ST. LOUIS LAMBERT INTERNATIONAL AIRPORT®

AIRPORT MASTER PLAN

CHAPTER 5 - ALTERNATIVES DEVELOPMENT AND EVALUATION

FEBRUARY 2023 - FINAL DRAFT

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5 ALTERNATIVES DEVELOPMENT AND EVALUATION

This chapter documents the identification and evaluation of alternatives for meeting STL's long-term aviation needs (2040), based on the facility requirements defined in Chapter 4. With the involvement of STLAA, 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, to gain a thorough understanding of the strengths, weaknesses, and other implications of each.
- Selection of the preferred alternative.

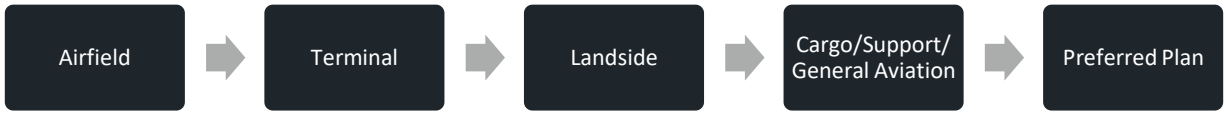
The analyses in this chapter are based on the conditions at STL as of December 2020.

5.1 APPROACH AND METHODOLOGY

The alternatives analysis process builds on the facility requirements defined in Chapter 4. The alternatives accommodate the long-term (20-year) facility needs, which in turn reflect the FAA-approved forecast.

Planning facilities priorities were identified, starting with airfield, given the land-intensive nature of airfield development. Upon selecting a preferred airfield alternative, terminal alternatives were developed, 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 terminal alternative was selected, multimodal landside access was addressed, based on the need to link the 2040 terminal to the surrounding transportation network and region, and the need to accommodate various modes of travel to the Airport (encompassing both access and parking). Finally, cargo, corporate and general aviation, and airport support facilities were incorporated in the alternatives. The alternatives analysis process is depicted on **Figure 5.1-1**.

Figure 5.1-1: Alternatives Analysis Process



Source: WSP USA, 2022.

5.2 AIRFIELD

This section presents the Airfield Alternatives Development and Evaluation, which identifies and evaluates alternatives needed to accommodate the facility requirements presented in Chapter 4. As an essential component in the planning process, this section reviews alternatives STL could develop to meet the needs of the airport users, satisfy future demand and conform to Federal Aviation Administration (FAA) design criteria.

5.2.1 SUMMARY OF AIRFIELD FACILITY REQUIREMENTS

- Airfield capacity:
  - Runway capacity: adequate through the planning horizon
  - Taxiway capacity: extension of Twy F to the east to provide access to the Runway 30R end from the cargo and general aviation aprons
- Airfield design standards:
  - Runway length: adequate for international service through the planning horizon
  - Runway exits: adequate through the planning horizon
  - Twy D-Twy/Tln C separation insufficient at times
  - Taxiway geometry: numerous areas of non-compliance with current standards
  - Runway vertical curves: non-standard grades within the final quarter of Runways 12R, 30L, 6 and 24.
  - RSA/ROFA penetrations: operations restrictions on service roads
  - RPZs: roadways and incompatible land uses inside RPZs. Mitigate if possible.
- Deicing system: need additional capacity
- Airfield signage/markings: five non-standard markings/signs
- Airspace: prepare an Obstacle Action Plan

5.2.2 AIRFIELD CAPACITY

Per the Facility Requirements analysis, the airfield throughout is adequate to accommodate future aircraft movements with minimal delay. Therefore, no runway capacity improvements are required through the planning horizon.

Taxiway capacity improvements include the extension of Taxiway F to the east, which will be depicted on later airfield figures.

5.2.3 AIRFIELD DESIGN STANDARDS

Ideally, all runways and taxiways are designed and constructed in accordance with FAA guidelines and requirements at the time of construction. These guidelines stipulate basic geometric requirements that enable runway or runway system to accommodate regular traffic by a certain type or size of aircraft, and assist airport planners with identifying any airfield constraints that require modification. FAA guidance is not static but always being improved upon. Given that airfield pavements last decades, over time, airfields will have areas that will become nonstandard or suboptimal, and that need improvement. The following subsections present the runway compliance constraints at STL based on FAA AC 150/5300-13B, *Airfield Design*, and AC 150/5000-17, *Critical Aircraft and Regular Use Determination*.

Given the size and scope of the airfield pavements at STL, an iterative process combined with stakeholder panels were used to vet and accept or eliminate alternatives. Alternatives were initially evaluated in "silos" and eventually combined into holistic airfield layouts for consideration by stakeholders. This section presents these alternatives and the steps taken to arrive at a Preferred Airfield Plan.

RUNWAY LENGTH

Takeoff and landing length requirements were calculated following the process in FAA Advisory Circular (AC) 150/5325-4B, *Runway Length Requirements for Airport Design*, as part of the Facility Requirements analysis. This analysis found that the existing runway length at STL (11,020 feet for Runway 12R-30L) is adequate to accommodate nearly unrestricted operations by all aircraft that regularly operate at the Airport as of December 2020, and is projected to do so in the future. In addition, the existing lengths of all three parallel runways (11-29, 12R-30L, and 12L-30R) at STL are adequate to accommodate landing runway length requirements by all aircraft types in the fleet mix. No runway extensions are therefore required throughout the planning period.

RUNWAY WIDTH

Runway width requirements were determined as part of the Facility Requirements analysis. The projected critical aircraft for each runway, which drives the runway width requirement, was identified and discussed. **Table 5.2-1** summarizes the projected critical aircraft for each runway.

Table 5.2-1: Critical Aircraft by Runway

RUNWAY	CRITICAL AIRCRAFT	AIRCRAFT APPROACH CATEGORY	AIRPLANE DESIGN GROUP	EXISTING RUNWAY WIDTH	REQUIRED RUNWAY WIDTH PER 13B
12L-30R	B763	D	IV	150 FT.	150 FT.
12R-30L	B763	D	IV	200 FT.	150 FT.
11-29	B738	D	III	150 FT.	100 FT.
6-24	B737	C	III	150 FT.	100 FT.

Source: St. Louis Airport Authority, *L3 Harris Operations Data,* 2019 (aircraft operations); CMT, September 2020 (analysis).

As shown in Table 5.2-1, the most demanding runway width for the projected fleet mix at STL is 150 feet. Given that the pavements of Runways 11-29 and 6-24 are still in good condition, it is recommended that these widths be retained until the next runway reconstruction projects. At that time, width could be

reassessed to determine compliance with standards. Runway 12R-30L is 200 feet wide, and is planned to be narrowed to 150 feet in 2023, as part of its reconstruction, to match the anticipated fleet mix at the Airport.

RUNWAY VERTICAL CURVES AND GRADE

There are areas of noncompliant vertical curves on Runways 6-24 and 12R-30L. Per FAA AC 150/5300-13A, Section 313, *Surface Gradient*, "provide a smooth transition between the intersecting pavement surfaces as well as adequate drainage of the intersection. Give precedence for the dominant runway (e.g., higher speed, higher traffic volume, etc.) in a runway-runway situation." Since Runway 12R-30L is considered the dominant runway when considering the runway-runway intersection of Runway 12R-30L and Runway 6-24, its grades are given precedence over the Runway 6-24 grades. Therefore, what would normally be a deviation from standards on the Runway 6-24 vertical curve spacing is negated by AC guidance to provide precedence for the dominant runway.

Longitudinal Grade Limitations for Aircraft Approach Categories, C, D and E, dictates that within the last quarter of the runway (or 2,500 feet, whichever is less) grades should be a constant 0.00% to ±0.80%. Within the final quarter of Runways 12R, 30L, 6 and 24, however, vertical curves exist. Based on the definition and need for a vertical curve as defined by FAA, these vertical curves contained within the first or last quarter of each of these runways represent a deviation from standards. It is recommended that during reconstruction efforts for each of these pavements, longitudinal grades be reevaluated.

RUNWAYS EXITS

As part of the Facility Requirements analysis, the FAA's Runway Exit Design Model (REDIM) was used to analyze the runway system and its utilization by the existing and projected fleet mix. Over time, the Airport's fleet of aircraft has changed and this analysis serves to identify whether the exits locations are suitable for the current and projected fleet. REDIM results were used to complement discussions with stakeholders (STLAA, FAA, and ATC), to understand the existing condition and issues at the various runway exits at STL. These discussions, along with the REDIM outcome, provided a complete picture of the baseline conditions and utilization of the airfield. One of the REDIM outputs is the weighted average runway occupancy time (ROT) of an aircraft mix selected by the user.

The REDIM results presented in the Facility Requirements chapter show that ROTs of each runway are not impacted negatively by changes to the fleet mix. Therefore, additional exits are not required to solve ROT issues. In fact, in most cases, ROT slightly improves (decreases) for the future fleet mix, as the fleet becomes more consistent.

However, the location of exits that connect Runway 12R-30L to the ramp is not optimal, and alternative configurations should be considered. The following sections will consider alternatives for the configuration of various existing taxiway connectors at STL.

AIRFIELD LAYOUT

The *Facility Requirements* chapter discussed geometric issues associated with various taxiways. **Appendix 5A** summarizes individual taxiway issues, evaluations and alternatives.

AIRFIELD LAYOUT ALTERNATIVES

Based on the taxiway geometry alternatives developed for each individual taxiway connector (Appendix 5A), the alternatives with the highest scores were combined to create six airfield layout alternatives, presented in **Appendix 5B**. These six alternatives incorporate a blend of the most desired attributes from each individual alternative presented previously. **Appendix 5C** includes the *Comparative Safety Assessment* conducted as part of this STL ALPU/MP, which details the alternatives evaluation process.

The objective of these alternatives is to achieve a more effective airfield flow that complies with current FAA taxiway geometry standards and increases safety during taxi operations. The six airfield layout alternatives also consider input on preferred modifications received from STLAA engineering and operations staff, applicable stakeholders, and FAA partners.

An important step prior to selecting a preferred airfield layout alternative was to seek input and assessment on the 6 alternatives from STL staff, airport stakeholders, FAA, and members of the Planning Team (the Planning Team consists of WSP, CMT, Faith Group, STLAA, FAA Region, FAA STL ATCT and FAA Runway Safety). This step involved an online evaluation of the 6 alternatives and the opportunity for interested parties to provide general comments about their opinion of each alternative.

Airport staff, airport stakeholders, FAA, and members of the Planning Team received an online survey soliciting input and evaluation of each alternative. Specifically, participants rated each alternative on a scale from 1 to 7 (1 being least preferred and 7 being highly preferred). In addition, participants were asked to identify and comment on preferences or concerns identified in each alternative. **Table 5.2-2** shows the average score of each alternative obtained through the evaluation survey.

Table 5.2-2: Airfield Layout Alternatives - Evaluation Average Score

ALTERNATIVE	AVERAGE SCORE
1	**4.83**
2	3.33
3	**4.83**
4	3.50
5	3.33
6	4.00

Source: CMT, 2021

As shown in Table 5.2-2, the two alternatives with the highest average score are Alternatives 1 and 3. It is important to understand that in order to shape a preferred airfield alternative, the average score is not the only factor taken into account. The evaluation survey included an opportunity for feedback and opinions through general comments. These comments were an important element used in assessing the 6 airfield layout alternatives and narrowing the focus to two preferred alternatives. The next step in the process of selecting a preferred airfield alternative was to narrow the options to two composite airfield layout alternatives.

COMPOSITE AIRFIELD LAYOUT ALTERNATIVES

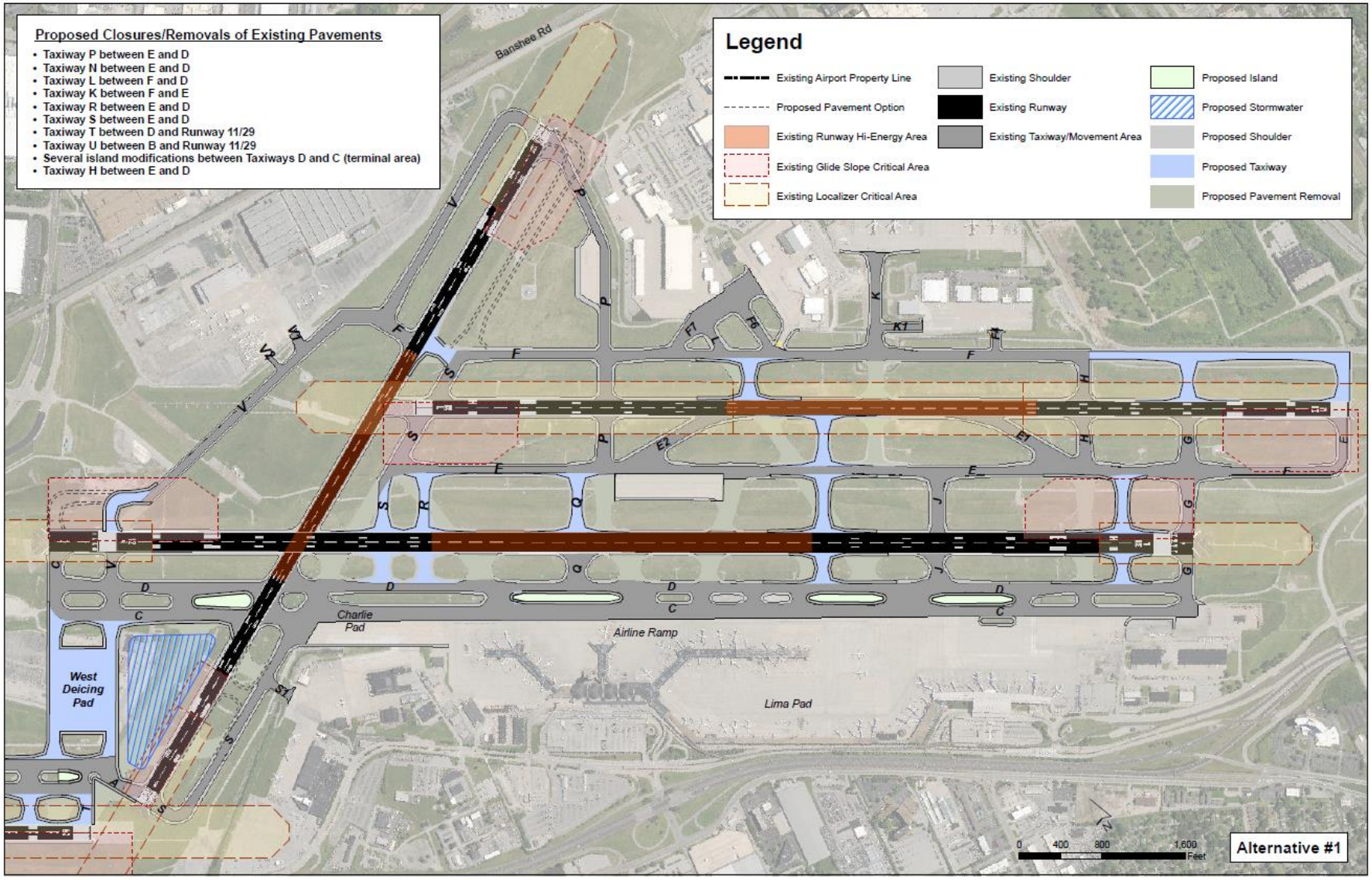
The responses to the airfield alternatives evaluation survey provided valuable perspectives from FAA, STL leadership, and stakeholders regarding the 6 alternatives. These comments, likes, dislikes, and observations were analyzed for the development of two composite airfield alternatives. The two composite alternatives seek to blend the alternatives that received the most support through the survey process and during overall engagement activities with stakeholders. **Figure 5.2-1** and **Figure 5.2-2** show these two composite airfield layout alternatives.

Composite Airfield Layout Alternative 1

Composite Airfield Alternative 1 is derived primarily from initial Airfield Alternatives #3 and #4, which were the direct result of two stakeholder engagement sessions to assess individual intersections from an operational perspective. During initial screening, these two alternatives received high scores from participants. Composite Airfield Alternative 1 depicts the following airfield modifications:

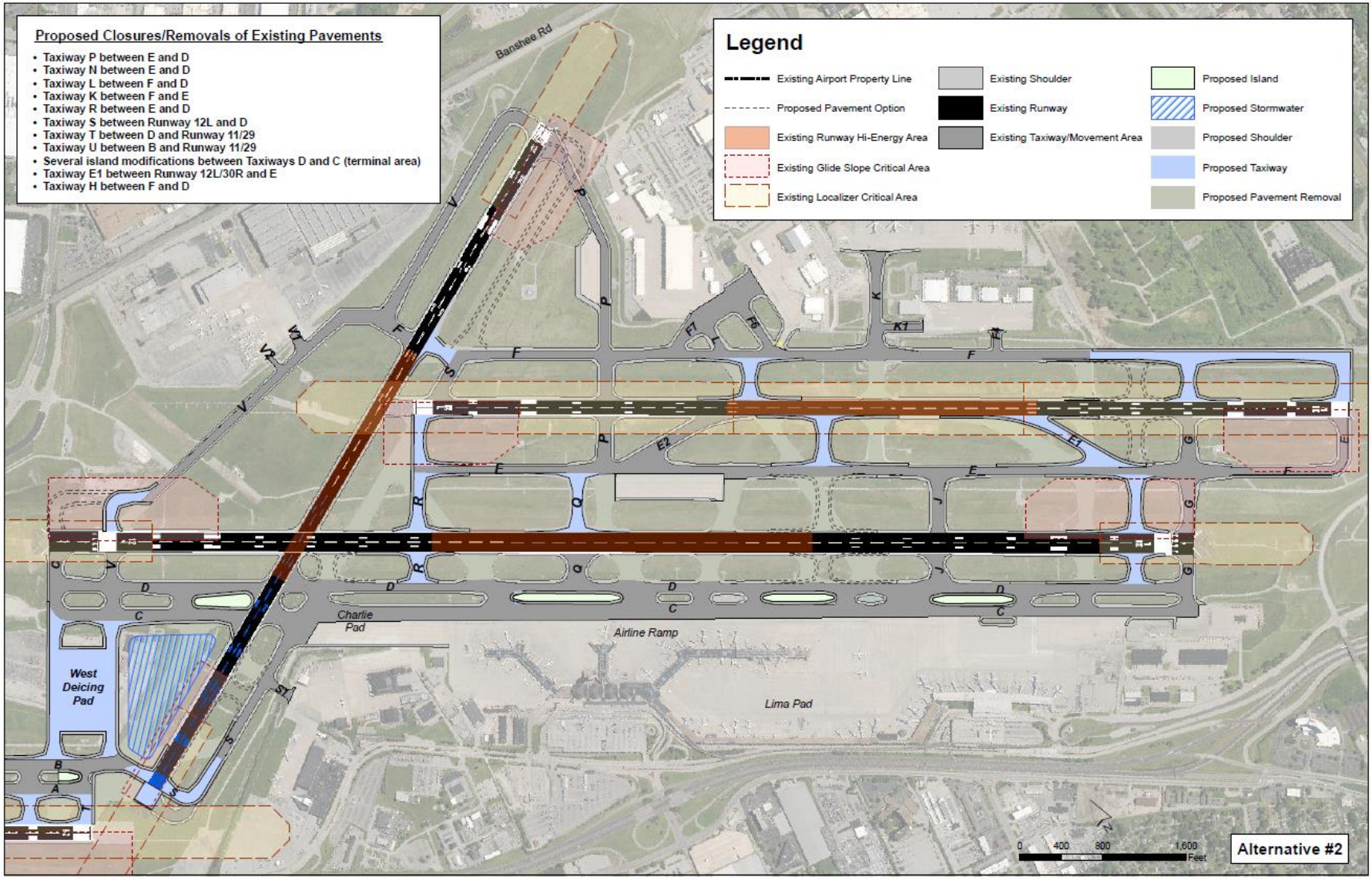
- Construct Taxiway F at 90° angle with Runway 6-24
- Retain Taxiways E2 and P between Taxiways F and E
- Taxiway L at 90° angle between Taxiway F and Runway 12L-30R
- Taxiway F extension with a crossing at Taxiway G
- Retain existing Taxiways E1 and H between Taxiways F and E
- Construct a new Taxiway H crossing north of Runway 30L
- New 90° angle Taxiway L crossing from Taxiways E to D
- Extend Taxiway Q from Taxiway D to Taxiway E. Stagger Taxiways P and Q crossings of parallel runways.
- New Taxiway B crossing at 90° angle with Runway 6. Extend Taxiways U and V to Taxiway B with central deicing pad
- Close Taxiway N from Taxiways D to E
- Maintain Taxiways S and R crossing of Runway 12L – potential Taxiway S extension to Runway 24
- Maintain high-speed taxiways in their current position

Figure 5.2-1: Composite Airfield Layout Alternative 1



Source: CMT, 2021.

Figure 5.2-2: Composite Airfield Layout Alternative 2



Source: CMT, 2021.

Composite Airfield Layout Alternative 2

Composite Airfield Alternative 2 is derived primarily from initial Airfield Alternatives 4 and 6, which were the direct result of two stakeholder engagement sessions to assess individual intersections from an operational perspective. A new REDIM analysis was conducted for Runways 12L-30R, 12R-30L, and 6-24 to determine the optimal locations for both 90° and high-speed exits. While assessed from a clean-slate perspective, there were a few constants incorporated, based on discussions to date with STLAA and ATCT leadership. During initial screening, these two alternatives received high scores from participants. Composite Airfield Alternative 2 shows:

- Construct Taxiway F at 90° angle with Runway 6-24
- Retains Taxiways E2 and P between Taxiways F and E
- Taxiway L at 90° angle between Taxiway F and Runway 12L-30R
- Taxiway F extension with a crossing at Taxiway G
- Realign Taxiway H between Taxiways D and E
- Realign high-speed exit Taxiway E1
- New 90° angle Taxiway L crossing from Taxiway D to Runway 12L-30R
- Extend Taxiway Q from Taxiways D to E. Staggered Taxiway Q from Taxiways E to F.
- Reconfigured Taxiway B crossing at 90° angle with Runway 6 and shortened Runway 6 by 200 feet. Extend Taxiways U and V to Taxiway B with central deicing pad.
- Close Taxiway N from Taxiways D to E
- Remove Taxiway R and realign S from Taxiway D to Runway 12L. Potential extension to Runway 24.

Additional Considerations

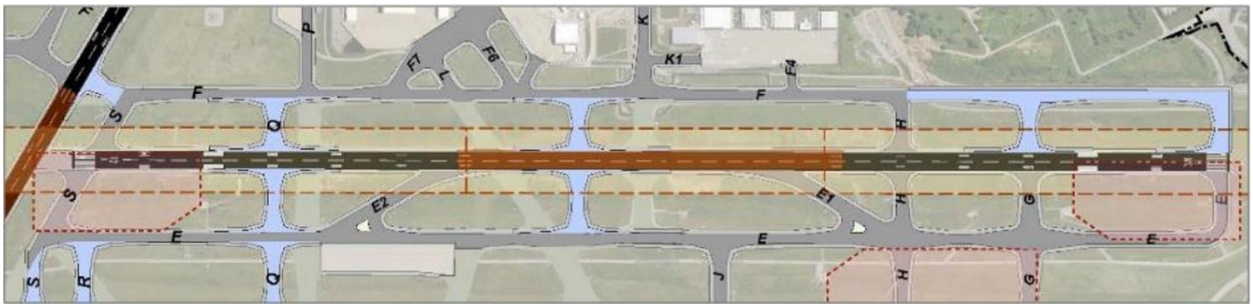
There were two outstanding decisions at the outcome of the evaluation of the composite alternatives that required further discussions with stakeholders and collaboration in order to select a preferred airfield alternative:

- Crossing point on Runway 12R-30L in the approximate location of existing Taxiway P or Q. Area of focus was associated with taxi times when landing on Runway 30R and taxi routes to the terminal core with and without a Taxiway P/Q crossing point (high-energy runway crossing).
- Highspeed exit location associated with landing on Runway 12L (existing Taxiway E1) and best location to consider in final preferred airfield configuration.

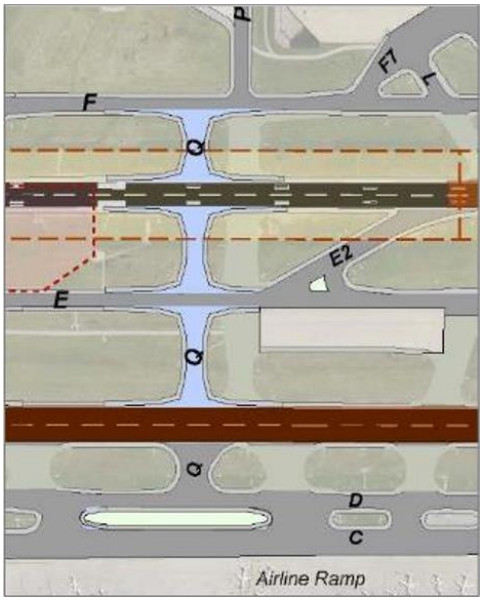
Figure 5.2-3 depicts the areas in question.

The Planning Team determined that addressing the operational issues associated with the location of a Runway 12R-30L crossing (Taxiways P or Q location) needed to be carried forward for further discussion and decision-making (final preferred alternative). The extension of Taxiway Q between Runway 12R-30L and closure of Taxiway P (between Taxiways D and E) was selected as preferred.

Figure 5.2-3: Composite Airfield Layout Alternatives - Additional Considerations



- Taxiways P or Q crossing of Runway 12R-30L:
  - Taxi time impact
- High-speed exit locations:
  - REDIM analysis
  - Future fleet mix projections
  - Taxiway E1: 400-ft shift to the east
  - Taxiway E2: good location

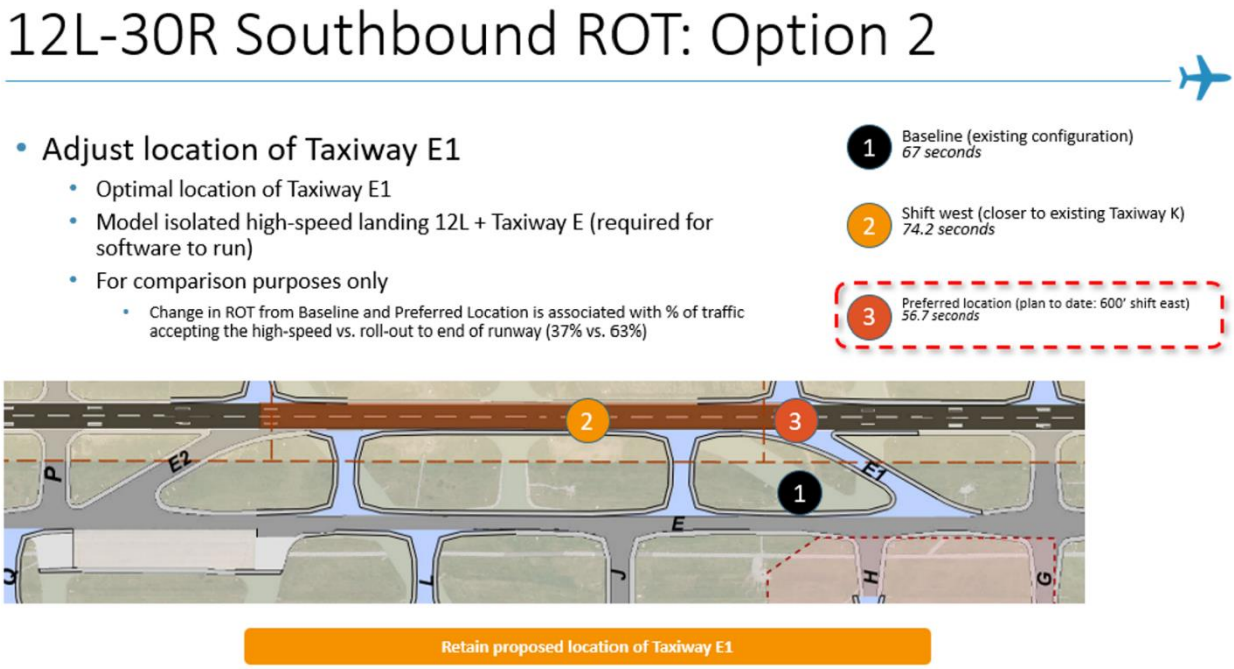


Source: CMT, 2022.

It should be noted that the consolidated airfield alternatives carried forward included a significant improvement to the existing configuration of Taxiways Q and P (eliminates a dual taxiway crossing and eliminates direct access from the airline/commercial apron). This emphasizes the collaborative solution development and decision-making process the Planning Team engaged in to finalize an airfield solution that balanced various priorities/objectives.

As part of the development of the preferred airfield alternative, the Planning Team held additional discussions regarding the location of high-speed exits associated with Runway 12L-30R. Results of additional REDIM analysis on the location of Taxiways E1 and E2 were discussed, and future aircraft fleet mix projections were cross-checked. Based on the refined analysis, the recommendation was made to relocate Taxiway E1, in order to maintain Runway Occupancy Times (ROT) within an acceptable range (less than 50 seconds) and resolve the existing multi-node intersection at Taxiways E, E1 and H, as depicted on **Figure 5.2-4**.

Figure 5.2-4: Runway 12L-30R Southbound Runway Occupancy Times



Source: CMT, 2021.

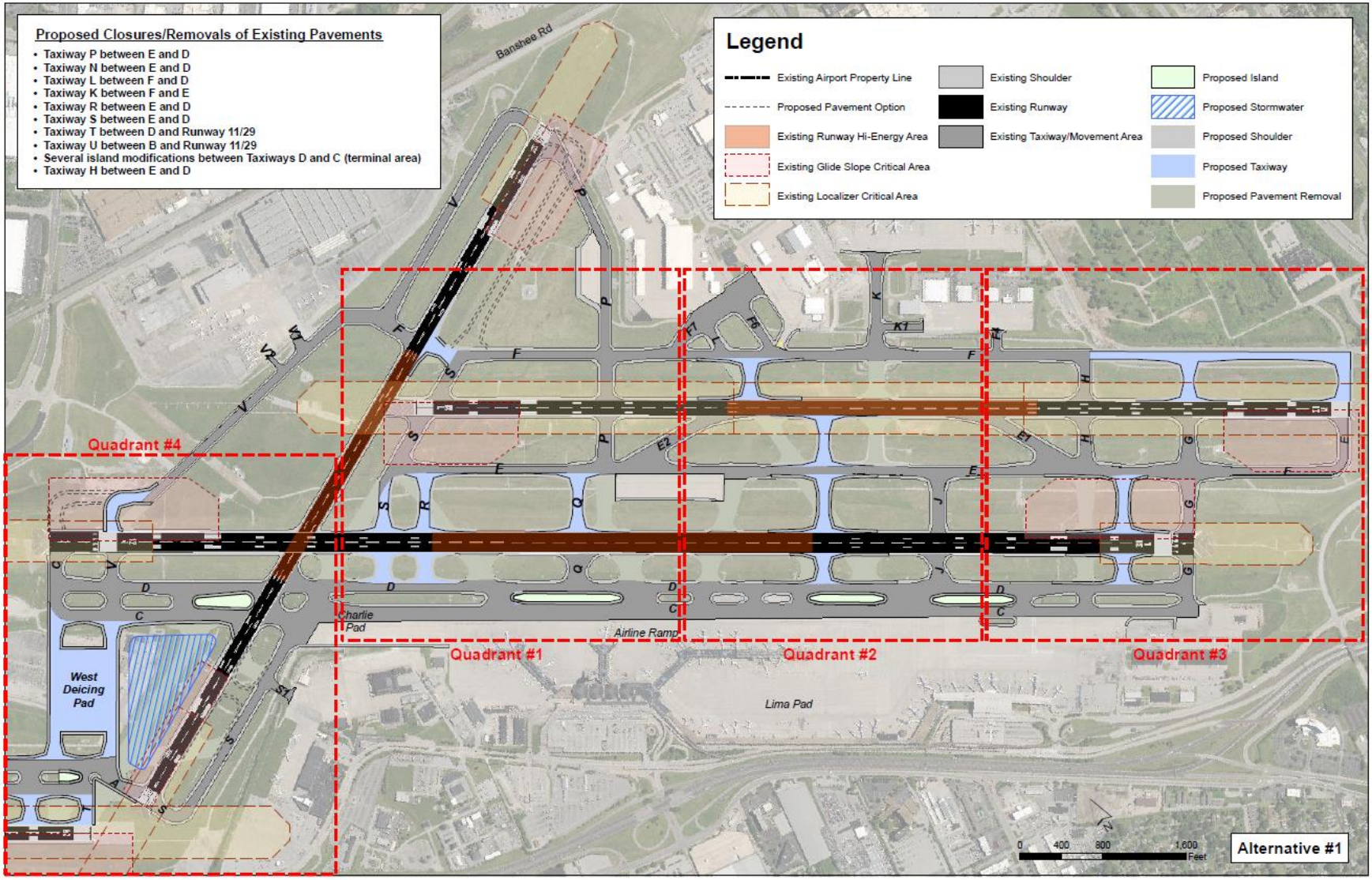
Analysis by Quadrant

To facilitate the development of the preferred airfield alternative, the airfield was divided into four quadrants, to allow for detailed discussions focused on each quadrant. The proposed quadrants for the two composite airfield layout alternatives are depicted on **Figures 5.2-5** and **5.2-6.**

Each quadrant was discussed and evaluated separately. A clear decision was made for only one quadrant; the other three quadrants required consolidation of both alternatives to address the issues. The decisions taken for each quadrant are summarized below. Bolded statements indicate the alternative that was chosen and if there are any specific caveats or additional study needs.

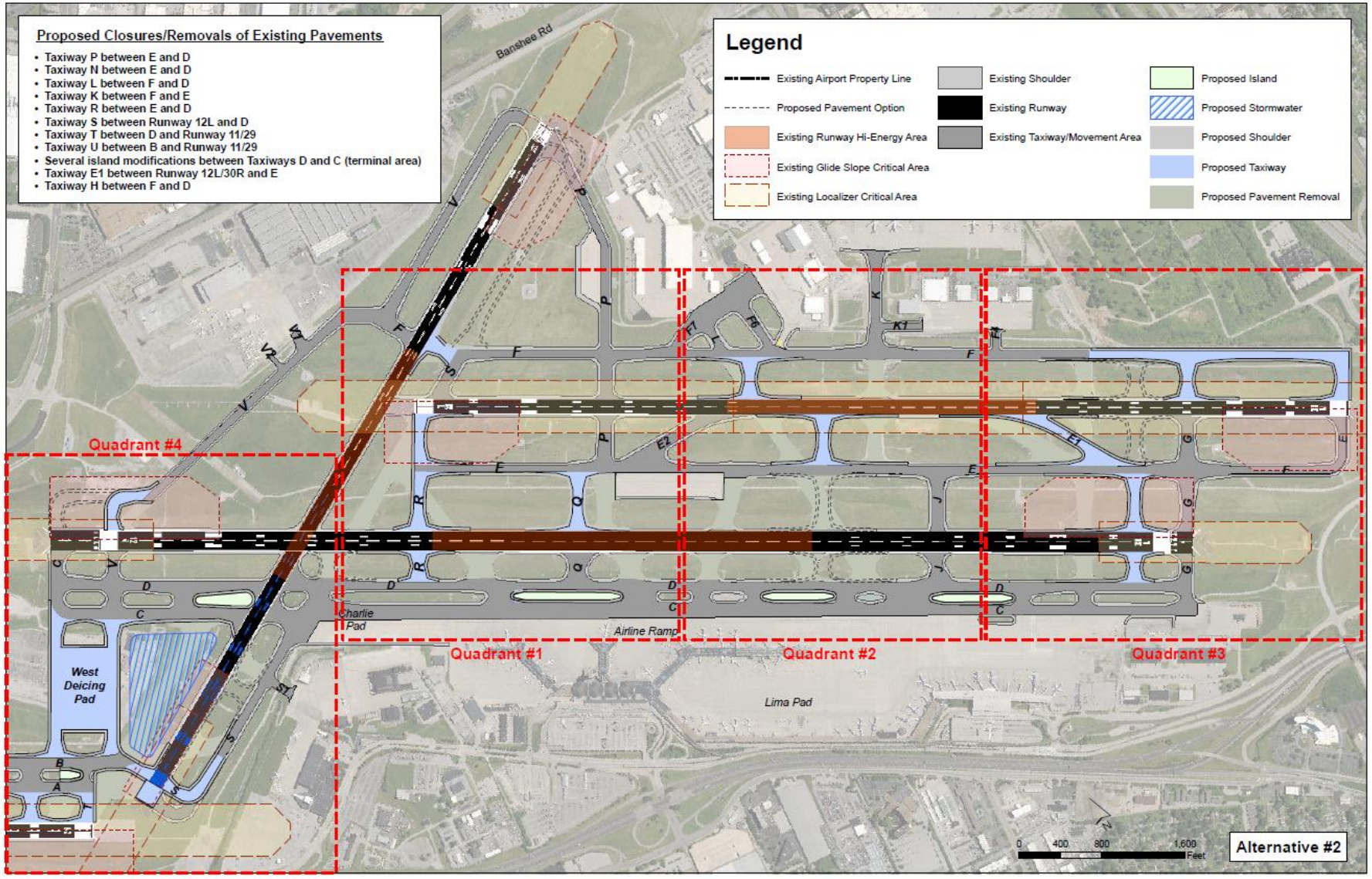
- Quadrant 1 (**Figure 5.2-7**)
  - Square up Taxiway F crossing at Runway 6-24.
  - It was confirmed that there is a 500-foot centerline-to-centerline separation for Taxiways S and R (Composite Airfield Layout Alternative 1).
  - Taxiway Q crossing in the high-energy zone of Runway 12R-30L is a nonconforming, but acceptable and subordinate to achieving operational efficiency when landing on Runway 30R (Note: both composite airfield layout alternatives have the same condition at Taxiway Q).
  - Redundant taxiway crossings are more desirable. Two crossings at Taxiways S and R are preferred over just one crossing at Taxiway R. By having redundant taxiway crossings and access to Runway 12L, multiple crossings can occur simultaneously when departing Runway 12L, or additional crossing points for aircraft taxiing to the terminal core after arrival on Runway 12L-30R, for example.
  - **Composite Airfield Layout Alternative 1 was selected.**

Figure 5.2-5: Composite Airfield Layout Alternative 1 - Quadrants



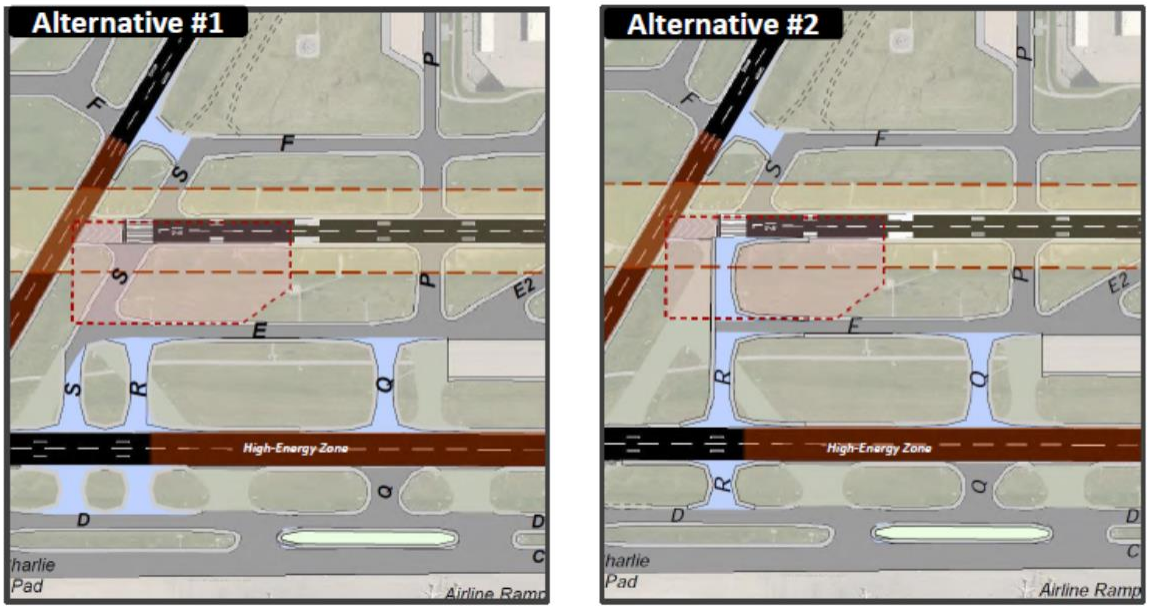
Source: CMT, 2021.

