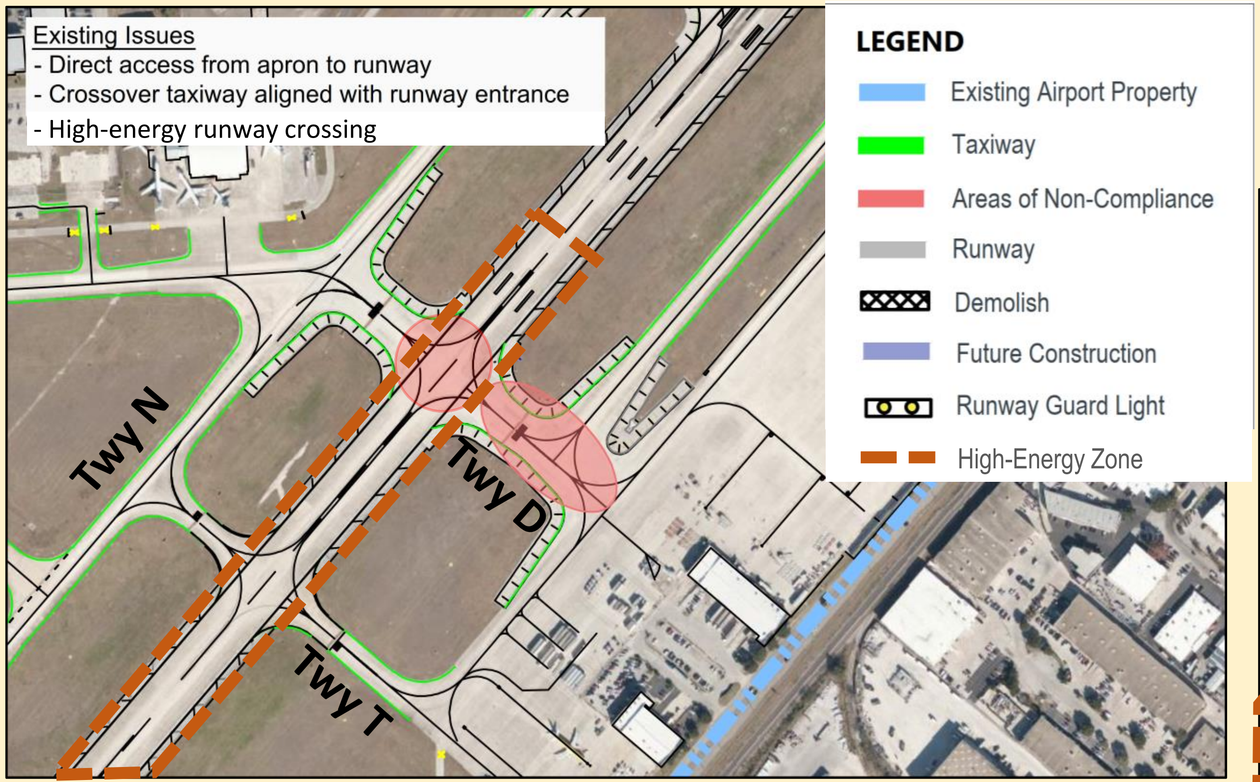


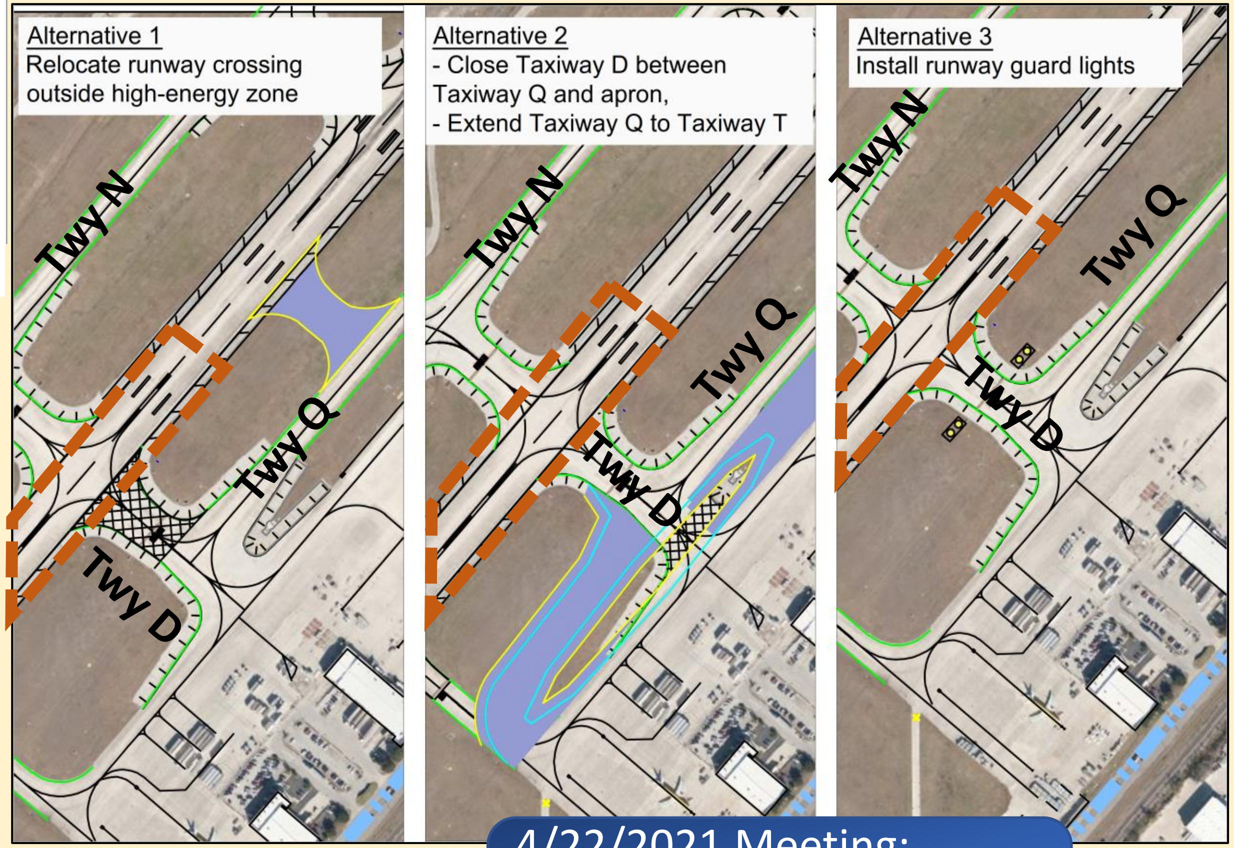
Recommended Improvement:

- Install RGLs on both sides of Rwy 4-22, at Twy T
- Beyond 6-y CIP

4/22/2021 Meeting:
- Install RGLs

Decision Needed
Areas 21 & 22 Preferred Alternative





Proposed Improvement:

- Install RGLs on both sides of Rwy 4-22, at Twy D
  - *RGLs are already installed at Twy D*
- No action, RGLs already in place

4/22/2021 Meeting:
- RGLs already installed at Twy D

Summary of Preferred Mitigation Alternatives

In 6-Year CIP

- Areas 10, 15 & 16: Close Twy P
- Area 12: relocate Rwy 31L end by 340’

Beyond 6-Year CIP

- Area 1: install no taxi island
- Area 3: install RGLs at Twy J, west of Rwy 13R-31L
- Areas 9 & 14: close Twy A, relocate compass rose
- Areas 19 & 20: install RGLs on both sides of Rwy4-22, at Twy T

Per 4/22/2021 Meeting

Summary of Preferred Mitigation Alternatives

Include in Other Projects

- Area 7: reconstruct Twy J (part of *ADG VI Midfield Taxiway* project)
- Areas 8 & 13: convert Twy M to service road for ARFF response (part of *Package 7* project)
- Area 23: install no-taxi island (part of *Twy N Rehab* project)

No Action

- Area 2: RGLs already in place
- Area 4: tenant will shift apron access
- Areas 5 & 6: already included in Twy H Reconstruction project
- Area 11: RGLs already in place
- Areas 17 & 18: operation procedures already in place
- Areas 21 & 22: RGLs already in place

Per 4/22/2021 Meeting

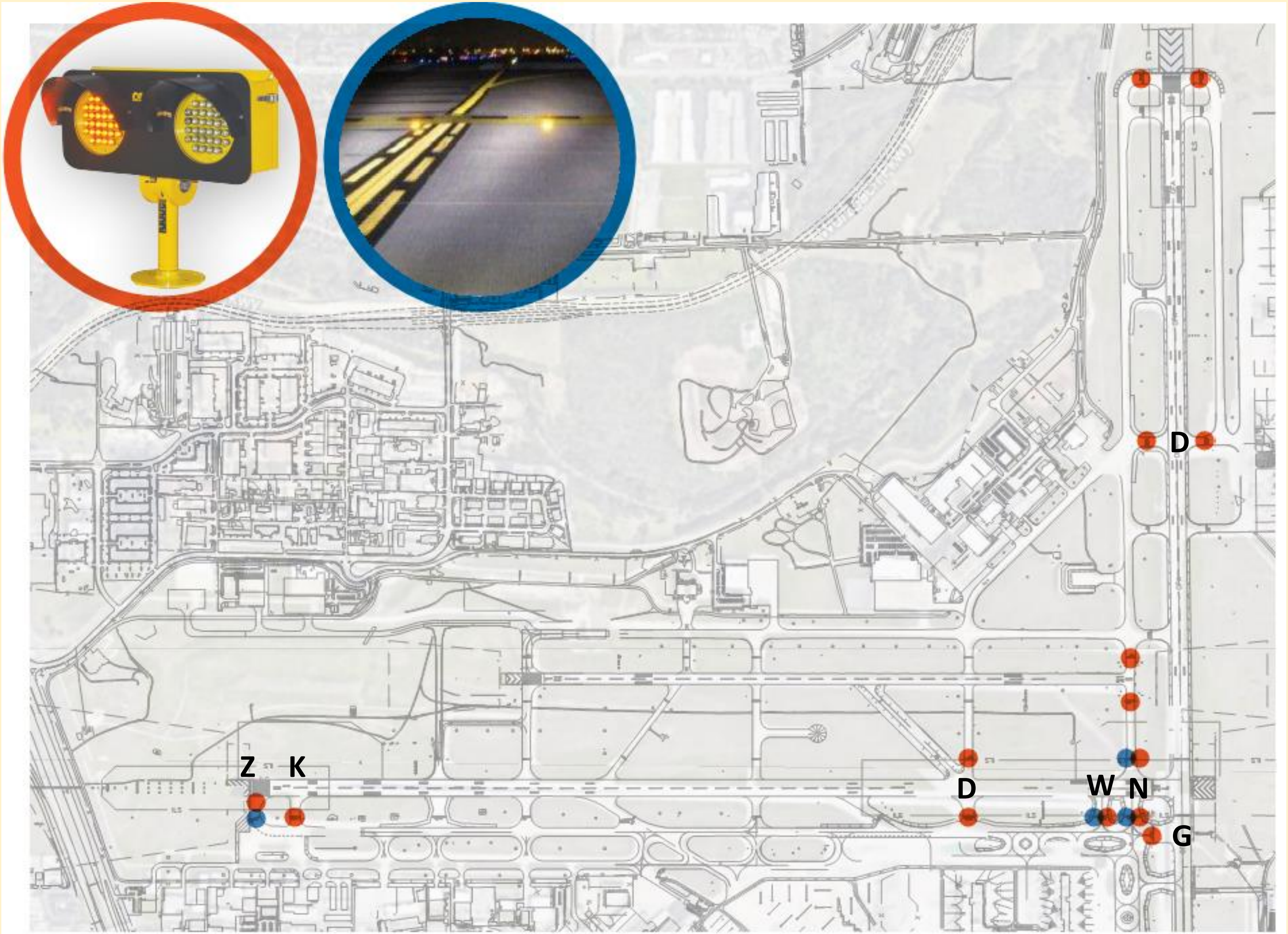
Next Steps in SDP

Next Steps

- Incorporate selected mitigations into proposed airfield layout


international airport
THANK YOU

RGLs



San Antonio Airport System Strategic Development Plan

2021 AIRPORT MASTER PLAN

MASTER PLAN UPDATE
CHAPTER 5 – ALTERNATIVES DEVELOPMENT AND EVALUATION
APPENDIX 5F – RUNWAY 4-22 DISPOSITION

MEMO

TO: Susan St. Cyr, P.E., SAAS

FROM: John van Woensel

SUBJECT: **San Antonio International Airport Strategic Development Plan Runway 4-22 Long-Term Disposition**

DATE: **February 12, 2020**

This memorandum summarizes the San Antonio Airport System (SAAS) planning decision about the **future of Runway 4-22 at San Antonio International Airport (SAT)**. The Runway's disposition will be reflected on the Future (2038) Airport Layout Plan (ALP) sheet, which is being developed as part of the Strategic Development Plan (SDP).

<u>Decision:</u>

Upon reaching its useful pavement life in approximately 20 to 30 years, reconstruction of Runway 4-22 as an air carrier runway will no longer be eligible for Federal Aviation Administration (FAA) funding, due to the agency's wind coverage requirements. At that time, it will need to be closed or shortened, because without FAA funding participation, full-runway reconstruction is unaffordable to SAAS. This future issue requires a decision now, because the runway's future role is central to ongoing long-term planning of all the Airport's land uses that are to be depicted on the 2038 ALP. The SDP team conducted additional wind analysis, considered Runway 4-22 throughout the airfield alternatives evaluation process, discussed the issue with the FAA, and ultimately decided that there is insufficient benefit to retention of a downgraded runway. The information considered in making the decision is summarized below.

<u>Issue:</u>

Per Federal Aviation Administration (FAA) policy, and as confirmed by their Airports District Office (ADO) staff and management, Runway 4-22 is not required for crosswind coverage. As such, it will no longer be eligible for Airport Improvement Program (AIP) funding for reconstruction as an air carrier runway in approximately 20 to 30 years. SAAS needs to decide the likely future of Runway 4-22 at this time for 20-year ALP purposes. Long-term options for Runway 4-22 include closing the runway, as well as shortening it, and downgrading it to a small aircraft design code (A-I/B-I or A-II/B-II), approximately 5,000' in length, to keep it clear of the parallel runways.

<u>Background:</u>

The need for reconsidering the long-term future of Runway 4-22 was first brought up by the FAA ADO before SDP consultant procurement in 2017. There are three reasons for this:

- First, the FAA has a national policy regarding crosswind runway eligibility. It is contained in Order 5100.38D, *Airport Improvement Program (AIP) Handbook*, which states that for a crosswind runway to be eligible for FAA funding participation, the wind coverage on the primary runway (Runway 13R-31L) must be less than 95% for the future Runway Design Code (RDC) of D-VI (approved by the FAA in October 2018). This criterion is also contained in FAA Advisory Circular 150/5300-13A, *Airport Design*. WSP USA is also familiar with this policy, as it has been applied to airports across the country.

- Second, wind coverage provided by the primary runway (Runway 13R-31L) is exceptional, so much so that no crosswind runway is required at SAT.
- Third, decommissioning Runway 4-22 would enhance safety by eliminating the Runways 13R-31L and 4-22 intersection, which continues to be the location of runway incursions (shortening Runway 4-22 would also achieve this goal).

The FAA policy affects eligibility for funding participation and SAAS could theoretically fund the entire cost of a Runway 4-22 reconstruction project without FAA funds (typically 75% of the airfield project cost). Given the high cost of major airfield projects, this is not likely to be feasible. The prospect of Runway 4-22 being ineligible for AIP grants and being decommissioned in 20 to 30 years was first shared with the SDP advisory groups, community, City Council, and others during Phase 1 in late 2018.

Following the start of Phase 2 of the SDP in June 2019, concerns about the likely long-term closure of Runway 4-22 were expressed by community members concerned about a resulting increase in future air traffic on the Runways 13-31, and a Technical Advisory Committee (TAC) member who represents the business/corporate aviation users at SAT. The former wanted to continue and increase us of Runway 4-22 as an air carrier runway, and the latter expressed concern about seasonal wind conditions that might require a shortened crosswind runway for users who operate A-I through B-II aircraft.

Additional Analysis to Inform the Planning Decision:

In response to these concerns, in September 2019, the SDP planning team committed to the TAC to:

- Conduct additional seasonal wind analysis.
- Consider in the development and evaluation airfield alternatives, potential options that keep Runway 4-22 open as a downgraded runway.

The team considered many options to maintain Runway 4-22 as an air carrier runway, extend it, and even build a parallel to it. During the technical evaluation of these concepts, they were eliminated for the following reasons:

- The FAA policy is clear about the runway not being required as an air carrier runway, and as such, making it ineligible for FAA AIP grants for reconstruction as an air carrier runway.
- The FAA’s preference to remove the intersection with main runway, Runway 13R-31L, prohibits a full-length Runway 4-22 without shortening or shifting the main runway (such an option would make Runway 4-22 the main runway).
- Making Runway 4-22 (or a runway with a similar northeast-southwest alignment) the Airport’s main runway is not viable because it would increase airspace interference with

the area's military airfields and there is insufficient space to extend the runway to the 20-year planning length of 10,700 feet.

Additional wind data analysis was conducted and is documented in a separate memorandum dated October 22, 2019. The key findings from this wind analysis were:

- Wind coverage of the primary runway (Runway 31R-31L) for the FAA-approved future SAT critical aircraft (RDC D-VI) is very high at more than 99% of the time. Because the minimum wind coverage requirement is 95% of the time, as mentioned above, there is no need or justification for a crosswind runway (Runway 4-22) per FAA policy.
- The analysis also considered the needs of SAT's smaller users, who often are more sensitive to the effects of crosswinds. Wind coverage for the next two smaller aircraft categories also exceeds 95%.
- Only the smallest user category (A-I and B-I aircraft) falls just below the 95% wind coverage.
- Lastly, the use of annual wind coverage over a multiyear period means that higher and lower crosswind months and years are averaged. As a result, a seasonal analysis was also conducted and it confirmed anecdotal information that during the winter months, crosswinds on the primary runway are stronger. Specifically, in November, December and January, crosswind coverage falls below the annual requirement for the two smallest aircraft groups (A-I/B-I and A-II/B-II).

In addition to closure of Runway 4-22, the SDP 20-year airfield alternatives evaluation considered reconstruction as a small aircraft RDC runway, which would be narrower and approximately 5,000 feet long in order to clear the future extended Runway 13L-31R Object Free Area). Additional length could only be obtained by extending the runway to the northeast, which would be complicated by dropping terrain and the nearby recreational area, floodplain, and wetlands associated with Salado Creek. It appears that limited space is available before reaching these environmental limitations, and to maximize any extension in this direction might also require an Engineered Material Arresting System (EMAS) runway safety area, which is a bed of crushable concrete designed to stop aircraft that overrun the runway end.

The FAA clearly expressed that spending its funds on an extension of Runway 4-22 to the northeast is not justified for such a small user group at a medium hub air carrier airport. Due to the high cost of airfield construction, it is unlikely that SAAS could fund this project on its own.

As a result, the options for Runway 4-22 are to:

- Close the runway in 20 to 30 years, when it reaches the end of its useful life
- Reconstruct a narrower and approximately 5,000 feet long general aviation runway

Assessment of Potential Dispositions of Runway 4-22:

<u>Benefit of constructing a narrower, approximately 5,000-foot long Runway 4-22</u>:

- A shortened and narrowed Runway 4-22 would allow the smallest users at SAT to continue operating during all seasonal strong crosswind conditions. This includes aircraft such as the Cessna Caravan C-208, currently used by the cargo carriers and their contract operators, and small business jets.

Downsides of constructing a narrower, 5,000-foot Runway 4-22:

- The project may not be eligible for FAA funding participation. It will be subject to an FAA Benefit Cost Analysis (BCA), and it is unlikely that it will be found to have a positive benefit-to-cost ratio. Only projects that show a benefit greater than the cost, reflected in a BCA ratio of 1.0 or greater, are eligible for FAA funding participation. See also subsequent discussion regarding the low number of aircraft potentially affected, which is also considered in the project's eligibility.

- SAT is categorized by the FAA as a medium hub airport, and as such, its role is to primarily serve larger air carrier aircraft, as reflected in the airport's RDC and SAAS' and FAA's past investment in the airfield. A general aviation runway would only serve the smallest users of the airport, and funding for the project would compete with other SAT and other airports' airfield projects for limited FAA AIP grant funds.

- The wind analysis estimated the number of smaller aircraft likely to be affected by the seasonal crosswind conditions, based on aircraft operations recorded by the SAT Airport Noise and Operations Monitoring System (ANOMS) between September 2018 and August 2019. During the 12-month analysis period, it is estimated that approximately 626 annual A-I through B-II aircraft operations on Runway 4-22 (out of a total of 54,310 annual aircraft operations on Runway 4-22 and a total of 148,539 captured by the ANOMS for all runways), were required to use Runway 4-22, because the crosswinds on the primary runway (Runway 13R-31L) exceeded the small aircraft crosswind limitations. The breakdown of the affected aircraft is 194 A-I, 268 B-I, 17 A-II, and 147 B-II aircraft.

- It should be noted that during strong crosswinds, some users of small aircraft, especially slower propeller aircraft used for nonbusiness purposes, choose to cancel their flights or wait until the weather improves—meaning that the actual number of flights affected would likely be lower than the 626 annual aircraft operations calculated based purely on wind conditions. FAA considers the number of aircraft operations affected by airfield projects, and this low number may affect its willingness to participate in providing AIP grant funding the project (generally, the FAA will only consider projects that benefit at least 500 operations annually).

- Some of the corporate users in the affected aircraft design groups might prefer the wider and longer primary runway (Runway 13R-31L), versus a short and narrow general aviation crosswind runway. Wider runway pavement - Runway 13R-31L at 150-feet wide is wider than the operating requirement for these aircraft - is considered a mitigating factor in dealing with crosswinds, as the extra runway width provides an extra safety buffer for aircraft drifting away from the runway centerline in high crosswinds. The additional length offered by Runway 13R-31L is also generally considered a benefit by pilots. These factors also would likely reduce the number of aircraft to be actually affected by the lack of a crosswind runway.

- The number of A-I and A-II aircraft – the aircraft most susceptible to crosswind limitations – is decreasing gradually over time, both nationally and at SAT, further reducing the number of actual aircraft likely to be affected.

- Airport property is scarce, and the SAAS Properties Department has indicated it will soon be out of available space to accommodate existing tenant expansion requests, as well as new aviation tenants. Retaining a general aviation runway and associated taxiways north of Runway 13R-31L would “block” significant property that would otherwise become available for aviation uses north of Runway 13R-31L. Some height and use restrictions could also apply to land south of Runway 13R-31L. In addition to limiting SAAS’s ability to accommodate tenant needs, the associated nonairline revenues would also be limited. SAAS can buy additional land to accommodate the tenant needs, but this is both time-consuming and financially less attractive.

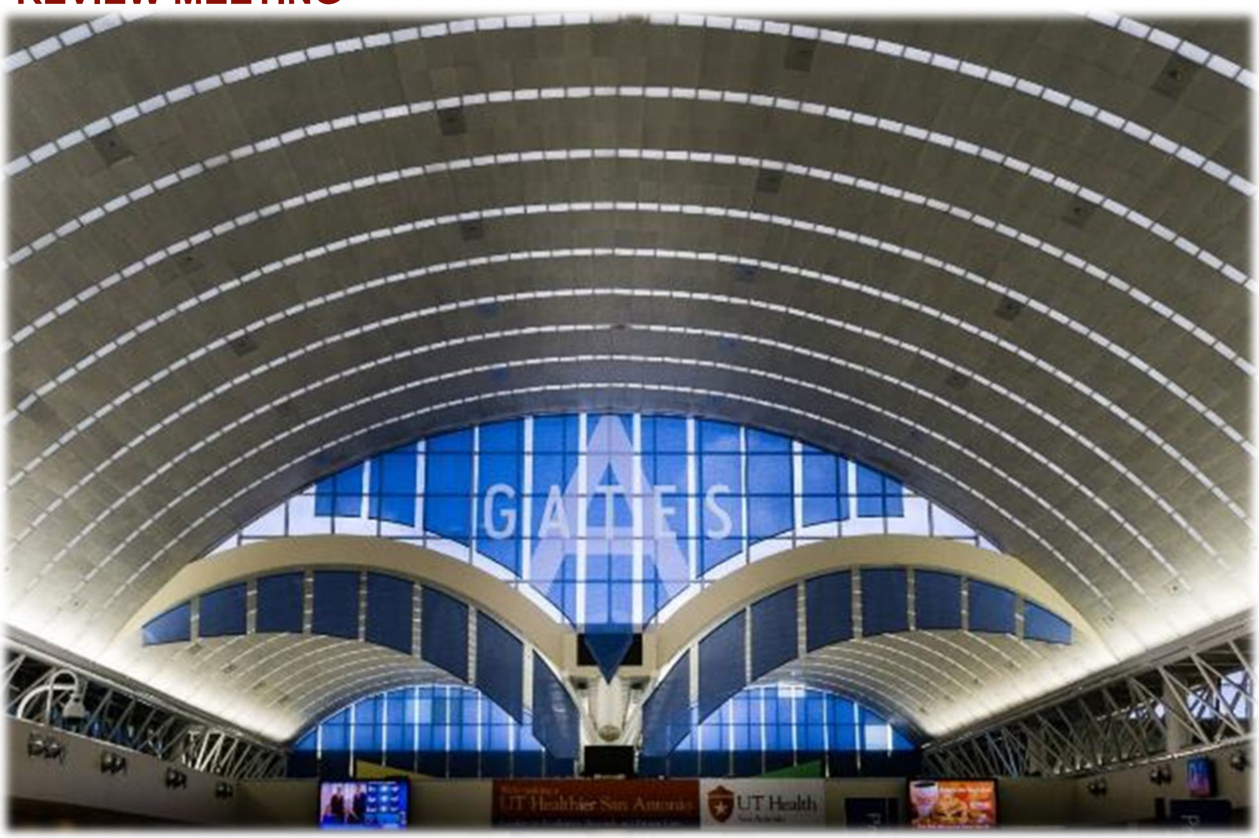
- A general aviation crosswind runway would require inspection, annual operation and maintenance (O&M) expenses, and rehabilitation and replacement capital costs at some point in the future, compared to no O&M expenses or capital costs, when considering the closure of Runway 4-22.