Figure 5.2-6: Composite Airfield Layout Alternative 2 - Quadrants



Source: CMT, 2021.

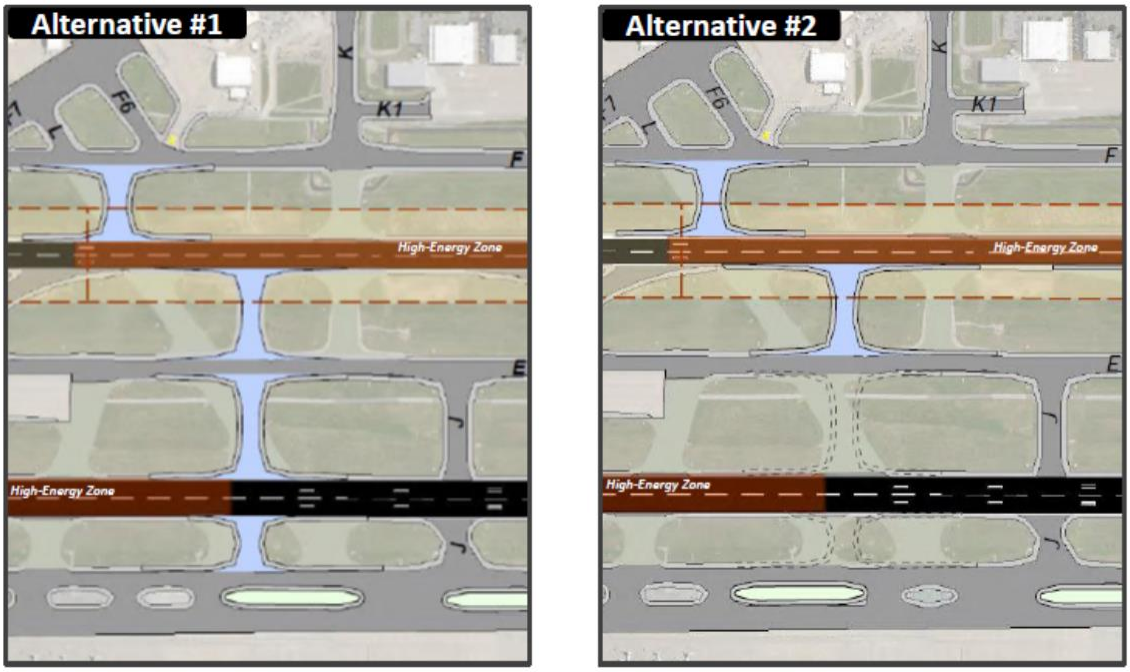
Figure 5.2-7: Quadrant 1 Analysis



Source: CMT, 2021.

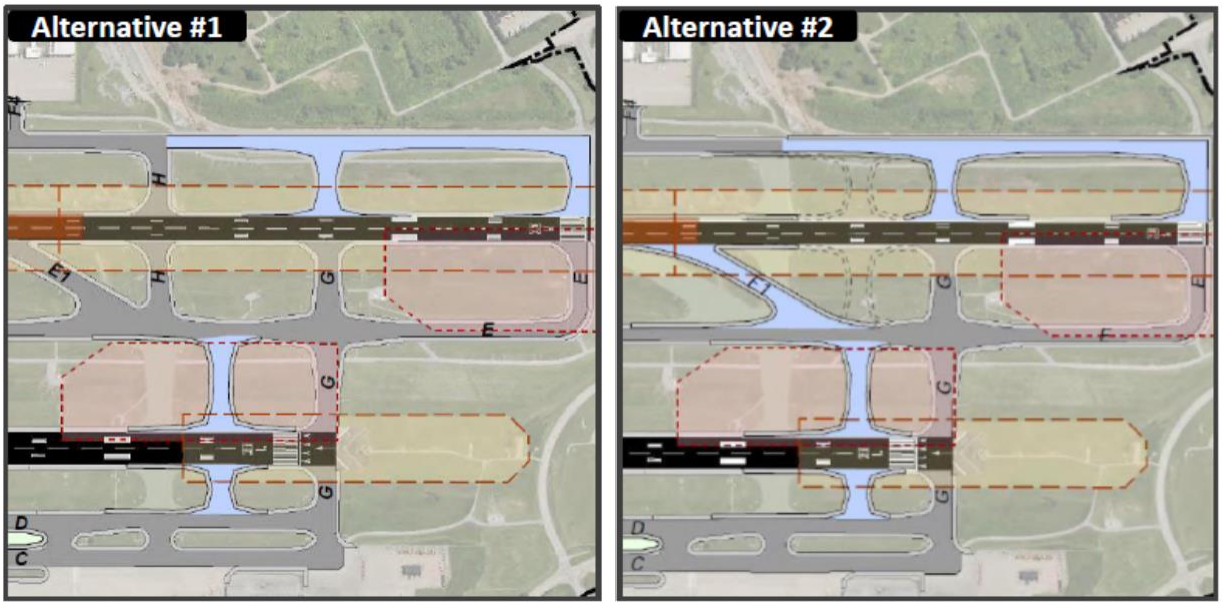
- Quadrant 2 (**Figure 5.2-8**)
  - Add a turnoff east of Taxiway K, around the Taxiway F4 area (ATCT request). Note, subsequent discussions identified the preferred location of the additional taxiway connector noted in the Comparative Safety Assessment (CSA) process associated with long-term solution associated with Taxiway L and Runway 12L-30R.
  - **Composite Airfield Layout Alternative 1 was selected if Taxiway L southbound were adjusted (approximate location of current Taxiway L southbound exit).**
- Quadrant 3 (**Figure 5.2-9**):
  - **Alternative 2 selected** if Taxiway E1 can be shifted.
  - Keep Taxiway H south of Taxiway E to cross Runway 12R-30L without restriction.
  - Taxiways C and D connections might need to move.
  - There is no need for Taxiway H northbound shown in Composite Airfield Layout Alternative 2.
  - Rework island at intersection of the airline/commercial ramp.

Figure 5.2-8: Quadrant 2 Analysis



Source: CMT, 2021.

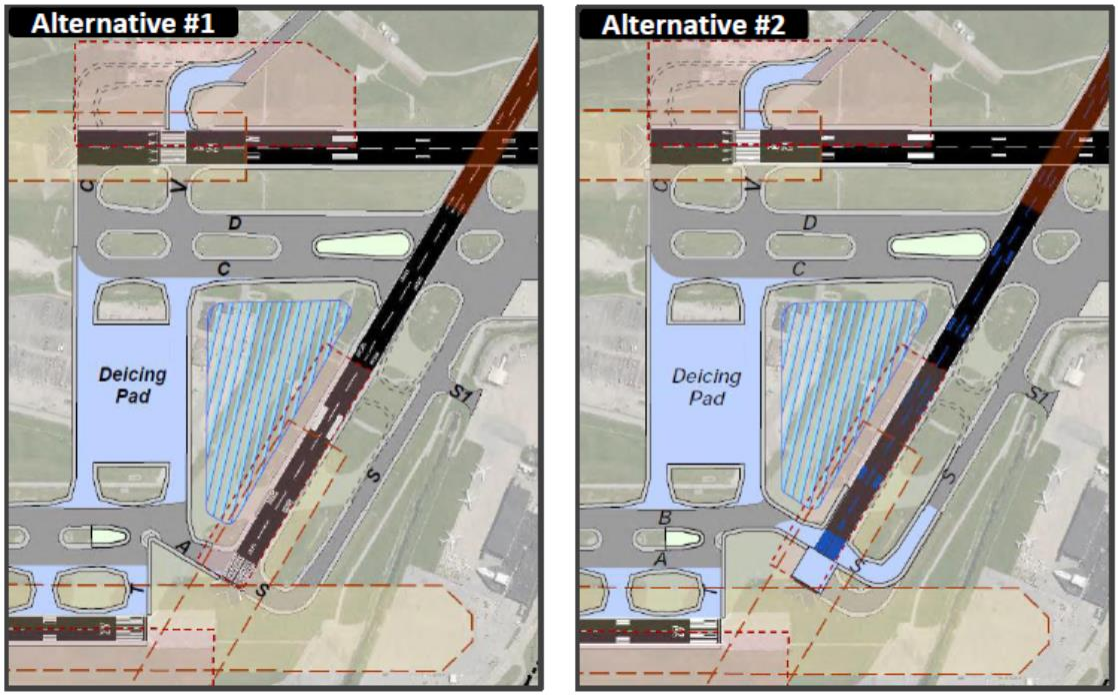
Figure 5.2-9: Quadrant 3 Analysis



Source: CMT, 2021.

- Quadrant 4 (**Figure 5.2-10**):
  - Approach departure surfaces are addressed in Composite Airfield Layout Alternative 2. There is currently a Modification to Standards (MOS) for Taxiway S.
  - Runway 6 has an "End-Fire" glideslope antenna that needs special consideration. However, it is used infrequently.
  - Composite Airfield Layout Alternative 2 requires a shortening of Runway 6 to mitigate approach surfaces and safety areas penetrations. The question/need is to further study the approach surfaces and see if there are new impacts to the Runway 11-29 complex.
  - **Alternative 2 is preferred, but a dual path to Runway 29 must be provided that is free of operational restrictions (Runway 29 approach protection – aircraft ground movement is restricted through the Runway 29 approach corridor when landing Runway 29). More study is required as removal of Taxiway B creates an operational restriction.**
  - The proposed deicing pad will result in movement areas immediately adjacent to non-movement areas. This can be addressed with a Memorandum of Understanding (MOU) with ATCT, or through subsequent design efforts to further refine and/or address the movement area vs. non-movement area strategy. Requires further study.
  - Confirm the overall need to shorten Runway 6-24 to eliminate the existing Taxiway S MOS and address Runway 29 approach restrictions (aircraft traversing the Runway 29 approach corridor). Subsequent discussion by STLAA leadership identified the decision to retain Runway 6-24 in its current configuration (no shortening of Runway 6). Additional coordination with FAA will be conducted regarding the Taxiway S MOS when appropriate.

Figure 5.2-10: Quadrant 4 Analysis



Source: CMT

AIRCRAFT DEICING PAD ALTERNATIVES

As identified in Chapter 4, dedicated East and West Deicing Pads are required at STL in the long term. To accommodate peak hour operations, deicing pads should provide 14 aircraft deicing positions.

West Deicing Pad

The following subsections discuss deicing considerations and the selected deicing pad alternatives. A detailed analysis was conducted to determine the most efficient location, geometry, configuration, and size of a new deicing pad.

Pad Site Alternatives

A previously-identified site for a centralized deicing pad was retained as the site of the proposed West Deicing Pad. This site would require the relocation of the Airfield Maintenance Complex.

Considerations

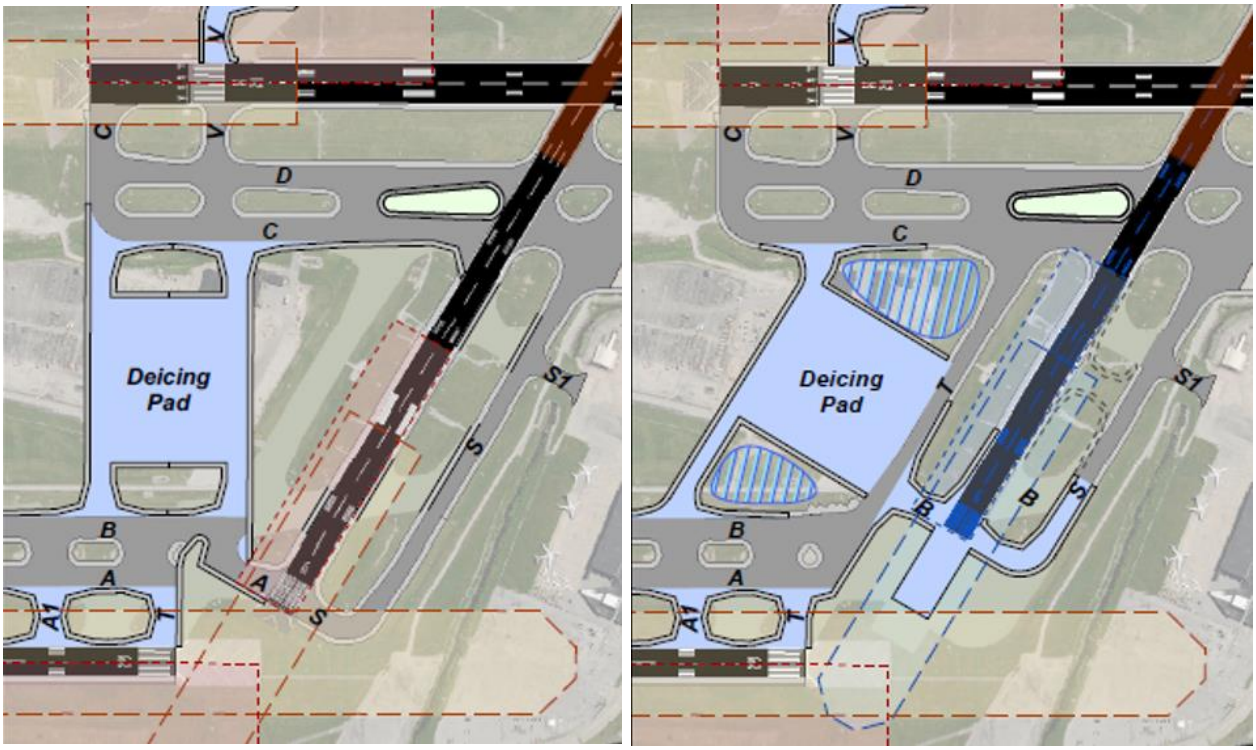
- The West Deicing Pad would be used in the Northwest Flow (predominant flow) to accommodate Runway 29 departures, along with the East Deicing Pad for Runways 30L/R departures. In Southeast Flow (in effect about a third of the time or less), the West Deicing Pad would accommodate all deicing operations.
- Plan 10 to 14 positions to accommodate peak window during southeast flow (Runway 12R departures)
- Deicing lanes were established using ADG III criteria
- ADG IV lane identified to accommodate widebody aircraft (temporary impact to 1 ADG III lane)
- Deicing lanes will be stacked to accommodate number of deicing positions (first-in/first-out)
- Several deicing lanes provided to allow for operational flexibility
- Ability to consider dedicated deicing infrastructure (lighting, electronic message board, etc.)
- New infrastructure required (deicing fluid collection system)

Pad Orientation

The Airfield Layout Alternatives and Composite Airfield Layout Alternatives depict two West Deicing Pad orientation alternatives, one parallel to Taxiway T, one perpendicular to Taxiways C and B, as shown on **Figure 5.2-11**. These layouts were the result of discussions with STLAA and the FAA.

The deicing pad orientation that is parallel to Taxiway T was selected as the preferred orientation, because it results in less confusing taxiway geometry in the area Taxiway T meets Taxiways B and C.

Figure 5.2-11: Deicing Pad Orientation Alternatives



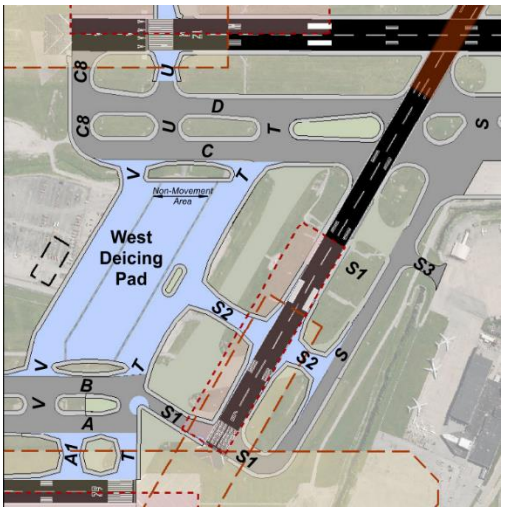
Source: CMT, 2021.

Configuration

Figure 5.2-12 depicts three configurations for the west deicing pad along Taxiway T. Alternative 1 proposes the west deicing pad to be parallel to Taxiway T, with the closure of Taxiway T, while Alternative 2 proposes Taxiway T to remain open until its pavement reaches the end of its useful life. Alternative 3 is adjacent to Taxiway T, with Taxiway T used as ingress/egress to the proposed deicing pad.

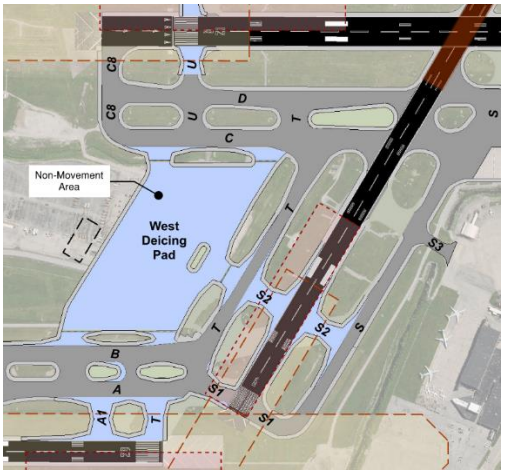
Figure 5.2-12: West Deicing Pad Configuration Alternatives

Alternative 1



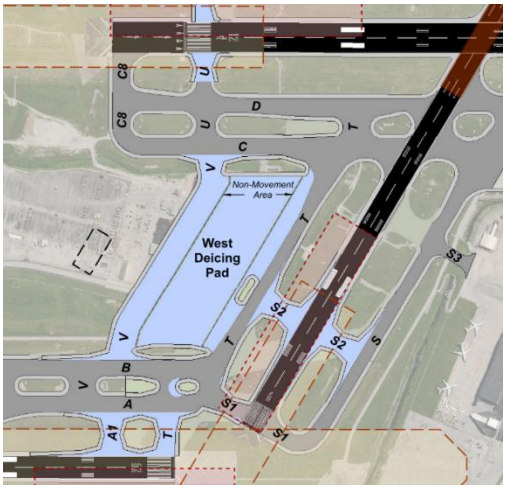
- Remove existing Taxiway T between Taxiways B and C
- Integration of stormwater basins
- Full compliance with design standards

Alternative 2



- Keep existing Taxiway T until pavement condition facilitates removal
- Separate deicing pad ingress
- Interim enhancements to design standards

Alternative 3

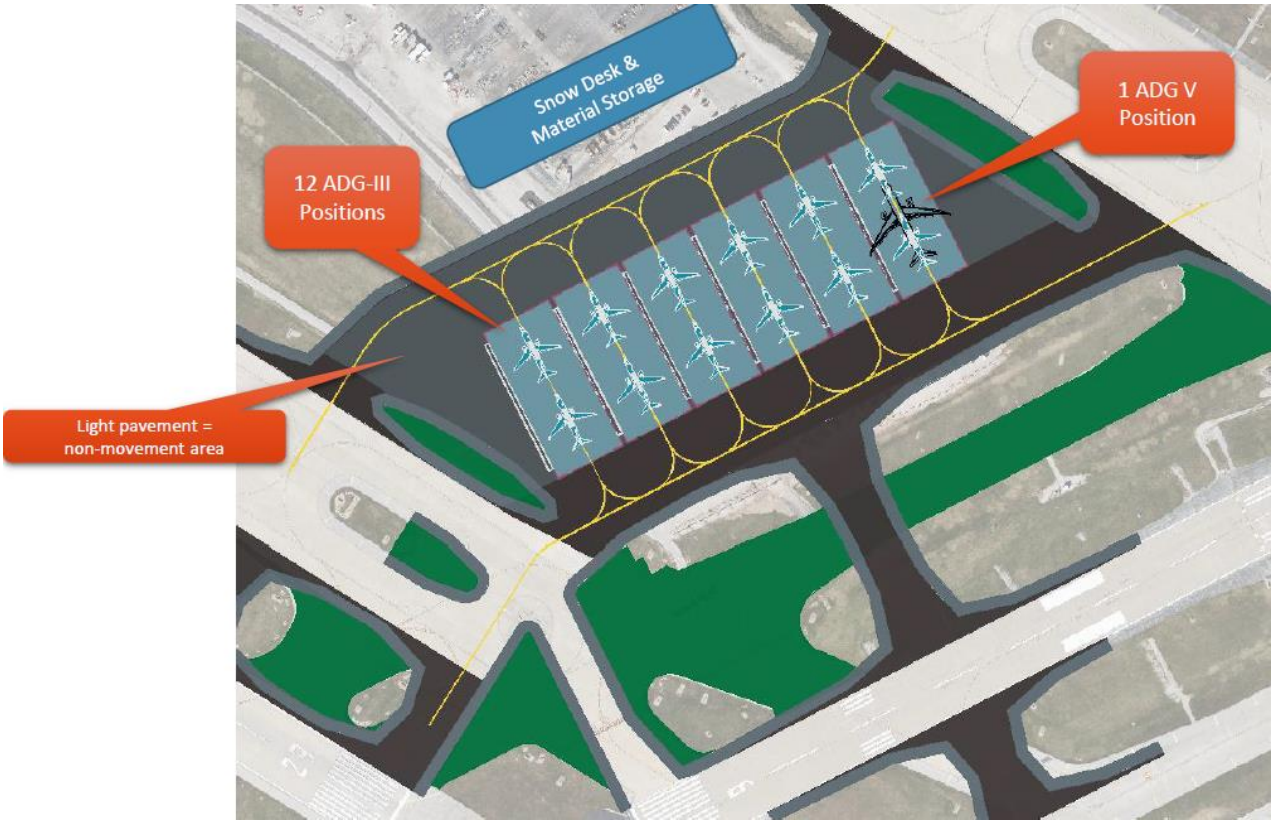


- Utilize existing Taxiway T as deicing pad ingress
- Sets long-term location of deicing pad
- Does not allow long-term compliance with design standards

Source: CMT, 2022.

Following coordination with the FAA, Alternative 2 was selected as the preferred deicing pad configuration. Alternative 2 provides interim improvements to taxiway geometry standards, while providing long-term flexibility. Upon Taxiway T reaching the end of its useful life, Taxiway T will be closed, and the taxilanes/taxiways adjacent to the proposed west deicing pad will replace Taxiway T in providing crossfield aircraft movements. The layout shown in Alternative 1 will be implemented upon closure of Taxiway T (shortening of eastern end of Taxiways A and B, lengthening of Taxiway S1). **Figure 5.2-13** shows a detailed view of the ultimate West Deicing Pad layout proposed in Alternative 1.

Figure 5.2-13: Ultimate West Deicing Pad Layout



Source: CMT, 2021.

East Deicing Pad

Figure 5.2-14 summarizes the East Deicing Pad considerations. In Northwest Flow (predominant flow during winter conditions), the East Deicing Pad would accommodate Runways 30L/R departures, while the West Deicing Pad would accommodate Runway 29 departures.

Figure 5.2-15 depicts the proposed East Deicing Pad detailed layout.

Both the proposed West and East Deicing Pads were carried forward to the preferred airfield alternative.

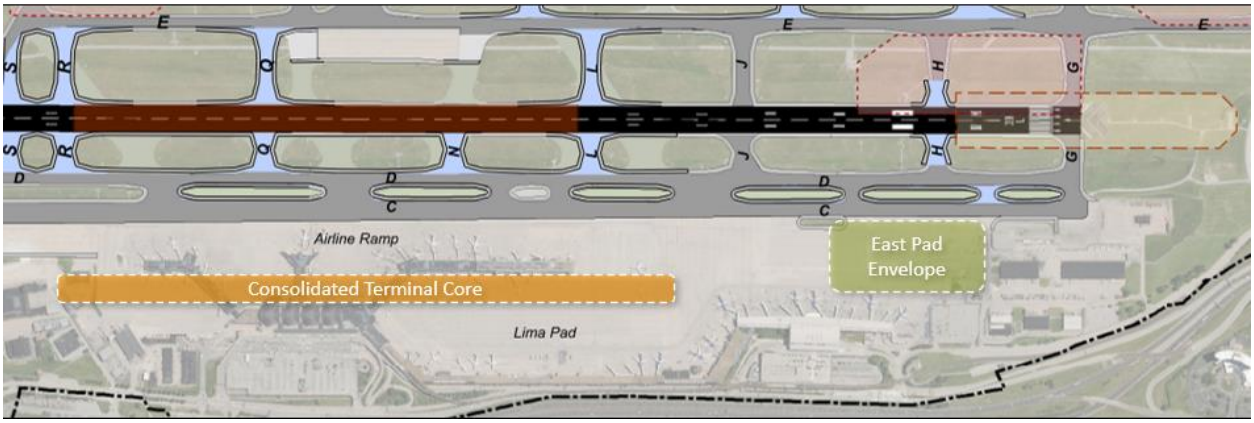
PREFERRED AIRFIELD LAYOUT ALTERNATIVE

Based on the analysis and decisions presented so far, an initial consolidated preferred airfield alternative was prepared to review for completeness, and is depicted in **Figure 5.2-16**.

Figure 5.2-14: East Deicing Pad Considerations

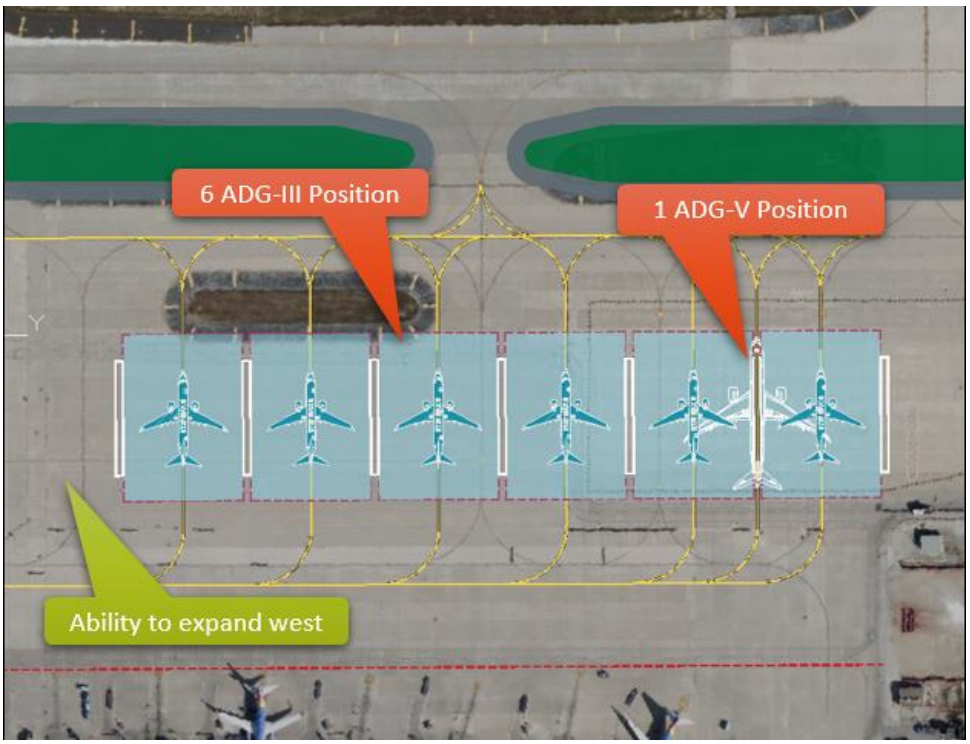
East Deice Pad Concept

- 6 to 8 deice lanes established using ADG III criteria
  - ADG IV lane identified to accommodate widebody aircraft (temporary impact to 2 ADG III lanes)
  - Ability to consider dedicated deice infrastructure (lighting, electronic message boards, etc.)
- Future consolidated terminal expansion
- Single aircraft deice lanes for operational flexibility
- No consideration for Cargo/GA users (planned improvements & long-term objectives for those land uses)



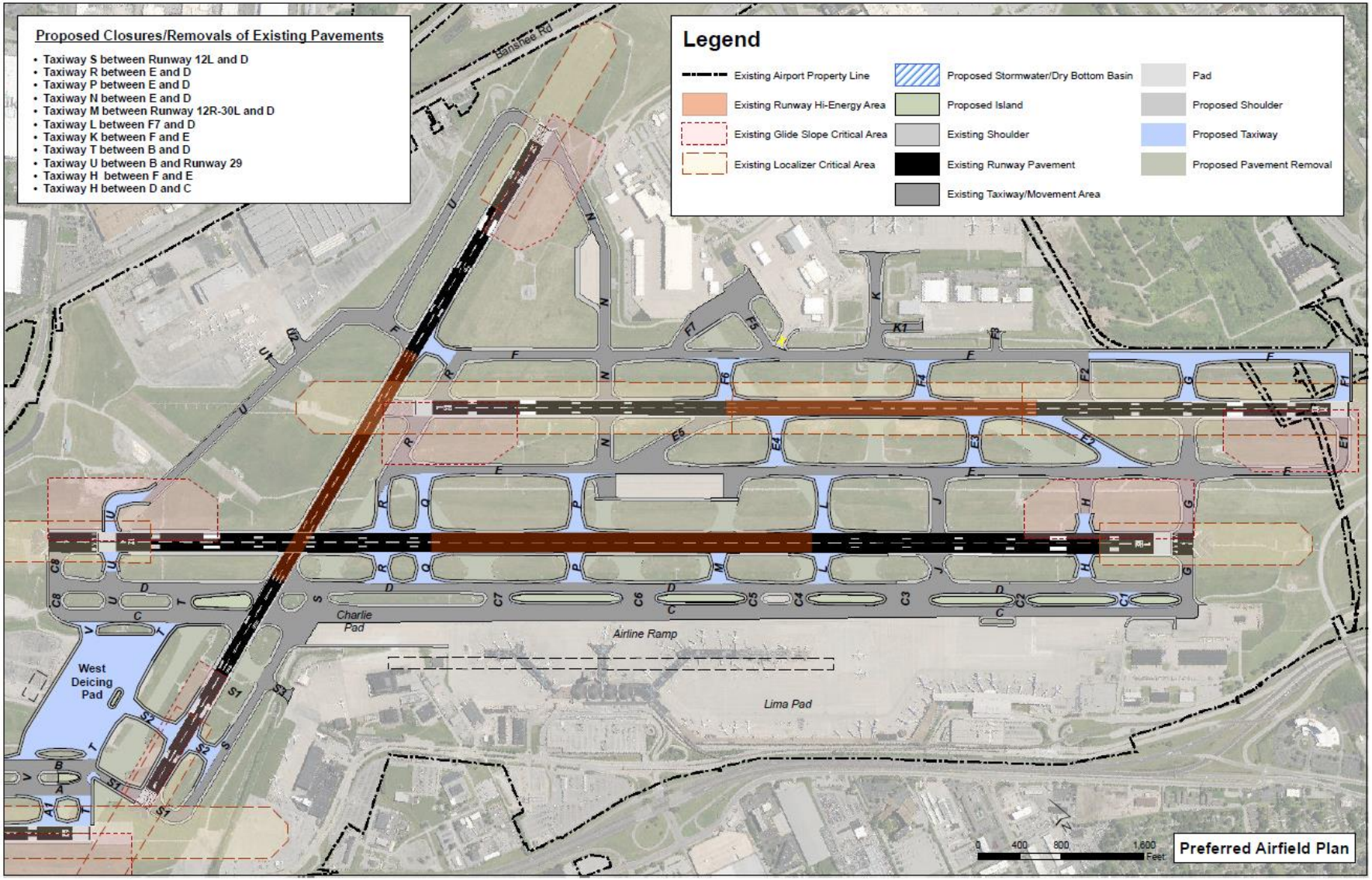
Source: CMT

Figure 5.2-15: Proposed East Deicing Pad Layout



Source: CMT, 2021.

Figure 5.2-16: Initial Consolidated Airfield Layout Alternative



Source: CMT, 2021.

Initial Consolidated Airfield Layout Alternative Review

The initial consolidated airfield alternative presented one suboptimal issue for consideration in the final ALP review: the need for a runway crossing in the high-energy zone of Runway 12R-30L (Taxiway Q between Taxiway E and Taxiway D).

The initial consolidated airfield alternative brings the airfield up to design standards, eliminates Hotspot #1, protects for long-term flexibility to accommodate future aircraft operations, and addresses the need for consolidated remote deicing facilities as part of the Airport's long-term vision. Ultimately, the initial consolidated airfield alternative was a consolidation of several elements from the individual preferred alternatives. Achieving consensus was an important component of the effort.

To finalize the preferred airfield plan, a focused effort was made to hold a meeting with the airline/users to ensure adequate opportunity was supplied for their input. More information regarding that stakeholder engagement is presented in the next section.

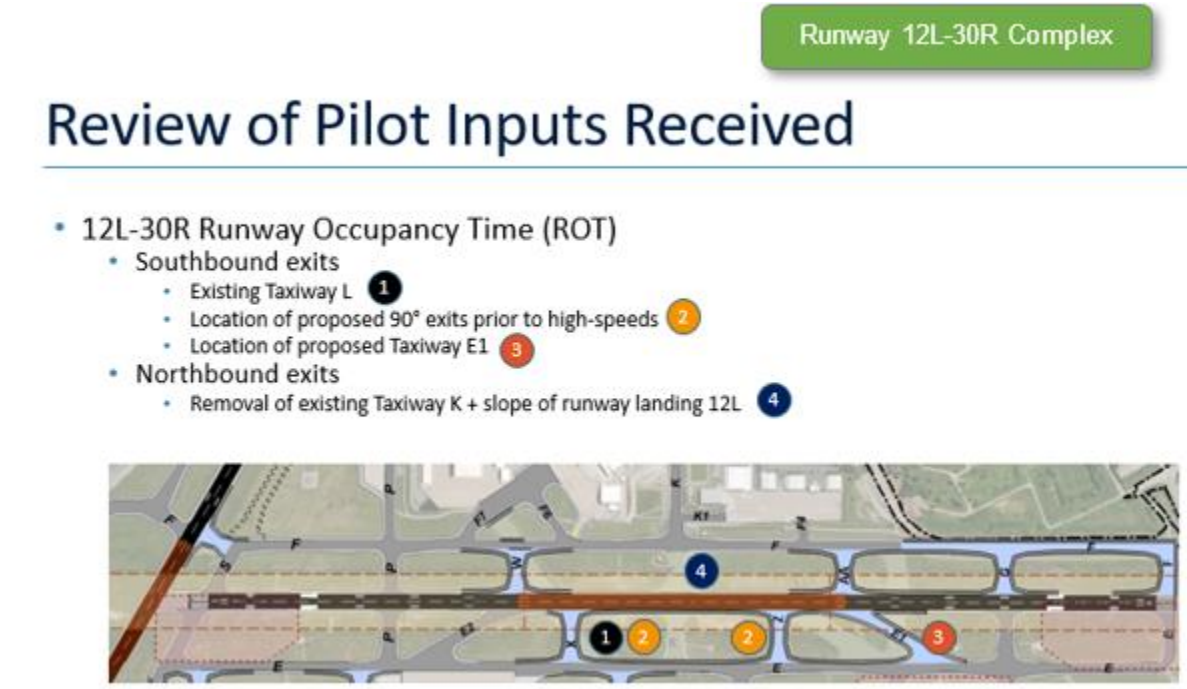
Airline/Users Workshop

While the Planning Team (airport, FAA, and consultants), tenants, and operators attending the meetings agreed with the initial consolidated airfield alternative, additional briefings occurred between the Planning Team and Airport stakeholders. Specifically, the Airline/User Engagement, comprised mainly of the pilot community, was held on September 3, 2021. This meeting provided an opportunity to present the airfield alternatives process (high-level), key outcomes of the Comparative Safety Assessment process, and to review the initial consolidated airfield alternative.

During the Airline/User Engagement, several key observations were noted by the pilots (**Figures 5.2-17** and **5.2-18**) and discussed in detail:

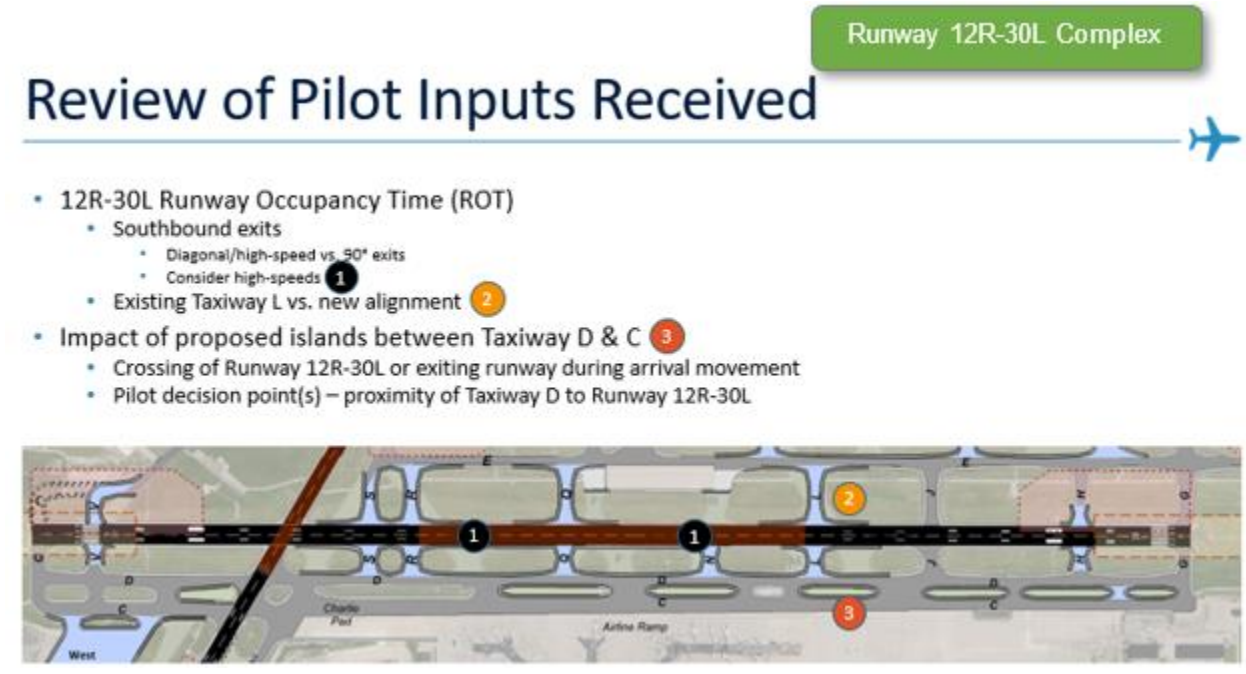
- ROT is critical, specifically the need to keep ROTs under an average of 50 seconds, which allows intrail separation to decrease from 3 miles to 2.5 miles
- Preference for diagonal/high-speed exits compared to 90° exits
- Minimize risk of go-arounds, which are disruptive events in the National Airspace System
- Concern with exiting or crossing Runway 12R-30L with new grass islands between Taxiways D and C
  - Impact of new islands relative to stopping short of the Taxiway D intersection and creating a go-around event for the next arriving aircraft (taxiing aircraft tail in the safety area for Runway 12R-30L).
  - Impact to ROT with introduction of 90° exits and new islands.
- Taxi time impacts ("every second counts")

Figure 5.2-17: Pilots Inputs Received on Runway 12L-30R Complex



Source: CMT, 2021.

Figure 5.2-18: Pilots Inputs Received on Runway 12R-30L Complex



Source: CMT, 2021.

Refinement of Initial Consolidated Airfield Layout Alternative

Following the Airline/User Engagement, additional REDIM analysis was conducted to assess the location of Runway 12L-30R northbound exits (a primary arrival runway), and the optimal location of Runway 12L-30R southbound exits (including high-speed exits). Based on this additional analysis, a change to Runway

12L-30R northbound exits was recommended (shift one exit closer to existing Taxiway K and retain existing Taxiway H between Taxiway F and Runway 12L-30R). No change to the proposed Runway 12L-30R southbound exits was recommended, validating the proposed exits are in the optimal location.

Additional analysis was conducted to understand the impacts associated with the introduction of high-speed exits southbound from Runway 12R-30L (serves as the primary departure runway). The introduction of high-speed exits created several challenges relative to proposed taxiway improvements and had minimal benefit to ROTs of Runway 12R-30L arrivals.

With regards to the introduction of new islands between Taxiway D and Taxiway C (to eliminate direct access from the apron areas), additional discussions were held with FAA ATCT to understand what operational procedures could be considered to alleviate the airline/user concerns. The islands will be implemented in full compliance with FAA design standards (markings, lighting, shoulders, etc.) to make the new islands stand out. Also, specific taxi instructions will be provided when existing or crossing Runway 12R-30L to minimize the potential for pilot confusion.

Preferred Airfield Layout

Recognizing the importance of the input received by the airline/user group, the Planning Team conducted additional analysis to validate previous planning decisions and to assess concerns/recommendations offered by the airline/user group. To finalize the airfield planning decisions, an additional meeting was held with the Planning Team in October 2021.

It is important to note that during the development of the airfield alternatives, members of the Planning Team were working through terminal needs and development concepts. Throughout the planning process, an understanding of the terminal direction was in place within the Planning Team to make sure the preferred airfield development plan would be compatible with the preferred terminal alternative. The Planning Team understood that both the airfield and terminal represent significant infrastructure investments for the Airport and FAA throughout the planning period. The preferred airfield alternative presented in this section includes the preferred terminal alternative (new terminal concourse in the general location of Terminal 1 and decommissioning of Terminal 2).

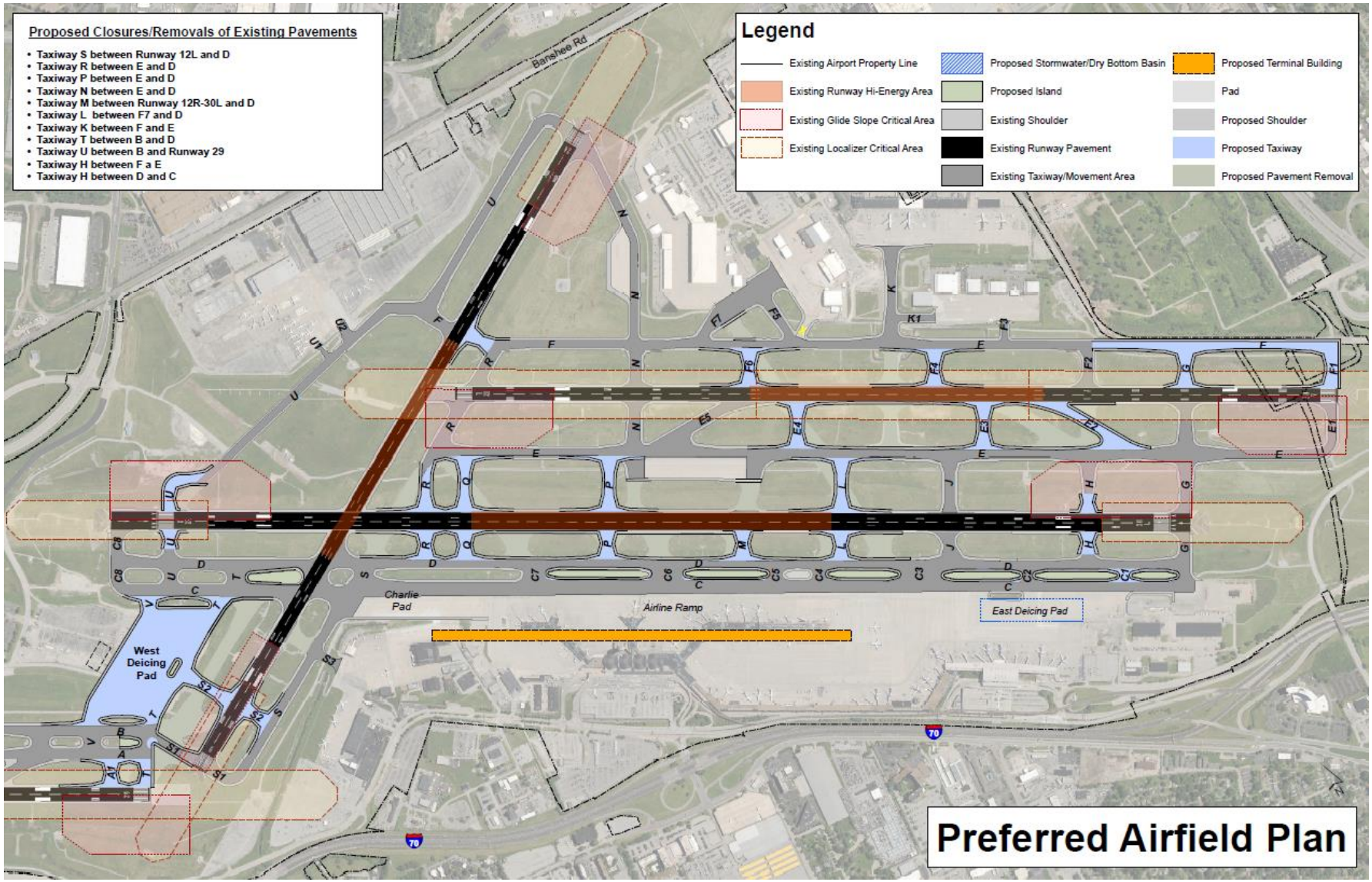
Overall, consensus was reached that the preferred airfield alternative allows the overall ALP study effort to move forward in such a way that it brings the airfield up to standards and protects for growth throughout the planning period (next 20 years). The improvements proposed in the preferred airfield alternative will be completed as targets of opportunities (e.g., when pavement fails and needs reconstruction).

In the end, consensus for the preferred airfield alternative was reached through seven core meetings held with a wide range of stakeholders who have a vested interest in the STL airfield. Several other discussions occurred throughout the development of the preferred airfield alternative, as noted throughout the CSA documentation. **Figure 5.2-19** depicts the preferred airfield alternative, with the final taxiway naming convention.

It is important to note the Planning Team also held discussions regarding the mitigation of direct access taxiways from the future West Deicing Pad to Runways 6 and 29 via Taxiways S2, T, and V, respectively, which are mitigated with islands and staggered offset connectors, as shown in Figure 5.2-19.

The preferred terminal location identified elsewhere in this chapter is depicted for reference, to illustrate that it provides continuity with the preferred airfield plan.

Figure 5.2-19: Preferred Airfield Layout



Source: CMT, 2021.

AIRFIELD SAFETY AREAS

RUNWAY SAFETY AREAS AND OBJECT FREE AREAS

Table 4.1-23 summarizes the objects inside the various safety areas for each runway at STL. Per FAA AC 150/5300-13B, RSAs should be free of objects excluding those objects that have to be in the RSA because of their functions (i.e., fixed-by-function), such as navigational aid equipment.

However, the Airport needs to make sure that all elements that are in the RSA are frangible. According to FAA's AC-13B, a frangible object retains its structural integrity and stiffness up to a designated maximum load, but on impact from a greater load, breaks, distorts, or yields in such a manner as to present the minimum hazard to aircraft. Equipment located within an RSA also needs to be mounted on frangible couplings.

The service roads located inside the RSA and ROFA provide access to the different NAVAIDS equipment and are required, as they ensure proper operation of the equipment. Responsibility for the road (i.e., construction, maintenance, etc.) is generally a function of who owns and operates the equipment or facility.

Mitigation actions are proposed for each penetration in the following sections.

Runway 11-29 Mitigation Actions

RSA PENETRATIONS

- ALS System (Runway 11 and Runway 29): No mitigation required – Equipment is considered fixed-by-function and therefore is essential for the benefit of aviation operations and is frangible.
- ALS Service Road (Runway 11 and Runway 29): No mitigation required – ALS service road is necessary to provide access to the ALS equipment and is required to ensure proper operation of the equipment and is frangible.
- PAPI Lights (Runway 11 and Runway 29): No mitigation required – Equipment is considered fixed-by-function and therefore is essential for the benefit of aviation operations and is frangible.

ROFA PENETRATIONS

- PAPI Lights Service Road (Runway 11): No mitigation required – PAPI lights service road is necessary to provide access to the lighting equipment and is required to ensure proper operation of the equipment and is frangible.
- Windsock (Runway 11 and Runway 29): Windsock is required to be located inside the OFA and is mounted on a frangible structure.
- Glide Slope (Runway 11 and Runway 29): No mitigation required – Equipment is considered fixed-by-function and therefore is essential for the benefit of aviation operations, and is frangible.

Runway 12L-30R Mitigation Actions

RSA PENETRATIONS

- ALS System (Runway 12L and Runway 30R): No mitigation required – Equipment is considered fixed-by-function and therefore is essential for the benefit of aviation operations, and is frangible.

- ALS Service Road (Runway 12L and Runway 30R): No mitigation required – ALS service road is necessary to provide access to the ALS equipment and is required to ensure proper operation of the equipment, and is frangible.
- Runway End Identifier Light (REIL) (Runway 12L): No mitigation required – Equipment is considered fixed-by-function and therefore is essential for the benefit of aviation operations, and is frangible.
- PAPI Lights (Runway 12L and Runway 30R): No mitigation required – Equipment is considered fixed-by-function and therefore is essential for the benefit of aviation operations, and is frangible.
- Windsock (Runway 30R): Windsock may not be installed within the RSA. Relocation is recommended outside the RSA utilizing a frangible structure.

ROFA PENETRATIONS

- PAPI Lights Service Road (Runway 12L and Runway 30R): No mitigation required – PAPI lights service road is necessary to provide access to the lighting equipment and is required to ensure proper operation of the equipment, and is frangible
- Windsock (Runway 12L): Windsock can only be located inside the OFA if it is mounted on a frangible structure.
- Glide Slope (Runway 12L and Runway 30R): No mitigation required – Equipment is considered fixed-by-function and therefore is essential for the benefit of aviation operations.

Runway 12R-30L Mitigation Actions

RSA PENETRATIONS

- ALS System (Runway 12R and Runway 30L): No mitigation required – Equipment is considered fixed-by-function and therefore is essential for the benefit of aviation operations.
- ALS Service Road (Runway 12R and Runway 30L): No mitigation required – ALS service road is necessary to provide access to the ALS equipment and is required to ensure proper operation of the equipment.
- PAPI Lights (Runway 12R and Runway 30L): No mitigation required – Equipment is considered fixed-by-function and therefore is essential for the benefit of aviation operations.
- Airport Service Road (Runway 12R): A displaced threshold and declared distances are currently used to mitigate the RSA penetration.

ROFA PENETRATIONS

- PAPI Lights Service Road (Runway 12R and Runway 30L): No mitigation required – PAPI lights service road is necessary to provide access to the lighting equipment and is required to ensure proper operation of the equipment.
- Windsock (Runway 12R): Windsock can only be located inside the OFA if it is mounted on a frangible structure.
- Glide Slope (Runway 12R and Runway 30L): No mitigation required – Equipment is considered fixed-by-function and therefore is essential for the benefit of aviation operations.

- Banshee Road (Runway 12R): If relocation is not possible, a MOS applicable to the portion of Banshee Rd. inside the OFA is an alternative to allow the road to be kept inside the OFA.

Runway 6-24 Mitigation Actions

RSA PENETRATIONS

- ALS System (MALSR) (Runway 6 and Runway 24): No mitigation required – Equipment is considered fixed-by-function and therefore is essential for the benefit of aviation operations.
- ALS Service Road (Runway 6 and Runway 24): No mitigation required – ALS service road is necessary to provide access to the ALS equipment and is required to ensure proper operation of the equipment.
- Banshee Road, airport perimeter fence, and perimeter service road (Runway 24): Declared distances are currently used to mitigate the RSA penetrations.
- PAPI Lights (Runway 6 and Runway 24): No mitigation required – Equipment is considered fixed-by-function and therefore is essential for the benefit of aviation operations.
- Windsock (Runway 6 and Runway 24): Windsock cannot be installed within the RSA. Relocation is recommended outside the RSA utilizing a frangible structure.

ROFA PENETRATIONS

- PAPI Lights Service Road (Runway 6 and Runway 24): No mitigation required – PAPI lights service road is necessary to provide access to the lighting equipment and is required to ensure proper operation of the equipment.
- Glide Slope (Runway 6 and Runway 24): No mitigation required – Equipment is considered fixed-by-function and therefore is essential for the benefit of aviation operations.
- Airport Service Road (Runway 24)
  - Eliminate – If possible, eliminate the portion of the airport service road that penetrates the north corner of Runway 24 OFA.
  - MOS – If elimination is not possible, a MOS applicable to this airport service road is an alternative to allow the road to be kept inside the OFA.
- Banshee Road (Runway 24): If relocation is not possible, a MOS applicable to the portion of Banshee Rd. inside the OFA is an alternative to allow the road to be kept inside the OFA.
- Railroad (Runway 24): a MOS applicable to the portion of the railroad inside the OFA is an alternative to allow the railroad to be kept inside the OFA.
- Expanse of Pavement (east of Runway 24) that connects the Boeing development with Taxiway Papa: Eliminate – If possible, eliminate this portion of pavement that penetrates Runway 24 OFA.

RUNWAY PROTECTION ZONES

Incompatible land uses for Runway Protection Zones are summarized in Table 4.1-24. Proposed mitigations follow.

There are different kinds of incompatible land uses within the various RPZs at the Airport. The general categories for the incompatible land uses are the following:

- Traffic-related incompatible land uses:
  - Public Roads
  - Interstates
  - Parking Lots
  - Metrolink Tracks
- Incompatible buildings:
  - U.S. Navy Installation
  - American Airlines Maintenance Base
  - Community Credit Union
  - Hunter Engineering Campus

FAA recommends that airport owners have sufficient property ownership interest in the RPZs to protect them from both obstructions and incompatible land use. Sponsor may attain sufficient interest in the Runway Protection Zones in three primary ways:

- The first and the preferred method is for the airport to purchase the approach areas in fee. Ownership in fee is preferred because it provides maximum control for the airport.
- The second is through purchase of an easement (or a combination of easement and zoning).
- The third alternative is to rely upon adequate zoning which should be enacted even if fee or easement ownership is in place.

In addition, the airport owner must strive to attain compatible zoning around the airport in order to prevent incompatible land uses that:

- Could cause sufficient conflict that endangers the airport
- Cause it to be closed, or
- Require substantial remedial investment to purchase conflicting developed property.

As previously discussed, many of the incompatible RPZ land uses for the various runways at STL are traffic-related, such as public roads and parking lots. While it is desirable to clear all objects from the RPZ, some uses are permitted, provided they do not attract wildlife, are outside the Runway OFA, and do not interfere with navigational aids. Automobile parking facilities, although discouraged, may be permitted, provided the parking facilities, in addition to meeting all the preceding conditions, are located outside of the object free area extension.

Realignment of public roads and interstates with the objective of relocating them outside an RPZ is not a feasible option for STL or the FAA, due to the cost of such measures.

Other incompatible facilities inside the various RPZs include the American Airlines Facilities, the Community America Credit Union, and a portion of the Hunter Engineering Campus. Because people occupy and use these facilities, these land uses need to be removed over time.

5.2.4 OBSTACLE ACTION PLAN

Following the collection and analysis of obstacle information within proximity of STL, an Obstacle Action Plan (OAP) was developed that prioritizes mitigation of obstructions based on several factors. The OAP documents (**Appendix 5D**) the process utilized to collect obstacles, determine obstructions based on FAA airspace requirements, and prioritization of mitigation actions.

The analysis began with safety critical data collected through the Airport GIS (AGIS) process, which establishes a comprehensive picture of the obstacle environment in and around the airport property. The obstacle data is then assessed against a variety of airspace surfaces to determine if the obstacles are penetrating, thereby becoming obstructions for further evaluation. Each obstruction is analyzed to determine potential impact to existing or planned instrument approach and/or departure procedures to the applicable runway environment. Following the analysis process, each obstruction is then classified by priority of mitigation, which is based on level of impact to key flight procedure requirements (ex. Obstruction that impacts approach minimums will be categorized as Priority 1 in the mitigation schedule). The priority ranking allows STLAA to implement a systematic program to mitigate obstructions by working from the largest impact to the lowest impact on airfield operations.

5.2.5 RUNWAY DECLARED DISTANCES COORDINATION

As part of the overall Airport Layout Plan (ALP) drawing set preparation, an analysis of existing and/or proposed runway declared distances was conducted, as required by the FAA SOP 2.00 checklist. Declared distances can be utilized by an airport to address airfield design standards on an interim basis recognizing certain improvements on and around the airport could influence overall airfield infrastructure. An example could consist of a service road that supports airport operations but encroaches on the Runway Object Free Area (ROFA). To accommodate the standard ROFA dimensions, an adjustment of takeoff and/or landing lengths can be made via declared distances to mitigate the service road encroachment. Similarly, declared distances can be used to mitigate incompatible land uses or obstructions. Specific to STL, an analysis of existing declared distances was conducted and coordinated with STLAA and FAA stakeholders. Based on the analysis completed to date and in conjunction with coordination with flight procedures, the ALP deliverables will identify the application of existing declared distances published for STL. No additional adjustments to published declared distances will be needed at this time.

5.2.6 FUTURE TAXIWAY NOMENCLATURE

Recognizing the preferred airfield plan contains several taxiway adjustments (closures, realignments, and/or relocations), the planning process included multiple coordination activities associated with identifying the future taxiway nomenclature. FAA provides guidance regarding taxiway nomenclature standards and updates this guidance on a regular basis. To incorporate the latest guidance and proposed taxiway configuration, an initial taxiway naming convention was provided to STLAA and FAA stakeholders for initial review and consideration. Following initial review, multiple comments were received based on different perspectives and integrated into a revised taxiway naming concept for consideration. Subsequent engagements were held with stakeholders to resolve outstanding issues isolated to a few areas of the airfield. The final preferred airfield layout includes the recommended future taxiway nomenclature for use

within the Master Plan and ALP deliverables. It is recognized that the implementation of recommended taxiway names will occur at the appropriate time (pavement programmed for reconstruction) and may be different based on FAA criteria at the time of project implementation. The agreed-upon taxiway nomenclature is used in Figure 5.2-19.

5.3 TERMINAL

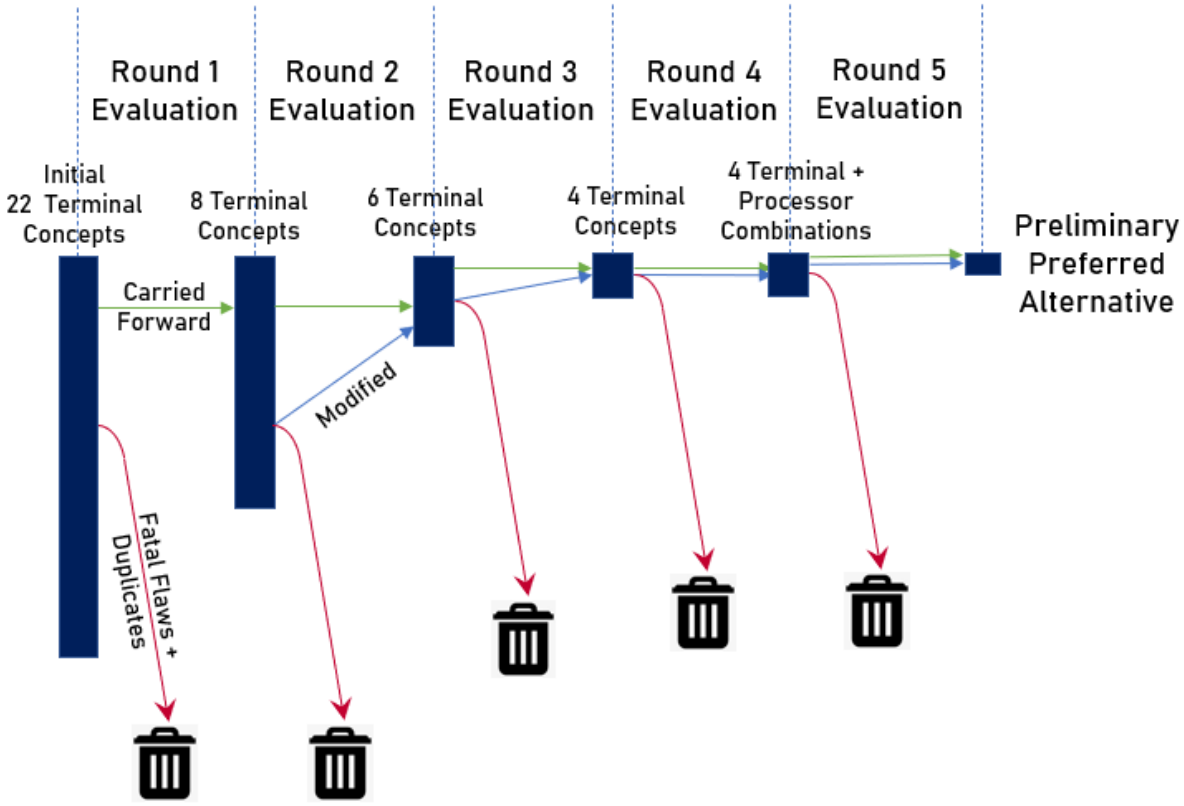
The focus of the terminal alternatives analysis was to identify long-term development options that meet the future terminal facilities needs for the 20-year planning horizon, as outlined in Chapter 4, *Facility Requirements*. The process for identifying and refining terminal alternatives focuses on, among other factors, maximizing efficiency and capacity, improving passenger experience, and maintaining balance between all major components of the Airport (airfield, terminal, landside).

The following section presents an overview of the terminal alternative process, the evaluation criteria used to refine the alternatives, as well as presenting short-listed terminal alternatives and their evaluation, leading to the preferred terminal alternative.

5.3.1 APPROACH AND METHODOLOGY

The terminal alternatives development process started with several sketch planning and visioning sessions with the planning team, followed by five technical evaluation rounds, each identifying and evaluating a list of concepts based on various evaluation criteria. The objective of this process was to identify a preferred terminal alternative that can accommodate the forecast demand, meet the facility requirements and provides flexibility in responding to changes in demand during and beyond the planning horizon. Each round captured a broad level of proposed concepts, then refined and evaluated these concepts. **Figure 5.3-1** summarizes the terminal alternatives and evaluation process.

Figure 5.3-1: Terminal Concepts Development and Evaluation Process



Source: WSP USA, 2021.

Six terminal and two processor concepts (the terminal processor is where ticketing, security screening and baggage claim functions are carried out) were shortlisted to move to **Round 3,** in addition to one new variant terminal concept. Additional considerations were made related to cost, walking distances, passenger convenience, consolidated vs. two-terminals and the Airport's image. At the end of Round 3, four terminal alternatives and two processor concepts were shortlisted and moved to Round 4.

Landside and terminal access were the determining factor of evaluation during **Round 4**. At the end Round 4, a total of two consolidated concepts and two two-terminal concepts remained. The preferred terminal alternative was then selected.

5.3.2 SUMMARY OF TERMINAL FACILITY REQUIREMENTS

The terminal alternatives were developed and screened to mitigate existing terminal issues and meet future planning needs. The following issues and requirements were identified for the passenger terminal through 2040.

CURRENT ISSUES

Several challenges and issues were identified at both terminal facilities during the early stages of this study. These issues were the drivers behind the development and evaluation of the terminal concepts. Terminal 1 is functionally obsolete, specifically:

- Four historic domes in the main processor area
- Facilities built in the 1950s (Domes and main structure) with adapted uses over time dating from the 1970s and 1980s (concourses)
- Two security checkpoints, at the eastern and western end limiting passenger circulation and concessions access
- Insufficient holdroom space
- Insufficient corridor widths
- Inadequate space to remedy shortfall of restroom space
- Inflexible gates, not able to accommodate the full fleet of aircraft at STL
- Significant unusable or abandoned space
- Remaining useful life of Terminal 1 Garage which is in need of replacement
- Unbalanced concessions' distribution pre- and post-security across concourses
- Terminal envelope constrained by Runway 12R-30L and I-70, as well as the MetroLink tracks south of Concourse D
- Aircraft parking on the north side of Terminal 1 push back onto Taxilane C, interfering with the flow of traffic.

Similarly, challenges and issues at Terminal 2 were identified in Chapter 4 – Demand/Capacity and Facility Requirements. Terminal 2 was built in the late 1990s, before 9/11 and the growth and increased connecting activity by Southwest Airlines. Today it is undersized and therefore congested. Specific shortfalls include:

- Inadequate security screening checkpoint capacity
- Inadequate ticket lobby circulation depth
- Undersized baggage make-up
- Undersized domestic and international baggage claim area
- No baggage recheck counters for connecting international passengers
- Undersized concession facilities
- Inadequate restroom facilities
- Single-loaded concourse
- Terminal site constrained by Runway 12R/30L and I-70

TERMINAL FACILITIES RECOMMENDATIONS SUMMARY

As the ALPU/MP facility requirements analysis was being completed, new strong COVID recovery occurred at STL, additional gates were being leased and new routes were announced. Therefore, it was decided with STLAA that the required number of gates in 2040 would be increased to 62 Narrow-Body Equivalent Gates (NBEG), to ensure the ALPU/MP would not under-plan. The number of gates that will ultimately be constructed will be refined and decided in the architectural design phase, based on airline negotiations, the number of common use gates, and other factors.

- Gates: 62 gates
- One consolidated terminal: 1,568,500 sq. ft.
- Two separate terminals:
  - Terminal 1:
    - Existing: 898,676 sq. ft.
    - 2040: 775,200 sq. ft.
  - Terminal 2:
    - Existing: 406,427 sq. ft.
    - 2040: ~442,000 sq. ft. additional, 848,400 sq. ft. in total (including 48,000 sq. ft. FIS)

MAJOR TERMINAL AREA CONSTRAINTS

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

- The existing terminal processor is under the historic domes. While alternatives will consider all options, the domes are a significant architectural feature, and alternatives will attempt to keep them.
- The airfield limits the terminal area on the north (Runway 12R-30L) and the west (Runway 6-24):
  - Twy D centerline stays as is (430' from Rwy 12R CL)
  - Twy D - Twy C separation for ADG IV: existing is 227'; proposed is 207', per FAA AC 150/5300-13B
  - Twy D = ADG IV
  - Twy/Tln C = ADG III or ADG IV
  - VSR = 25' wide
- The existing landside of the complex is bounded by a major roadway to the south (Lambert International Blvd or LIB) and Air Cargo Road to the east. LIB may be relocated as far south as I-70.
- I-70 is a constraint to the terminal area, but significant realignment of the highway to provide more terminal space is not an option due to prohibitive cost, community disruption, and construction duration. However, MoDOT is conducting a Planning and Environmental Linkage study to improve the safety and convenience of I-70, including in the Airport area. It is likely that minor shifts to the alignment will result. STLAA and MoDOT are coordinating these efforts.
- DOD property is located adjacent to Airport parking, between LIB and I-70. The US Navy Reserves and US Marine Corps are among the occupants of the site. This 34-acre area is located close to Terminal 1 and would be ideal for future parking and access road development. Acquisition and relocation of the federal occupants of the site would be involved and time-consuming. However, some alternatives did consider use of some or all of the site.
- Main ticket lobby architecturally significant and iconic 1956 domes, designed by important architect Yamasaki. While the domes are not "untouchable", as they are not on the Register of Historic

Places, they are considered important. The alternatives analysis will consider a full range of long-term options, including ones that retain or remove the domes.

5.3.3 GOALS AND OBJECTIVES

The goal of the terminal portion of the ALPU/MP is to develop a plan that addresses the following:

- Proposed terminal footprint between Taxiway C and I-70
- Dual ADG III taxilanes access to all gates
- Taxiway C as full-length taxiway
- Avoid pushing back onto Taxiway C
- Minimize elbows in concourses
- Avoid building on top of Coldwater Creek
- Expand T1 east rather than west to allow MRO expansion on west side
- Keep Metrolink access/connections
- Can realign LIB along I-70 if needed

CAPACITY

The terminal complex needs to meet the gate and facilities requirements for the forecast levels of activity, including peak period passenger numbers, the future fleet of domestic and international aircraft, and local as well as connecting passengers. These would meet the FAA-approved 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. 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” actually 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 plan will provide flexibility to accommodate architectural treatments and interior design elements 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. A logical, intuitive layout will make wayfinding easy, the traveler experience less stressful, and will minimize the need for signage.

- Opportunities for expanding the size and types of concessions in the locations where customers congregate and/or pass by.
- Unaided walking distances no greater than 1,000 feet, especially for connecting passengers; moving sidewalks will be considered when distances exceed 1,000 feet.
- Post-security connectivity between gates.

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 providing dual ADG III taxilanes where feasible.
- Provide flexibility for international gates, while maximizing domestic gate capacity (swing gates); and flexible aircraft parking positions/Passenger Boarding Bridges (PBB) configurations to handle a mix of narrowbody and widebody aircraft.
- Recognize that changes in airline operating practices can impact facilities and provide flexible spaces to accommodate these.
- Consider sustainability and environmentally friendly options.

5.3.4 PLANNING ASSUMPTIONS

Industry standards and parameters were used in the development of terminal alternatives. The following planning and programming assumptions are critical to the development of the geometry of the terminal concepts:

TERMINAL ENVELOPE

- The taxiway network remains the north boundary of the terminal complex:
  - Taxiway D centerline stays as is (430’ from Runway 12R-30L centerline).
  - Taxiway D = ADG IV
  - Taxiway D - Taxiway C separation for ADG IV: existing is 227’; proposed is reduced to 207’, per FAA AC 150/5300-13B, to maximize terminal envelope
  - Future Taxiway C = assuming ADG IV
- The proposed roadway network will be the south boundary of the terminal complex.

CONCOURSES

Future domestic concourse width is planned at approximately 110 feet, reflecting:

- 30-foot deep holdrooms.
- 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.

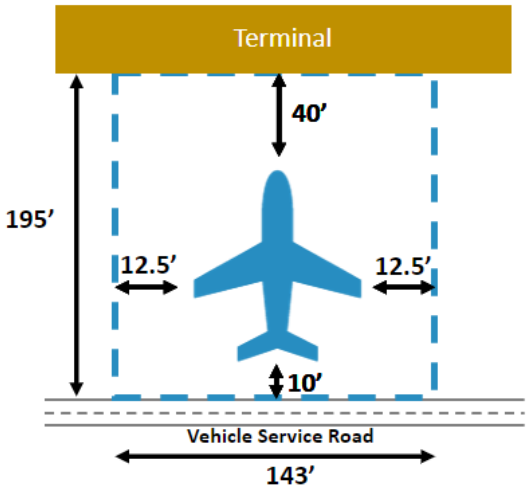
- Aircraft gates: Allow parking by up to two ADG V aircraft, by the FIS.
- For concourses with international gates, the width would be increased by 10 feet on the side(s) with the international gates for sterile arrivals circulation corridors.

TERMINAL PROCESSOR

- For initial concepts with a central processor and the SCCP behind the ATO, the processor depth will be planned to ±320 feet. The existing terminal domes have a depth of 320 feet.
- Length of processor reflects 2 international claim units in a new facility, and six domestic bag claim units in the domes (360 feet wide + space for concessions and seating). The existing terminal domes have a length of 580 feet.
- Processor would have up to a 25-foot-deep exterior sidewalks along the terminal curb.

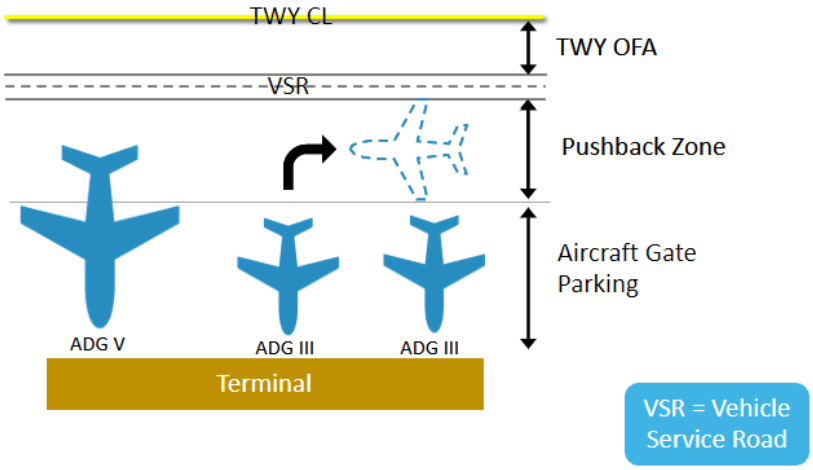
TERMINAL APRON AND TAXILANES

- Narrowbody aircraft parking envelope will be planned at 195 feet deep. Aircraft stand width is 143 feet for maximum ADG III wingspan + 25 feet.
- Widebody parking envelope will be planned at 270 feet deep based on A350-900/B787-9 aircraft, which is considered the largest likely aircraft for STL. 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 wingtip clearance.



- New vehicle service road (VSR) will be planned at 25 feet wide.
- International gates will be planned as swing gates for domestic use with loading bridges designed to accommodate the broadest range of aircraft types.
- ADG V aircraft operations:
  - The critical or design aircraft in the FAA-approved forecast is ADG IV, but the proposed plan will not preclude ADG V operations
  - If a low number of ADG V aircraft operate on the airfield (less than 500 per year), it does not drive the FAA standards and any ADG V aircraft would be accommodated with a Modifications of Standards. Note that since this analysis started, Lufthansa has started operations with an ADG V aircraft.
- Dual ADG III taxilanes can accommodate a single ADG V taxilane for international gate access.

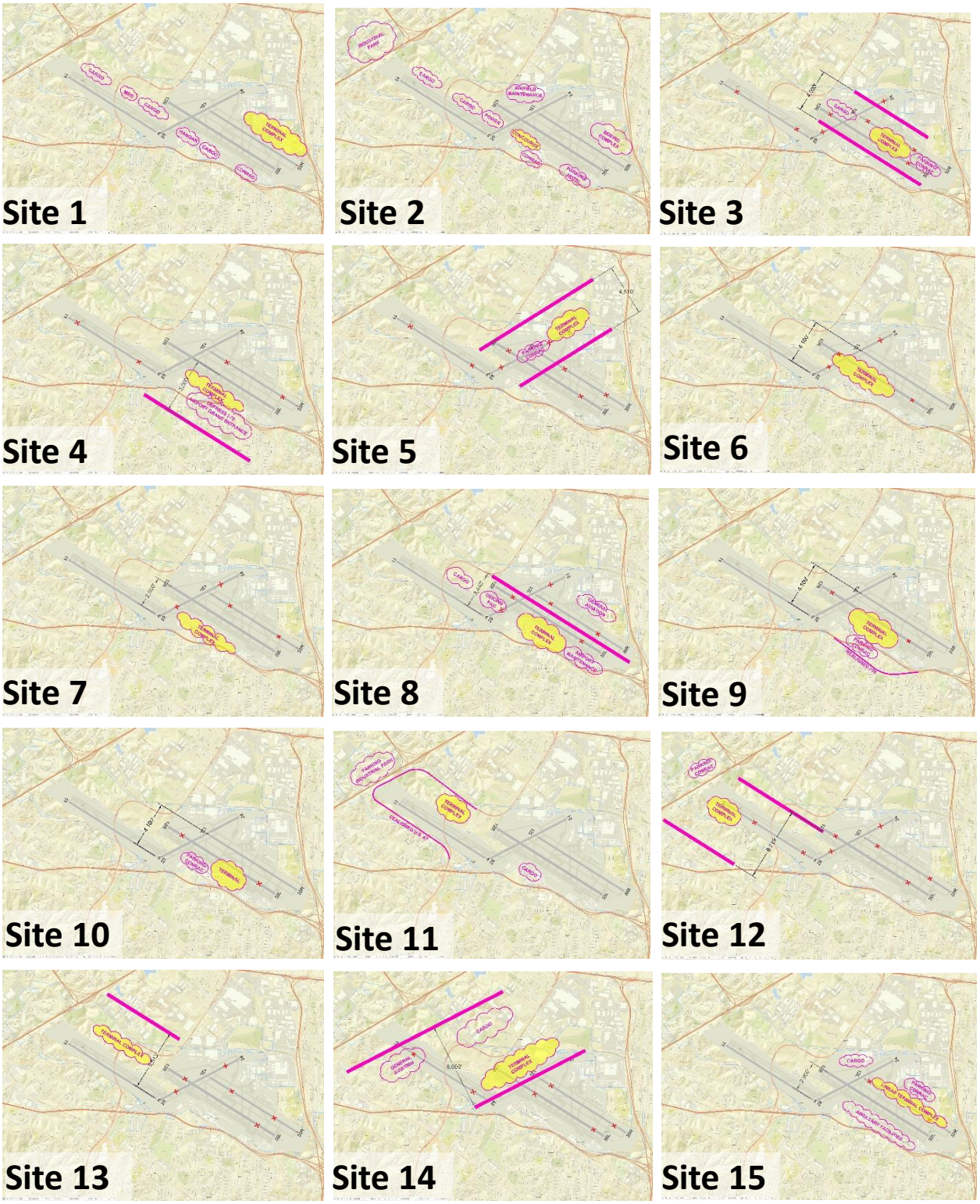
- Provide a dedicated aircraft push-back zone (there are no dedicated push-back areas, pushbacks occur onto taxilane C, which interrupts taxi flows):
  - 120’ narrowbody push-back zone for ADG III aircraft
  - Per AC 150/5300-13B, the pushback zone can be either between the VSR and the taxiway Object-Free Area (OFA) or the VSR can be shifted outboard to allow parking an ADG V aircraft. The latter is the preferred alternative, since it can accommodate parking of a ADG V aircraft while at the gate.



5.3.5 PRELIMINARY TERMINAL SITES

During the sketch planning session, 15 preliminary terminal sites were considered across the entirety of the Airport property, as depicted in yellow on **Figure 5.3-2**.