If future conditions at SAT are not ideal for general aviation users, several other airports are available to them in the San Antonio metropolitan area, including some that primarily serve general aviation users. The FAA does not allow airports to exclude users of any category; however, like airports, the FAA has limited funds. The FAA sees aviation as a system of airports, and generally holds that its funds be allocated based on where the users are best accommodated - general aviation users at general aviation airports, and commercial users at air carrier airports.

San Antonio Airport System Strategic Development Plan

2021 AIRPORT MASTER PLAN

MASTER PLAN UPDATE
CHAPTER 5 – ALTERNATIVES DEVELOPMENT AND EVALUATION
APPENDIX 5G – POST-2040 AIRFIELD LAYOUT SAFETY REVIEW MEETING



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STRATEGIC DEVELOPMENT PLAN

San Antonio Airport System

SAT ALP Safety Review

01/25/2022

SAAS
San Antonio Airport System

Meeting Agenda

- Background
- SDP Aviation Safety Approach
- Purpose of Today’s Meeting
- Current Airfield
- Planned 2040 Airfield
- CIP Phasing

< Break >

- Identify Safety Issues
- Mitigation Plan
- Wrap Up & Next Steps

Background

- This safety review will analyze the proposed Airport Layout Plan (ALP) which represents the 2040 horizon buildout of SAT.
- This safety review is in accordance with the FAA Airport's Division's internal Safety Management Systems' (SMS) requirements for ALP approvals.
- This approach was agreed with the FAA ADO in June 2021.

SDP Aviation Safety Approach

- Dec. 6, 2018: Discussion “Can the current airfield configuration be maintained until possible 4-22 closure (~20 years)?” during FAA/SAT RIPSA Site Survey and On-site Stakeholder meeting.
- Feb. 4, 2020: Aviation Safety Review Meeting #1.
- Dec. 2-3, 2020: SRA for De-Coupling Runways 31L and 4.
- Feb. 18, 2021: Comparative Safety Analysis (Panel Report) for De-Coupling RW31L & RW4 Compared to an Extension of RW31L to the Southeast of 340’.
- Jan. 25, 2022 (Today): Aviation Safety Review for the 2040 ALP.

Purpose of Today’s Meeting

- This ALP safety review is focused on:
  - ✓ Aprons and taxilanes.
  - ✓ Taxiway system.
  - ✓ Redevelopment of RW 13L-31R & the closure of RW 4-22 (2040 horizon).
- Expected outcome: safety review results confirm proposed airfield configuration and/or propose mitigation as needed.

Purpose of Today's Meeting

- This safety review does NOT include:
  - RW 13R-31L extensions (will be addressed through specific SRA/SRMP).
  - Construction project sequencing (will be addressed through specific SRA/SRMPs).
- Not a Full SRA/SRMP – Review to identify if additional risk is potentially being introduced into the system.

IMPORTANT: Detailed SRA/SRMPs will be done at time of individual project development.

Current Airfield

STRATEGIC DEVELOPMENT PLAN

SAAS
San Antonio Airport System


Runway 13L-31R (5,519 ft.)
Runway 13R-31L (8,502 ft.)
Runway 4-22 (8,505 ft.)
ATCT/TRACON
G
H
G
G
R
R
N
N
Q
N
1,000 ft.

Planned 2040 Airfield

STRATEGIC DEVELOPMENT PLAN

SAAS
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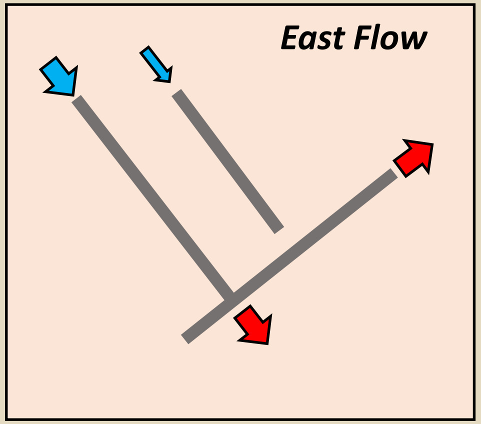
Expansion of corporate aviation
Closure of Runway 4-22
Conversion into taxiway
Redevelopment of Runway 13L-31R into a large commercial aircraft-capable parallel runway
RW 13R-31L decoupling addressed through previous SRM effort
Full parallel midfield taxiway
Runway 13L-31R (8,500 ft.)
Runway 13R-31L (10,092 ft.)
Expanded air cargo facilities
Expansion & redevelopment of terminal area
ATCT/TRACON
Additional RON and new airline support facilities
RW 13R-31L decoupling addressed through previous SRM effort
N
1,000 ft.

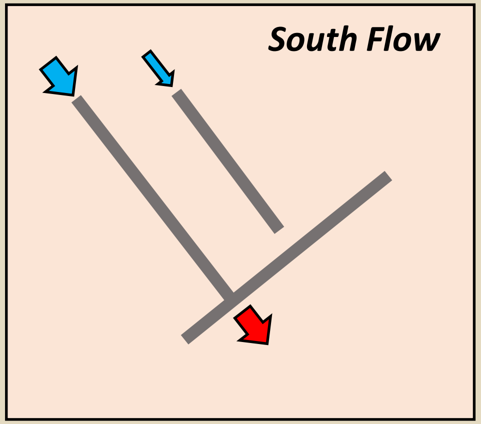
CIP Phasing

STRATEGIC DEVELOPMENT PLAN

SAAS
San Antonio Airport System

Proposed General Phasing
Short-Term

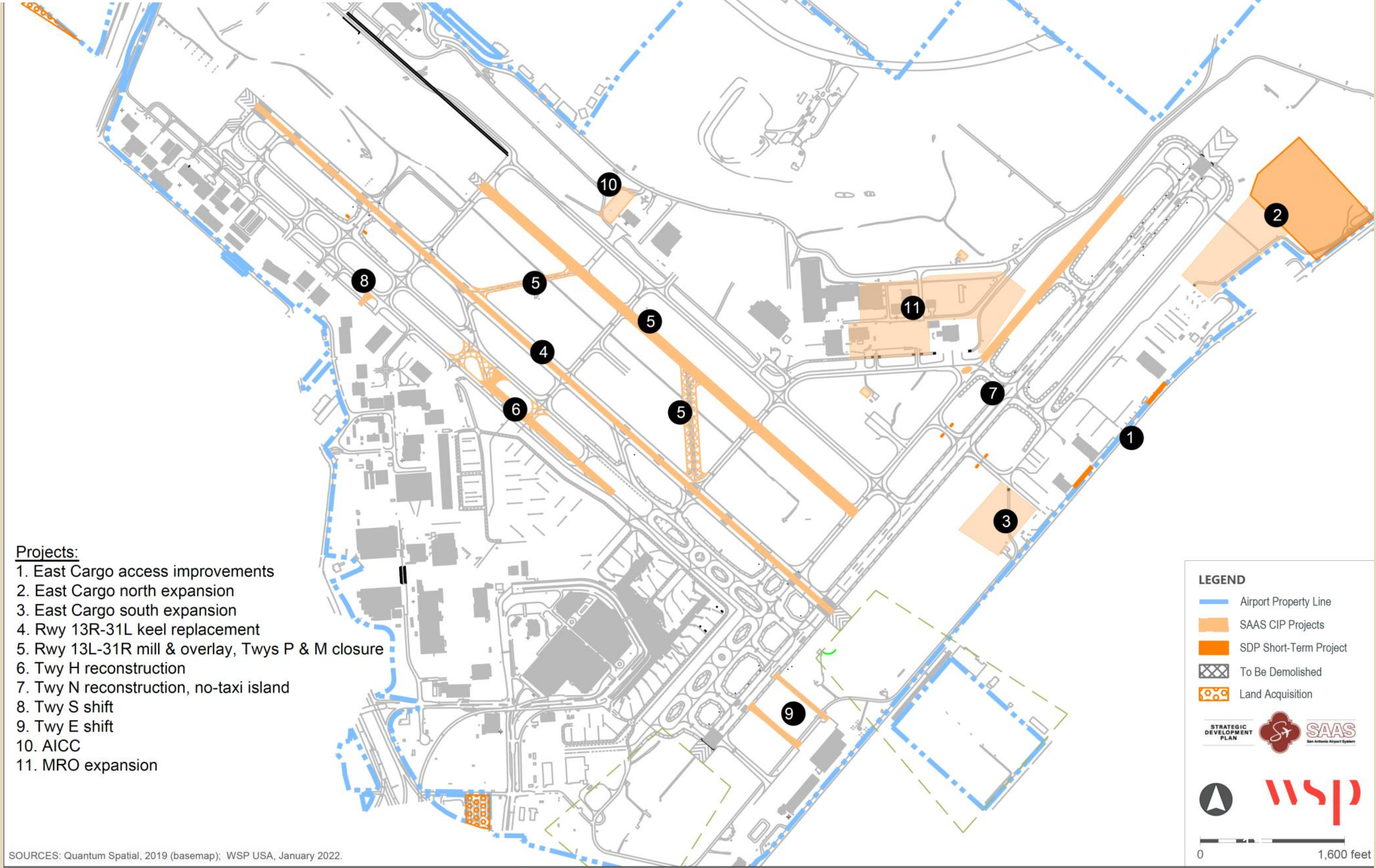




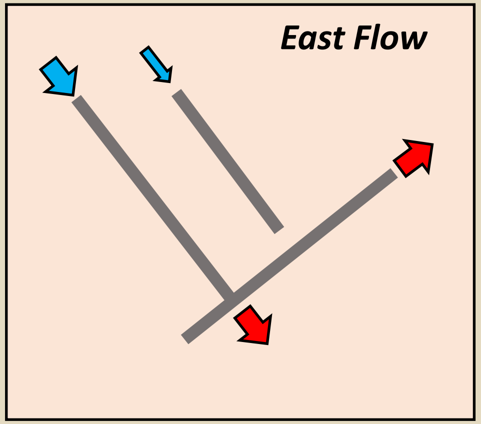
Main Arrival Flows

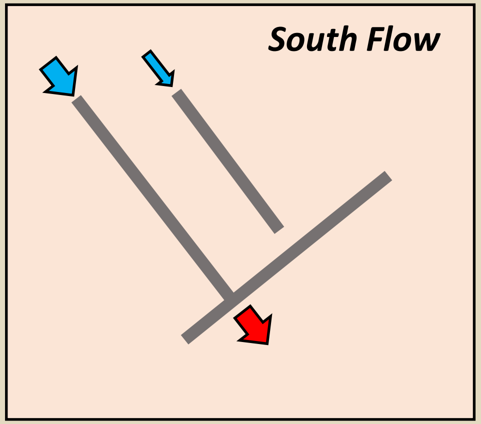
Main Departure Flows

Note: North flows not depicted. Same utilization in opposite direction.



Proposed General Phasing
Mid-Term





Main Arrival Flows

Main Departure Flows

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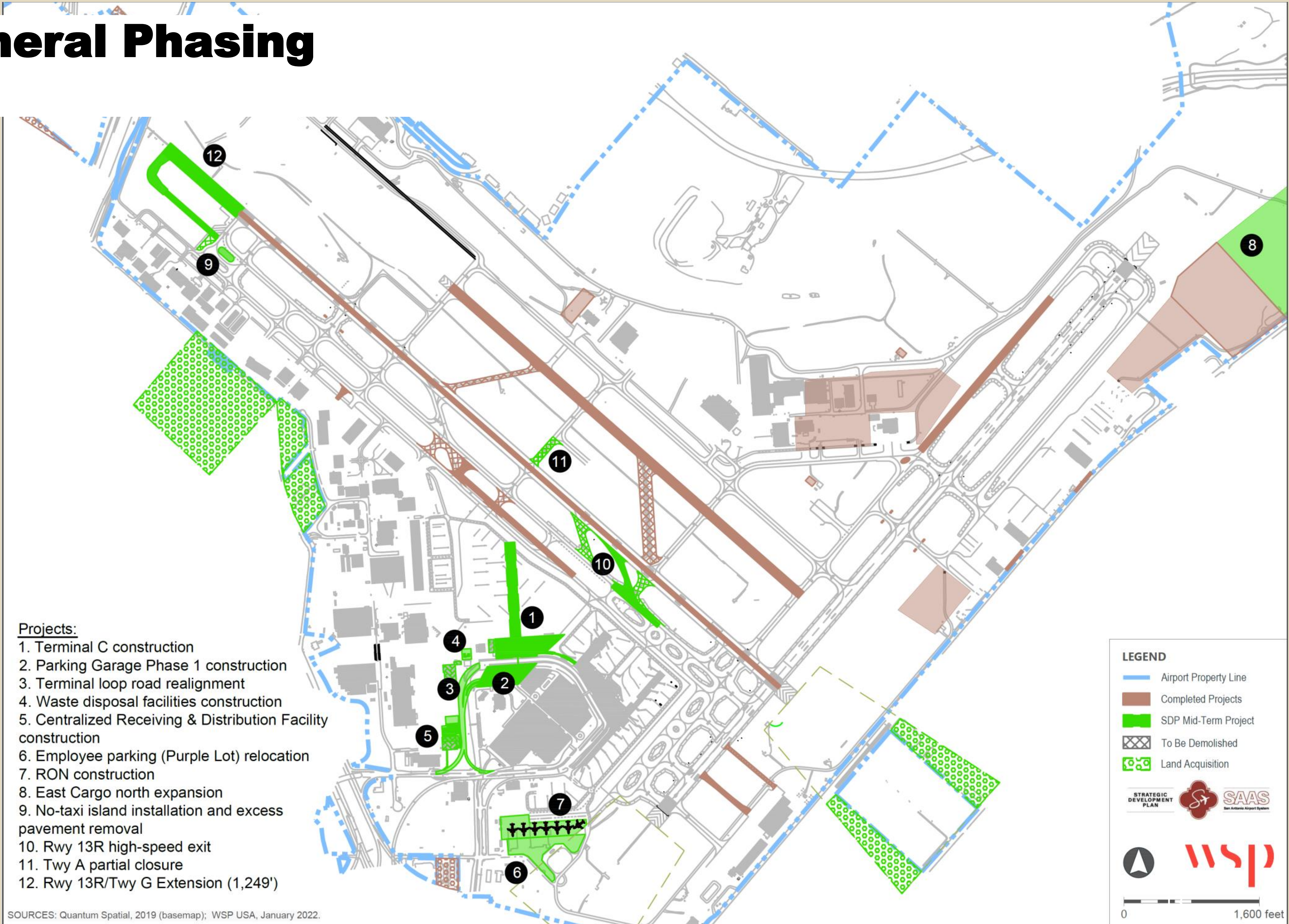
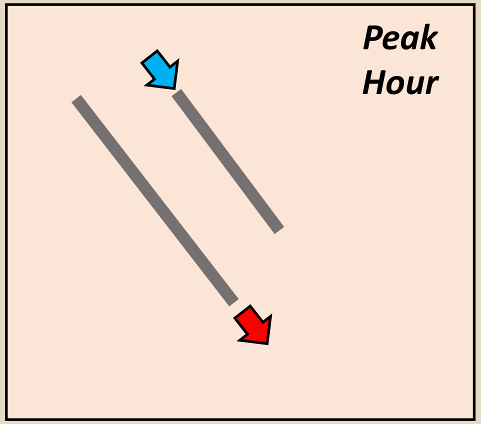
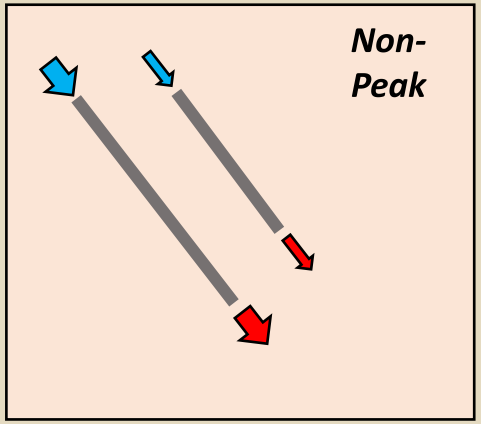