Figure 5.3-2: Sketch Planning Terminal Sites



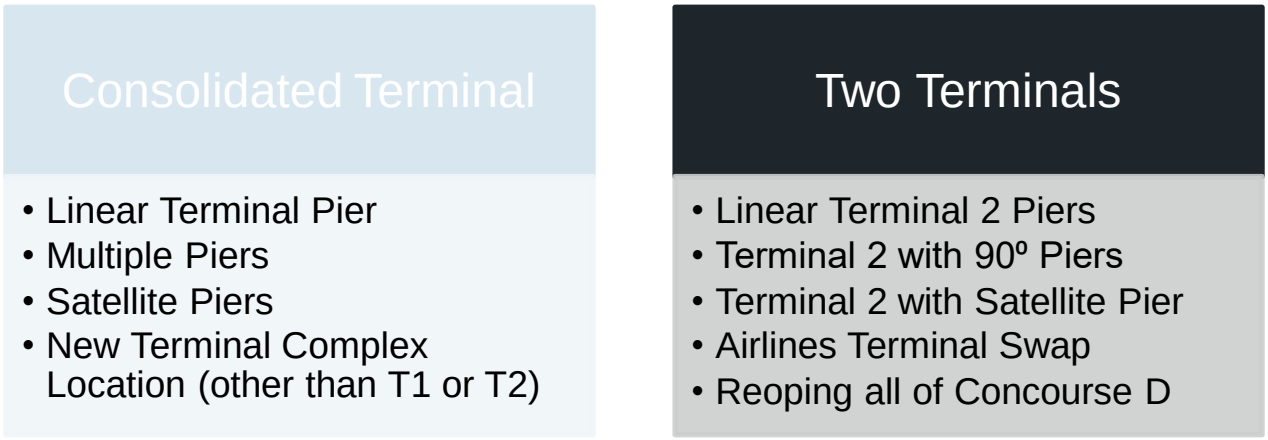
Sources: St. Louis Lambert International Airport Layout Plan Update, *Sketch Planning*, February 2020; WSP USA, 2020.

The scale of relocating the terminal complex, along with construction of new landside access infrastructure connected to a highway, was deemed cost prohibitive. It was therefore decided to only consider terminal developments on the existing general terminal site, south of Runway 12R-30L. Additionally, the existing Airport access to I-70 was considered optimal (although the on-airport roads are not, and this is addressed in alternatives); relocating the terminal complex to another part of the Airport would increase driving times to the Airport terminal area.

5.3.6 TERMINAL CONCEPTS DEVELOPMENT AND EVALUATION

Throughout the terminal planning process, two overarching terminal scenarios were considered to establish the set of alternatives evaluated during the process. These scenarios include consolidating the two existing terminals into one terminal complex, and maintaining two separate terminals. These two scenarios were further developed into a series of concepts as outlined in **Figure 5.3-3**. In addition to developing multiple terminal concepts, several processor concepts were also developed that can be combined with any of the terminal concepts.

Figure 5.3-3: Terminal Layout Scenarios



Source: Hirsh Associates, 2021.

ROUND 1

After establishing in the sketch planning session that the existing terminal site was the optimal site, 22 terminal concepts were developed and evaluated in Round 1, including the preferred alternatives from the STLAA *2012 Master Plan*[1] and the City Airport Advisory Working Group *2019 Due Diligence Report*[2]. The Round 1 concepts are depicted on **Figure 5.3-4** (Concept 21 [Terminal Swap] and Concept 22 [Reopening of Concourse D] are not depicted graphically).

[1] Landrum & Brown, Lambert-St. Louis International Airport Master Plan Update, November 2012.

[2] Ricondo on behalf of City Airport Advisory Working Group, *St. Louis Lambert International Airport Vendor Due Diligence Report*, December 2019.

Figure 5.3-4: Round 1 Terminal Concepts

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

The preliminary list of concepts was evaluated against fatal flaws, to mitigate operational weaknesses and proceed with higher utility concepts. The Round 1 fatal flaws were:

- Meets gate/aircraft parking position needs
- Brings passenger experience to industry standards
  - Walking distances: unbalanced walking distances, putting some airlines at a disadvantage compared to others
  - Functional criteria
- Provides dual taxilanes around concourses
- Workable landside access to curbfront
- NAVAID impacts

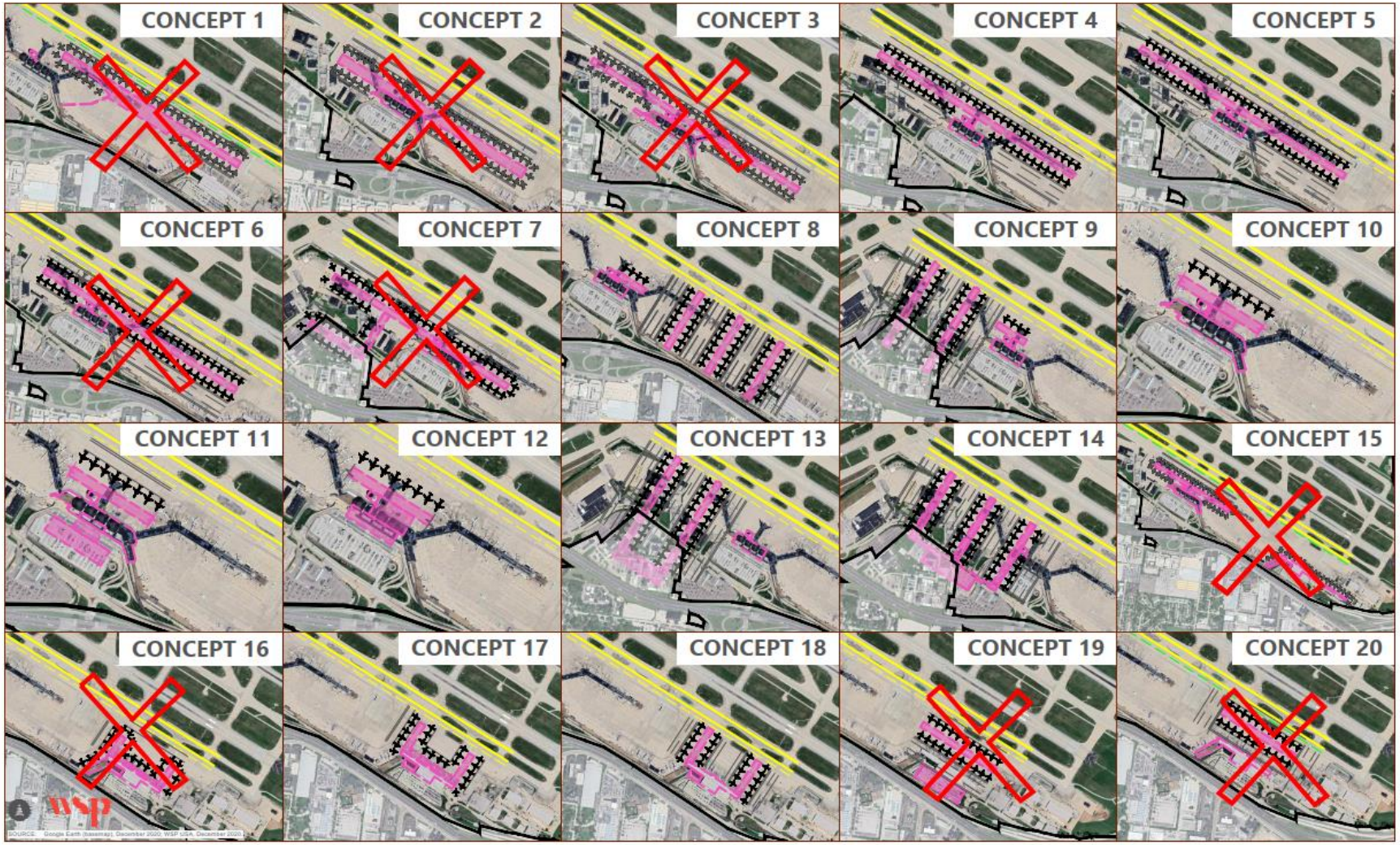
Concepts with fatal flaws were eliminated from further consideration, unless they could be modified, in which case they were carried forward. Other factors such as the acquisition of the DOD property were also considered; however, it was determined that such acquisition is not to be considered as a fatal flaw for the purpose of a preliminary evaluation.

As a result of the Round 1 evaluation, eleven concepts were eliminated, and eleven other concepts remained. The remaining concepts are moving to Round 2; they consist of:

- Six consolidated terminal concepts: Concepts 4, 5, 8, 9, 13 and 14
- Three processor concepts: Concepts 10, 11 and 12
- Two two-terminal concepts: Concepts 17 and 18

The Round 1 evaluation results are depicted in **Figure 5.3-5**.

Figure 5.3-5: Round 1 Terminal Evaluation Results



Notes:
[1] Concept 3 was eliminated as it is a near duplicate to Concept 5.
[2] Concept 21 (terminal swap) and Concept 22 (Reopening Concourse D), not shown, were also eliminated during Round 1.

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

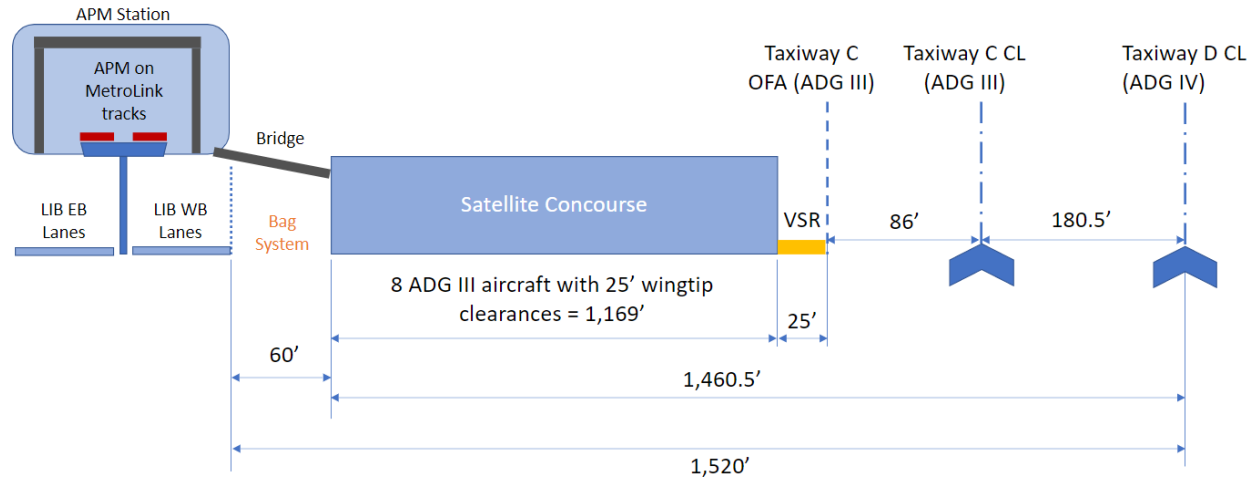
ROUND 2

During Round 2 discussions, two variants to Concept 8 (Satellites with Underground APM) were introduced to mitigate the significant costs associated with an underground APM:

- Concept 8A: Terminal 1 satellites with APM on MetroLink tracks
- Concept 8B: Terminal 1 satellites with at-grade APM along LIB

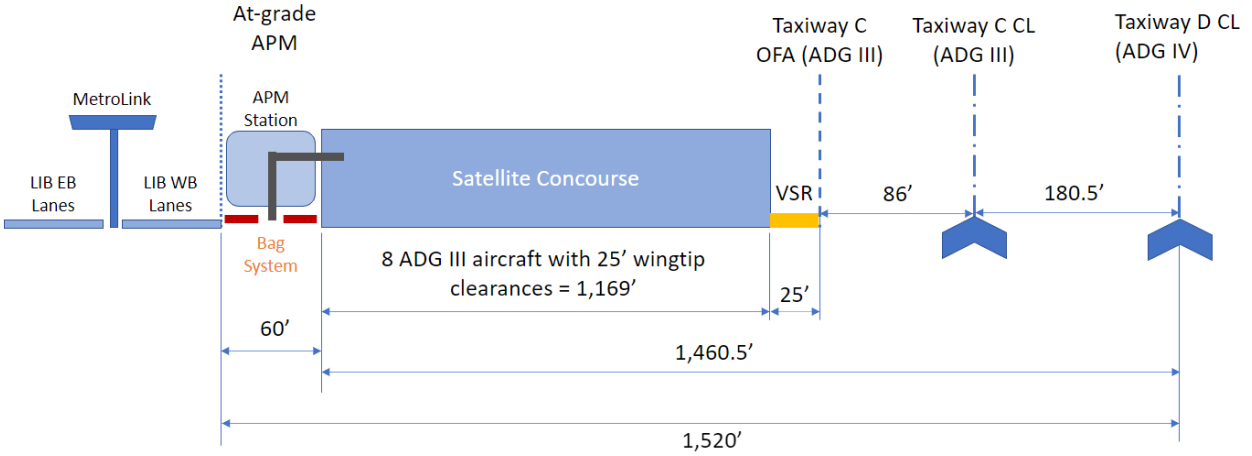
Figure 5.3-6 illustrates the proposed cross-section of Concept 8A (APM on the existing MetroLink tracks) and **Figure 5.3-7** for Concept 8B (at-grade APM).

Figure 5.3-6: Concept 8A - APM on MetroLink Tracks



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

Figure 5.3-7: Concept 8B - At-grade APM

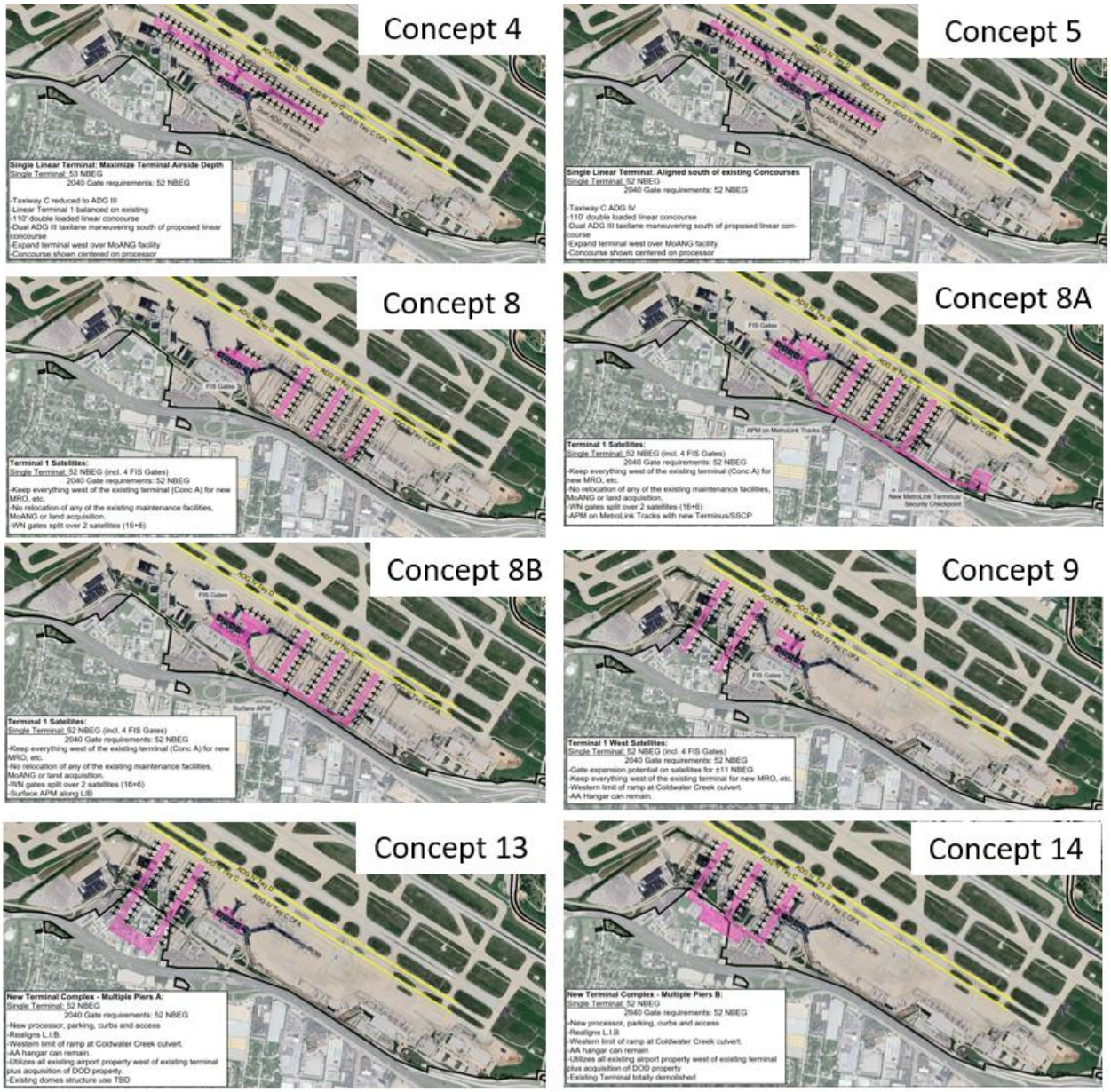


Sources: Hirsh Associates, 2021; WSP USA, 2021.

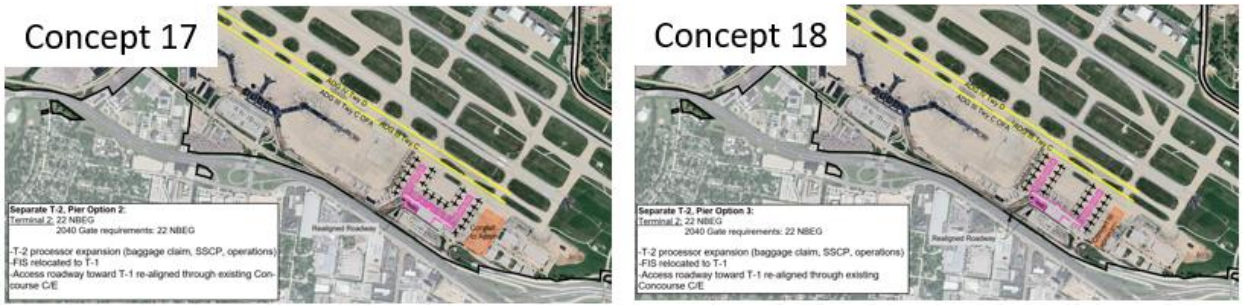
These two new variants were added to the terminal concepts evaluated in Round 2, which are depicted in **Figure 5.3-8**.

Figure 5.3-8: Terminal Concepts Evaluated in Round 2

Consolidated Terminal Concepts



Two-Terminal Concept



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

During the Technical Advisory Committee (TAC) Meeting #2, an attendee inquired if a terminal concept with a bridge over a road and/or future apron, similar to the new terminal complex at LaGuardia Airport (LGA), was considered. The main features of the LGA terminal program include:

- Early construction of a parking garage
- Satellite concourses
- Taxilanes on the back of concourses

The Planning Team compared the LGA terminal complex with the proposed STL terminal concepts. Some or all of the LGA features are reflected in a number of the STL terminal concepts.

EVALUATION CRITERIA

The Round 2 evaluation criteria focused on two project implementation phases: impacts during construction and impacts at the end state (year 2040), as described below:

- During construction:
  - Duration of enabling projects
  - Passenger experience (walking distances, temporary facilities, wayfinding, etc.)
  - Ease of phasing and constructability
  - Operational considerations (terminal, airside, landside)
  - Flexibility to respond to actual demand
- End state (2040):
  - Passenger experience
  - Relative cost (comparison)
  - Operational considerations
  - Impacts to other facilities (roads, buildings, etc.)
  - Future expansion potential (beyond 2040)

EVALUATION RESULTS

Consolidated Terminal Concepts

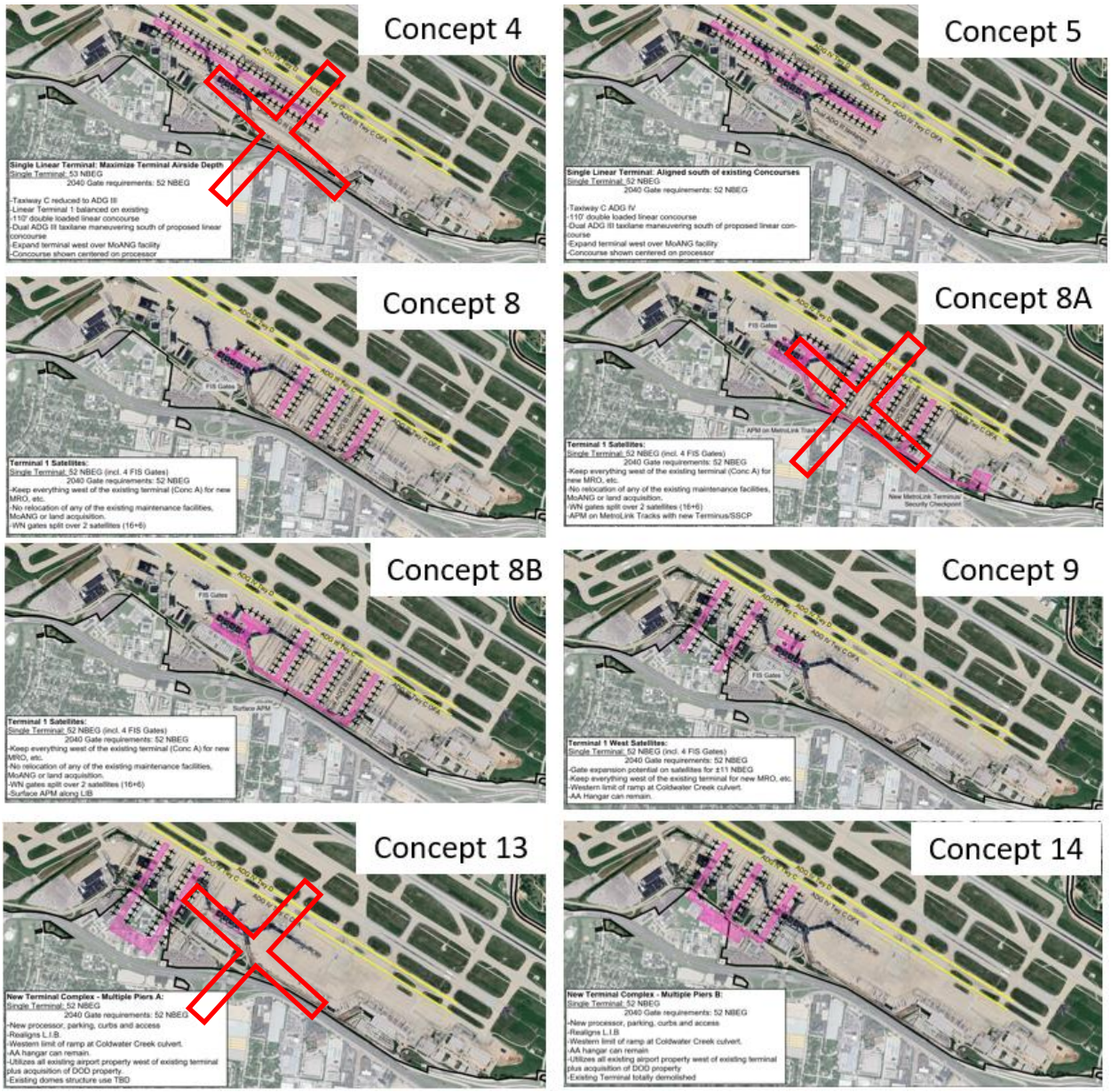
While the preliminary cost comparison for Concept 8 is high compared to other concepts due to the underground APM component, Concept 8 was carried to Round 3, per discussions with Airport staff, with two variants of the Concept 8 underground APM to be explored (Concepts 8A and 8B) as part of Round 2.

Concept 9 also includes a costly APM component, in addition to requiring the acquisition of the entire DOD property. However, Airport staff indicated that the acquisition of the DOD parcel is feasible in time to build the new terminal complex by 2040. Therefore, Concept 9 will move to Round 3.

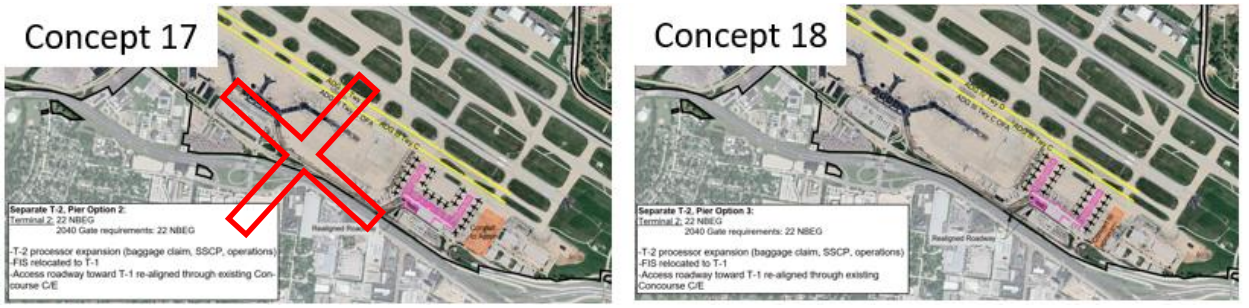
The results of the Round 2 evaluation led to the selection of five consolidated terminal alternatives to move forward to the Round 3, as shown in **Figure 5.3-9**.

Figure 5.3-9: Round 2 Terminal Concepts Evaluation Results

Consolidated Terminal Concepts



Two-Terminal Concept



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

Concepts with significant negative impacts compared to other alternatives were eliminated:

- Concept 4: Concept 5 is similar and superior to this concept, with far less significant impacts to passenger experience and phasing during construction
- Concept 8A: Significant impacts on passenger experience once Concept 8A is fully built, and significant high cost associated with building a new MetroLink terminus with processor and security capabilities
- Concept 13: lack of expansion potential beyond 2040

Two-Terminal Concepts

Concepts 17 and 18, as previously described, propose keeping a two-terminal operation. The Round 2 evaluation led to the selection of a single two-terminal concept to proceed to Round 3. Since Concept 18 is similar but superior to Concept 17, Concept 17 was eliminated due to significant operational impacts at the end state.

Processor Concepts

Three processor concepts were also evaluated as part of Round 2 ("Processor Only" Concepts P1, P2 and P3), depicted in **Figure 5.3-10**. Pros and cons of each are summarized:

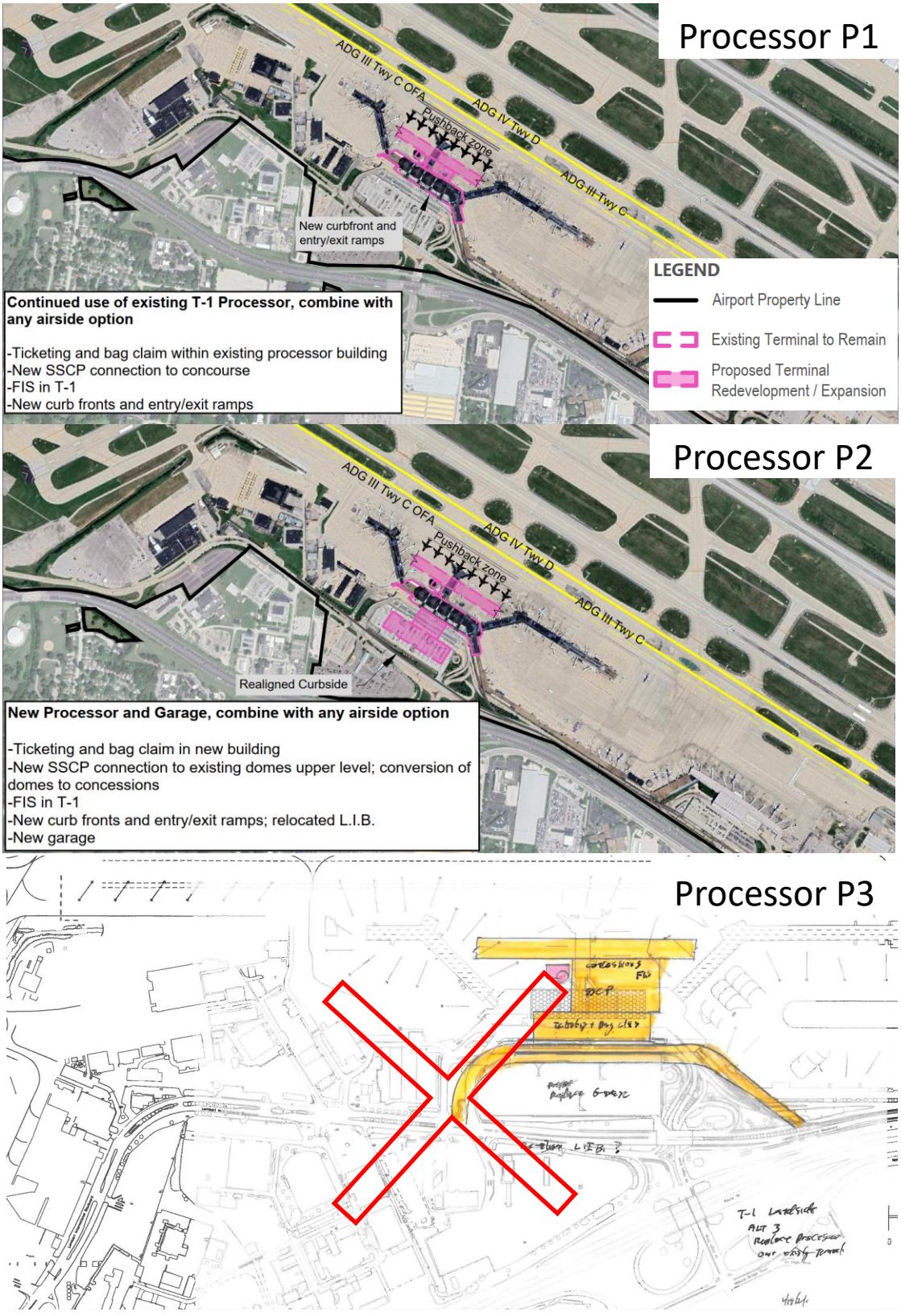
Concept P1:

- Pros:
  - Maintains most functions within existing terminal building
  - Replaces curb fronts and access roads
- Cons:
  - Architectural limitations within existing building limit some uses
  - Phasing for replacement roadways and curbs could be complicated

Concept P2:

- Pros:
  - New terminal processor to meet current functional and design standards
  - Repurpose historic domes
  - New curb fronts and access roads
  - Replace existing garage
- Cons:
  - Cost

Figure 5.3-10: Terminal "Processor Only" Concepts



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

Concept P3:

- Pros:
  - New terminal processor to meet current functional and design standards
  - Repurpose historic domes
  - New curb fronts and access roads
  - Replace existing garage
- Cons:
  - Cost

The same evaluation criteria used for the terminal concepts were applied to the processor only concepts. As a result, Concept P3 was eliminated, as it requires building a processor on top of the existing footprint, which results in significant phasing and constructability impacts.

ROUND 3 TERMINAL ALTERNATIVES

Six terminal concepts and two processor only concepts were selected to move to Round 3. Discussions with Airport staff during Round 3 led to exploring an additional concept derived from Concept 14, referred to as Concept 14A, which would keep and repurpose the domes for non-terminal functions. Instead of having three double-loaded piers, the latter adds two additional gates to each of the western piers with a single loaded east pier to help retain the existing domes.

Figure 5.3-11 depicts the concepts evaluated in Round 3 and associated results.

EVALUATION CRITERIA

In order to further advance the planning process and refine the remaining terminal concepts, additional assessment criteria were considered that focused on the following:

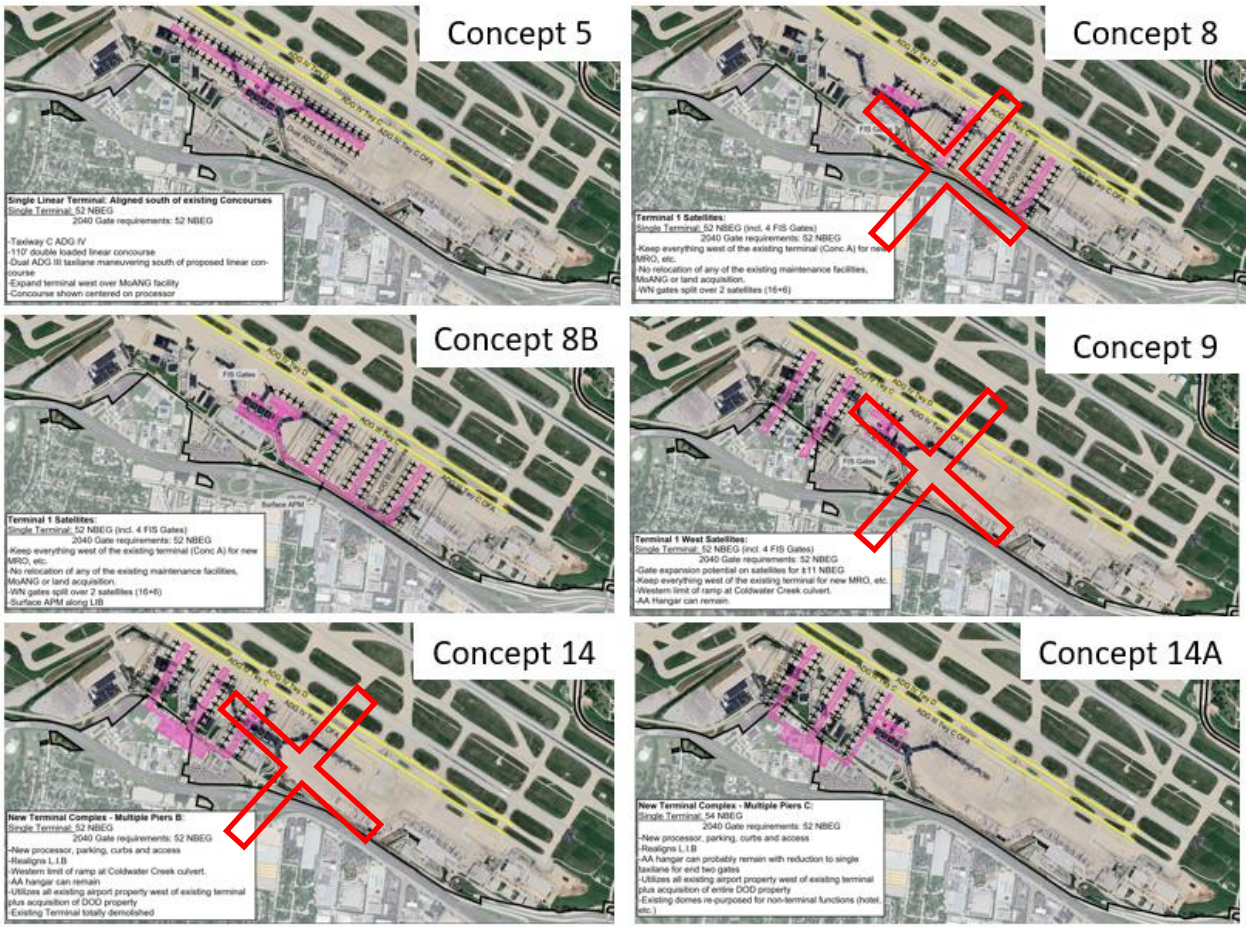
- Cost
- Walking distances
- Passenger convenience
- One vs. two terminals (one consolidated terminal accommodating all airlines or two terminals, similar to today)
- Airport's image

EVALUATION RESULTS

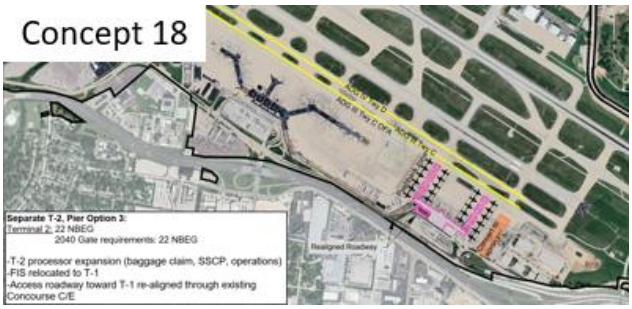
Similar to the evaluation process adopted in Round 2, an evaluation matrix was reviewed with Airport staff to classify the impact of each Round 3 evaluation criteria. Each criterion was assigned an impact category as either minimal, moderate or significant. Results are shown in **Table 5.3-1**.

Figure 5.3-11: Round 3 Terminal Concepts Evaluated and Results

Consolidated Terminal Concepts



Two-Terminal Concept



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

Table 5.3-1: Terminal Concepts Round 3 Evaluation Matrix

Concept	Cost Considerations	Walking Distances	Pax Convenience	One vs. Two Terminals	Airport Image
Concept 5 - Balanced linear south of existing		Average		One	New entrance roadway/processor/ concourses
Concept 8 – Underground APM	Underground APM			One	New entrance roadway/processor/ concourses
Concept 8B – Surface APM along LIB	At-grade APM			One	New entrance roadway/processor/ concourses
Concept 9 - West satellites	DOD land acquisition/ relocation **Underground APM**			One	New entrance roadway/processor/ concourses
Concept 14 - New Complex Multiple Piers B	DOD land acquisition/relocation			One	New entrance roadway/processor/ concourses; Remove domes
Concept 14A - New Complex Multiple Piers C	DOD land acquisition/relocation			One	New entrance roadway/processor/ concourses; Keep domes
Concept 18 - Separate T2 Pier Option 3	Also need to improve T1		1 or 2 FISs?	Two terminals: duplicate facilities/functions	**T1: will improve + new front door;** T2: existing processor, new concourses, potential landside access

Legend:
- Significant Impacts
- Moderate Impacts
- Minimal to No Impacts

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

Concepts with significant impacts were eliminated:

- Concept 8: high cost of underground APM
  - A preliminary high-level cost estimate was prepared to compare the cost of a tunnel APM (Concept 8) and a surface APM (Concept 8B). **Table 5.3-2** shows a significantly higher capital, operations and maintenance costs for an underground APM.
- Concept 9: high cost of underground APM
- Concept 14: dual FIS facilities at the Airport were not deemed feasible. Therefore, the remaining two-terminal concept will operate with a single FIS on property.

At the end of Round 3, four terminal concepts remained and moved to Round 4.

Table 5.3-2: High-Level Cost Estimate of Airport People Mover Concepts

		Cost in Millions (2021 Dollars)			
		Concept 8 - Tunnel APM		Concept 8B – Surface APM	
ID	Program Component	Low	High	Low	High
1	Guideway and Stations	$886	$1,019	$106	$121
2	Maintenance Facility	$52	$59	$52	$59
3	Vehicles	$22	$25	$22	$25
4	Professional Services (40% of construction costs)	$375	$431	$63	$72
5	Unallocated Contingency (10%)	$133	$153	$24	$28
	Program Total	**$1,468**	**$1,688**	**$266**	**$306**
	Operation & Maintenance as % of Construction	2%	2%	4%	4%
6	Operation & Maintenance (Yearly)	**$18.8**	**$21.6**	**$6.3**	**$7.2**

Notes:

[1] Underground APM is assumed to consist of a 2,700 FT tunnel guideway and 1,000 FT surface guideway for access track to maintenance facility.

[2] Surface APM is assumed to a consist of 3,700 RF surface guideway including access track to maintenance facility.

[3] Cost estimates are based on four APM stations and six APM vehicles.

Source: WSP USA, February 2021.

PROCESSOR CONCEPTS

The two remaining processor concepts did not present any significant impacts, as shown in **Table 5.3-3,** and both “processor only” concepts moved to Round 4.

Table 5.3-3: Terminal Concepts Round 3 Evaluation Matrix

Concept	Cost Considerations	Walking Distances	Pax Convenience	One vs. Two Terminals	Airport Image
Concept 11 - New Processor and Garage		N/A		N/A	
Concept 12 - New Processor and Garage over Existing		N/A		N/A	Greater opportunity to improve image

Legend:

- Significant Impacts
- Moderate Impacts
- Minimal to No Impacts

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

ROUND 4 TERMINAL ALTERNATIVES

Round 4 consisted of a high-level assessment of terminal access, focusing on three main elements:

- Remediating curbside capacity issues
- Improving inbound and outbound traffic
- Providing adequate parking

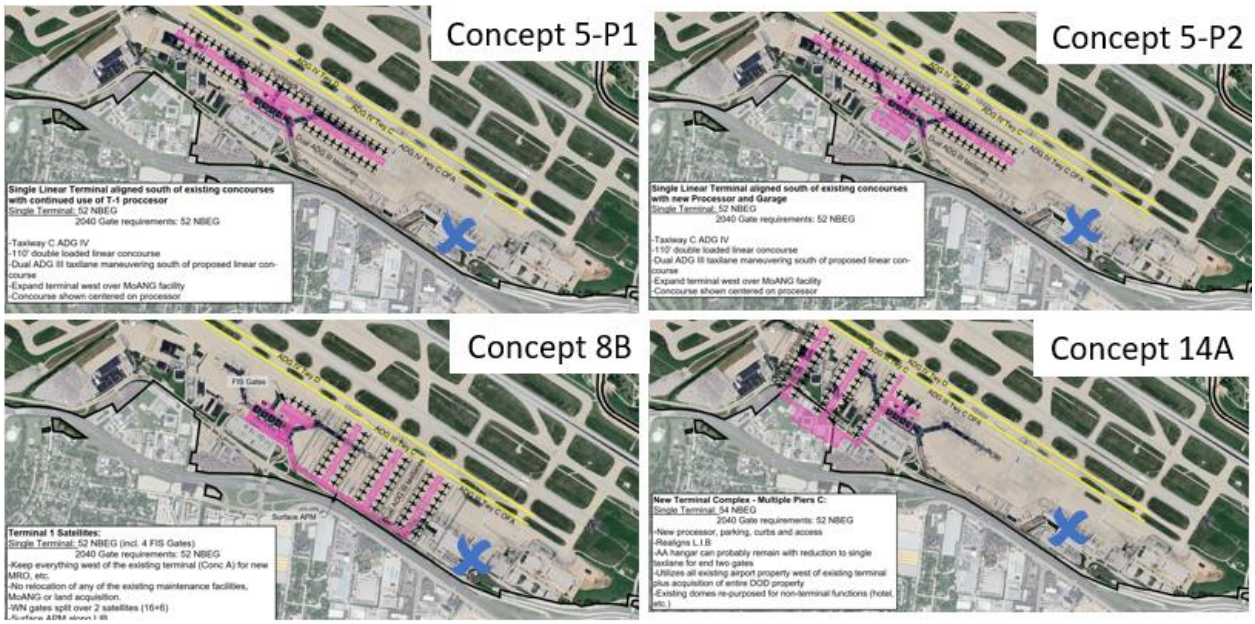
Three consolidated terminal concepts and a single two-terminal concept remain in Round 4. At this stage of the analysis, Concept 5 and Concept 18 were paired with the remaining processor-only concepts, as follows, to assess ground access to the terminal:

- Concepts 5: paired with processor only concepts P1 or P2
- Concept 18: paired with a scaled down version of the consolidated Concepts 5 or 14A.

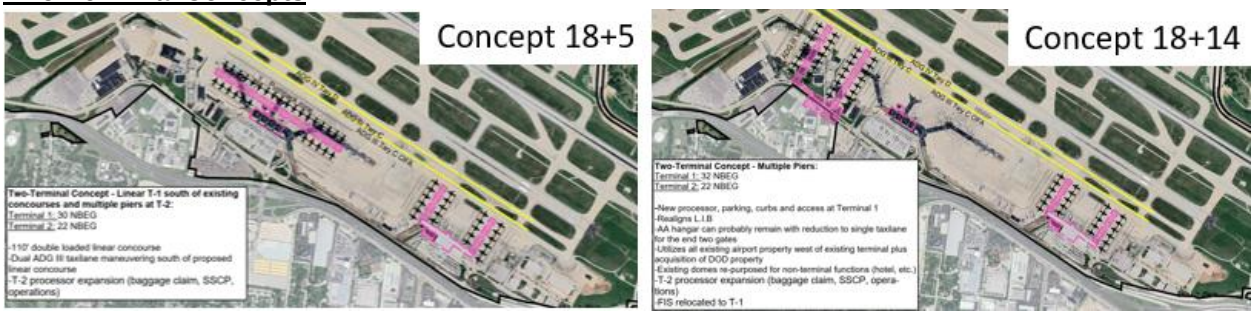
The remaining and paired-up concepts assessed in Round 4 are depicted in **Figure 5.3-12**.

Figure 5.3-12: Terminal Concepts Assessed in Round 4

Consolidated Terminal Concepts



Two-Terminal Concepts



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

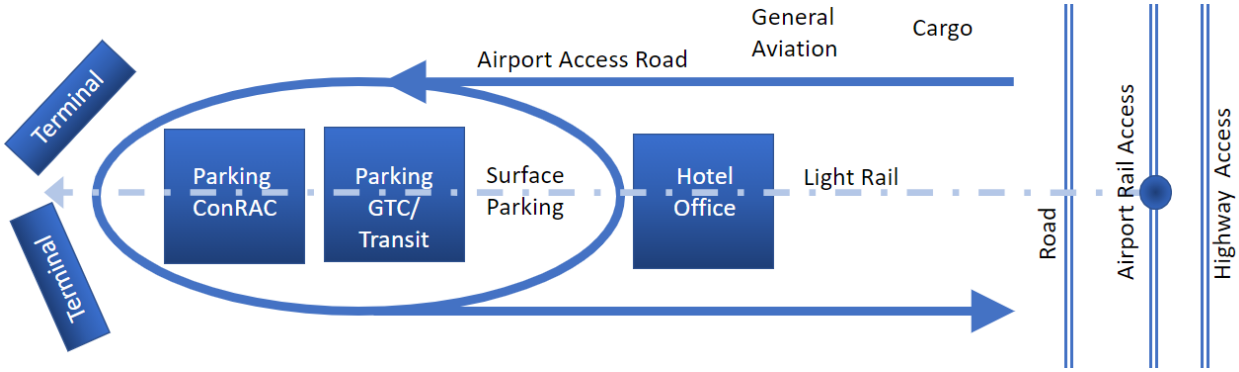
EVALUATION CRITERIA

Round 4 evaluation criteria included:

- Fluid, independent traffic flows:
  - Separate terminal traffic from non-terminal uses
  - All traffic shouldn't be forced through terminal area by realigning Lambert International Boulevard
- Adequate distance for decision-making and signage:
  - I-70 Exit 236 location towards Pear Tree Dr is close to the terminal
- Prioritize inbound improvements over outbound improvements:
  - Inbound traffic: getting to the terminal quickly, important for locals
  - Outbound traffic: more important to visitors
- Consolidated Rent-A-Car (CONRAC):
  - A business driver that would justify an investment has yet to arise. Given that this is a long-term plan, potential future CONRAC sites are identified to preserve STLAA options, in case there is a future need.
- Runway Protection Zone (RPZ):
  - Roads: existing roads may remain inside the RPZ (grand-fathered in); new roads should be planned outside the RPZ, to the extent possible
  - Auto parking: flexible location, keep proposed parking facilities outside the RPZ

Figure 5.3-13 illustrates the ideal generic terminal access, which provides one way in and one way out for all airport users. Additionally, passengers should be able to exit airport access road to non-terminal destinations such as parking facilities, hotel, cargo facilities, etc. before getting to the terminal.

Figure 5.3-13: Ideal Generic Terminal Access



Source: WSP USA, 2021.

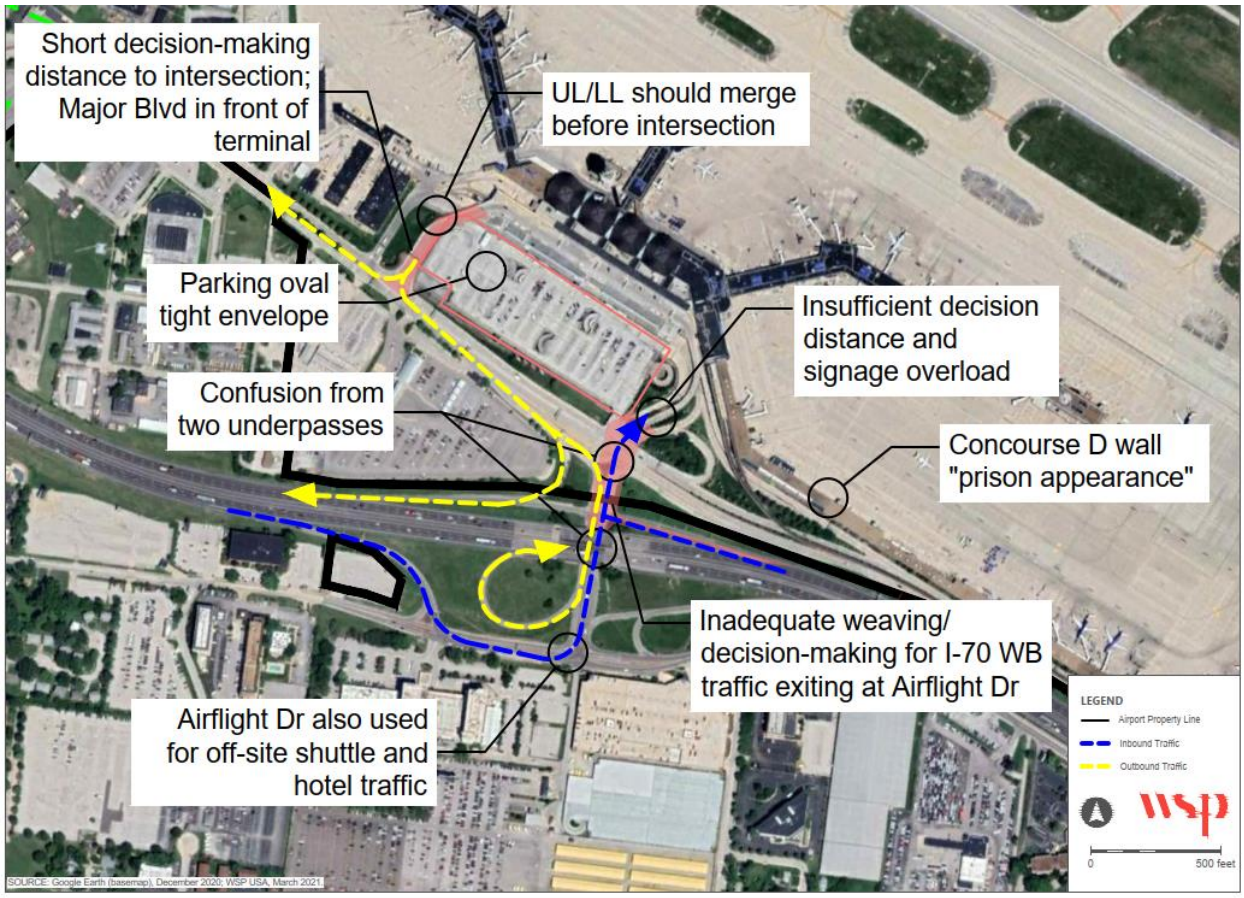
The proposed terminal processors, P1 and P2, will be assessed against the major landside access issues at both Terminal 1 and Terminal 2. These issues must be overcome to improve capacity and customer experience when using the terminal access roadways and curbsides.

TERMINAL 1

Existing Access Constraints

Existing landside access issues to Terminal 1 are depicted on **Figure 5.3-14**. Insufficient distance from I-70 to the terminal curbs is the main issue.

Figure 5.3-14: Terminal 1 Existing Access Constraints



Source: WSP USA, 2021.

Potential Access Improvements

High-level landside access improvements were prepared to identify fatal flaws associated with the remaining terminal concepts and their landside access.

<u>Terminal Concept 5+P1</u>

Figures 5.3-15 and **5.3-16** depict potential landside access alternatives to Terminal Processor P1.

Terminal Processor P1 Landside Access 1, depicted on Figure 5.3-13, proposes a fly-over ramp from I-70 WB over LIB for inbound traffic, as well as an elongated route for outbound traffic. No pros were identified for this access alternative. Cons include:

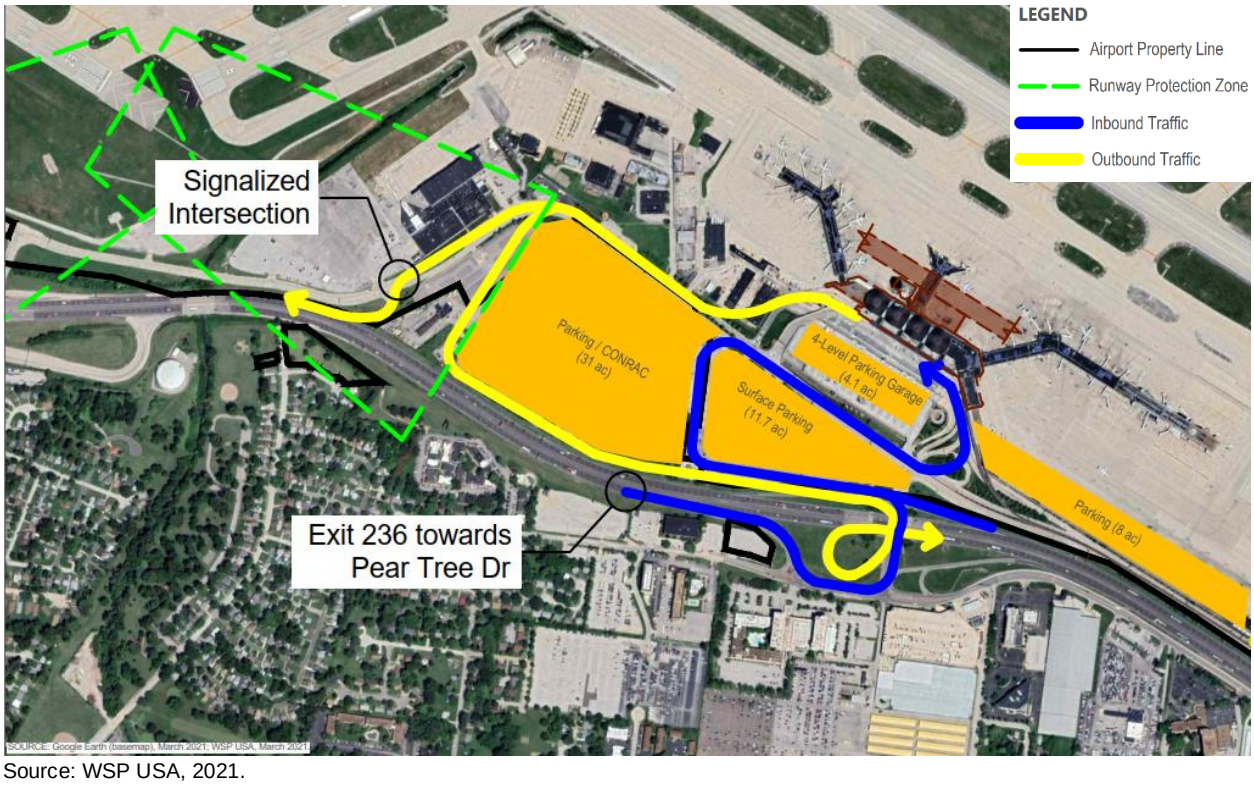
- Access to some parking facilities would require driving in front of the terminal curbside
- No I-70 EB inbound improvements (signage, decision distance)

This landside alternative was eliminated.

Figure 5.3-15: Concept P1 Potential Landside Access 1

Source: WSP USA, 2021.

Figure 5.3-16: Concept P1 Potential Landside Access 2



Source: WSP USA, 2021.

Terminal Processor P1 Landside Access 2, depicted on Figure 5.3-14, proposes elongated access routes for both inbound and outbound traffic. Pros and cons for the proposed Terminal Processor P1 Landside Access 2 include:

- Pros:
  - Additional decision distance
  - Parking access prior to curbside
- Cons:
  - Signalized interaction at LIB/I-70 westbound ramp
  - Requires shifting I-70

This landside alternative was retained.

Terminal Concept 5+P2

Terminal Processor P2 can be combined with consolidated terminal Concepts 5 and 8B. **Figures 5.3-17** and **5.3-18** depict potential landside access alternatives to Terminal Processor P2.

Terminal Processor P2 Landside Access 1, depicted on Figure 5.3-14, proposes an elongated access routes for outbound traffic, however, inbound traffic would have a very short distance between exiting the I-70 and the terminal curbside. No pros were identified for this access alternative. Cons include:

- 90° turn onto curbside
- I-70 WB traffic still has traffic light, short distances
- IB not improved
- Go through curb to go to surface parking

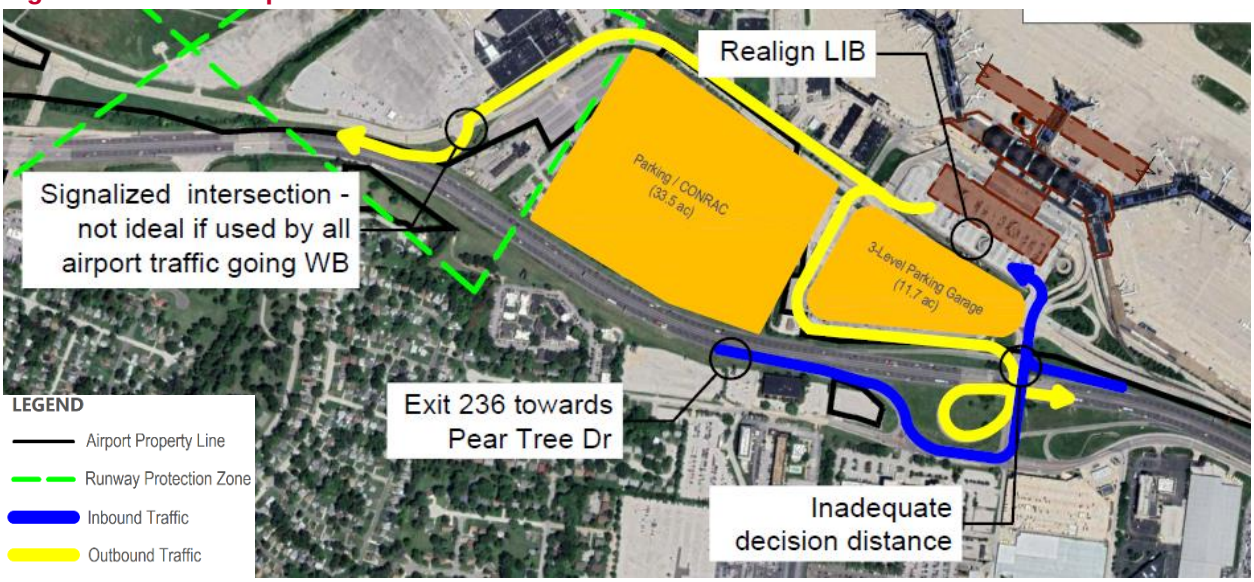
This landside alternative was eliminated.

Terminal Processor P2 Landside Access 2, depicted on Figure 5.3-15, proposes elongated access routes for both inbound and outbound traffic. Pros and cons for the proposed Terminal Processor P2 Landside Access 2 include:

- Pros:
  - Additional decision distance
  - Parking access prior to curbside
- Cons:
  - Redesign of Cypress interchange is needed to increase capacity to accommodate I-70 eastbound traffic using Exit 235C

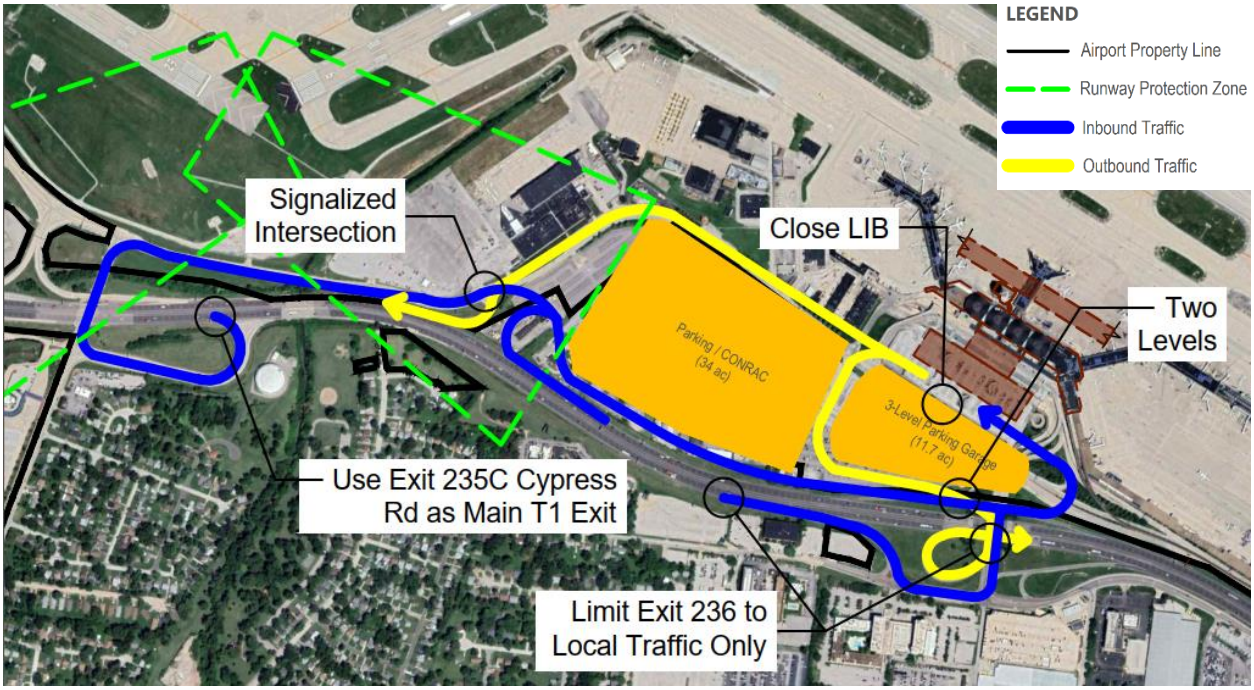
This landside alternative was retained.

Figure 5.3-17: Concept P2 Potential Landside Access 1



Source: WSP USA, 2021.

Figure 5.3-18: Concept P2 Potential Landside Access 2



Source: WSP USA, 2021.

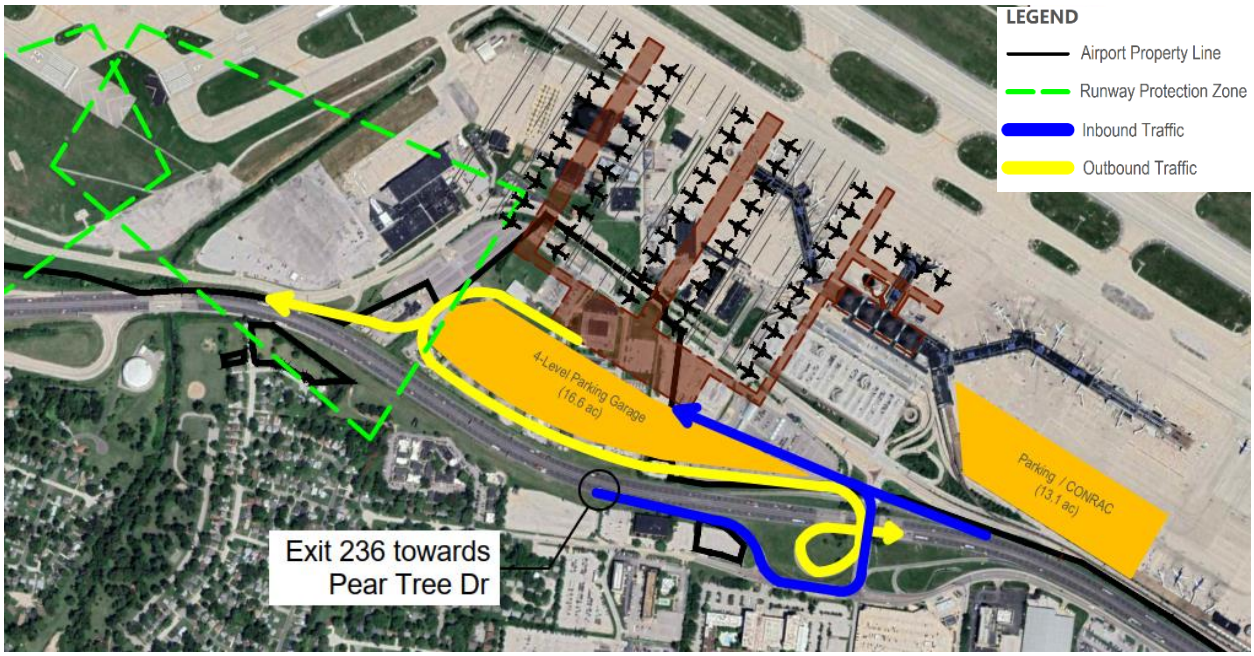
Terminal Concept 5+P1

Figure 5.3-19 depicts a potential landside access alternative for Concept 14A. As shown, aircraft gates at the end of the westernmost pier are inside the Runway 11-29 RPZ. In addition, the terminal processor extends south inside the DOD property, hence limiting the space available for parking and landside operations in front of the terminal. Therefore, it is recommended that Concept 14A is eliminated for the following reasons:

- Limited roadway queuing space before terminal curbside
- Narrow landside envelope in front of terminal providing limited parking and roadway options
- Limited concourse/gate expandability beyond 2040
- Keeping the domes requires single-loaded concourse and wrap around which results into added cost with no added benefit
- Limited/inefficient uses of domes
- Inefficient landside access to the historical domes
- Entire DOD property is needed before construction is started to limit risk (terminal processor/landside access are on DOD property)
- Two aircraft parking positions inside the Runway Protection Zone

This landside alternative was eliminated.

Figure 5.3-19: Concept 14A Potential Landside Access



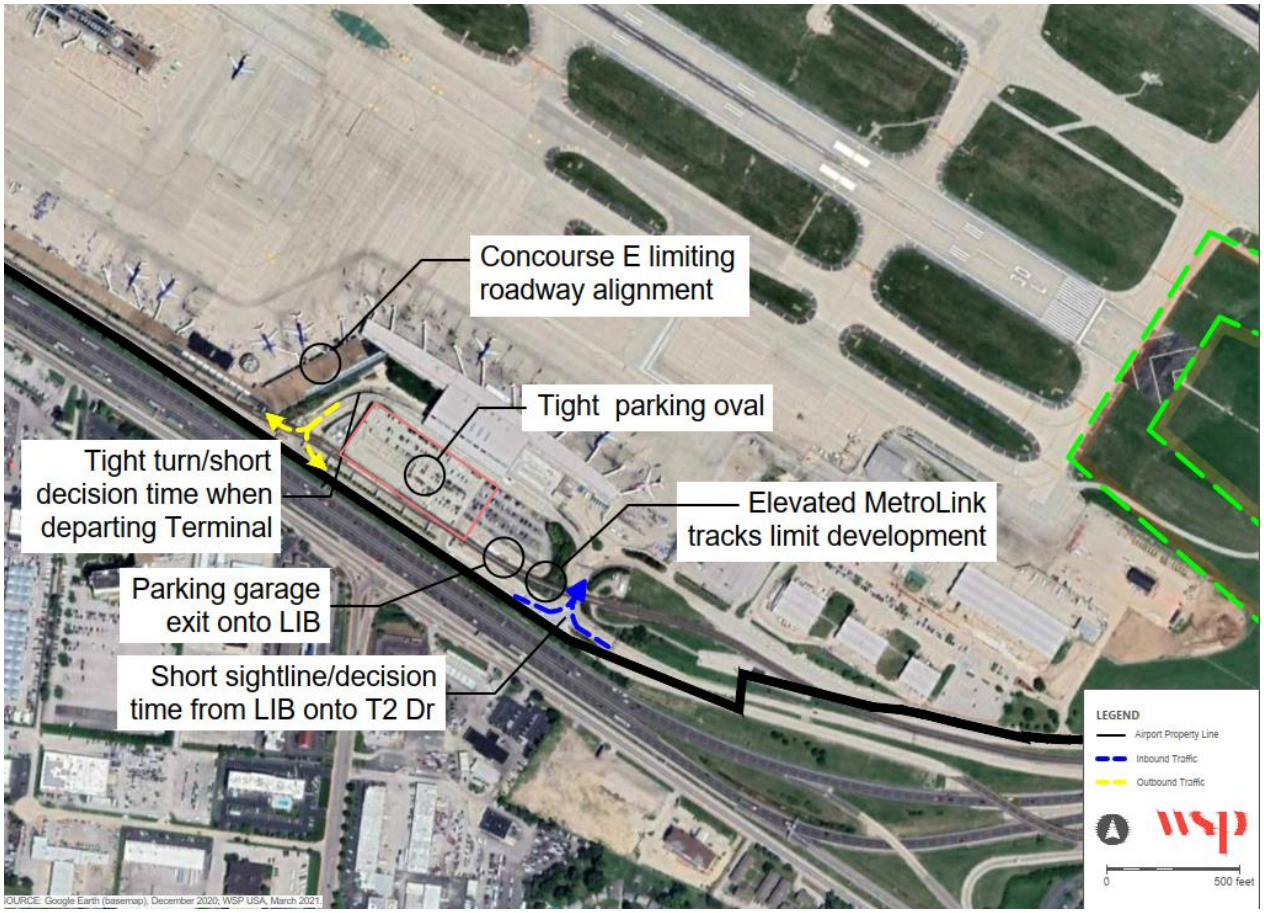
Source: WSP USA, 2021.

TERMINAL 2

Existing Access Constraints

Figure 5.3-20 below illustrates the major access issues at Terminal 2 that must be overcome with the newly proposed two-terminal Concept 18. Short distance from LIB to the terminal curbs and a very tight site are the main issues.

Figure 5.3-20: Terminal 2 Existing Access Constraints



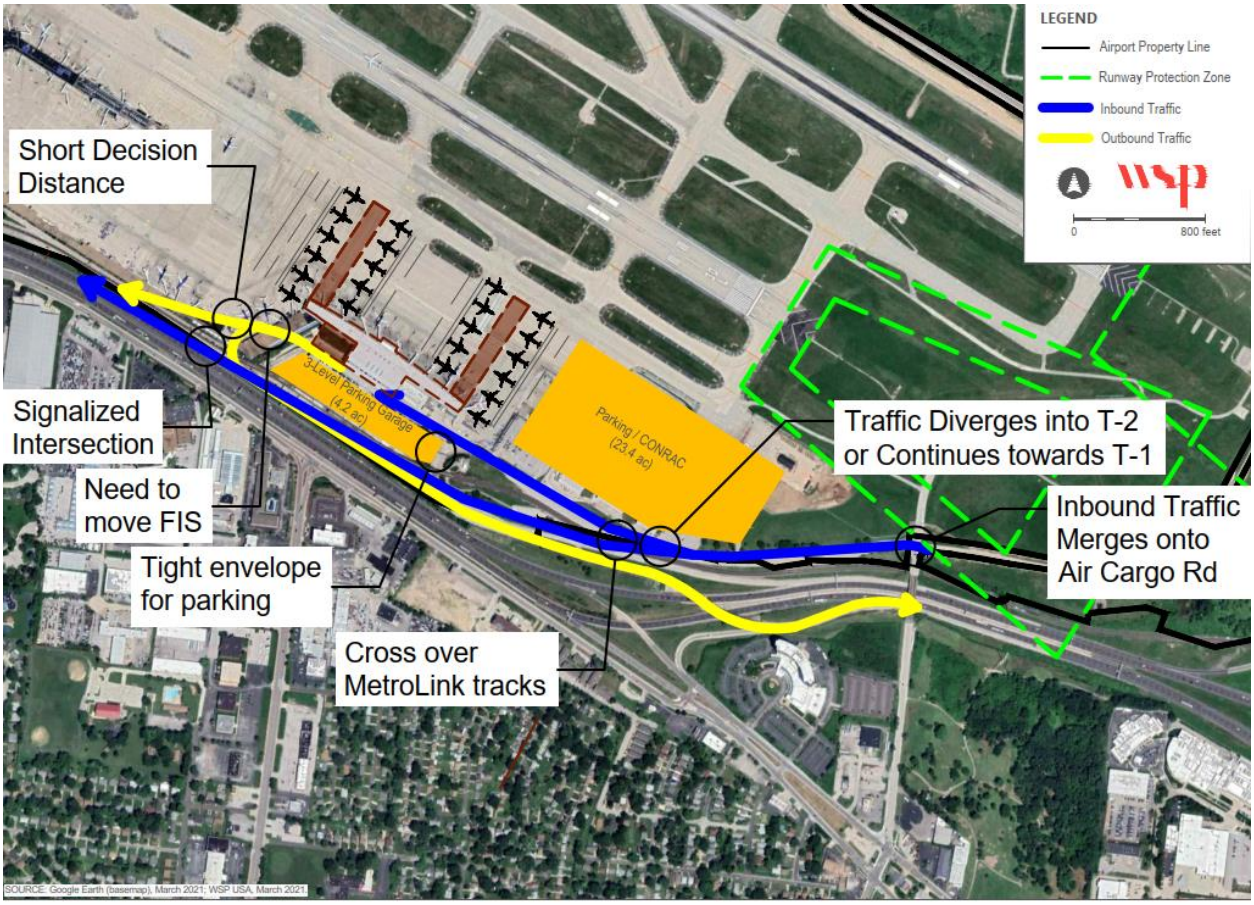
Sources: Google Earth, December 2020, WSP USA, March 2021.

Potential landside access for Concept 18 is illustrated in **Figure 5.3-21**. It is important to note that this concept would be paired with a scaled down version of the consolidated terminal Concepts 5 or 14A. The following summary list provides some pros and cons for potential landside access:

- Pros:
  - Additional decision distance for inbound traffic
  - Parking access prior to curbside
- Cons:
  - Short decision distance for outbound traffic
  - Signalized intersection for outbound traffic heading east

- Challenging FIS location at Terminal 2

Figure 5.3-21: Concept 18 Potential Landside Access



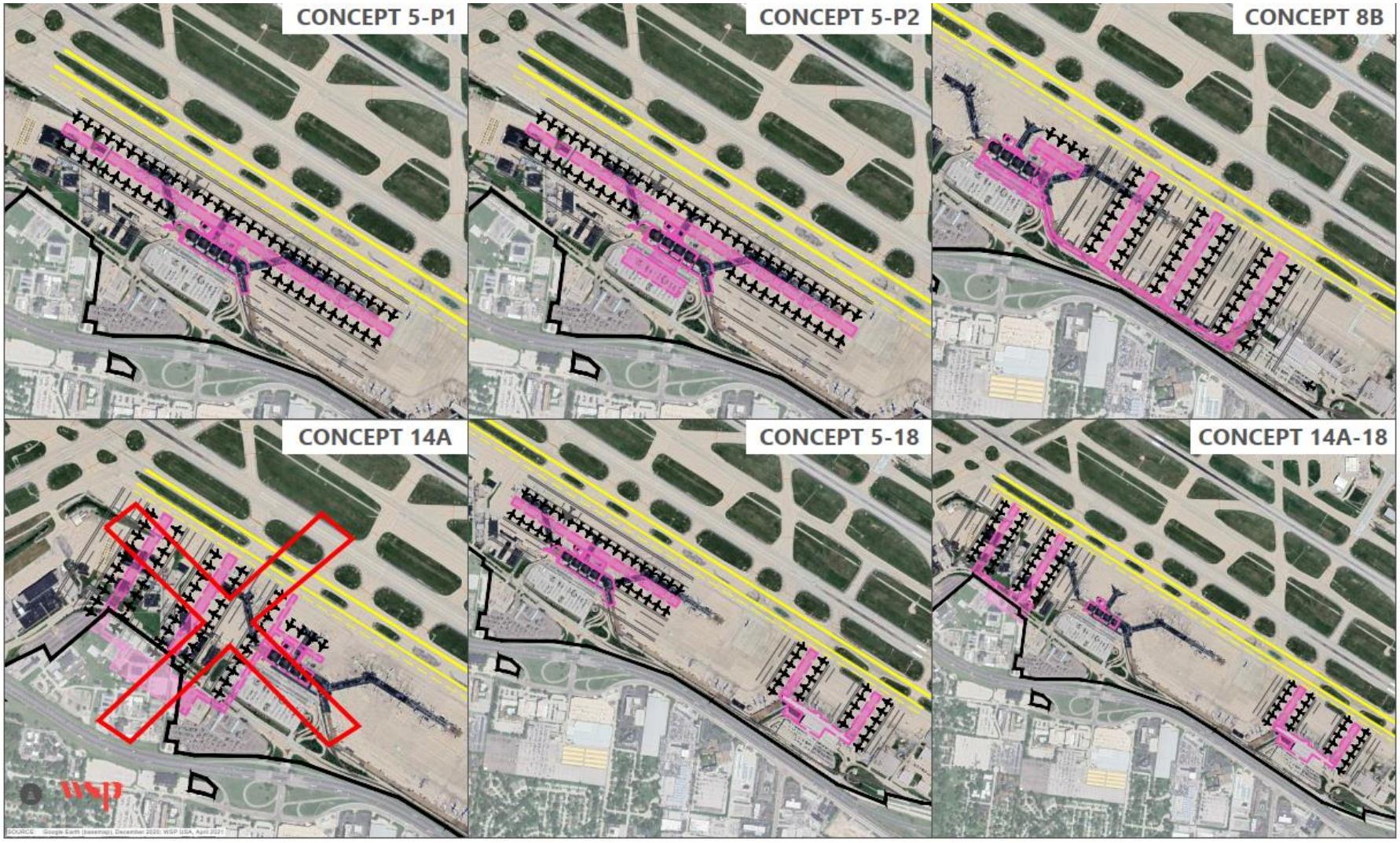
Sources: Google Earth, December 2020, WSP USA, March 2021.

While the potential landside access for Terminal 2 in Concept 18 is not fatally flawed, the proposed layout remain challenging for the following reasons:

- Tight landside envelope:
  - Lower level of service compared to consolidated terminal concepts
  - Potential parking facilities on south side of I-70 (Woodson Terrace)?
- Flexibility to expand beyond WN's 2040 forecast of 22 domestic gates is compromised
  - Possible expansion through a third pier to the east would require the relocation of the proposed parking garage
  - Limited outbound roadway improvements should the FIS and existing international E gates on Concourse D remain
- Require relocation of MEP room by gate E33

At the end of Round 4, a total of two consolidated concepts (Concept 5 and Concept 8B) and two two-terminal concepts (Concept 5-18 and Concept 14A-18) remain, as shown in **Figure 5.3-22**.

Figure 5.3-22: Shortlisted Round 4 Terminal Alternatives



Sources: Google Earth, December 2020, WSP USA, March 2021.

ROUND 5 TERMINAL ALTERNATIVES

After Round 4, the One Terminal vs. Two Terminals concepts were compared. **Table 5.3-4** shows comparison criteria and results (color-coded). Green text indicates favorable conditions, orange text indicates challenging conditions, and red text indicates fatal flaws.

The two-terminal concepts present many challenges and fatal flaws, and were eliminated. Linear, satellite, and 90-degree expansion of gates were considered for two-terminal concepts. Alternatives 17 and 18 depict the preferred Terminal 2 expansion, which is two 90-degree piers, with an enlarged processor to remedy ticket lobby size and SSCP capacity issues, as well as a bag claim expansion. However, the landside envelope is still tight, and in 2040, the site is out of room, as then either parking needs to be expand to the east, OR a concourse needs to be added to the east; as both cannot be done, but both are needed, expanding Terminal 2 was not a viable option.

Table 5.3-4: One Terminal vs. Two Terminals Comparison

Criteria	One Terminal	Two Terminals
Post-2040 Gate Expansion	Incremental expansion as needed	New pier needed for T2 (high cost of 1st gate, impacts potential parking garage)
FIS	Accessible to all carriers	Tow-off operation for some carriers; recheck for passengers
Capital costs	Lower than two terminals	Higher than one terminal
O&M costs	Lower than two terminals (shared resources)	Higher than one terminal (duplicate resources)
Roadway Access	Can be improved to meet world-class airport standards	Challenging (narrow T2 envelope)
Parking	Close-in parking can be increased	Increasingly challenging as traffic grows/terminal expands
Customer Convenience	More convenient. Potentially greater concessions selection	Less convenient at T2 and for connecting passengers

Source: WSP USA, 2021.