Proposed General Phasing Long-Term (2040 ALP)





Main Arrival Flows

Main Departure Flows

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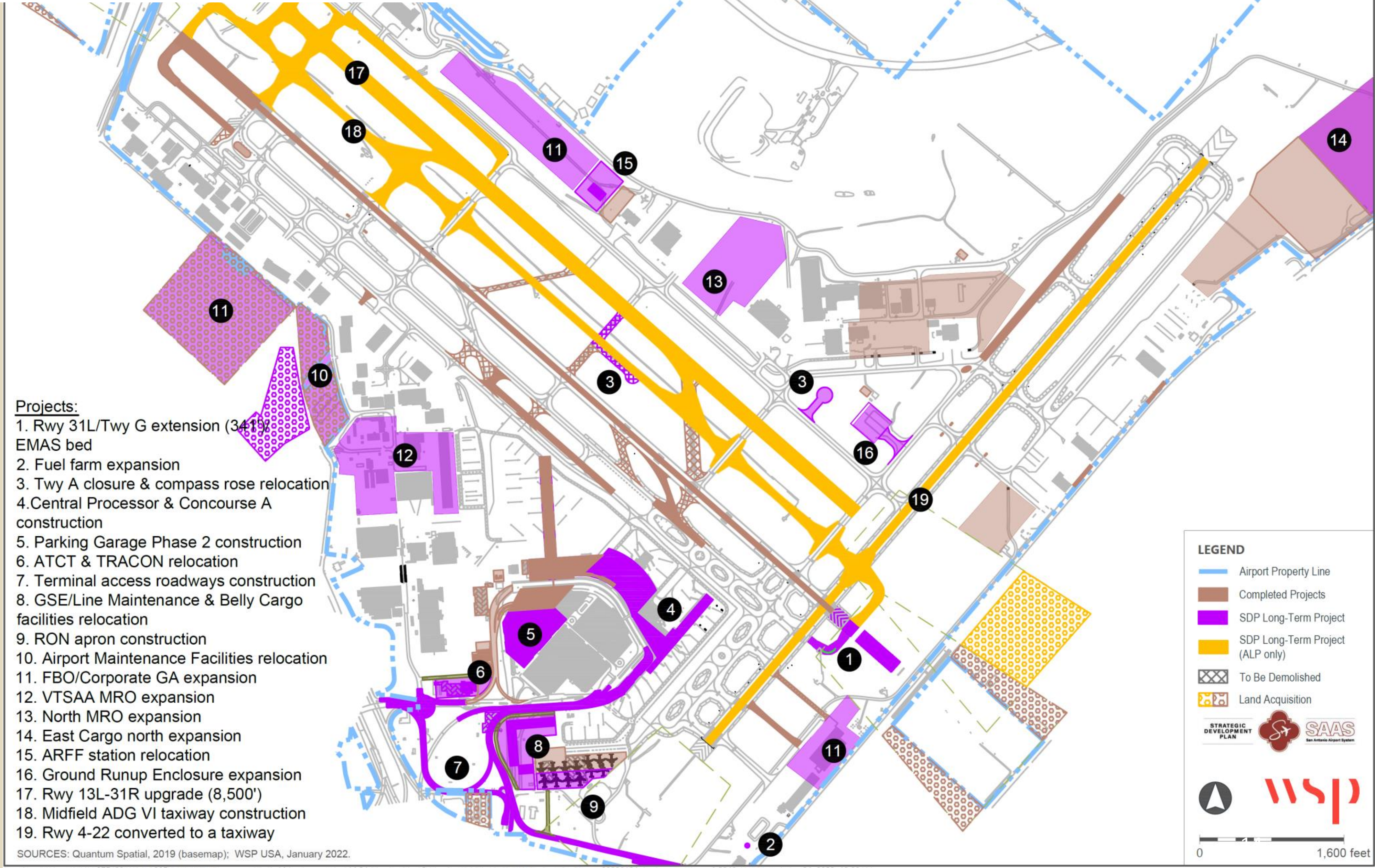


Identify Safety Issues

STRATEGIC DEVELOPMENT PLAN

SAAS
San Antonio Airport System

Severity & Likelihood Definitions

SAAS Severity Definitions

SEVERITY	Consequence: People	Consequence: Assets	Consequence: Environment	Consequence: Reputation
5 = Negligible	• No injuries	• No damage • Minor technical delay	• No impact	• No loss of public confidence
4 = Minor	• First Aid injury or • No disability or lost time	• Technical delay or • Ground equipment inoperable or • Aircraft (ACFT) grounded causing Operator to incur relatively minimal costs	• Release - Contained	• May be lowered, but public finds situation acceptable
3 = Moderate	• Lost time injury or • Passenger injured (broken bones) • No disability	• Technical delay or • Ground equipment inoperable or • Ground equipment damaged ACFT or • ACFT grounded causing Operator to incur substantial costs	• Small (< 50 Gallons) release - Uncontained	• Significantly lowered with high profile media coverage
2 = Major	• Disability or • Severe injuries	• Major technical delay or • Ground equipment inoperable or • Ground equipment caused major damage to ACFT causing delays to return ACFT to service or • ACFT grounded causing Operator to incur substantial costs	• Moderate (> 50 Gallons but < 100 Gallons) release - Uncontained	• Shaken to the point where significant numbers of the public will not fly on a particular aircraft or airline
1 = Catastrophic	• Fatal injuries to personnel or passenger • Public exposed to life threatening hazard	• Loss of ACFT • Loss of equipment	• Large (> 100 Gallons) release - Uncontained	• Shaken to the point where significant numbers of the public will not use SAAS

SAAS Likelihood Definitions

Likelihood (Probability)		
SAAS Likelihood Definitions	Qualitative words used by FAA	Value
Has happened more than five times at airport **(has occurred frequently)**	FREQUENT	A
Has happened more than once at airport or more than once in industry **(has occurred infrequently)**	PROBABLE	B
Has happened once at airport or once in industry **(has occurred)**	REMOTE	C
Heard of in industry **(has occurred rarely)**	EXTREMELY REMOTE	D
Never heard of in industry **(not known to have occurred)**	EXTREMELY IMPROBABLE	E

SAAS Risk Matrix

Risk Assessment Matrix

Consequence				Likelihood		Severity				
People	Assets	Environment	Reputation			5	4	3	2	1
						Negligible	Minor	Moderate	Major	Catastrophic
No Injury or Health Effects	No Damage	No Effects	No Impact	A	**Frequent** (Has happened more than five times at airport)	L5	M13	H20	H22	H25
Minor Inquiry or Health Effects	Minor Damage	Minor Effects	Minor Impact	B	**Probable** (Has happened more than once at airport or in industry)	L4	M12	M15	H21	H24
Moderate Injury or Health Effects	Moderate Damage	Moderate Effects	Moderate Impact	C	**Remote** (Has happened once at airport or once in industry)	L3	L8	M14	M17	H23
Major Injury or *PTD	Major Damage	Major Effects	Major Impact	D	**Extremely Remote** (Heard of in industry)	L2	L7	L10	M16	M19
Fatalities	Catastrophic Damage	Catastrophic Effects	Catastrophic Impact	E	**Extremely Improbable** (Never heard of in industry)	L1	L6	L9	L11	M18

*PTD = Permanent Total Disability

Low Risk: Acceptable Risk **Medium Risk: Acceptable Risk** **High Risk: Unacceptable Risk**

Potential Safety Issues

- Proposed ATCT location
- Non-movement area/apron layout
- Taxiway layout
- *OTHERS?*


Proposed 2040 ALP
N

Mitigation Plan

Mitigation Plan

Wrap Up / Next Steps

STRATEGIC DEVELOPMENT PLAN

SAAS
San Antonio Airport System

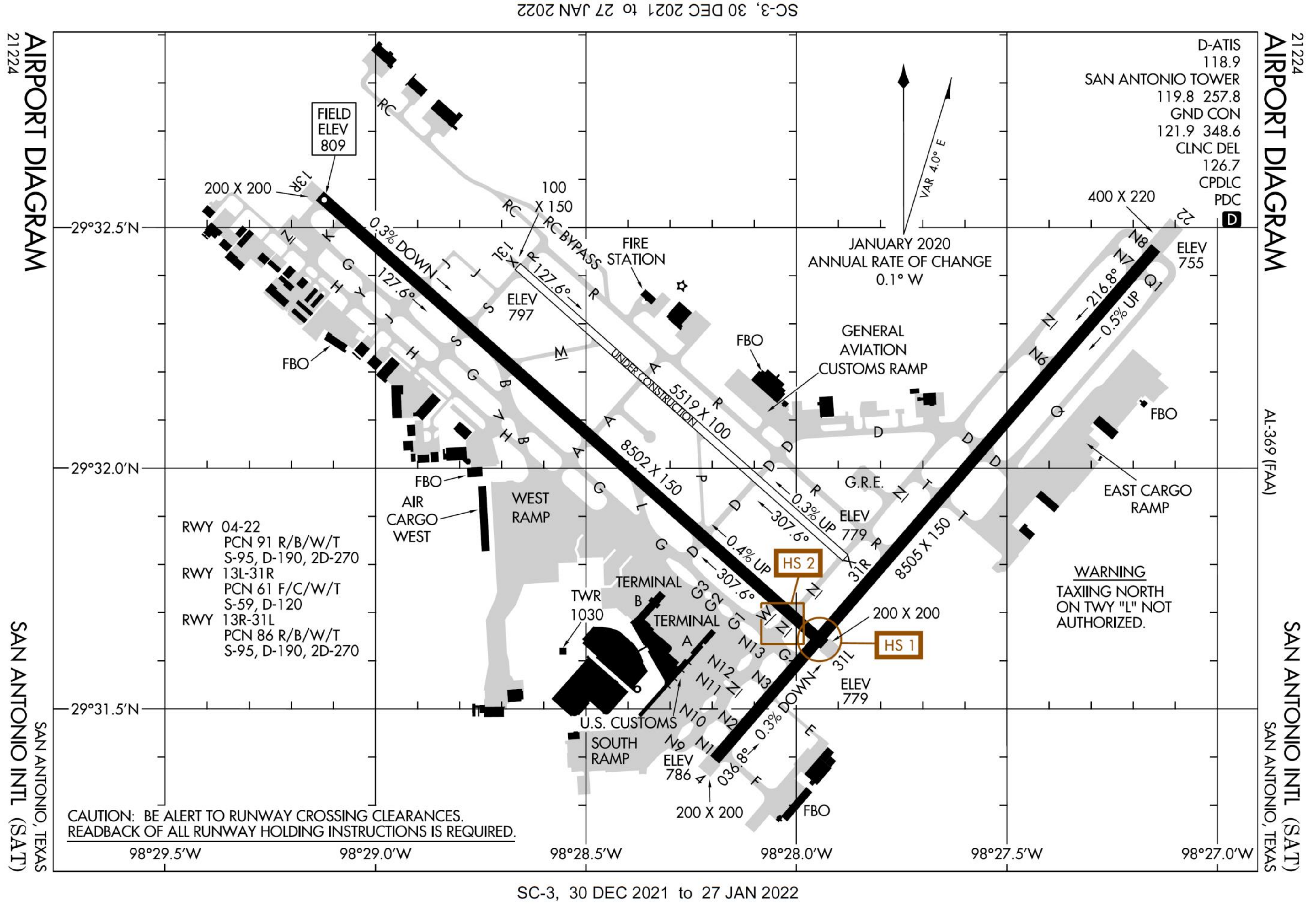
Wrap Up/Next Steps

THANK YOU!