The remaining one-terminal concepts include:

- 5-P1
- 5-P2
- 8B

Processor Concept P2 was eliminated for the following reasons:

- Pushes the processor over the existing parking garage footprint, resulting in an even narrower site for landside access.
- Limited landside expansion potential
- Domes repurposed as only a pass-through concession area

Terminal Concept 8B was eliminated for the following reasons :

- The concept includes an APM, which is costly to install and maintain
- The above-ground APM does not provide for baggage conveyance between the terminal processor and the concourses. A tunnel would be required for baggage conveyance.

PREFERRED TERMINAL ALTERNATIVE

The remaining preliminary preferred terminal concept is Concept 5-P1, as depicted in **Figure 5.3-23**.

Significant outreach was completed in the form of an open house, third public survey, various presentations on the preliminary plan, and significant media coverage and scrutiny was also received. Given that no major issues arose and that most feedback has been supportive of the preliminary plan, the preliminary preferred terminal alternative became the preferred alternative.

The main characteristics of the preferred terminal alternative are:

- 62 gates in 2040 (52 ADG III gates and 10 EAS gates)
- All-new double-loaded linear concourse, centered on processor:
  - 110’ wide
  - ~2,000’ from SSCP to concourse end
- Dual ADG III taxilanes around concourse
- Requires use of former MOANG site
- Potential land acquisition for additional landside ROW

Pros of the preferred terminal concept include:

- Taxiway/Taxilane C: ADG IV
- Passenger convenience
- FIS accessible to all carriers
- Single security checkpoint
- New airport entrance/image
- Concourse expansion as needed
- Reduced footprint (O&M)
- Double-loaded concourse results in shorter walking distances for passengers on same airline

Cons of the preferred terminal concept include:

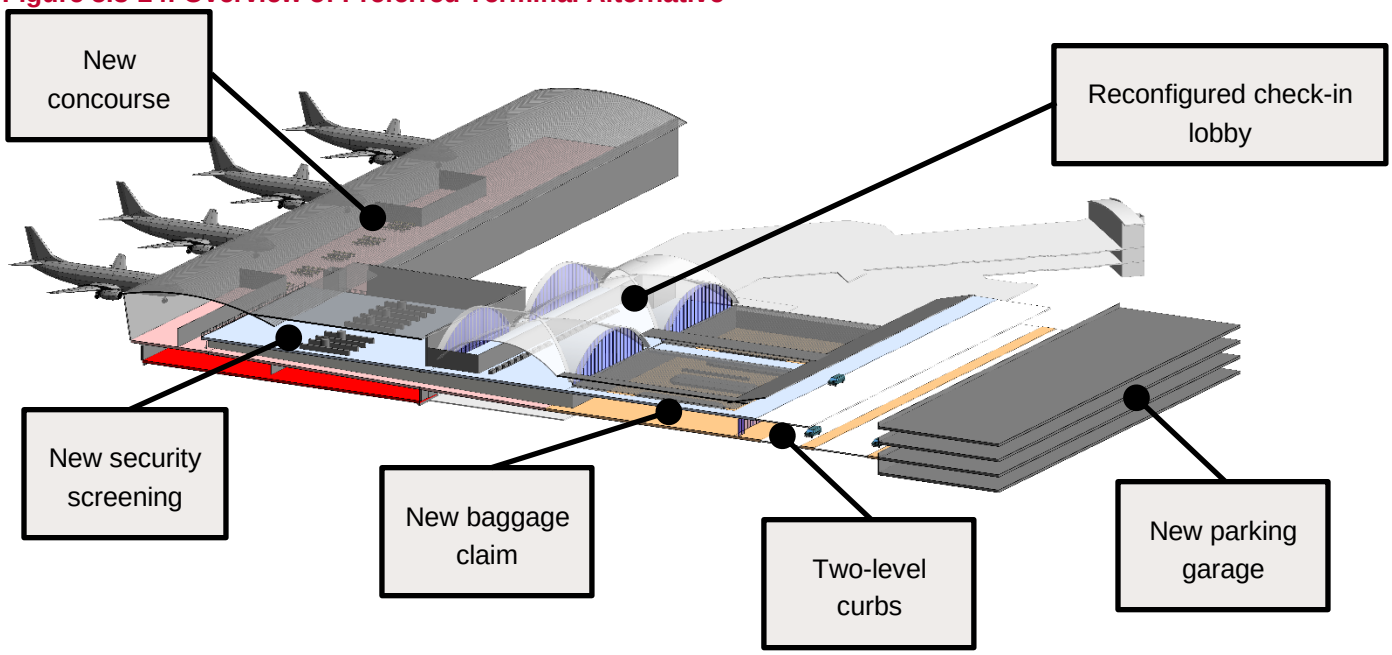
- Impacts south & west of existing terminal (relocate support facilities)
- Long walking distances to end of concourse require moving walkways

The preferred terminal concept is shown in **Figure 5.3-24**, with a detailed version in **Figure 5.3-25**.

Figure 5.3-23: Preferred Terminal Alternative (Concept 5-P1)

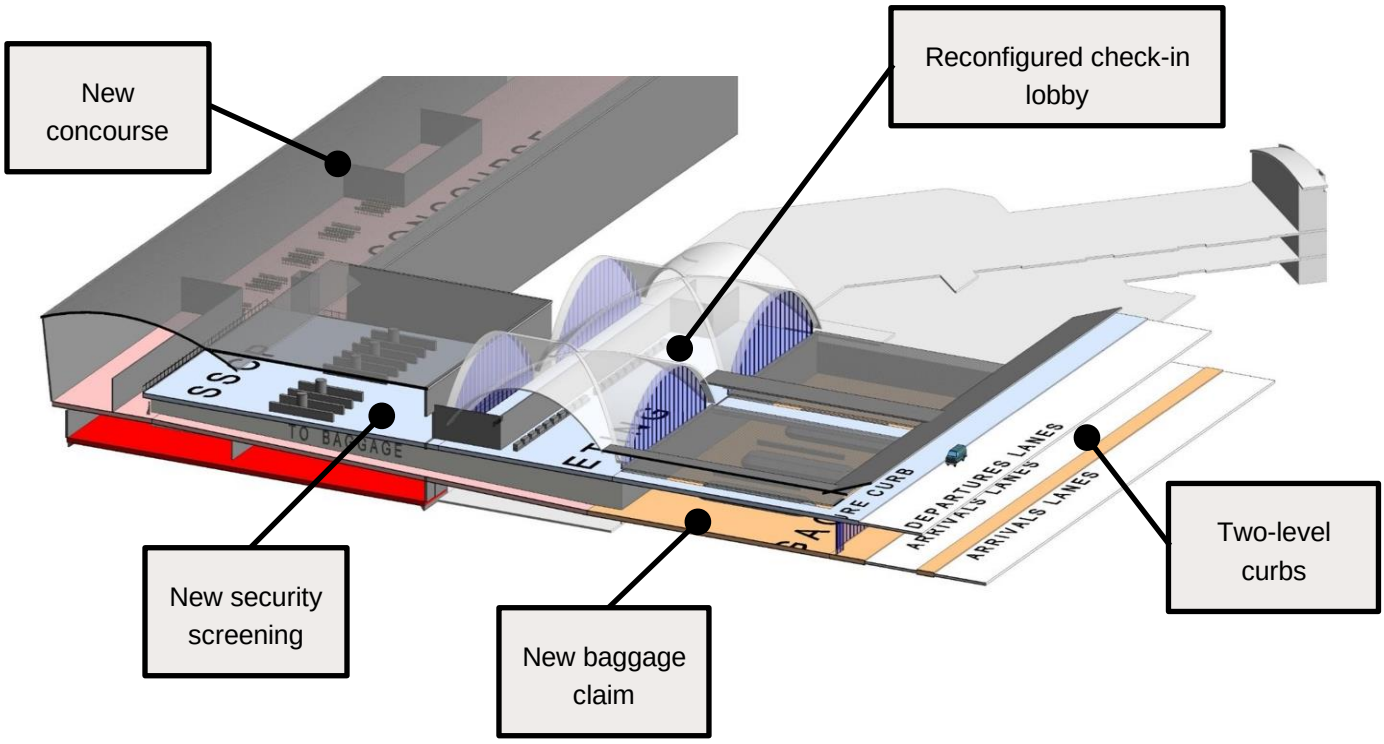
Sources: Hirsh Associates, 2021; WSP USA, 2022.

Figure 5.3-24: Overview of Preferred Terminal Alternative



Source: WSP USA, 2022.

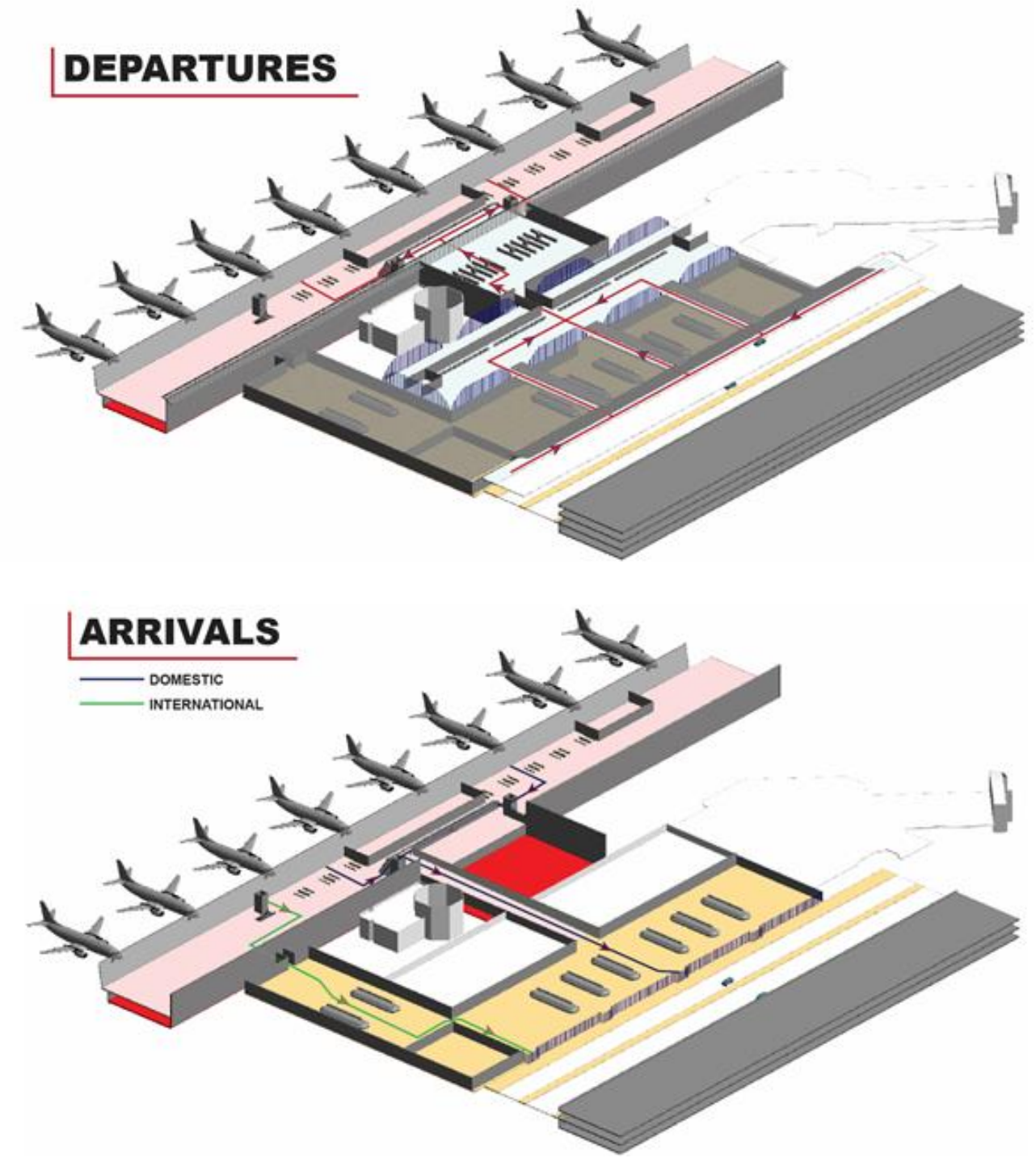
Figure 5.3-25: Detail of Preferred Terminal Alternative



Source: WSP USA, 2022.

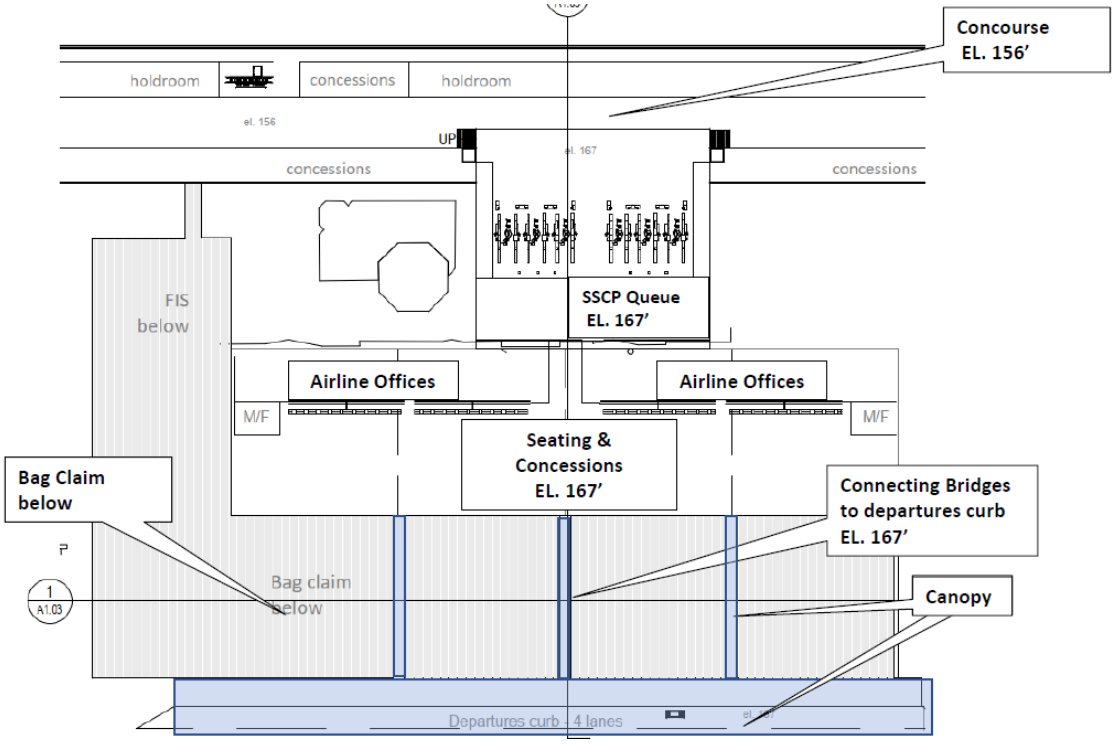
Figure 5.3-26 depicts the proposed arrivals and departure flows in the preferred terminal alternative. Preliminary terminal processor layouts are depicted in **Figures 5.3-27** and **5.3-28**, for the Ticketing and Baggage Claim Levels, respectively.

Figure 5.3-26: Departing and Arriving Passenger Flows in Preferred Terminal Alternative



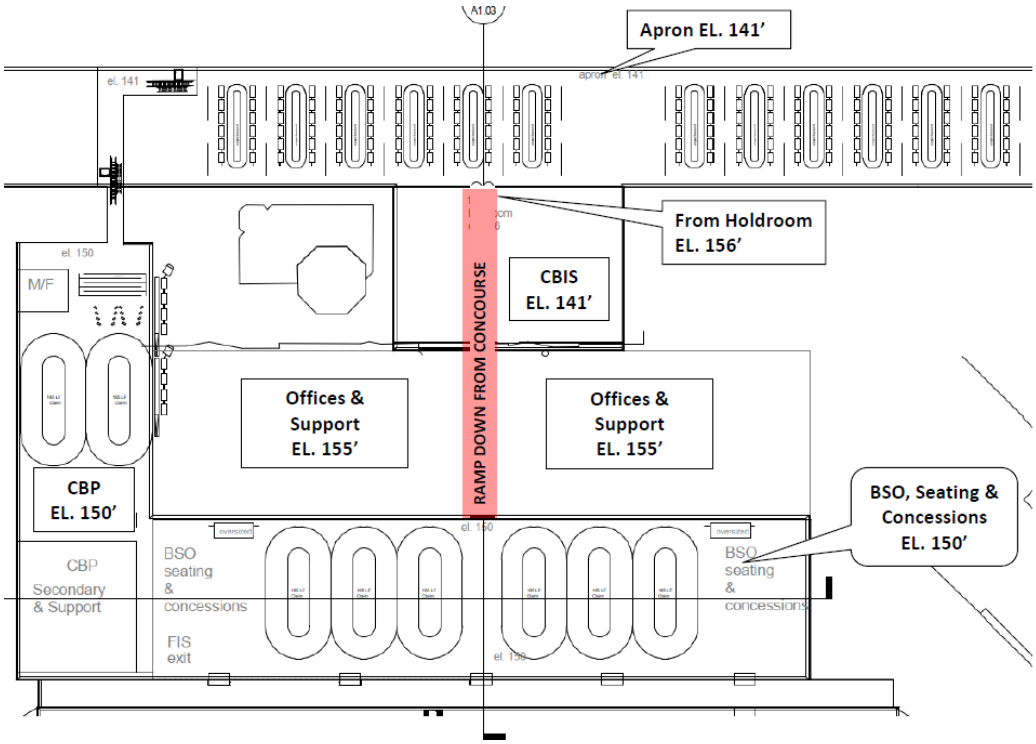
Source: WSP USA, 2022.

Figure 5.3-27: Preliminary Ticketing Level Layout



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

Figure 5.3-28: Preliminary Baggage Claim Level Layout



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

PREFERRED TERMINAL IMPACTS ASSESSMENT

As new building locations (and building removals), heights, volumes, and building materials and emitting frequencies become known during Advanced Planning and Design, the following assessments will need to be conducted:

- Potential impacts to the Instrument Landing Systems (ILS) for signal interference, reflections, and electromagnetic effects, from the new long linear terminal building parallel to Runway 12R-30L.
- Potential negative effects to any on-airport weather instruments, such as AWOS, ASOS, or SAWS.
- Potential physical or electromagnetic interference to the underground FAA cable loops, fiber and copper cables in duct banks around the Airport. Any FAA utility conflicts should be identified early and planned for remedy or relocation as early as possible in the project.
- Potential line of sight blockage of the Airport Surveillance Radar (ASR), to ensure all airspace sectors function properly. Likewise, if a building is removed and there was a software correction, then that would need to be assessed to ensure proper coverage.
- Functionality and coverage assessment of the Airport Surface Detection Equipment (ASDE).
- Assessment of Remote Transmitter Receivers (RTR) sites, to ensure redundant line-of-sight from the antennas to the runway ends, e.g., redundancy is if one RTR site is inoperable, another RTR site can provide backup air to ground communications between aircraft and the Airport Traffic Control Tower (ATCT). Air to ground communication channels can be moved from one RTR site to another RTR site in order to achieve redundancy, if needed and possible to achieve.
- Assessment of the ATCT line-of-sight (LOS) to all movement areas; this would typically be conducted as part of a simulation of the proposed new terminal building and aircraft movements to ensure a Concept of Operations (ConOps) between the new terminal's non-movement area and the handoff to Air Traffic Control (ATC) movement areas.
- Assessment of ATCT and connected base building access to maintain and replace the cab glass, roofing, windows, exterior caulking between the exterior precast panels, exterior painting, and other necessary exterior maintenance during the life of the structures.

5.4 LANDSIDE

The identification of current and future multimodal needs is important to the long-term operational effectiveness of an airport. Transportation alternatives focused on safety, improving roadway access/egress, and consideration of opportunities and constraints associated with other modes of transportation. For STL, the landside transportation alternatives included curbside and terminal roadway improvements, integration of a Ground Transportation Center (GTC), public and employee parking expansion, Metro Transit options, bicycle and pedestrian mobility, taxicab/TNC staging areas and cell phone waiting lots, rental cars.

5.4.1 AIRPORT ACCESS ROADS

The focus of landside improvements was to simplify the flow of traffic, reduce weaving and provide for easier decision-making while also handling the new traffic patterns. The main terminal access issue includes short decision distances that don't provide enough time for drivers to safely and efficiently move from the highway to either the curbside or parking facilities. Ideally, a single entrance to the airport would be used as the airport gateway. The airport entrance must be simple, allow free flow of traffic (no, or few, intersections and traffic signals ideally) and provide people plenty of decision time.

Ideally, airport access provides plenty of distance between the highway and the airport facilities. Figure 5.3-13 shows an ideal generic terminal access configuration. This configuration provides about a one-mile access road off the highway. This configuration simplifies traffic flow and provides ample distance for decision-making.

SUMMARY OF PASSENGER ROADWAY REQUIREMENTS

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

- Simplify access to/from the Airport
- Provide a dedicated approach road to the airport terminals and related facilities, in order to:
  - Provide a world-class driver experience
  - Allow better decision distances
  - Minimize confusion and lead to more driver-intuitive roads
  - Reduce conflict points and congestion

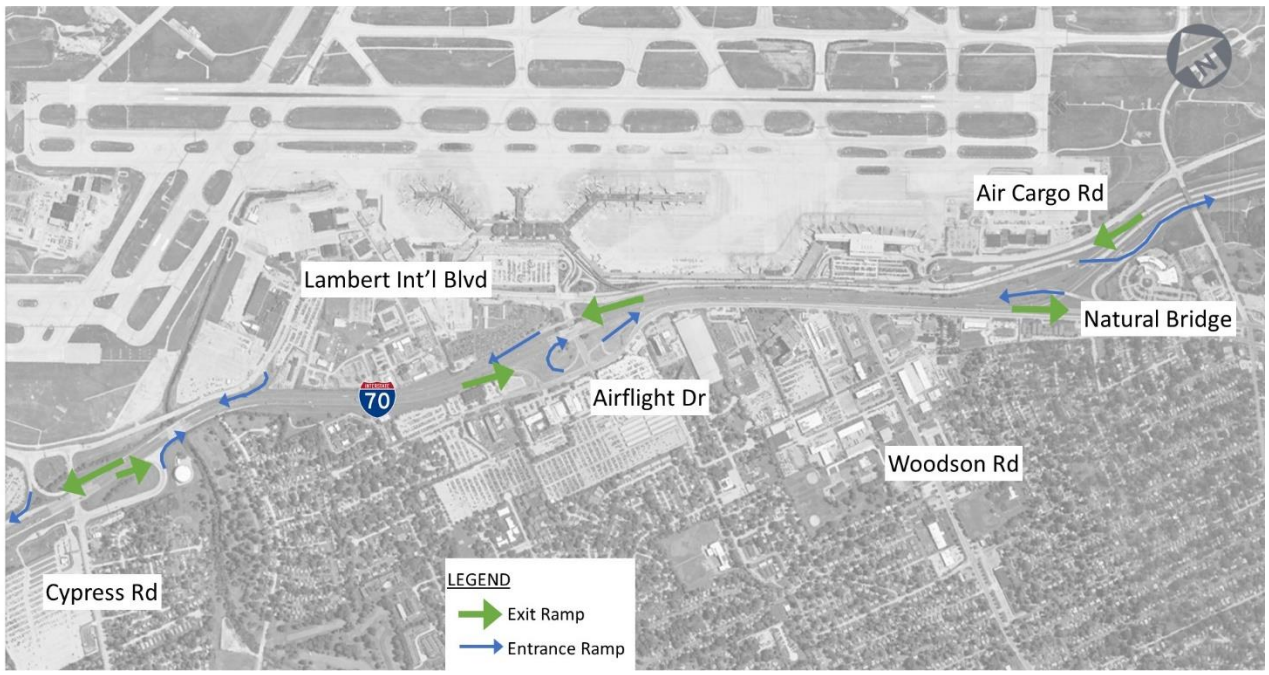
Goals for terminal access prioritized passengers, employees and shuttles.

INITIAL CONCEPTS DEVELOPMENT

Thirty initial high-level roadway access concepts were developed, without cost being a key factor, and therefore consisted of several direct connectors to the interstate to provide for improved traffic flow.

Figures 5.4-1 through **5.4-12** summarize the 30 initial concepts, including the "No Build" concept and a "Minor Improvements" concept. Some concepts dramatically improve access to/from the Airport, but includes several major roadway reconstructions, elevated structures and potential right-of-way (ROW) requirements.

Figure 5.4-1: No-Build and Minor Improvement Concepts

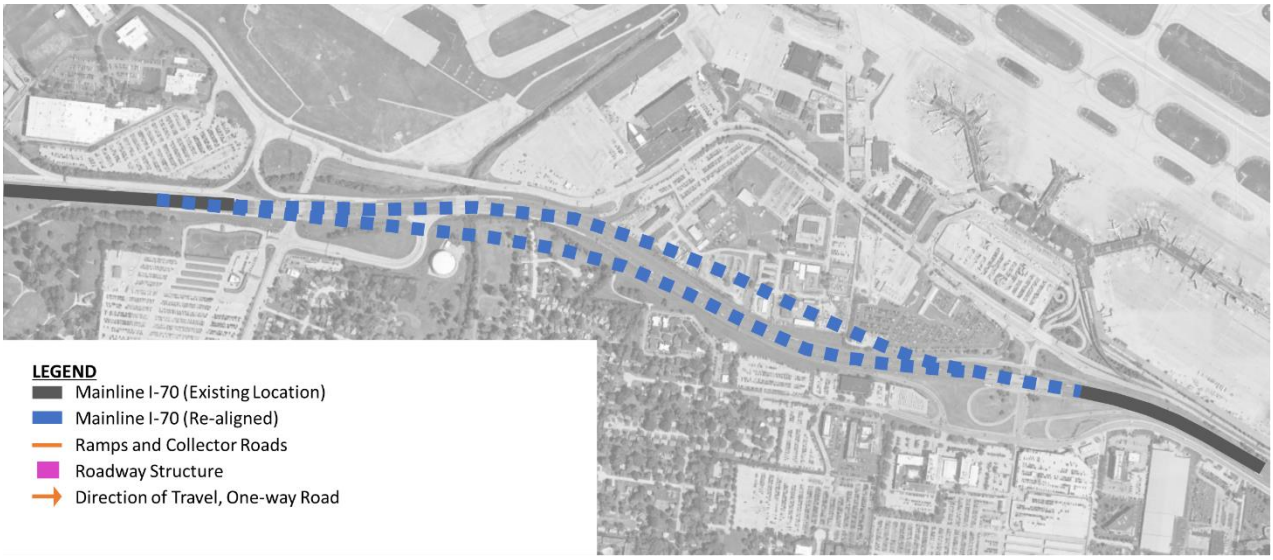


Source: WSP USA, 2022.

Figure 5.4-2: Concept 1 - One-way Outer Roads with Slip Ramps

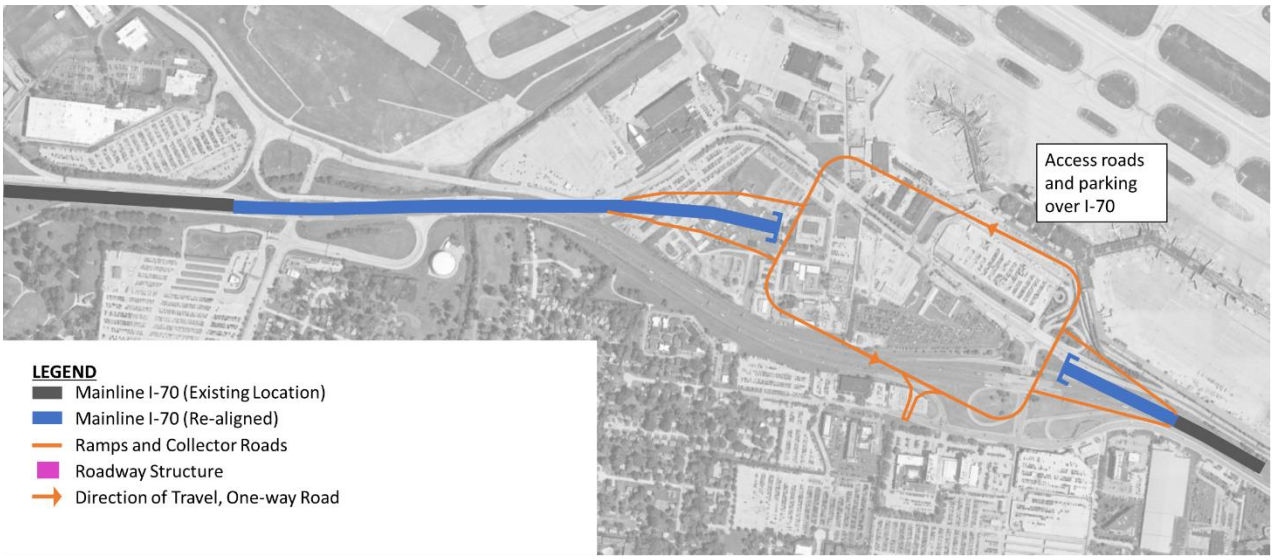
Source: WSP USA, 2022.

Figure 5.4-3: Concept 2 - Realign I-70 to the North



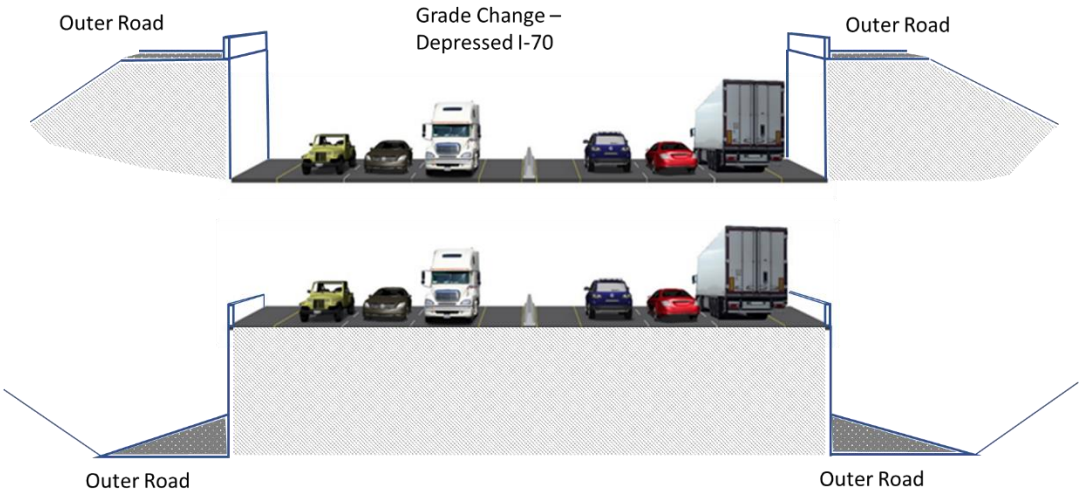
Source: WSP USA, 2022.

Figure 5.4-4: Concept 3 - Major Re-alignment of I-70 to the North with Tunnel



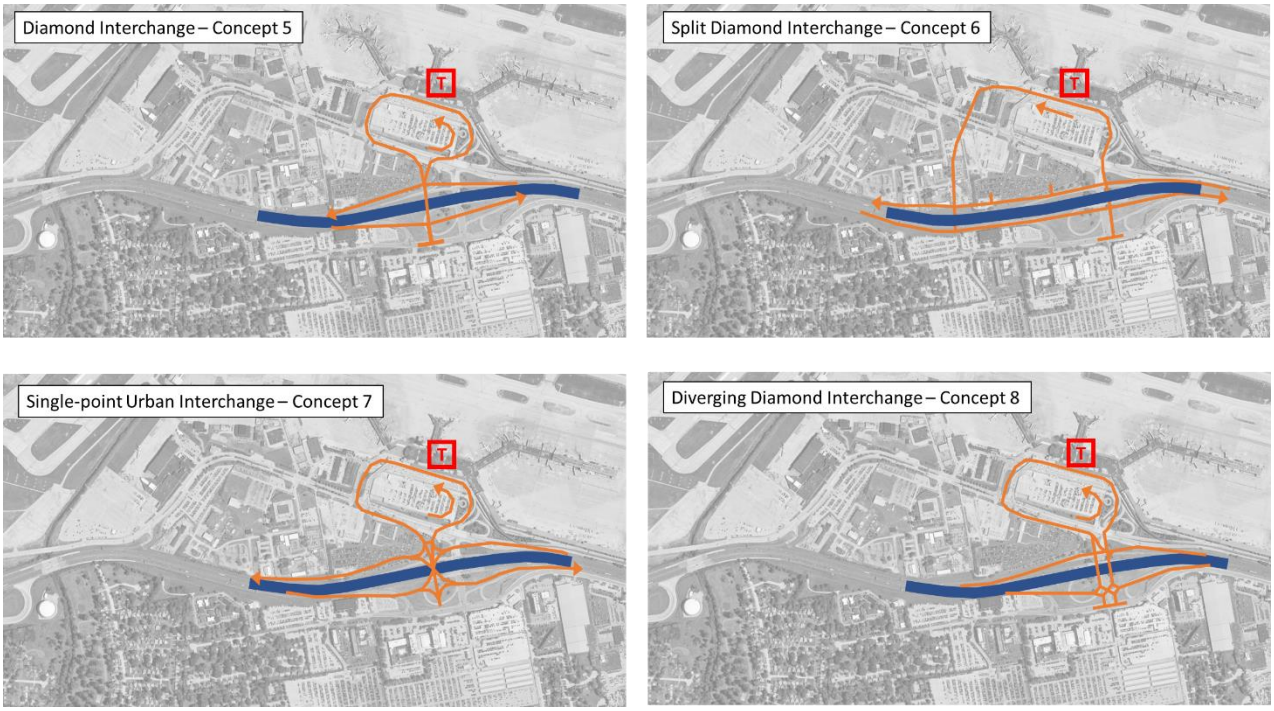
Source: WSP USA, 2022.

Figure 5.4-5: Concept 4 - Depress or Elevate I-70 Mainline



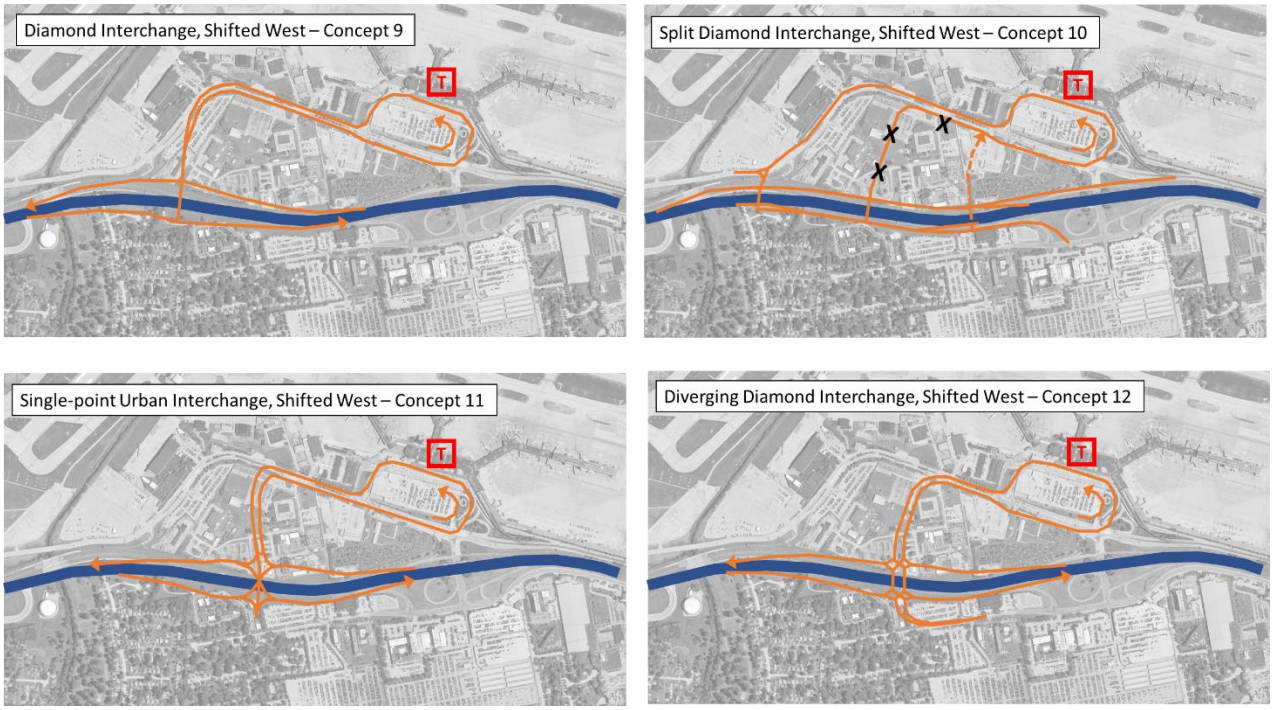
Source: WSP USA, 2022.

Figure 5.4-6: Concepts 5, 6, 7 and 8 - Various Interchange Types at Airflight Drive



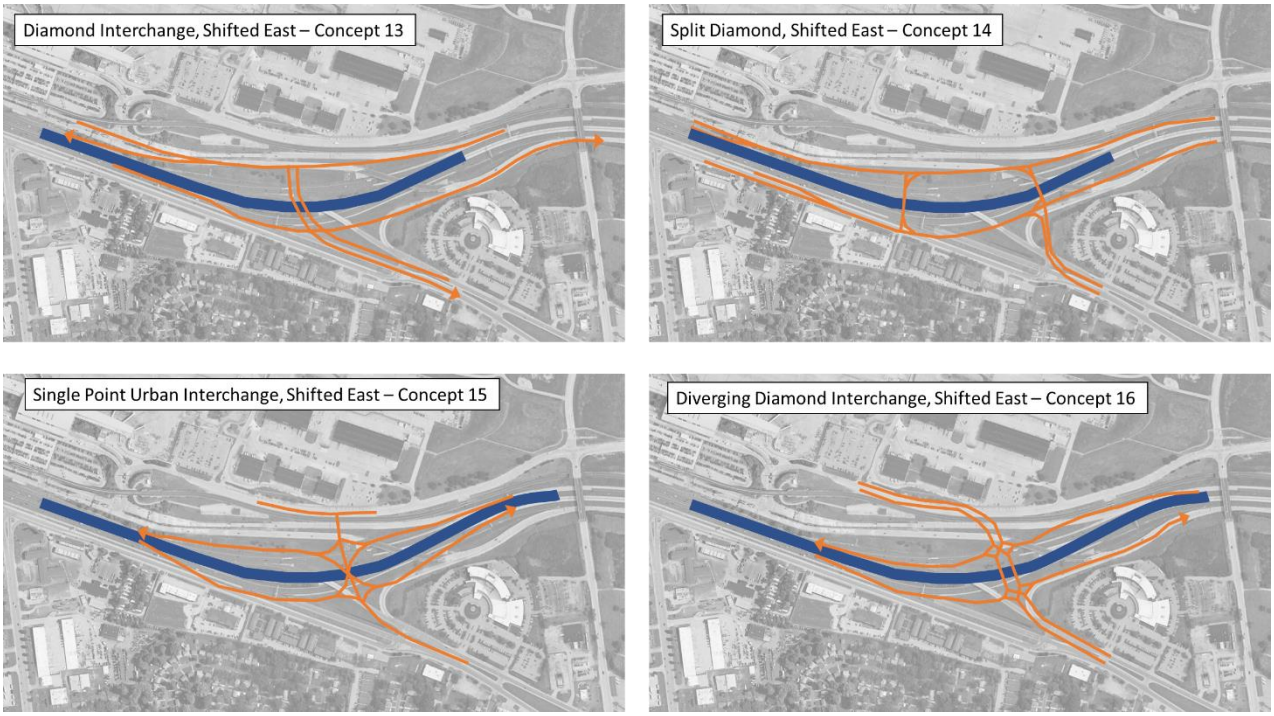
Source: WSP USA, 2022.