Appendix

STRATEGIC DEVELOPMENT PLAN

SAAS
San Antonio Airport System


SC-3, 30 DEC 2021 to 27 JAN 2022
21224
AIRPORT DIAGRAM
D-ATIS
118.9
SAN ANTONIO TOWER
119.8 257.8
GND CON
121.9 348.6
CLNC DEL
126.7
CPDLC
PDC
FIELD ELEV 809
200 X 200
13R
0.3% DOWN
127.6°
100 X 150
RC
RC BYPASS
13L
FIRE STATION
ELEV 797
UNDER CONSTRUCTION
5519 X 100
8502 X 150
JANUARY 2020 ANNUAL RATE OF CHANGE 0.1° W
VAR 4.0° E
GENERAL AVIATION CUSTOMS RAMP
FBO
400 X 220
22
ELEV 755
216.8°
0.5% UP
EAST CARGO RAMP
G.R.E.
0.3% UP
307.6°
ELEV 779
31R
8505 X 150
0.4% UP
HS 2
HS 1
200 X 200
31L
ELEV 779
WARNING
TAXIING NORTH ON TWY "L" NOT AUTHORIZED.
AL-369 (FAA)
29°32.5′N
29°32.0′N
29°31.5′N
WEST RAMP
AIR CARGO WEST
RWY 04-22
PCN 91 R/B/W/T
S-95, D-190, 2D-270
RWY 13L-31R
PCN 61 F/C/W/T
S-59, D-120
RWY 13R-31L
PCN 86 R/B/W/T
S-95, D-190, 2D-270
TWR 1030
TERMINAL B
TERMINAL A
U.S. CUSTOMS
SOUTH RAMP
ELEV 786
036.8°
0.3% DOWN
200 X 200
CAUTION: BE ALERT TO RUNWAY CROSSING CLEARANCES.
READBACK OF ALL RUNWAY HOLDING INSTRUCTIONS IS REQUIRED.
98°29.5′W
98°29.0′W
98°28.5′W
98°28.0′W
98°27.5′W
98°27.0′W
SAN ANTONIO INTL (SAT)
SAN ANTONIO, TEXAS

Future ALP

High-speed exit taxiway will incorporate island to remove alignment to next straight TW and to mitigate RIs.

LEGEND

EXISTING	FUTURE (2030)	FUTURE (2040)	DESCRIPTION
	N/A		AIRPORT PROPERTY LINE
N/A	N/A		AIRCRAFT RESCUE AND FIRE FIGHTING (ARFF)
			BUILDING
			RUNWAY PAVEMENT
			TAXIWAY PAVEMENT
			APRON PAVEMENT
N/A	N/A		ROAD PAVEMENT
N/A			LAND ACQUISITION
N/A			DEMOLITION
N/A	N/A	BRL	BUILDING RESTRICTION LINE (BRL)
750	SAME		CONTOUR ELEVATION (FEET)
N/A	N/A	XX	FENCE
N/A	N/A		GLIDESLOPE / LOCALIZER CRITICAL AREA
N/A	N/A		ASOS CRITICAL AREA
	SAME	SAME	HOLD BAR
	SAME	SAME	ILS CRITICAL AREA HOLD BAR
	SAME	SAME	LANDSIDE SECURITY GATE
		SAME	TAXIWAY CENTERLINE
	SAME	SAME	TAXIWAY EDGE
N/A	N/A	TOFA	TAXIWAY OBJECT FREE AREA (TOFA)
N/A	N/A	RPZ	RUNWAY PROTECTION ZONE (RPZ)
N/A	N/A	ROFA	RUNWAY OBJECT FREE AREA (ROFA)
N/A	N/A	OFZ	RUNWAY OBSTACLE FREE ZONE (OFZ)
N/A	N/A	RSA	RUNWAY SAFETY AREA (RSA)
N/A	N/A		PRECISION RUNWAY OBSTACLE FREE ZONE (POFZ)
N/A	N/A		ULTIMATE RUNWAY
	SAME	SAME	FLOOD PLAIN
	SAME	SAME	STREAM
N/A	N/A		RUNWAY VISUAL RANGE SENSOR
N/A	N/A		WIND CONE
	SAME	SAME	RAIL ROAD TRACKS
N/A	N/A		AIRPORT REFERENCE POINT

Notes:
1. Coordinates reference the North American Datum 1983 (NAD83).
2. Elevations reference North American Vertical Datum 1988 (NAVD 88) and are in feet MSL.
3. Aerial photography, Quantum Spatial, 2019.
4. Majority of Airport security fence is 6 feet tall.
5. All runway surfaces displayed represent those relevant to the Future (2040) airfield.
6. Design standards based on FAA Advisory Circular 150/5300-13B (DRAFT) for Future Conditions.
7. Future shading is also used on top of existing pavement for such projects as runway needing to be raised to meet runway slope standards, taxiway improvements, etc.
8. Some of the projects depicted on the Future (2040) ALP Sheet are likely to occur after 2040. They are shown on this 2040 drawing for long-term planning purposes, such as preserving future airspace.
9. Exact location of relocated ASOS to be determined in advanced planning/design.

EXISTING BUILDINGS TABLE

NO.	FACILITY	TOP ELEV
1010	RUNNING M HANGAR SERVICES	869.0'
1020	VACANT	854.3'
1021	VACANT	850.4'
1030	SECURITY AIRPARK HANGAR	869.7'
1031	SECURITY AIRPARK HANGAR	869.7'
1032	SECURITY AIRPARK HANGAR	869.7'
1033	SECURITY AIRPARK HANGAR	864.8'
1034	SECURITY AIRPARK HANGAR	860.8'
1035	SECURITY AIRPARK HANGAR	857.2'
1036	SECURITY AIRPARK HANGAR	841.4'
1038	SECURITY AIRPARK HANGAR	850.8'
1039	AVIATION OFFICE	835.0'
1040	SECURITY AIRPARK HANGAR	839.9'
1041	T-HANGARS	836.0'
1042	SECURITY AIRPARK HANGAR	839.4'
1043	SECURITY AIRPARK HANGAR	839.4'
1044	SECURITY AIRPARK HANGAR	839.4'
1045	SECURITY AIRPARK HANGAR	833.7'
1046	SECURITY AIRPARK HANGAR	827.0'
1047	SECURITY AIRPARK HANGAR	827.0'
1048	SECURITY AIRPARK HANGAR	829.4'
1049	SECURITY AIRPARK HANGAR	833.2'
1050	SIGNATURE FLIGHT SUPPORT FBO - NORTH	844.5'
1060	AHR AVIATION HANGAR	846.6'
1061	CAR CANOPY	821.4'
1070	USAA HANGAR	846.8'
1071	JET LINX HANGAR	Not Available
1072	JET LINX HANGAR	Not Available
1073	AIR MED HANGAR	857.9'
1074	VACANT	857.9'
1075	VACANT	857.9'
1076	CUTTER AVIATION HANGAR	851.9'
1077	CUTTER AVIATION HANGAR	851.9'
1080	SIGNATURE FLIGHT SUPPORT FBO - SOUTH	838.5'
1090	SIGNATURE FLIGHT SUPPORT FBO - SOUTH	833.0'
1095	SIGNATURE FLIGHT SUPPORT FBO - SOUTH	842.0'
1100	LEWIS ENERGY HANGAR	848.1'
1110	HOLT AVIATION HANGAR	845.4'
1120	HOLT AVIATION HANGAR	822.7'
1130	HOLT AVIATION HANGAR	848.0'
1140	QUINTANILLA MANAGEMENT CO. HANGAR	835.9'
1180	VT SAA HANGAR	898.9'
1208	VT SAA HANGAR	907.5'
1212	ELECTRIC VAULT - WEST	822.0'
1220	VT SAA HANGAR	884.3'

NO.	FACILITY	TOP ELEV
1226	VT SAA HANGAR	827.5'
1230	VT SAA HANGAR	877.9'
1235	VT SAA HANGAR	889.4'
1237	VT SAA HANGAR	828.6'
1250	VACANT (FORMER AVIS RENTAL CAR)	801.2'
1251	VACANT (FORMER AVIS RENTAL CAR)	793.6'
1323	CENTRAL HEATING AND REFRIGERATION PLANT	832.9'
1390	SHORT-TERM PARKING GARAGE/CONRAC	881.6'
1391	CONRAC QTA	873.1'
1392	PARKING/CONRAC ENTRANCE	808.4'
1400	AIRPORT ELECTRICAL SUBSTATION (Airport Blvd./Northern Blvd.)	Not Available
1410	GAS STATION/CONVENIENCE STORE	814.2'
1530	ALLIED AVIATION FUEL FACILITY	810.5'
1531	ALLIED AVIATION FUEL TANK BUILDING	793.7'
1532	ALLIED AVIATION FUEL TANK	815.0'
1533	ALLIED AVIATION FUEL TANK	814.4'
1540	HALMARK AVIATION HANGAR	810.9'
1543	HALMARK AVIATION	791.7'
1552	AVIATION AIRSTAR HANGAR	822.2'
1553	AVIATION AIRSTAR BUILDING	797.4'
1554	AVIATION AIRSTAR HANGAR	818.0'
1570	ELECTRIC VAULT - EAST	Not Available
1600	DHL CARGO FACILITY	800.7'
1620	FEDEX CARGO FACILITY	797.4'
1800	AEROSKY HANGAR	816.7'
1805	AEROSKY BUILDING	790.5'
1825	M7 AEROSPACE HANGAR	810.1'
1830	M7 AEROSPACE HANGAR	833.4'
1831	M7 AEROSPACE HANGAR	833.4'
1860	GENERAL AVIATION CUSTOMS FACILITY	795.7'
1880	SKYPLACE FBO HANGAR	837.1'
1890	CESSNA CORPORATION HANGAR	827.1'
1900	CITY BRUSH FACILITY	783.2'
2009	NUSTAR HANGAR	861.8'
2256	PARKING SUPPORT FACILITY	803.1'
2391	LONG-TERM PARKING GARAGE	900.0'
2402	TRASH COMPACTOR	814.7'
2403	TRITURATOR	815.9'
2650	LYNX CARGO FACILITY	801.9'
2651	UPS CARGO FACILITY	786.4'
2950	VALERO HANGAR	839.6'
2955	HEB HANGAR	840.1'
2960	ZACHRY HANGAR	841.3'

San Antonio Airport System Strategic Development Plan

2021 AIRPORT MASTER PLAN

MASTER PLAN UPDATE
CHAPTER 5 – ALTERNATIVES DEVELOPMENT AND EVALUATION
APPENDIX 5H – VISSIM MODEL CALIBRATION

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1 VISSIM NETWORK OBJECTS

This report highlights the various components involved in creating year 2018 (Existing Year) Microsimulation model for the San Antonio International Airport (SAT). VISSIM version 2021 was used as the software platform for modeling. The following is a list of components for the model:

- 197 Links
- 230 Connectors
- 8 Signal Controllers
  - 68 signal heads
  - 56 detectors
  - 19 stop signs
- 119 speed decisions
- 116 reduced speed areas
- Vehicle Demand
  - Night peak (20:00 – 24:00); 3566 trip chain records, 18 matrices (36x36)
  - PM peak (14:30-18-30); 5783 trip chain records, 18 matrices (36x36)
  - AM peak (04:00-07:00) 2119 trip chain records, 14 matrices (36x36)

    Note: Each peak period model has a 30-min warm-up and a 30-min cool-down respectively before and after of the main study period mentioned above. As the common practice, cool-down period has no demand.

    Note: Each trip chain consists of a trip from an Origin to the Curb and another trip from the Curb to a Destination. Matrices consist of trips from an Origin to a Destination, therefore in this model they are used for coding through traffic demand and other vehicles that do not stop at the curbs. Each matrix contains the trips of a 15-min interval.
- Mode Types
  - Private vehicles
  - Transportation Network Companies (TNC)
  - Taxi
  - Shuttle
  - Bus
  - Pedestrians at crosswalks
- 19 Dynamic vehicle re-routing points

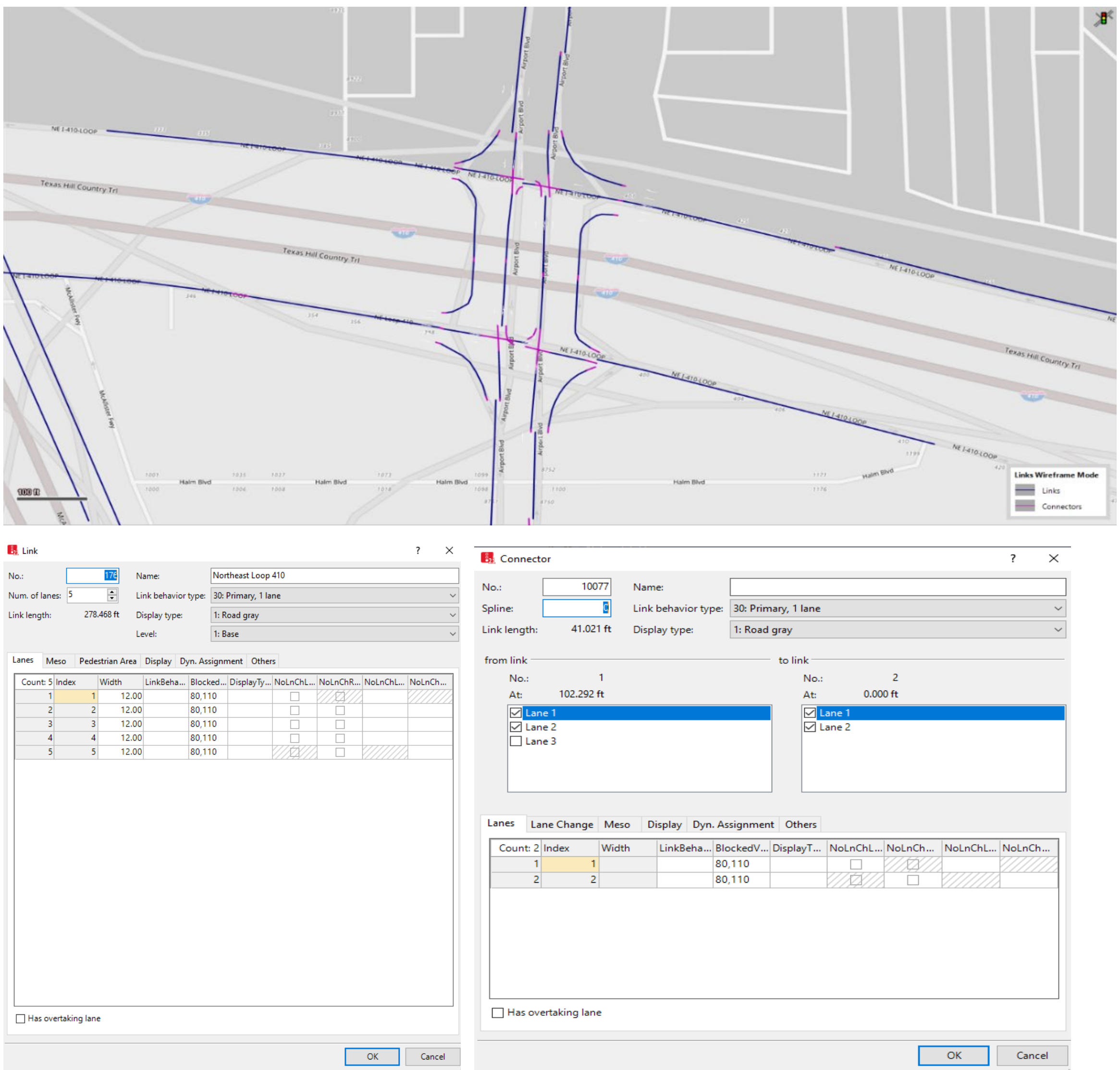
1.1 CURB PARKING LOTS LINKS AND CONNECTORS

VISSIM roadway network is created by links and are connected by connectors. Link length may vary and new links are created when there is a lane drop/addition.

The 2018 model has:

- 197 Links
- 230 Connectors

Figure 1-1: VISSIM Link and Connector

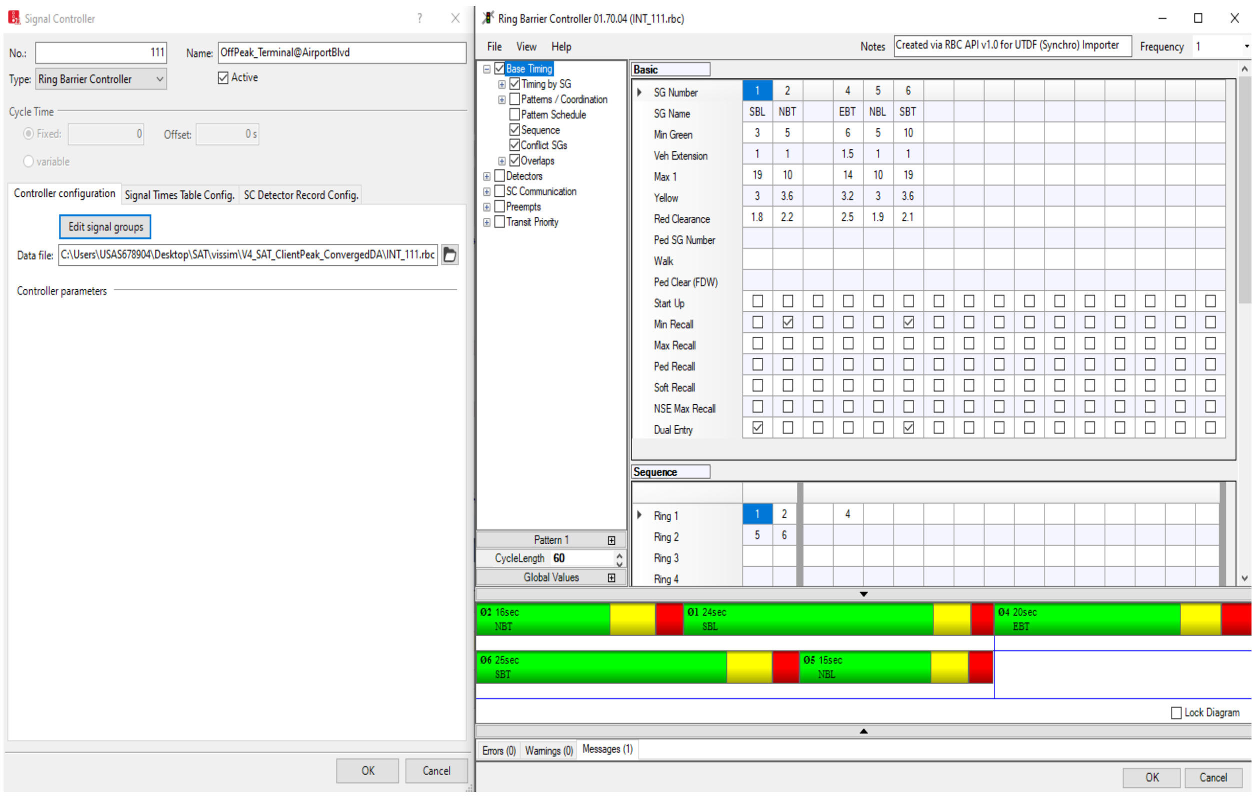


Source: WSP USA, 2021.

1.2 SIGNAL TIMINGS

The Existing condition model (year 2018 model) includes five signalized intersections. The signal timing data provided by City of San Antonio were coded directly into year 2018 micro-simulation model as .rbc signal files. As the common practice, the signal timings were not optimized for Existing conditions model.

Figure 1-2: VISSIM Signal Timing Window



Source: WSP USA, 2021.

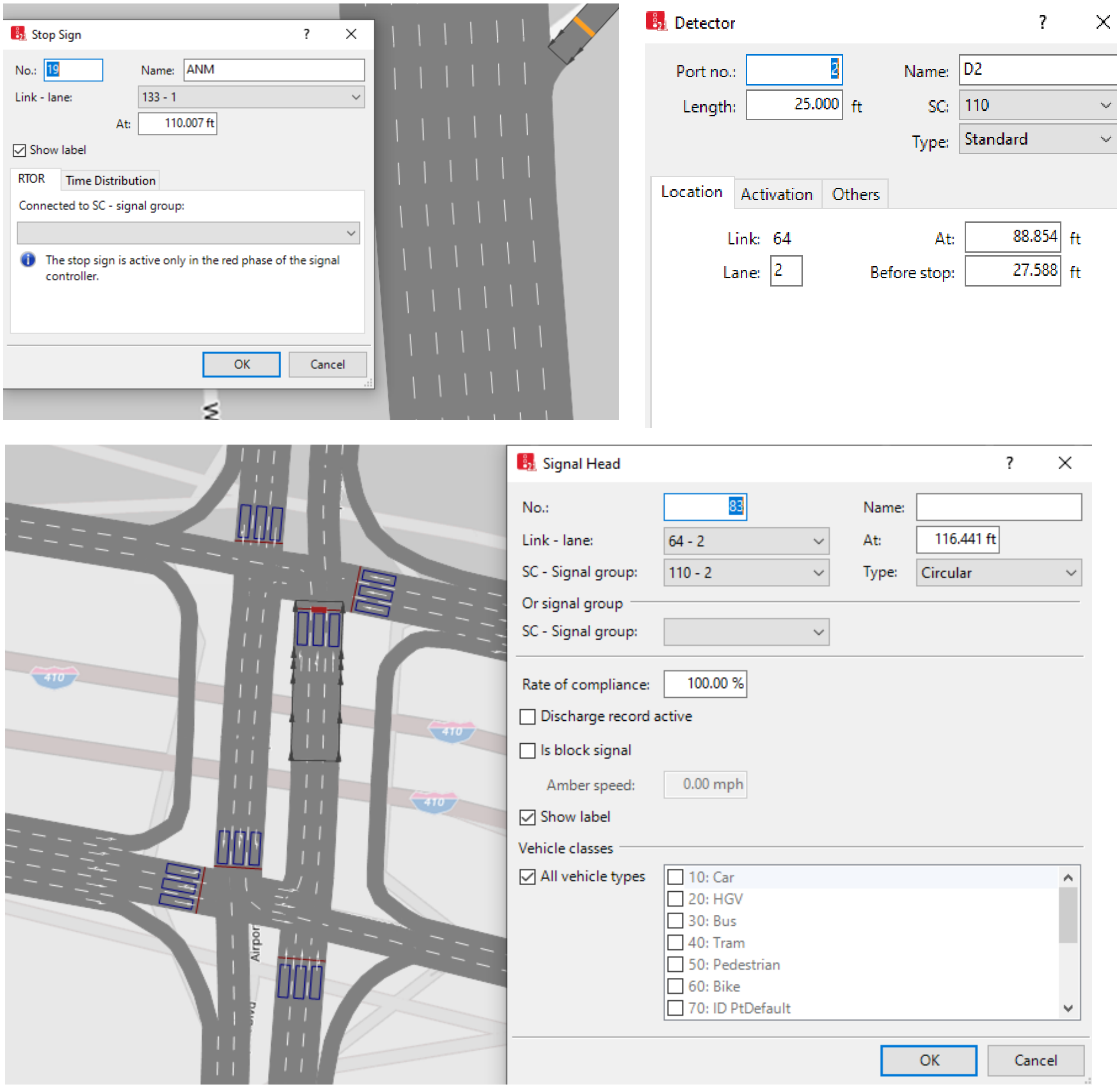
1.3 INTERSECTION CONTROL

The 2018 microsimulation model includes:

- 8 Signal Controllers
  - 68 signal heads
  - 56 detectors
  - 19 stop signs

From the eight signal controllers, five are signalized intersections coded as .rbc signal files. The three additional signal controllers are used at curb crosswalks to reproduce the method airport staff manage pedestrian flow for crossing the inner curb. The latter were coded as .vap signal files prepared via VISSIM VisVAP module.

Figure 1-3: Typical VISSIM Signal Head, Detector and Stop Sign Window



Source: WSP USA, 2021.

1.4 TRAFFIC DEMAND

Traffic demand of the model was developed with the use of matrix estimation techniques. VISUM travel demand modeling software version 2020 was used for this task. Trip matrices were estimated based on detailed traffic counts collected during June 2018 and feasible trip patterns for each of the modes previously listed.

The trips to and from the curbs and the trips that have no stop at the curb were estimated in VISUM. The trips that do not stop at the curbs were used as matrices directly in VISSIM. For each 15-min interval, a matrix was estimated. In trip matrices, each array t_{ij} is the number of trips from i to j.

Since the trips of a vehicle to and from the curb are actually linked, they need to be coded as a chain of trips in VISSIM. As a result, the estimated trips related to the curbs were post-processed through VBA codes to prepare the trip chain files for VISSIM. The trips of each vehicle type were calculated as part of the post-processing. Table 1.4-1 summarizes the vehicles types at coded with VISSIM.