Figure 5.4-7: Concepts 9, 10, 11 and 12 - Various Interchange Types West of Airflight Drive



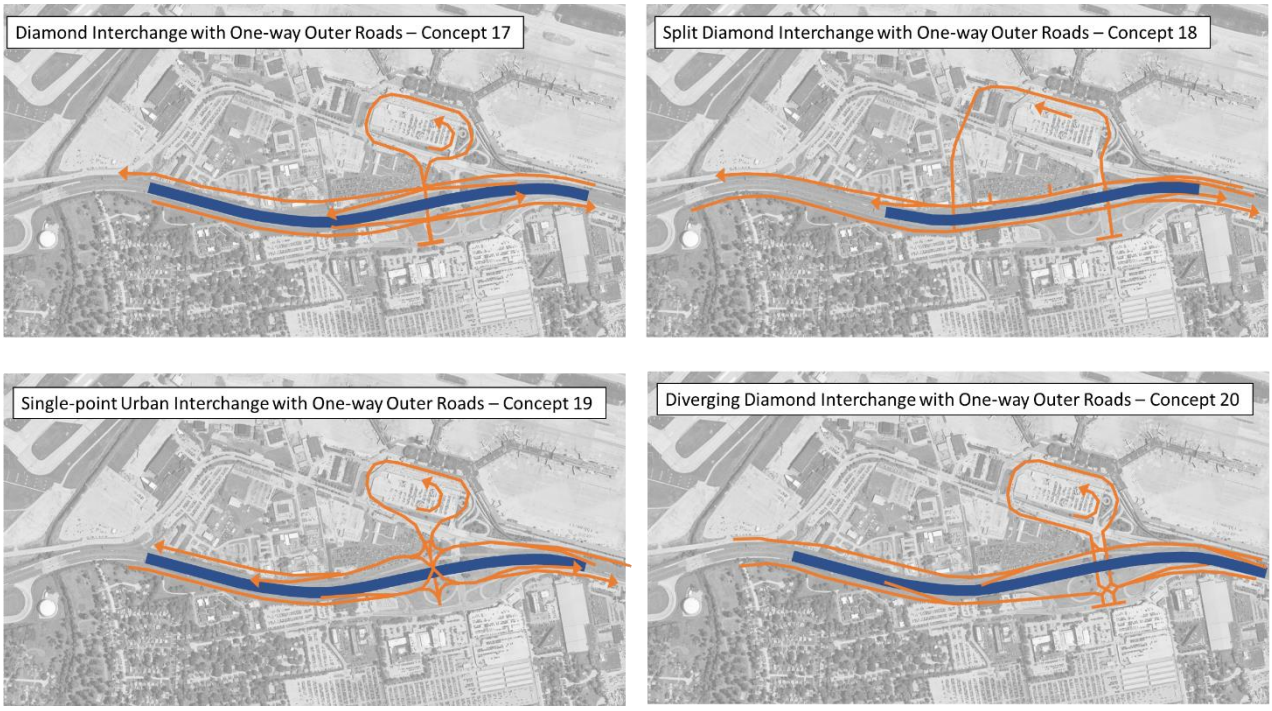
Source: WSP USA, 2022.

Figure 5.4-8: Concepts 13, 14, 15 and 16 - Various Interchange Types East of Airflight Drive



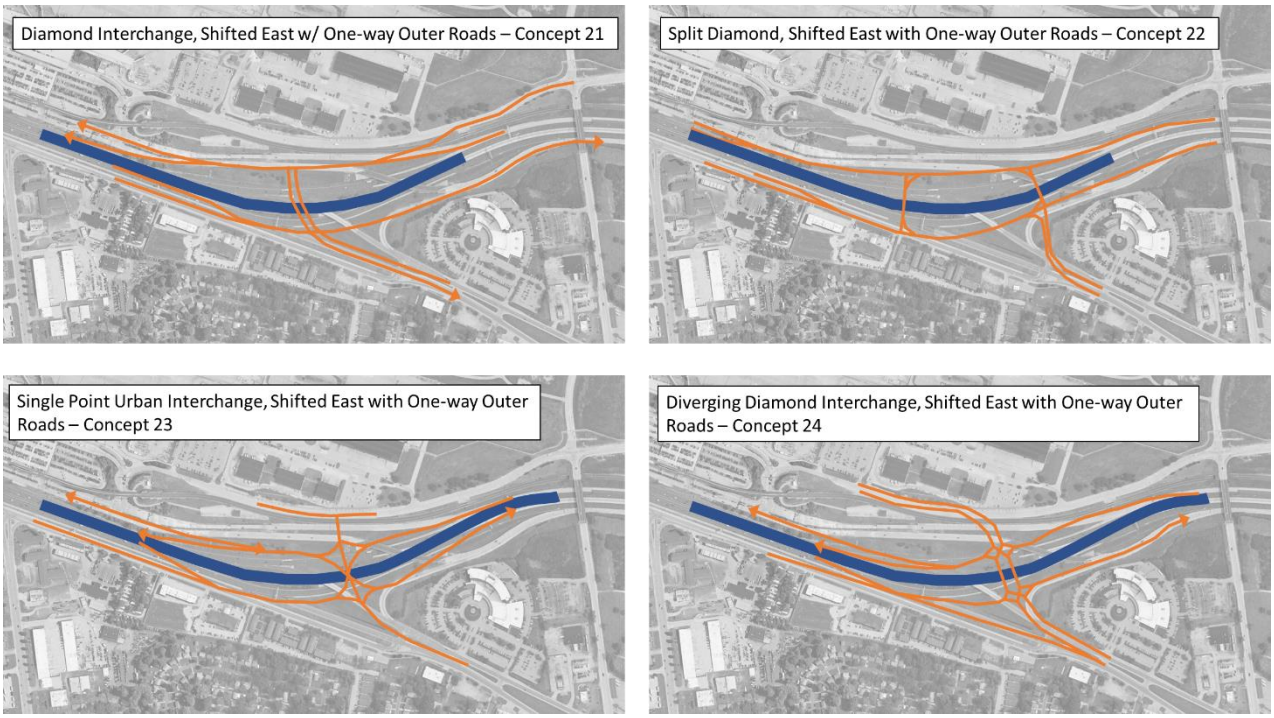
Source: WSP USA, 2022.

Figure 5.4-9: Concepts 17, 18, 19 and 20 - Various Interchange Types at Airflight Drive Combined with One-way Outer Roads



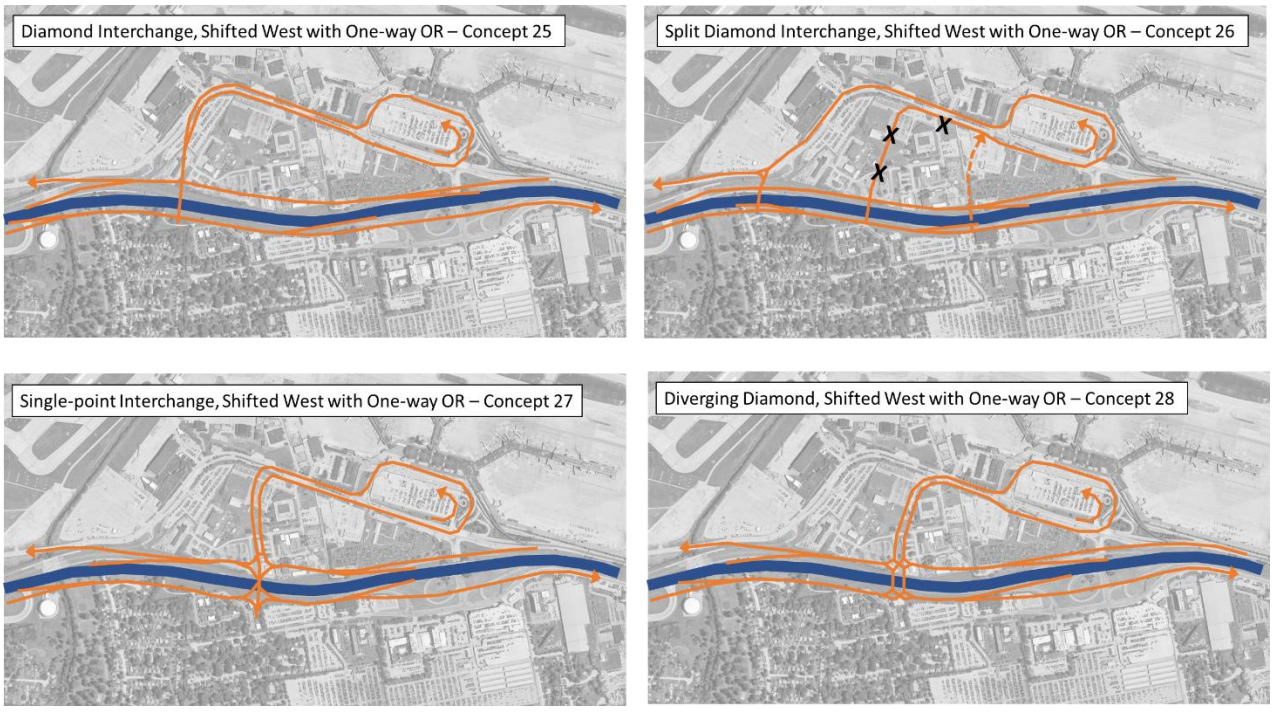
Source: WSP USA, 2022.

Figure 5.4-10: Concepts 21, 22, 23 and 24 - Various Interchange Types East of Airflight Drive Combined with One-way Outer Roads



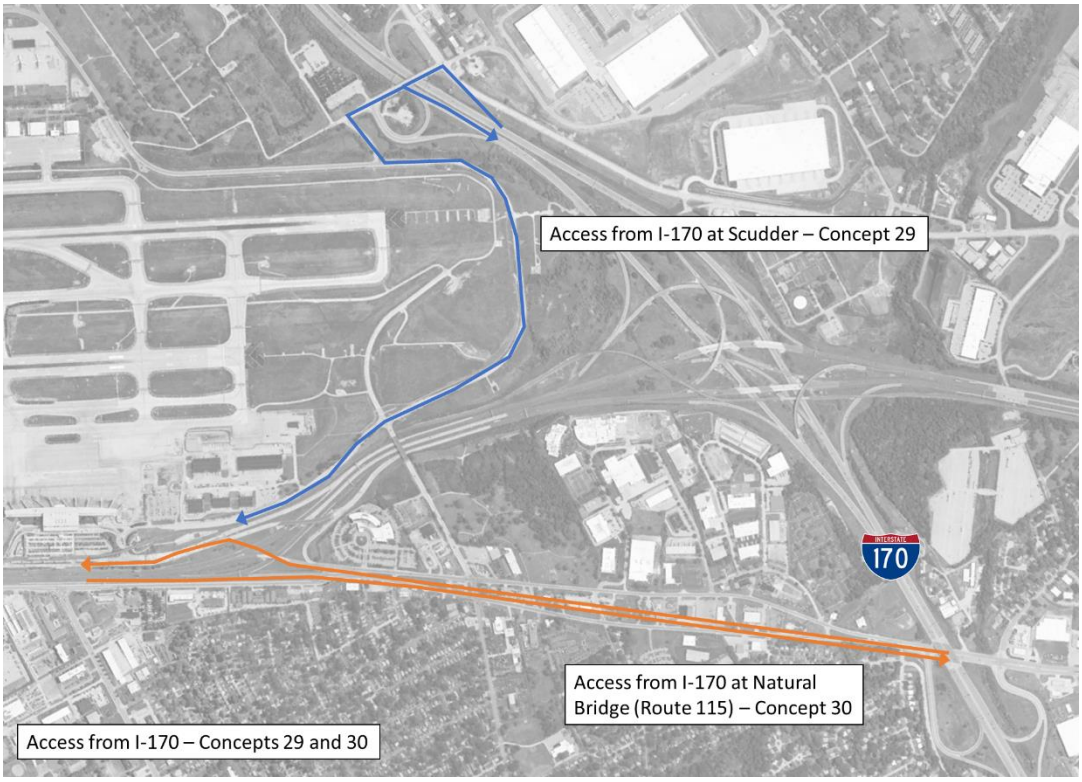
Source: WSP USA, 2022.

Figure 5.4-11: Concepts 25, 26, 27 and 28 - Various Interchange Types West of Airflight Drive Combined with One-way Outer Roads



Source: WSP USA, 2022.

Figure 5.4-12: Concepts 29 and 30 - Access from I-170



Source: WSP USA, 2022.

CONCEPT SCREENING

Each of the 30 roadway access concepts were evaluated through an initial screening process. Screening criteria were developed, weighted and applied to each of the 30 concepts. The screening criteria are:

- Access is simple/simplified
- Full access is provided (to and from EB and WB I-70)
- Access provides ample decision-making time/distance
- Sufficient capacity is provided
- Connectivity to local roads is available
- Opportunity for a grand entryway to STL and the region
- Improved north-south connectivity
- Improved bicycle and pedestrian access
- Avoids Runway Protection Zone
- Provides access to parking
- Avoids DOD property
- Order of magnitude cost (high, medium, low; noted for reference)

Table 5.4-1 summarizes the results of the initial screening. Each screening criteria was weighted on a scale of 1 to 3 scale. Several roadway planners individually screened each concept against the criteria, by allocating a score of 0, 1 or 2 (low, medium or high) to each screening criteria. Screening results from each planner were then consolidated, reviewed and finalized.

Table 5.4-1: Results of Initial Roadway Concepts Screening

Concept No.	Alternative	Alt Description	Simplified Access	Symmetrical (Full) Access	Long Decision Making	Sufficient Capacity	Good Local Access	Gateway (Grand) Entry	Improved North-South Connectivity	Improved Bike/Ped Circulation	New Roadway Alignment Inside RPZ	Good Access to Parking Options	Avoids DOD Property	TOTAL	Order of Magnitude Cost
0	No-build	Existing ramp/access configuration	0	2	0	0	0	0	0	0	2	1	2	10	L
1	One-way outer roads, slip ramps	Ramp locations variable	0	2	1	2	0	0	0	1	2	1	0	16	M
2	I-70 Realignment to the North	Combine with Alts 5 thru 8												NA	M
3	Major realignment of I-70, Tunnel	Combine with Alts 5 thru 8	2	0	2	1	0	1	0	0	1	2	0	16	H
4	Depress or Elevate I-70	Combine with any other Alts												NA	H
5	Diamond Interchange	at Airflight	2	2	1	0	0	0	0	1	2	1	1	14	L
6	Split Diamond Interchange	at Airflight	2	1	1	1	0	0	0	2	2	1	0	16	M
7	Single point Urban Interchange	at Airflight	2	2	1	0	0	0	0	1	2	1	1	14	L
8	Diverging Diamond Interchange	at Airflight	2	2	1	0	0	0	0	1	2	1	1	14	L
9	Diamond Interchange	Towards or at Cypress	2	2	2	1	1	2	0	0	1	1	1	22	M
10	Split Diamond Interchange	Towards or at Cypress	2	1	2	2	1	2	1	2	2	1	1	31	M
11	Single point Urban Interchange	Towards or at Cypress	2	2	2	1	1	2	1	1	2	1	0	25	M
12	Diverging Diamond Interchange	Towards or at Cypress	2	2	2	1	1	2	1	1	2	1	0	25	M
13	Diamond Interchange	Towards or at Natural Bridge	2	2	2	1	1	2	1	1	2	1	2	29	M
14	Split Diamond Interchange	Towards or at Natural Bridge	2	1	2	2	2	2	1	2	2	1	2	35	M
15	Single point Urban Interchange	Towards or at Natural Bridge	2	2	2	1	0	2	1	1	2	1	2	27	M
16	Diverging Diamond Interchange	Towards or at Natural Bridge	2	2	2	1	0	2	1	1	2	1	2	27	M
SCORE WEIGHTING			1	1	2	3	2	2	2	2	1	2	2		

Source: WSP USA, 2022.

Concepts 17 through 30 were scored with similar results. The addition of one-way outer roads to Concepts 5 through 16 resulted in no change to the scoring relative to each other. For example, Concept 22 (split diamond towards cypress with one-way outer roads) and Concept 26 (split diamond towards Natural Bridge with one-way outer roads), both scored highest in comparison to all other alternatives with one-way outer roads.

Concepts 10 and 14 scored the highest overall and were retained for further evaluation and refinement. Note that Concept 10 performs similarly with or without one-way outer roads; it was decided that this concept, without corridor-wide outer road assumptions, was carried forward (i.e., with Natural Bridge and Lambert International Boulevard remaining with two-way operation).

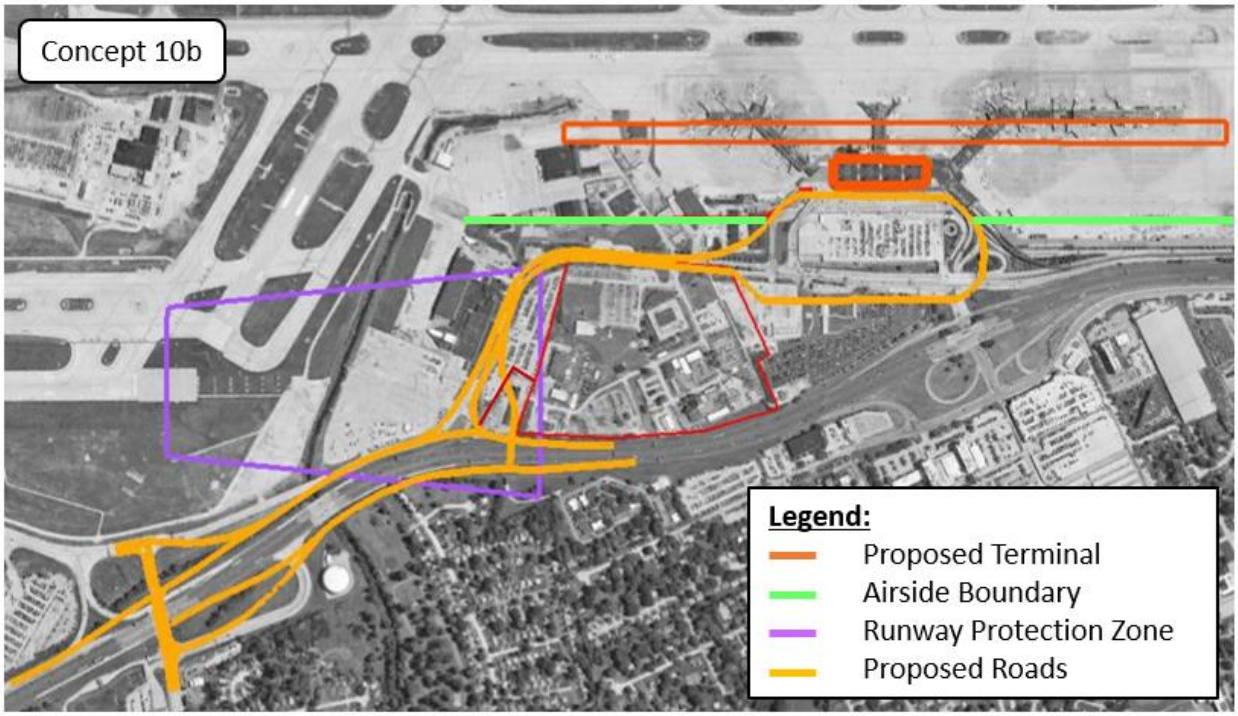
CONCEPT REFINEMENT

Refinement of shortlisted Concepts 10 and 14 resulted in Alternatives 10b and 10c, as well as Alternative 14b.

ALTERNATIVE 10B

Alternative 10b, depicted on **Figure 5.4-13**, is a modified split diamond configuration with one crossover at Cypress Road and a new crossover to the east, near Lamber International Boulevard (LIB). Access to and from the terminal loop road is via LIB. Access from I-70 in this concept is just east of Cypress (from eastbound I-70) and just east of the new crossover (from westbound I-70). Access to I-70 is provided just east of Cypress (to westbound I-70) and just east of the new crossover (to eastbound I-70).

Figure 5.4-13: Roadway Alternative 10b – Split Diamond to the West

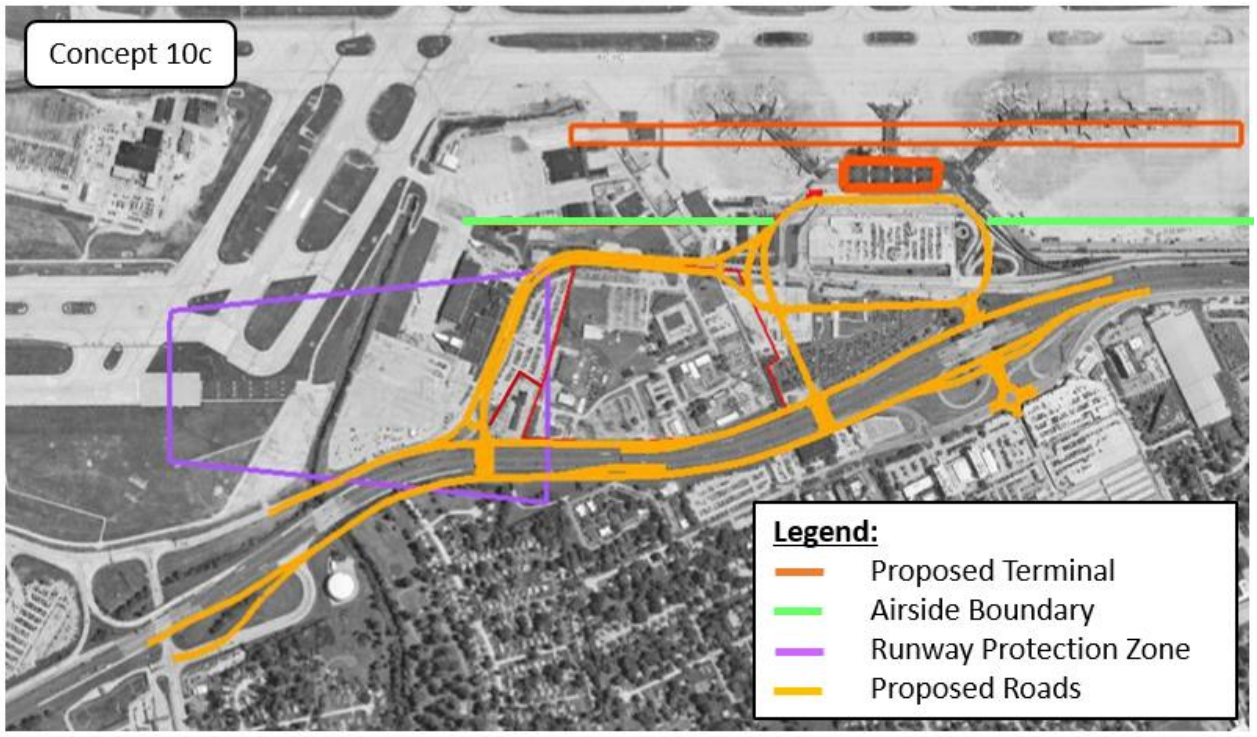


Source: WSP USA, 2022.

ALTERNATIVE 10C

Alternative 10c, depicted on **Figure 5.4-14**, is another variation of a modified split diamond configuration with two new crossovers of I-70; one near LIB and the other west of Airflight Drive. Access to the terminal loop road is provided via LIB. Access from the loop road back to the interstate is via LIB or via a new direct access that is grade-separated from the inbound movements just west of the terminal loop. Access from I-70 is provided just east of Cypress (from eastbound I-70) and east of Airflight (from westbound I-70). Access to I-70 is provided between the two crossovers (to westbound I-70) or east of Airflight (to eastbound I-70). A secondary westbound I-70 access is also available via LIB and Cypress Road.

Figure 5.4-14: Roadway Alternative 10c – Split Diamond West of Airflight

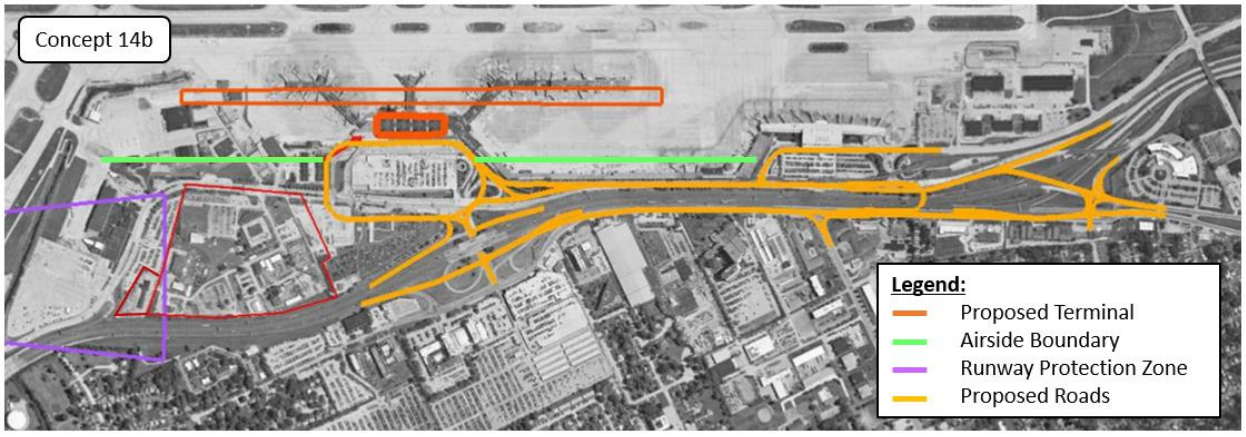


Source: WSP USA, 2022.

ALTERNATIVE 14B

Alternative 14b, depicted on **Figure 5.4-15**, is a modified split diamond between Airflight Drive and Natural Bridge Road to the east, with crossovers at Airflight and a new overpass between Woodson Road and Natural Bridge. Access to and from the terminal loop is via LIB (converted to westbound) and via Natural Bridge (converted to eastbound) between the two crossovers. Access from I-70 is provided west of Airflight (from eastbound I-70) and east of Natural Bridge (from westbound I-70). Access to I-70 is provided at Airflight (to both eastbound and westbound I-70).

Figure 5.4-15: Roadway Alternative 14b – Split Diamond East of Airflight



Source: WSP USA, 2022.

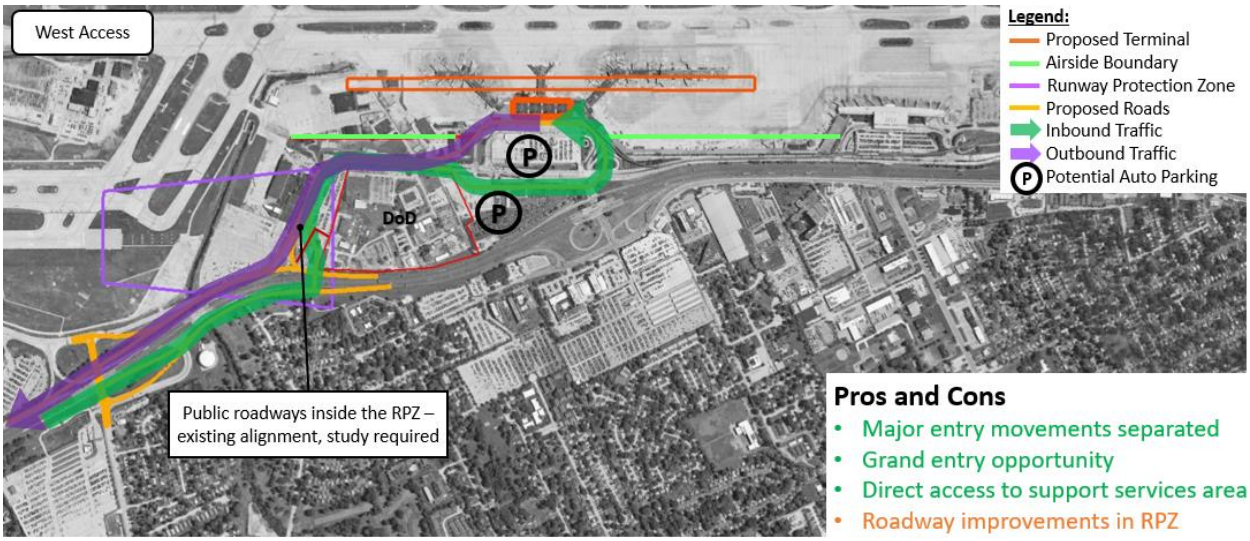
EVALUATION OF REMAINING ACCESS ROAD ALTERNATIVES

AIRPORT ACCESS

Access to and from the east and west was reviewed for each alternative. **Figures 5.4-16** to **5.4-21** summarize access and pros and cons for Concepts 10b, 10c and 14b.

In each scenario, primary ingress and egress access is provided. Factors evaluated included the length of each route, redundancy of adjacent alternative routes, and visibility of the airport destination for each approach.

Figure 5.4-16: East/West Airport Access

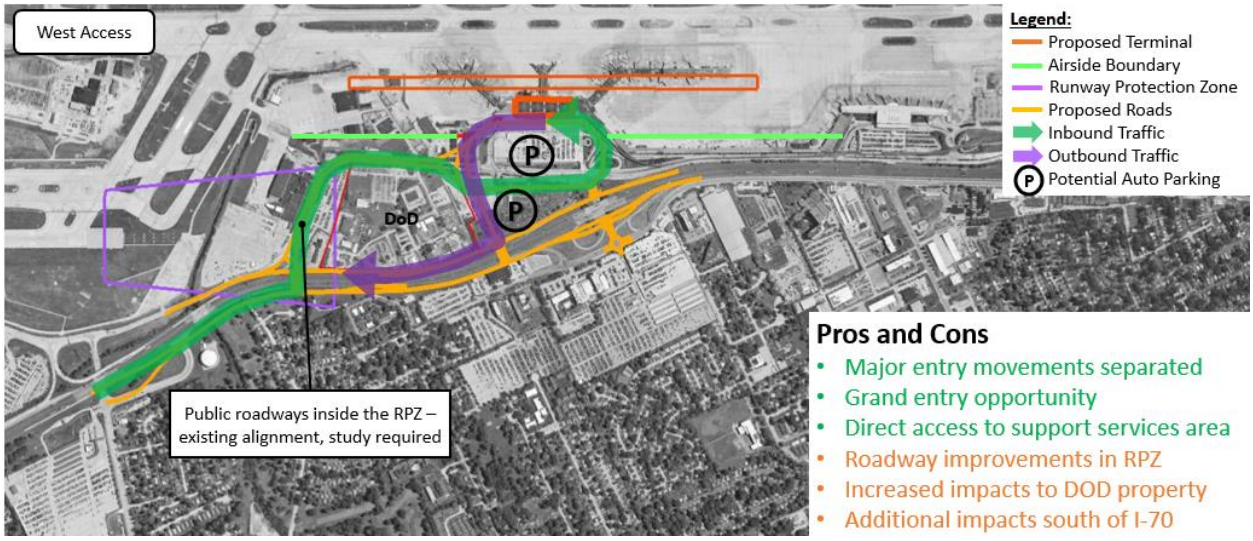


Source: WSP USA, 2022.

Figure 5.4-17: East Access for Concept 10b

Source: WSP USA, 2022.

Figure 5.4-18: West Access for Concept 10c

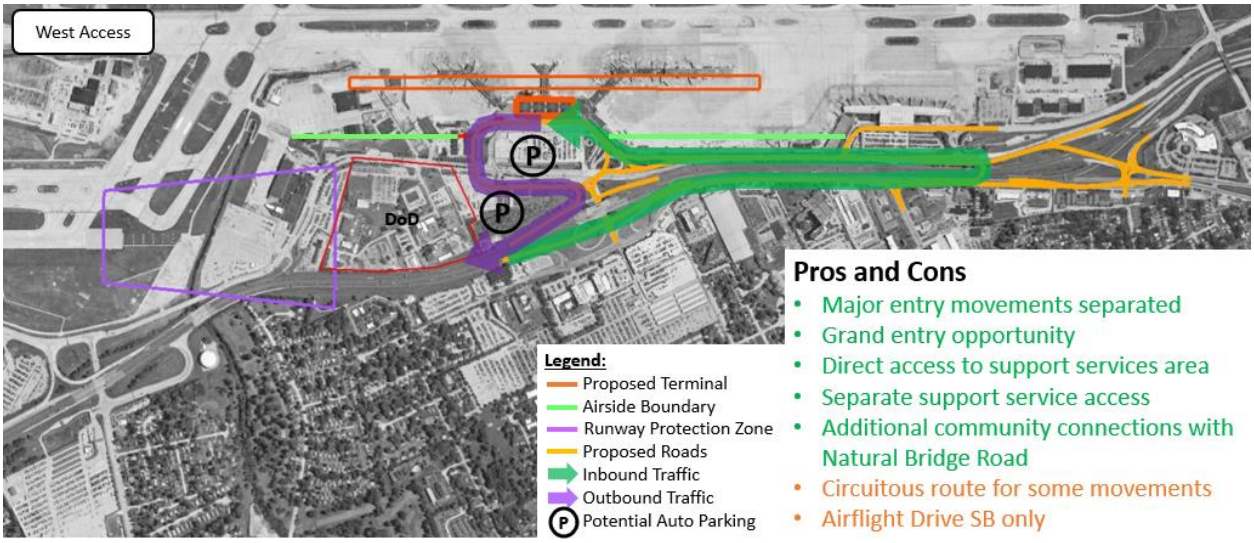


Source: WSP USA, 2022.

Figure 5.4-19: East Access for Concept 10c

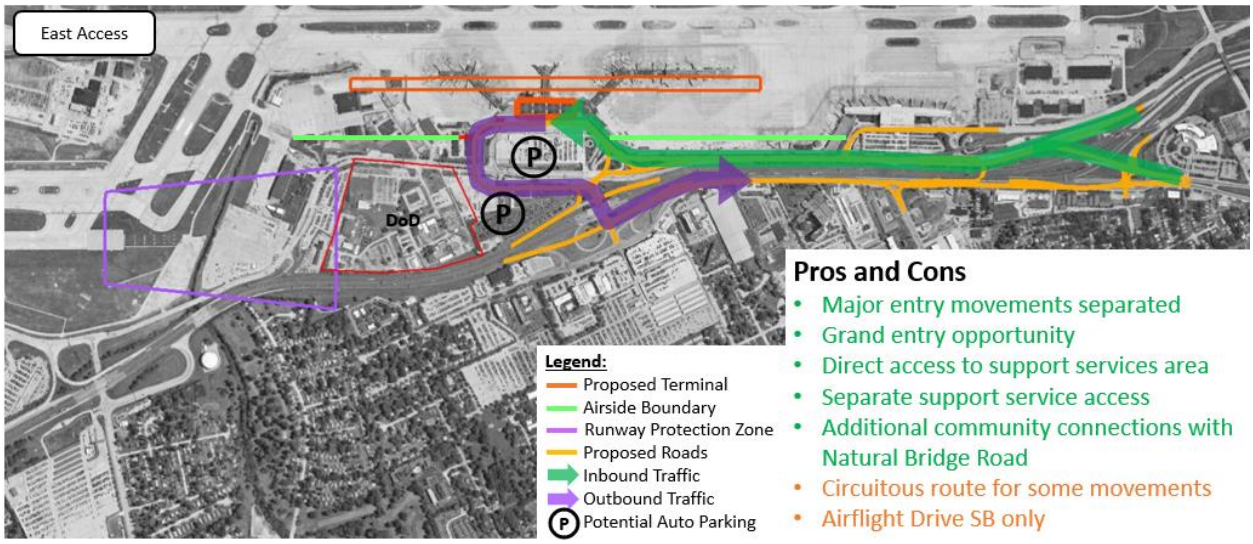
Source: WSP USA, 2022.

Figure 5.4-20: West Access for Concept 14b



Source: WSP USA, 2022.

Figure 5.4-21: East Access for Concept 14b

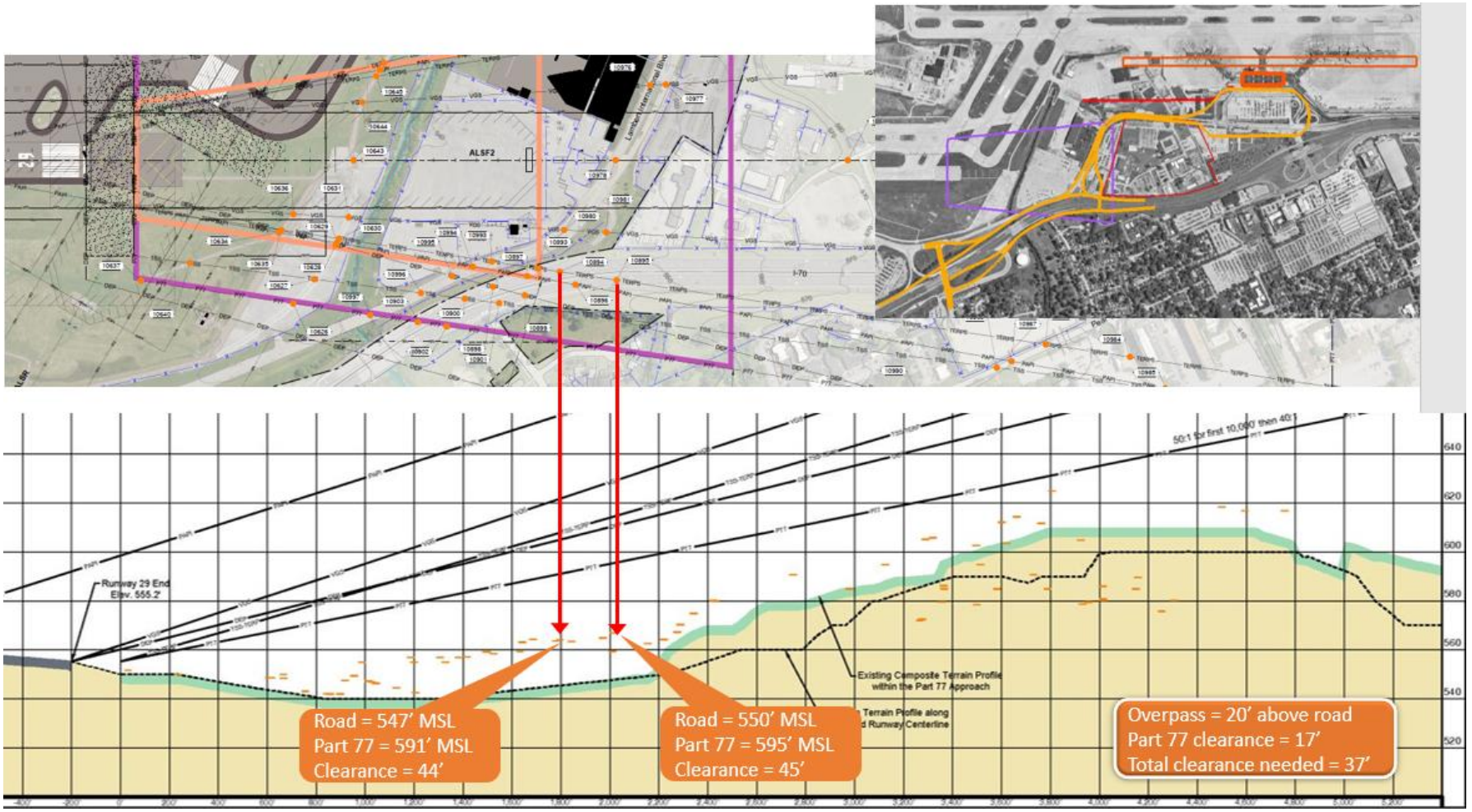


Source: WSP USA, 2022.