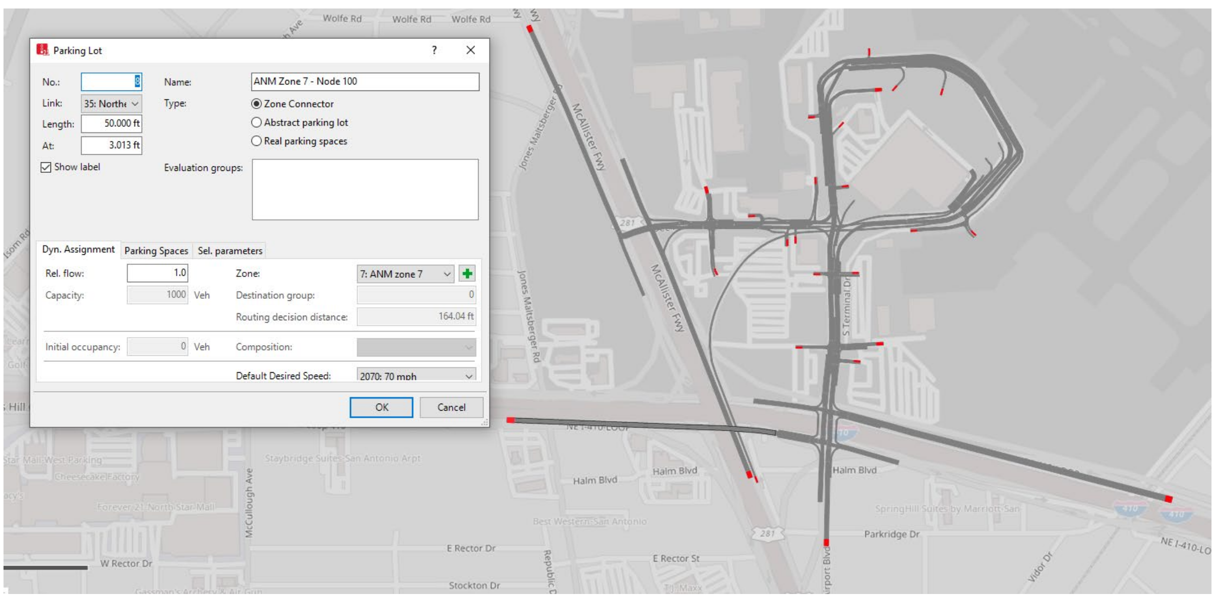
Table 1-1: Vehicle Types

Vehicle Type	Departures (%)	Arrivals (%)
Private and staff	57	40
FlyAway Valet (Private)	-	12
Taxi	7	8
TNC	28	31
Shuttle	7	5
Bus	1	3

Source: WSP USA, 2021.

The red segments on the links shown in Figure 1.4-4 are where vehicles enter the network.

Figure 1-4: VISSIM Vehicle Demand



Source: WSP USA, 2021.

As the result of the process described above, the estimated demand coded within VISSIM follows:

- Night peak (20:00 – 24:00); 3566 trip chain records, 18 matrices (36x36)
- PM peak (14:30-18-30); 5783 trip chain records, 18 matrices (36x36)
- AM peak (04:00-07:00) 2119 trip chain records, 14 matrices (36x36)

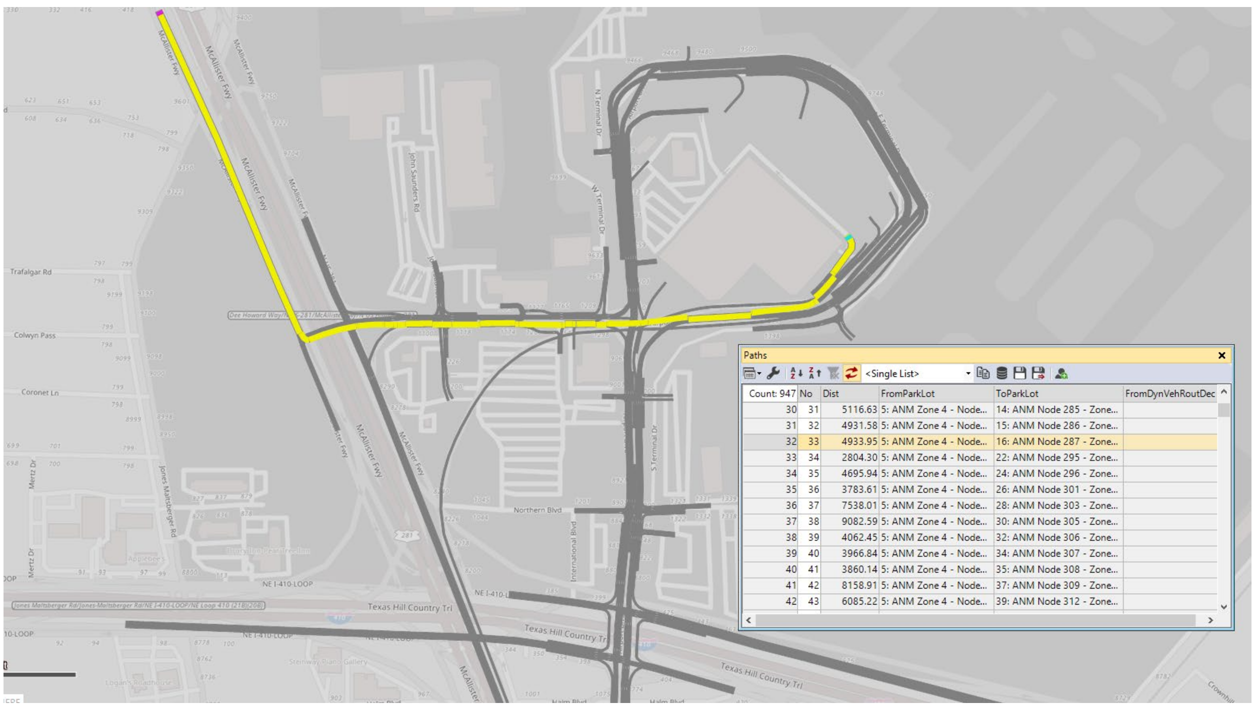
The number of pedestrians crossing the inner curb at the crosswalks over each 15-min period was calculated based on the estimated demand of each vehicle type on the outer curb and the average number of passengers of the vehicle type obtained from the June 2018 survey.

1.5 VEHICLE PATHS

The vehicular demand was assigned to the network through Dynamic Assignment algorithm in VISSIM. In this approach, the vehicles are allocated to the paths from the Origin to the Destination based on a comparison of the travel times along the paths.

- VISSIM model has 36 zones (the entry and/or exit points) and 8 curb zones (each for a vehicle type). There are around 270 feasible Origin-Destination pairs with demand greater than zero in the model. Approximately 370 paths were found between the pairs.

Figure 1-5: VISSIM Vehicle Paths



Source: WSP USA, 2021.

Nineteen Dynamic Routing Decisions were configured to make the vehicles circulate in the network and return to the curbs if they could not find a parking spot along the curb.

1.6 PARKING DURATION AT CURBS

Curb activity data collected in June 2018 was used to estimate the mean and standard deviation of the dwell times for each vehicle type at the arrivals/departure curbs.

Table 1-2: Parking Duration at Curbs

VEHICLE TYPE	DEPARTURES (MIN)		ARRIVALS (MIN)	
	mean	Std dev	mean	Std dev
Private and staff	2.1	1.63	1.8	2.33
Flyaway	2.1	1.63	2.1	2.33
Taxi	2.2	1.09	1.6	0.59
TNC	1.0	0.64	2.1	1.80
Shuttle	1.5	0.73	3.8	2.48
Bus	3.8	1.98	6.0	6.70

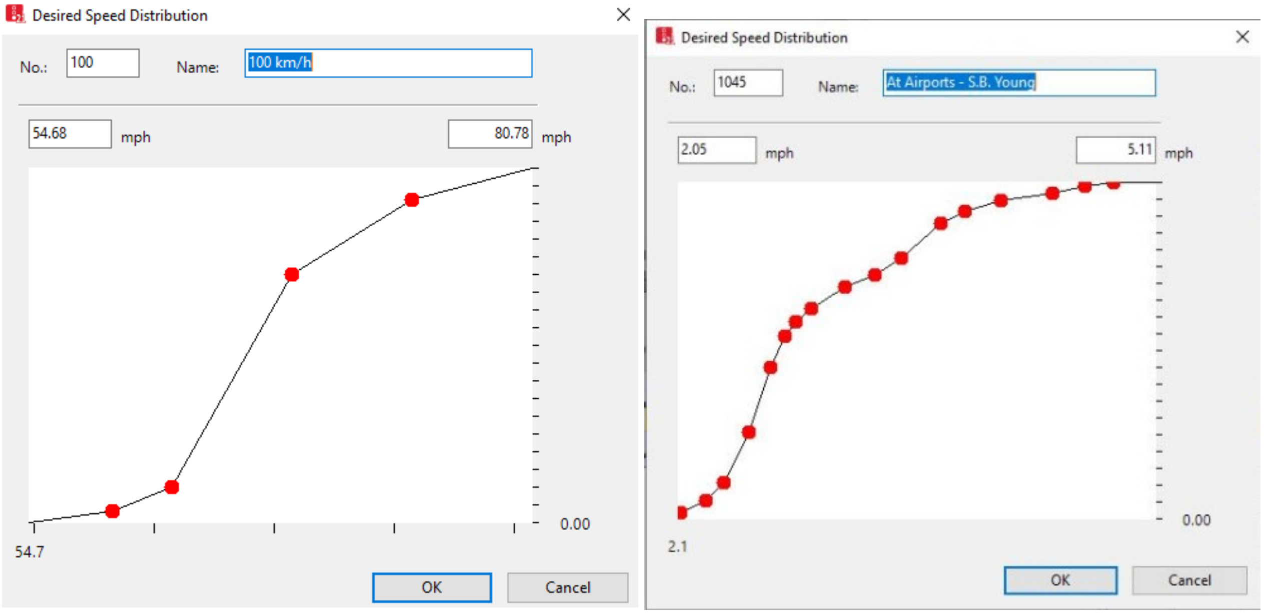
Source: WSP USA, 2021.

1.7 SPEED DISTRIBUTION

Speed data was defined based on the June 2018 field survey notes. Speed distributions are created as shown below with maximum speed, minimum speed and additional points so that not all vehicles travel at the same speed. Speed distributions are then assigned as follows:

- Initially as vehicles first enter the network, discussed in Section 1.4.
- In reduced speed areas where vehicles need to momentarily slow down, discussed in Section 1.8.
- At decision points where vehicles transition from one type of roadway to another, discussed in Section 1.7.
- The pedestrian speed distribution in the terminal was based on a paper published by Young, Seth B. “Evaluation of Pedestrian Walking Speeds in Airport Terminals.” *Transportation Research Record: Journal of the Transportation Research Board*, vol. 1674, no. 1, 1999, pp. 20–26., doi:10.3141/1674-03.

Figure 1-6: VISSIM Speed Distribution



Source: WSP USA, 2021.

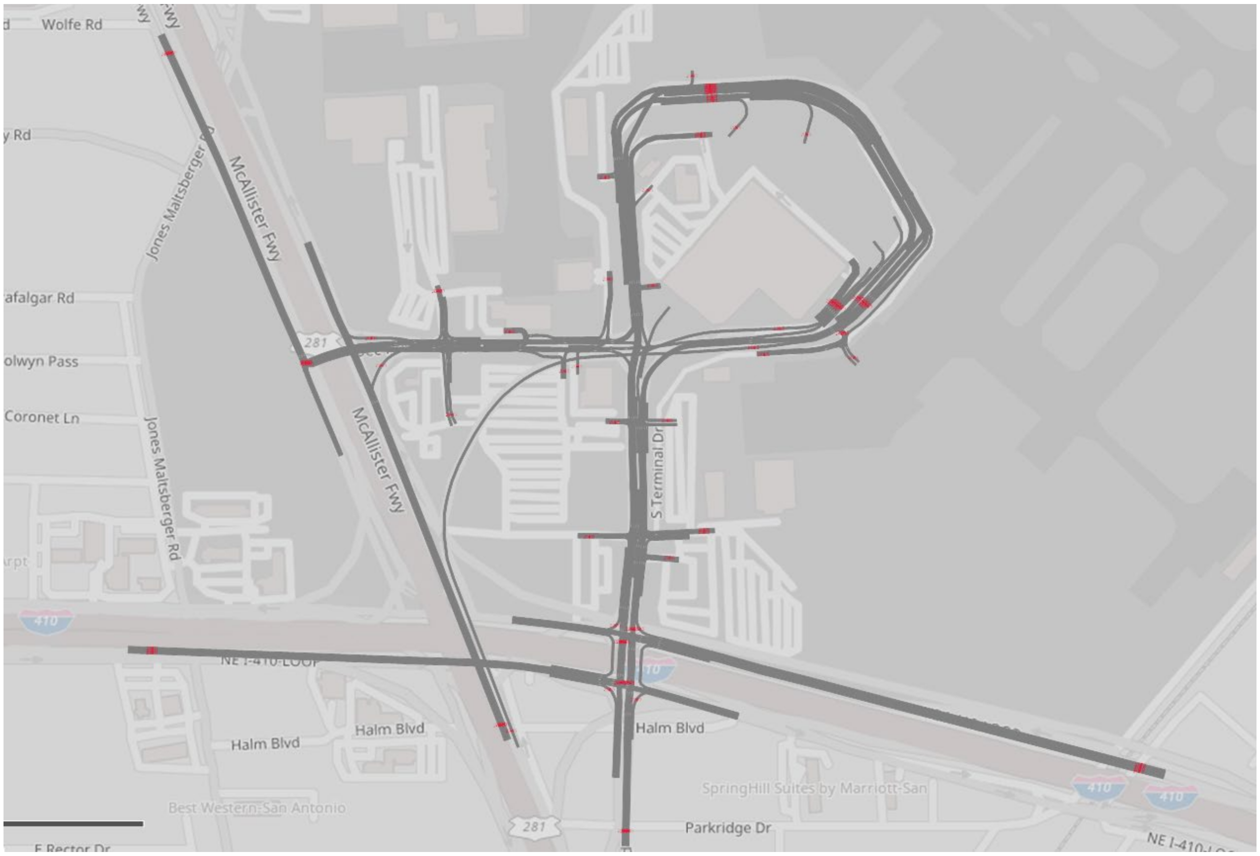
1.8 SPEED DECISION

Vehicles are assigned a new speed range when they cross a Speed Decision. Typically, this occurs when vehicles transition from one type of roadway to another (i.e. inner curb to outer curb, entrance / exit to CONRAC facility and Terminal) and at freeway merge/diverge points.

The 2018 microsimulation model has:

- 119 speed decisions (shown in red)

Figure 1-7: VISSIM Speed Distribution



Source: WSP USA, 2021.

1.9 REDUCED SPEED AREA

Reduced Speed Areas are assigned in small areas where vehicles should slow down, but the speed limit does not change. Generally, they are used at intersections and freeway ramps. In this model it is also applied at the Terminal roadway. Vehicles are not assigned new permanent speeds; they only reduce their speed based on pre-determined speed distribution as they pass through the areas shown in yellow.

The 2018 microsimulation model has:

- 116 reduced speed areas (shown in yellow)

Figure 1-8: VISSIM Reduced Speed Area

Source: WSP USA, 2021.

1.10 VEHICLE TYPES

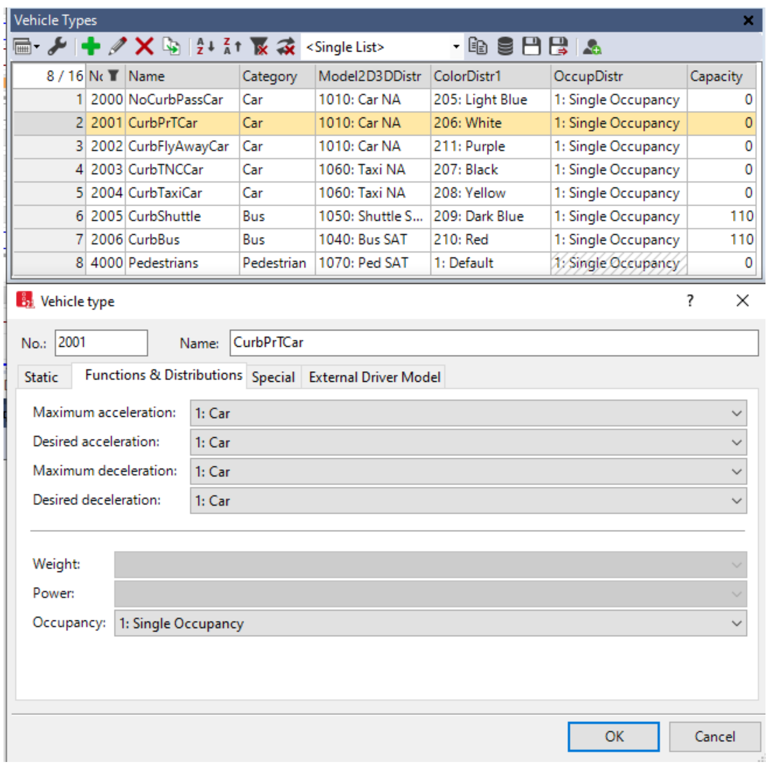
Vehicle types were defined based on field visit data collected on June 2018. In VISSIM 2020 model network different mode types were assigned and assigned different dwell times for each to more accurately reflect existing conditions.

Table 1-3: Vehicle Types

VEHICLE TYPE	COLOR
Passenger Cars (with no stop at the curb)	Light Blue
PrT Car	White
Flyaway Car	Purple
Transportation Network Company Vehicles	Black
Taxi	Yellow
Shuttle	Dark blue
Bus	Red

Source: WSP USA, 2021.

Figure 1-9: VISSIM Vehicle Types



Source: WSP USA, 2021.

2 VISSIM MODEL CALIBRATION

This section summarizes the effort conducted to calibrate existing conditions AM, PM and Night peak models within the study area. The traffic and field data collected during June 2018 were used for calibration. This section includes calibration criteria, parameters that were subject to modification during calibration, calibration approaches and adjustments and calibration results.

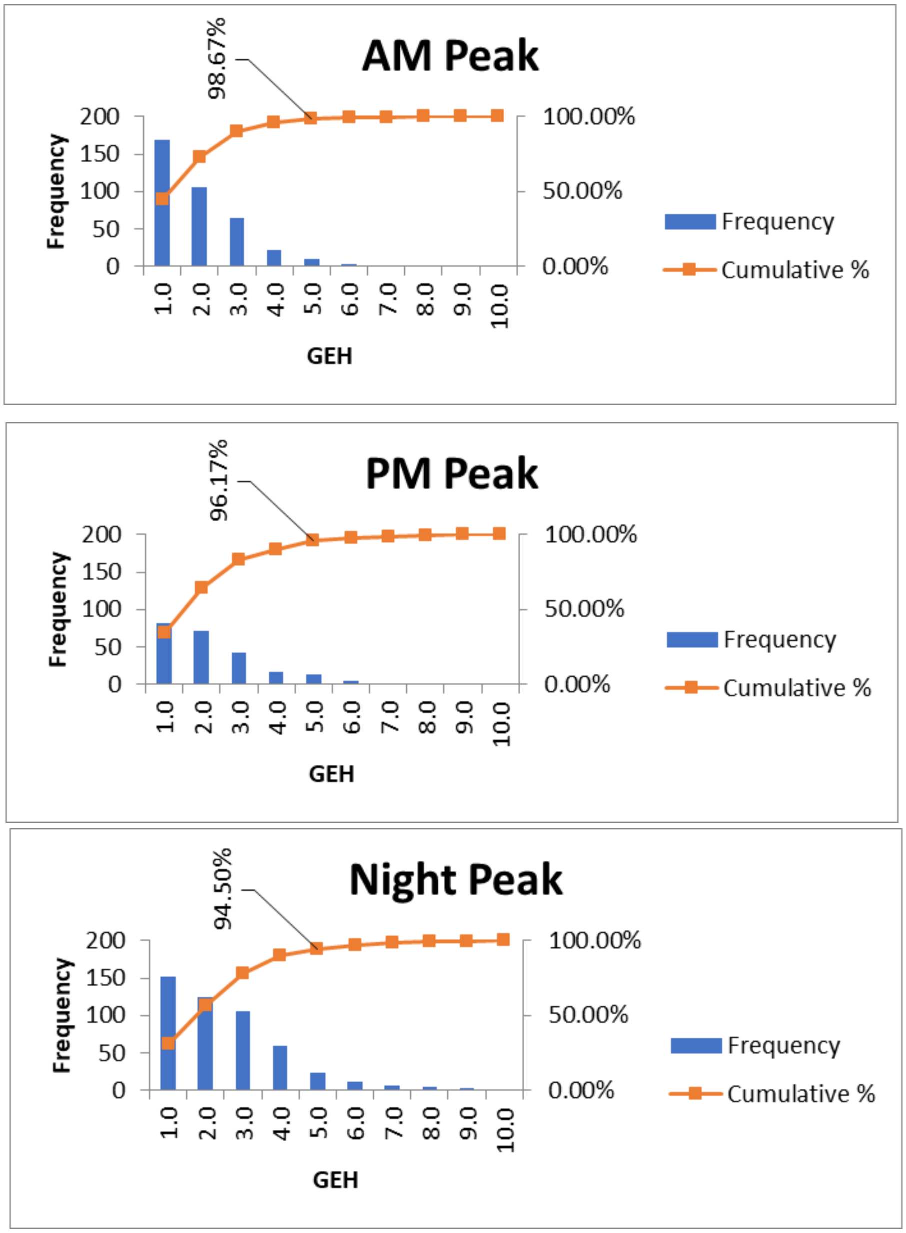
2.1 CALIBRATION CRITERIA

Traffic volumes and vehicle queue length were used as the key criteria to calibrate each of the models.

Queue lengths were calibrated based on the data collected during June 2018 survey at both departure and arrival curbs. Additionally, *Google Maps* typical time of day traffic was used for reference in the absence of field-collected queue data as a supplemental data source. The emphasis of the queue length comparison were used for validating locations where extended queueing and queue spillover occurs; Terminal Dr (from both arrival and departure curbside roadway) and upstream roadway (Northern Blvd and Dee Howard Way) leading to Terminal Drive. The queueing issues were evaluated and calibrated on a location-by-location basis in order to replicate actual field conditions.

The traffic volumes reproduced by VISSIM are compared to traffic count data collected during June 2018 for all three peak periods. The FHWA calibration criteria states that for at least 85% of the link flows the GEH statistic should be less than five (5). As shown in Figure 2.1-10 GEH is less than 5 for more than 85% of link segments for each three peak period models.

Figure 2-1: VISSIM Vehicle Types



Source: WSP USA, 2021.

2.2 CALIBRATION APPROACH AND ADJUSTMENTS

The AM, PM and Night peak VISSIM models were calibrated to meet target volumes, queue lengths and congestion patterns. When the traffic demand were satisfied, the calibration process started.

3D models of the vehicles were implemented in the model due to the effect they have on the capacity of the road.

The calibration process consisted of several iterative loops since several key parameters have strong interactions with each other. The following adjustments were completed within each VISSIM model until existing conditions were replicated;

- Free-flow speed at each segment in the network was adjusted, including the turns at junctions
- Lane Change Distance of the Connectors were adjusted to account for matching lane change patterns and the queue lengths
- The driving behavior at the intersections was adjusted with the use of Conflict Areas and Priority Rules
- Driving behavior parameters were also adjusted to reflect the behavior observed in the field, including double parking along the curbs

The primary parameters that were adjusted are described in the following sections.

2.2.1 DRIVING BEHAVIOUR

VISSIM incorporates two different car-following models – one for freeways and one for arterials. In combination with other operational parameters, these parameters can be adjusted as needed to achieve desired flow conditions. Car-following parameters can effectively change roadway capacity by adjusting vehicle spacing and headways. Within VISSIM's lane-changing models, VISSIM includes parameters for necessary (in order to make a turning movement) and discretionary lane changes (for more room/higher speed). The lane-changing parameters were also modified from default values in order to achieve more realistic lane-changing behavior in the model.

Table 2-1 provides a summary of driver behaviors used in the VISSIM models, showing parameters that are subject to change and applicable use cases. The parameters shown in red color were altered from the default values.

Table 2-1: Driving Behaviors Used in VISSIM Models

PARAMETERS		URBAN MOTORIZED DRIVER BEHAVIOUR USED IN VISSIM MODELS			
		VISSIM DEFAULT PARAMETERS	AM PEAK PERIOD	PM PEAK PERIOD	NIGHT PEAK PERIOD
CAR - FOLLOWING PARAMETERS	Car-Following Model	WIEDEMANN 74			
	Look Ahead Distance: Minimum , Maximum (ft)	0 FT , 820.21 FT			
	Look Ahead Distance: Number of observed vehicles	4			
	Look Back Distance : Minimum - Maximum (ft)	0 FT – 492.13 FT			
	Additive Part of Safety Distance	6.56 FT			
	Multiplicative Part of Safety Distance	9.84 FT			
	Average Standstill Distance (ft)	6.56 FT			
LANE CHANGING PARAMETERS	Maximum Deceleration (Own Vehicle) (ft/s^2)	-13.12 FT/S^2			
	Maximum Deceleration (Trailing Vehicle) (ft/s^2)	-9.84 FT/S^2			
	Accepted Deceleration (Own Vehicle) (ft/s^2)	-3.28 FT/S^2			
	Vehicle Routing Decision Look Ahead	OFF			
	Safety Distance Reduction Factor	0.6	0.6	0.35	0.6
	Maximum Deceleration for Cooperative Braking (ft/s2)	-9.84 FT/S^2			
	Advanced Merging	ON			
	Cooperative Lane Change	OFF	OFF	ON	OFF

Source: WSP USA, 2021.

2.2.2 LANE-CHANGE DISTANCE FOR CONNECTORS

Lane-change distance for Connectors is the distance within VISSIM where a vehicle will start attempting to make a lane change to a downstream connector prior to a merge/diverge segment, a lane drop, or change in travel direction. This lane-change distance is a parameter on every connector in the VISSIM network, and its default value is 656 feet. This distance is typically acceptable for low speed, intersection turning movements; however, it would provide challenging and unrealistic lane changing behavior for heterogenous traffic condition. During model calibration, the lane-change distances for roadway segments and lane drops were reviewed and modified to match field conditions.

2.2.3 DESIRED SPEED DISTRIBUTION

In VISSIM the desired speeds (free-flow speeds) were coded at specific locations to replicated observed conditions. The speeds were initially set based on the speed limits. Based on the field visits the free flow speeds at each location were adjusted so that existing peak traffic flow conditions were replicated during the simulation.

Reduced speed areas were used to regulate turning speeds at intersections. The right-turn and left-turn speed profiles used for this study are based on past practice experiences. Higher speed distributions were used for turning movements with large turn radii, such as at intersections with a large footprint or channelized right turns. Furthermore, at some locations where right-turns and left-turns were observed to operate at higher speeds, the adjustments were part of the calibration for throughput.

2.2.4 CONFLICT AREA PARAMETERS AND PRIORITY RULES

VISSIM provides two types of network elements to create conditions in which vehicles traveling on one link must yield to vehicles traveling on another link: conflict areas and priority rules. Both of these elements allow for replication of the upstream/downstream headways and speeds that vehicles are willing to accept in order to conduct movements, such as right turns on red, permissive left turns from a signal or stop sign, yielding at pedestrian crosswalks, and others. Conflict areas were coded at all locations in which two links/connectors overlap in the network with the parameters for front gap, rear gap, and safety distance factor adjusted as necessary. In some locations, conflict areas were replaced with priority rules, typically to prevent vehicles from entering crosswalks until pedestrians clear the crosswalk or until the vehicles have enough space to clear the intersection and don't block it.