AIRSPACE CONSIDERATIONS

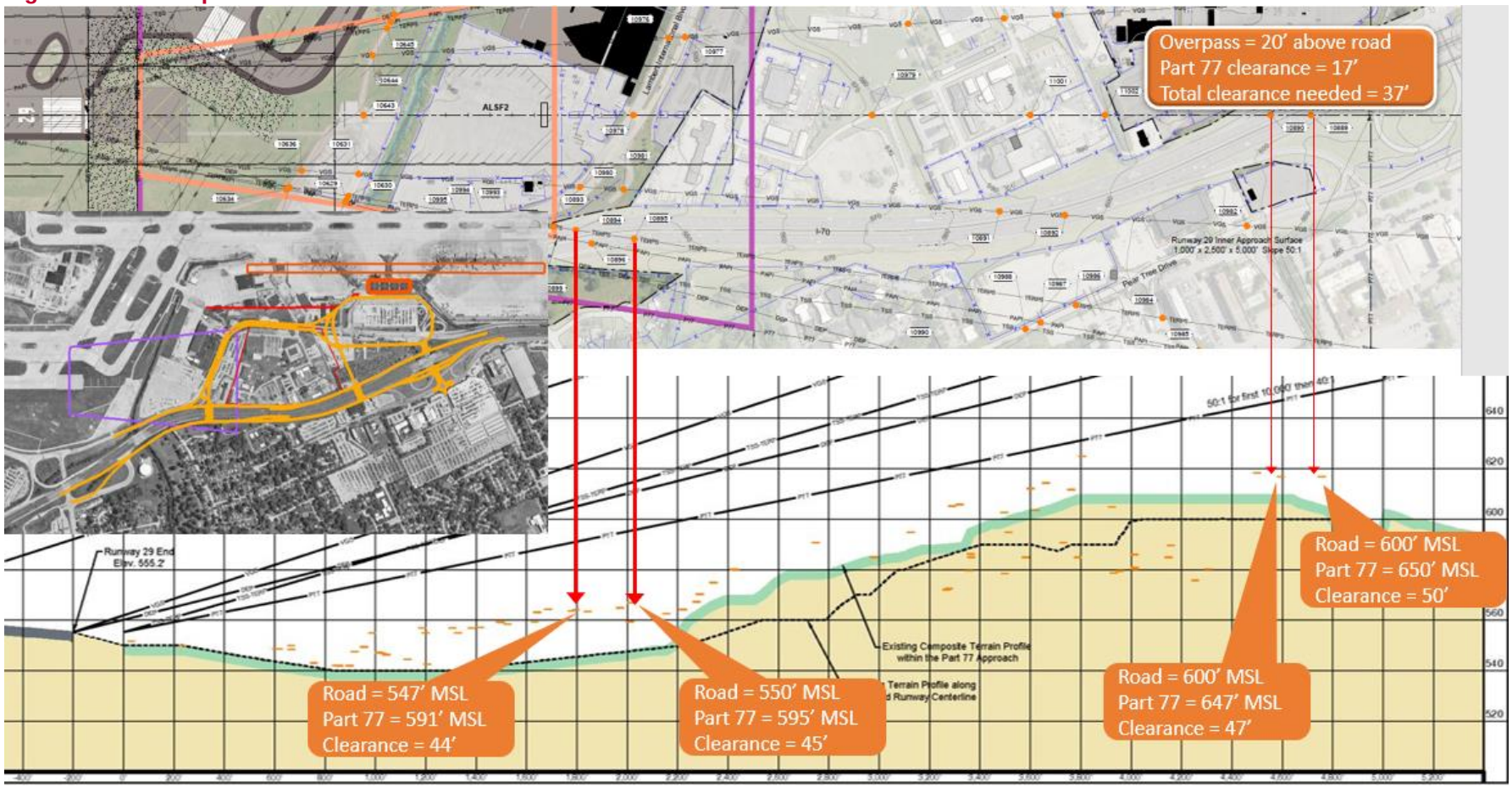
Potential airspace impacts of new overpasses were reviewed. Overpasses were assumed to be 20 feet above ground. Another 17 feet of clearance is prescribed in 14 CFR Part 77 for highways. As such, the total clearance between existing terrain and 14 CFP Part 77 surfaces (Runway 29 Approach Surface) needs to be 37 feet where potential Airport access roads may be constructed. As shown in **Figures 5.4-22** and **5.4-23**, both Alternatives 10b and 10c provide more than 37 feet of clearance between existing terrain and 14 CFR Part 77 surfaces above potential roadways.

Figure 5.4-22: Airspace Considerations for Alternative 10b



Sources: WSP USA, 2022; CMT, 2022.

Figure 5.4-23: Airspace Considerations for Alternative 10c



Sources: WSP USA, 2022; CMT, 2022.

PREFERRED ACCESS ROAD ALTERNATIVE

ULTIMATE PREFERRED ALTERNATIVE

Concept 10b was removed due to the proximity and overlapping traffic patterns with the Cypress and Lindbergh Boulevard interchange. Concepts 10c and 14b were then evaluated and compared, based on the ingress and egress pros and cons and access configuration for all modes. Results are summarized in **Table 5.4-2**.

Table 5.4-2: Summary of Ingress and Egress Opportunities for Concepts 10c and 14b

CATEGORY	ALTERNATIVE 10C	ALTERNATIVE 14B
VEHICULAR ACCESS		
Terminal Access from the West	Exit near Cypress, new crossover of I-70 to reach LIB; route length of 1.3 miles.	Exit near Airflight, double back on north outer road; route length of 2.0 miles.
Terminal Access from the East	Exit near Airflight, outer road access to LIB; route length of 1.8 miles.	Exit near McDonnell Boulevard and follow north outer road; route length of 1.3 miles.
Exit to the West	Fast direct access; route length of 0.9 miles.	Fast direct access; route length of 0.6 miles.
Exit to the East	Fast direct access; route length of 0.9 miles.	Fast direct access; route length of 1.1 miles.
Local Access at Cypress	Unchanged	Unchanged
Local Access at Airflight Drive	Full access; must double-back 0.5 miles to access from the East; must exit at Cypress to access from the West	3/4 access - NB Airflight has to double back 1.6 miles to access Terminal or WB I-70
Local Access at Natural Bridge	Unchanged	Mostly unchanged; removed left side entrance to WB I-70
Redundancy to/from the West	Redundancy to Terminal; three routes to exit to the West	Redundancy to Terminal provided at Natural Bridge; two routes to exit to the West
Redundancy to/from the East	Redundancy to Terminal provided at Cypress; three routes to exit to the East	Redundancy to Terminal provided at Airflight (requires double-back on north outer road); two routes to exit to the East
Capacity Pinch Points	North (WB) Collector/Outer Road at Exit Route	Exiting traffic at Airflight
BIKE & PEDESTRIAN ACCESS		
North-South at Cypress	Unchanged	Unchanged
North-South at Airflight	Greatly improved	Greatly improved
North-South at Natural Bridge	Unchanged	Greatly improved
New overpass East of Cypress	New potential route	Not applicable
ENTRYWAY AND DEPARTURE EXPERIENCE		

Location	West side of loop road; also, opportunity near I-70 east of Cypress	I-70 near Airflight and LIB
Visibility	Good visibility to both locations noted above	Limited, screened by MetroLink
Arriving at the Terminal Experience	Simple and long arrival experience; some doubling back for arrivals from the East	Not as simple but adequate in length; long double-back for arrivals from the West
Leaving the Terminal Experience	Relatively short, simple and redundant	Possibly too short; congestion pinch point possible at Airflight (especially for EB traffic)

Source: WSP USA, 2022.

Alternative 10c, depicted in **Figure 5.4-24**, was selected as the preferred Airport access road alternative for the following reasons:

- Drivers are provided improved traffic flow and ample decision-making time arriving predominantly via eastbound and westbound I-70. Ingress and egress routes are relatively simple and not excessively circuitous.
- Connectivity to local roadway network is improved, including for bicycles and pedestrians. Transit access is maintained at current levels.
- Traffic volumes are distributed across ingress and egress movements in order to provide adequate peak capacity through foreseeable future scenarios.
- North-south connectivity to the community and adjacent businesses

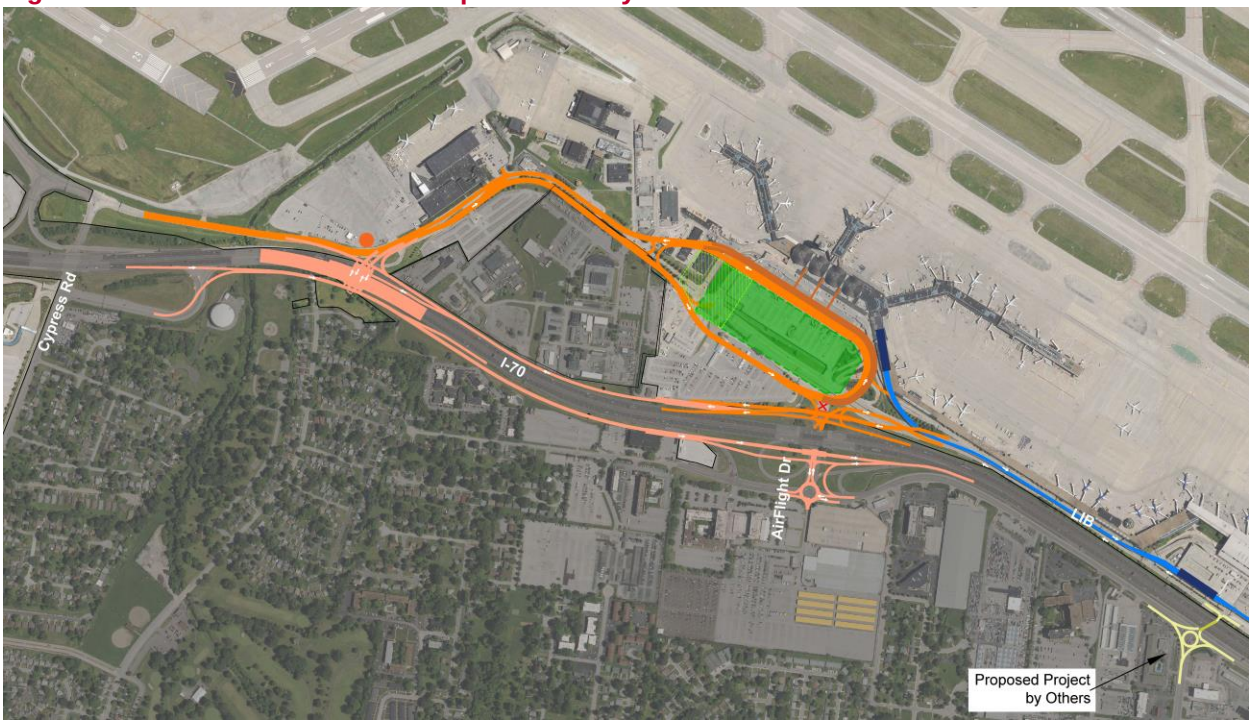
Refinements to accommodate shuttle access and circulation at Airflight Drive and to and from LIB, east of the terminal loop, will be considered in Advanced Planning. Coordination with Missouri Department of Transportation (MoDOT) and other third-party agencies will continue for further analysis and implementation.

INTERIM PREFERRED ALTERNATIVE

The preferred ultimate roadway alternative requires several connections to MODOT roadways, as well as improvements/new sections of road by MODOT. Until MODOT completes its analysis of the roadway network around the airport and defines how to best connect with the Master Plan's preferred alternative, an interim roadway access plan will be implemented, based on the current 2040 plan. The interim airport roadway access is depicted on **Figure 5.4-25**.

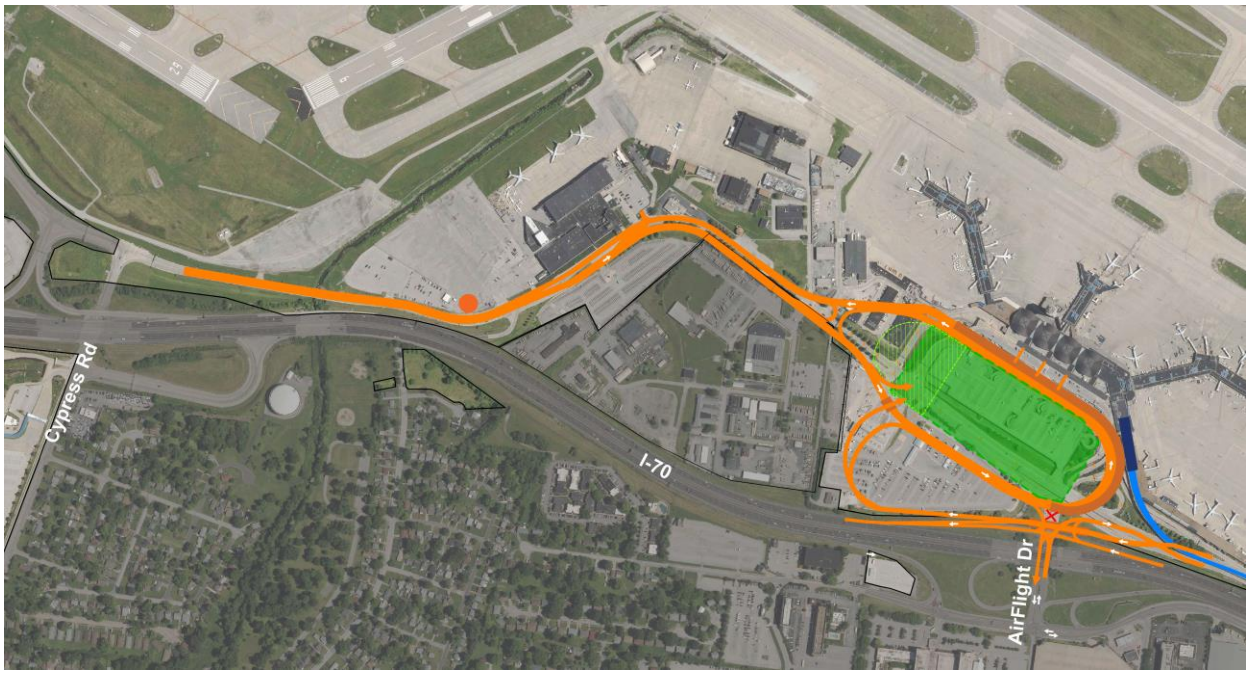
Both the interim and ultimate plans are still evolving, and will be refined in Advanced Planning.

Figure 5.4-24: Preferred Ultimate Airport Roadway Alternative



Source: WSP USA, 2023.

Figure 5.4-25: Interim Airport Roadway Access Plan



Source: WSP USA, 2023.

5.4.2 TERMINAL CURBSIDE

Improving curb operations is also a critical component of enhancing the experience and safety for STL users. The existing curbside at Terminal 1 cannot accommodate forecast roadway traffic in 2040.

SUMMARY OF FACILITY REQUIREMENTS

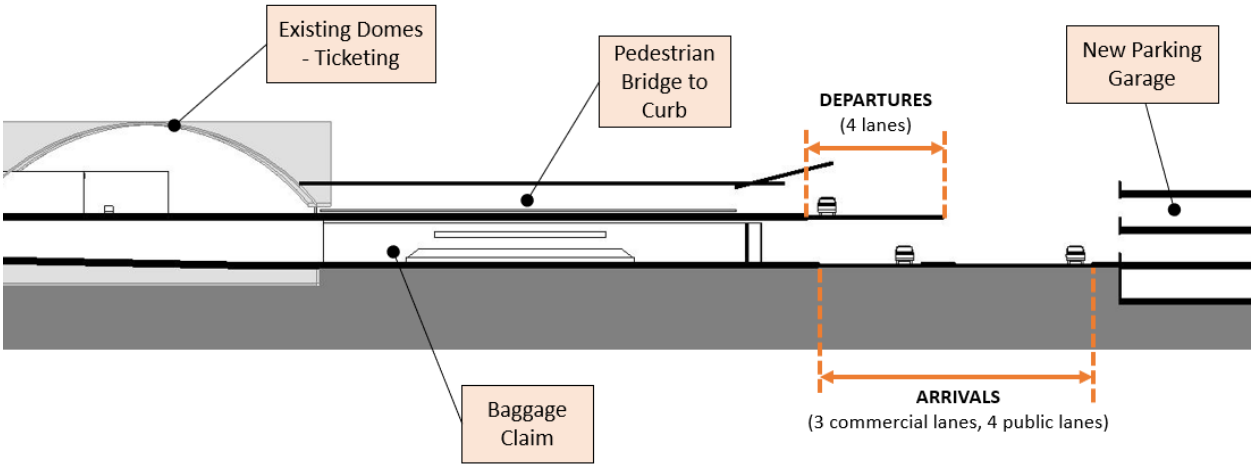
Although the existing terminal domes are planned to remain, the Arrivals and Departures Curbs would be reconstructed to optimize their layout and meet current industry standards.

The conventional terminal curbside is two levels, with Arrivals and Departures lanes stacked on top of each other. The Departures Curb is on the upper level and the Arrivals Curb on the lower level. The Departures Curb would consist of four lanes, and the Arrivals Curb of seven lanes (four lanes for public vehicles and three lanes for commercial vehicles). With a GTC, only four public lanes would be required on the lower level.

ALTERNATIVES

Figure 5.4-26 depicts a cross-section of the proposed two-level terminal curbs proposed at STL.

Figure 5.4-26: Proposed Two-Level Terminal Curbs



Source: WSP USA, 2022.

If a GTC is constructed at STL, the three commercial lanes on the Arrivals Level are no longer needed, and the four public lanes can be moved closer to the terminal, directly under the Departures Level lanes. This would also allow the Parking Garage footprint to extend closer to the terminal, making for a potentially larger parking garage.

5.4.3 AUTOMOBILE PARKING

PUBLIC PARKING

SUMMARY OF FACILITY REQUIREMENTS

Table 5.4-3 summarizes auto parking requirements. Approximately 12,000 on-airport parking spaces are needed. It is assumed that approximately 5,000 spaces will be provided in existing surface lots B, C and D, which will remain.

Table 5.4-3: Public Parking Spaces Requirements

	NUMBER OF SPACES				ACRES
	2019 (EXISTING)		2040		2040
	DEMAND	SUPPLY	DEMAND	SUPPLY	
On-Airport	8,400	9,000	11,000	12,000	94
Off-Airport					
Private Operator		10,100		13,500	
Hotel Operator		1,100		1,100	

Notes:

No off-airport demand data.

Assumes same off-airport private parking supply share (53% of total parking).

Source: WSP USA, 2021.

ALTERNATIVES

Assumptions

A series of workshops were held to discuss various auto parking alternatives. The following assumptions were used:

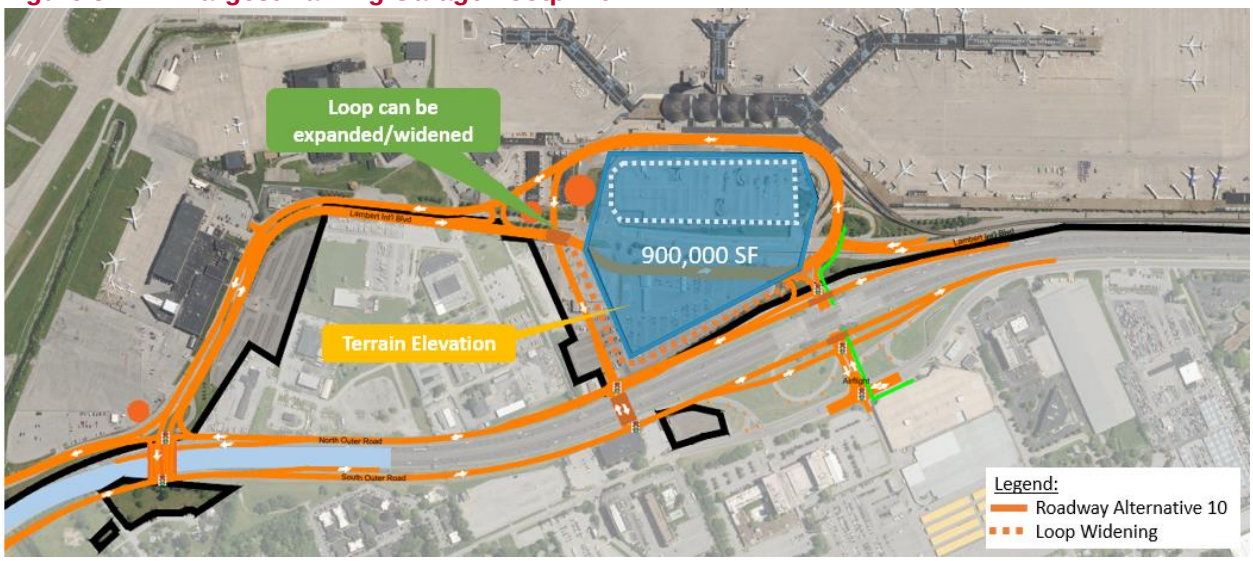
- Needs based on approved passenger forecast through 2040
- Existing demand reflects peak day peak hour (93% parking utilization)
- 2040 supply assumes:
  - Same share of on/off-airport parking
  - 90% parking utilization (10% buffer is industry standard for short-term parking)
- Approximately 12,000 on-airport parking spaces are needed. It is assumed that approximately 5,000 spaces will be provided by surface lots B, C and D, and the remainder in a parking garage.

Considerations

Various factors were considered in developing the public parking alternatives. They included:

- **Parking garage footprint**: the approximate largest footprint of a parking garage in front of the proposed terminal building is 900,000 sq. ft., as shown on **Figure 5.4-27**. Pros and cons of a larger footprint (with fewer levels) include:
  - Pros:
    - Can accommodate all on- and off-airport growth
    - Provides flexibility as it can accommodate other uses (GTC, CONRAC, …)
  - Cons:
    - Terrain rises as get toward I-70; would require excavation
    - Construction cost of a larger structure

Figure 5.4-27: Largest Parking Garage Footprint



Source: WSP USA, 2022.

- **Parking garage number of levels**: visibility of the historic domes is an important consideration. The domes are already limited by trees and road signs today, as shown on **Figure 5.4-28.** The existing parking garage is 4 levels. As a result, the proposed parking garage may be 4 or 5 levels.

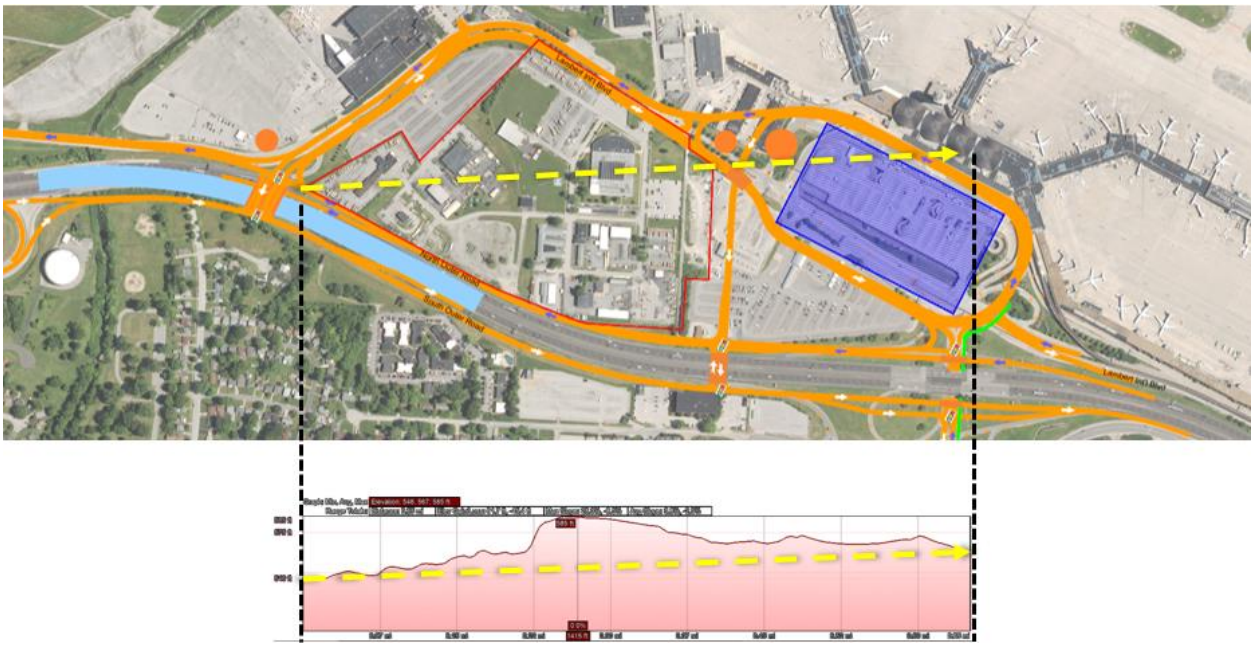
  Additionally, there is a large hill located southwest of existing Terminal 1, which already obstructs the view of the domes from I-70, as depicted on **Figure 5.4-29**.

- **Airspace penetrations**:
  - Ground elevation ranges from 570’ MSL (curbside) to 600’ MSL (I-70)
  - Allowable parking garage height, as depicted on **Figure 5.4-30**, based on 14 CFR Part 77 Airspace Surfaces:
    - Above ground: 40’-70’
    - More if excavate/underground

Figure 5.4-28: View of the Domes from Various Viewpoints

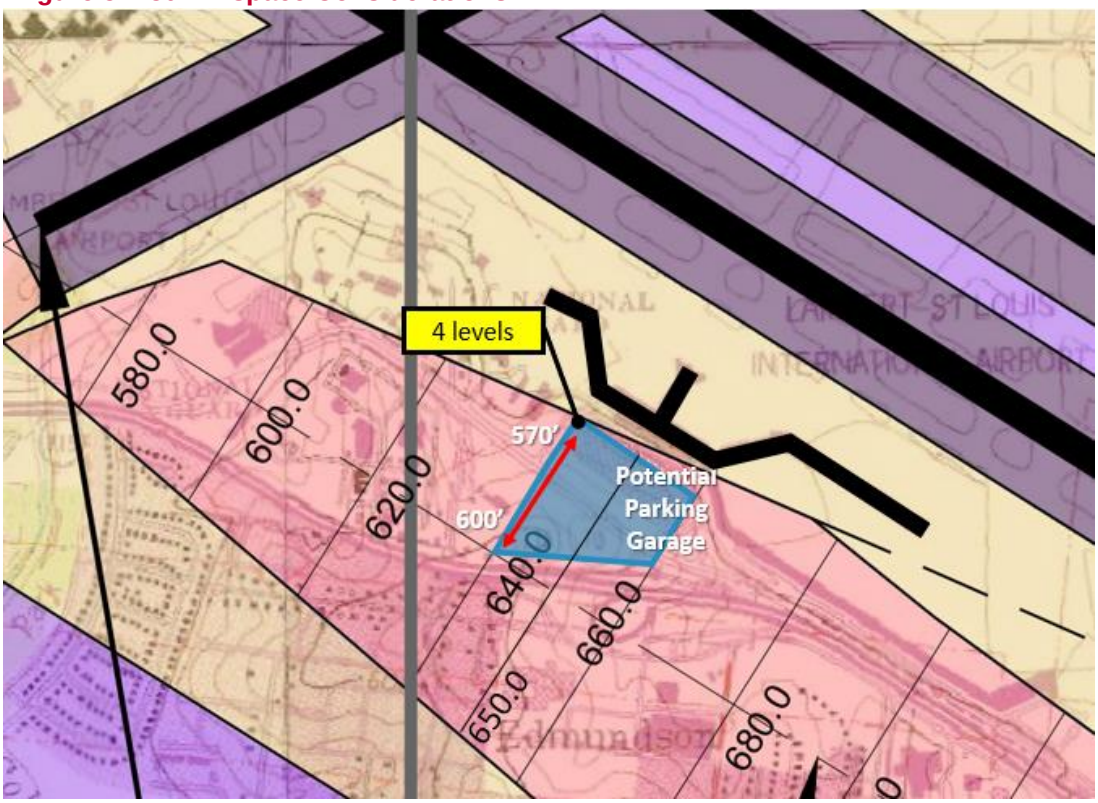
Sources: Google Earth Pro, 2022; WSP USA, 2022.

Figure 5.4-29: View of the Domes from Interstate 70



Source: WSP USA, 2021.

Figure 5.4-30: Airspace Considerations



Note:

Part 77 contour elevations are Mean Sea Level (MSL)

Sources: STL Airport Layout Plan, Part 77 Surfaces Sheet - DRAFT, CMT, 2021; WSP, 2021.

- **GTC (inside/outside parking garage)**:
  - Inside requires a higher floor clearance
  - Safety concerns inside
  - Preference for outside parking garage
  - GTC eliminates need for commercial arrival lanes in front of terminal
  - Estimated size = 175,000 SF
    - Estimated 2040 space requirements for modes of transportations accommodated inside GTC
    - Applied industry factors for vehicle length and sidewalk/driving lane widths

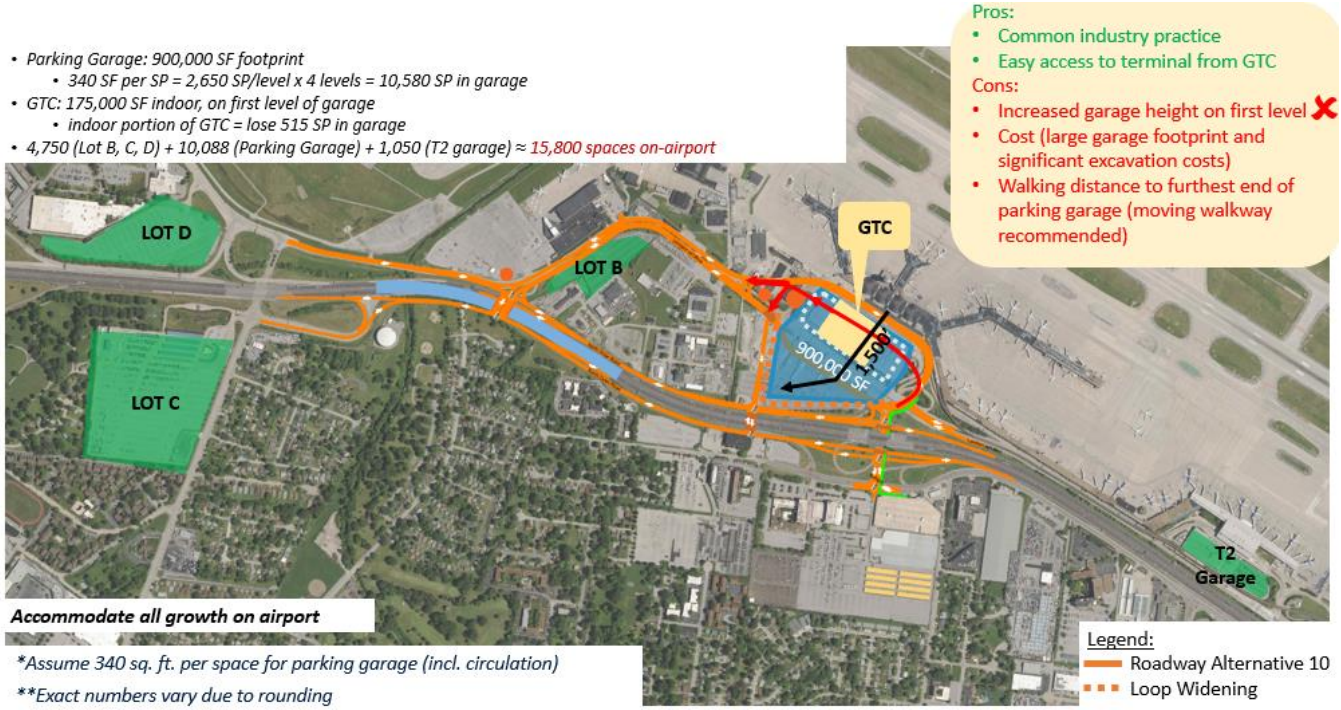
Alternatives

Seven parking alternatives were developed and assessed:

- Alternative 1A: Maximum Garage Footprint, GTC west in/outside, with Terminal 2 Garage (16,000 Spaces)
- Alternative 1B: Max Garage, GTC inside, with T2 Garage (15,800 Spaces)
- Alternative 2: Max Garage, GTC inside, no T2 Garage (14,800 Spaces)
- Alternative 3A: Smaller Garage, GTC inside, with T2 Garage (13,500 Spaces)
- Alternative 3B: Smaller Garage, GTC west in/outside, with T2 Garage (13,700 Spaces)
- Alternative 3C: Smaller Garage, GTC east in/outside, with T2 Garage (13,700 Spaces)
- Alternative 4: Smaller Garage, GTC/Moving Walkway on Lot A, with T2 Garage (14,000 Spaces)

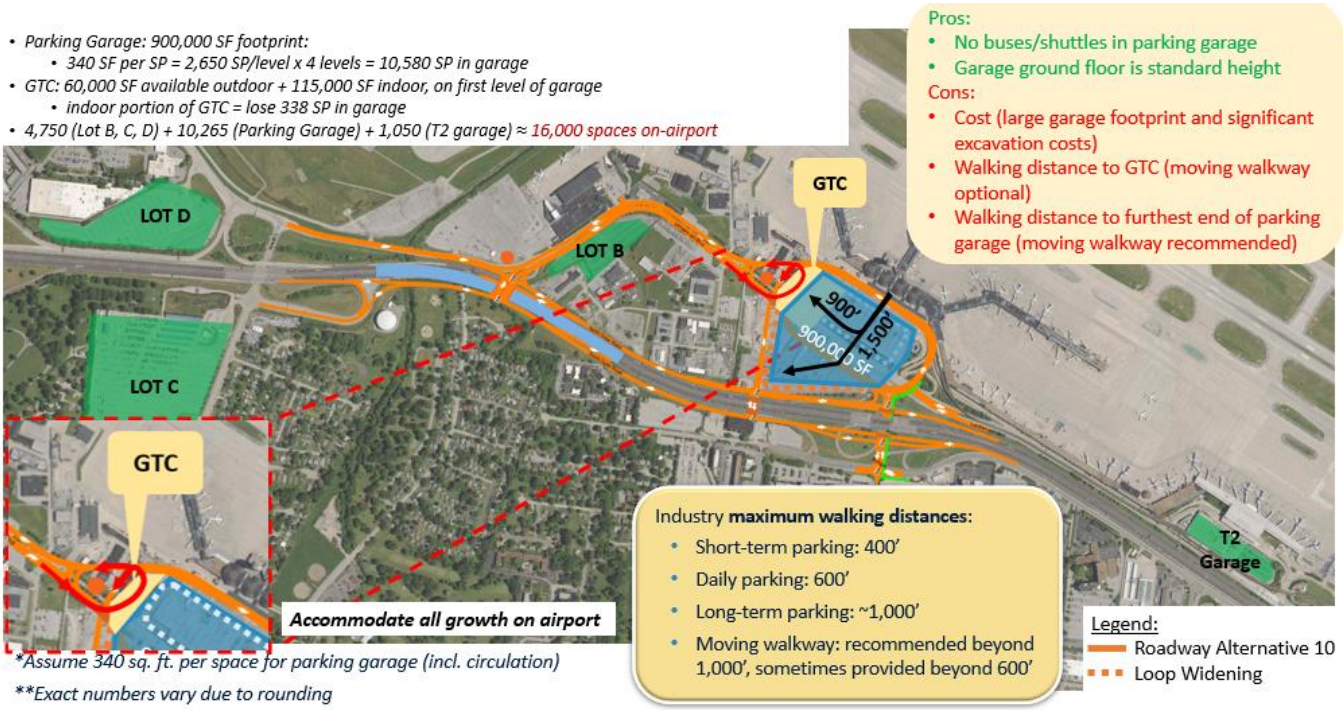
They are depicted in **Figures 5.4-31** through **5-4-37**.

Figure 5.4-31: Parking Alternative 1A



Source: WSP USA, 2022.

Figure 5.4-32: Parking Alternative 1B



Source: WSP USA, 2022.

Figure 5.4-33: Parking Alternative 2

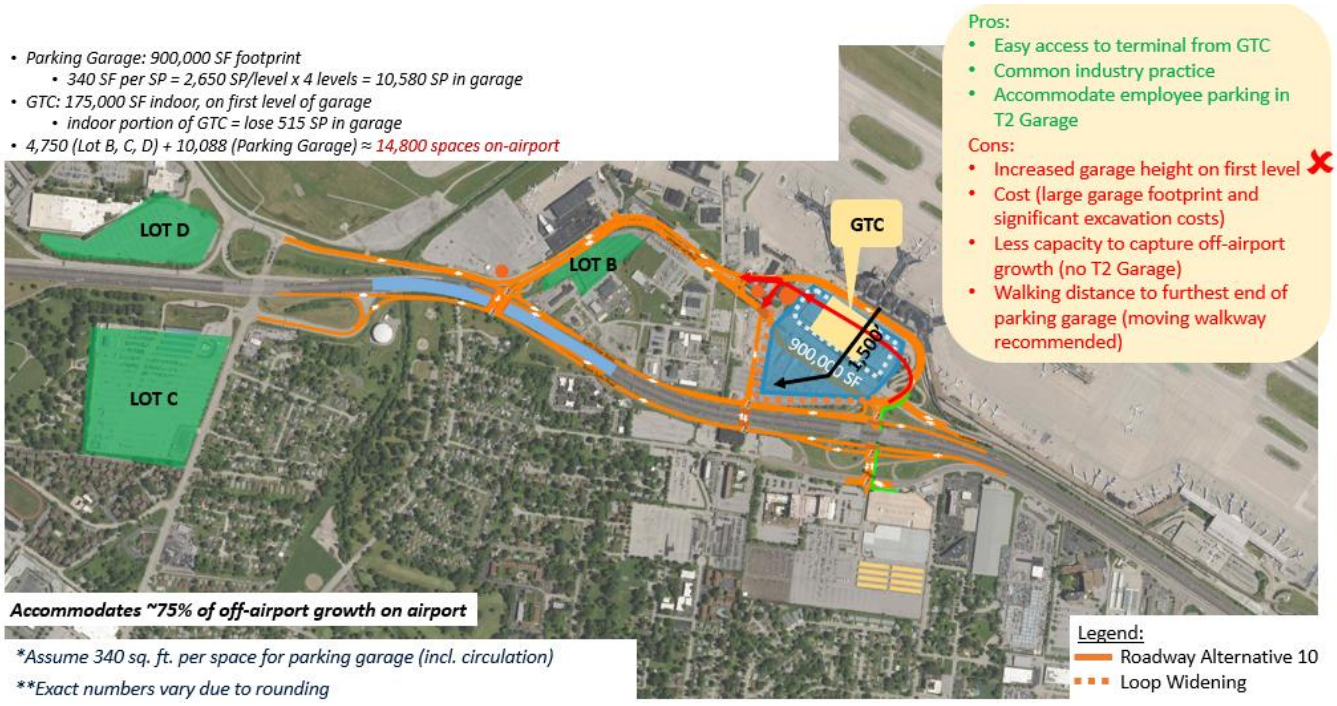
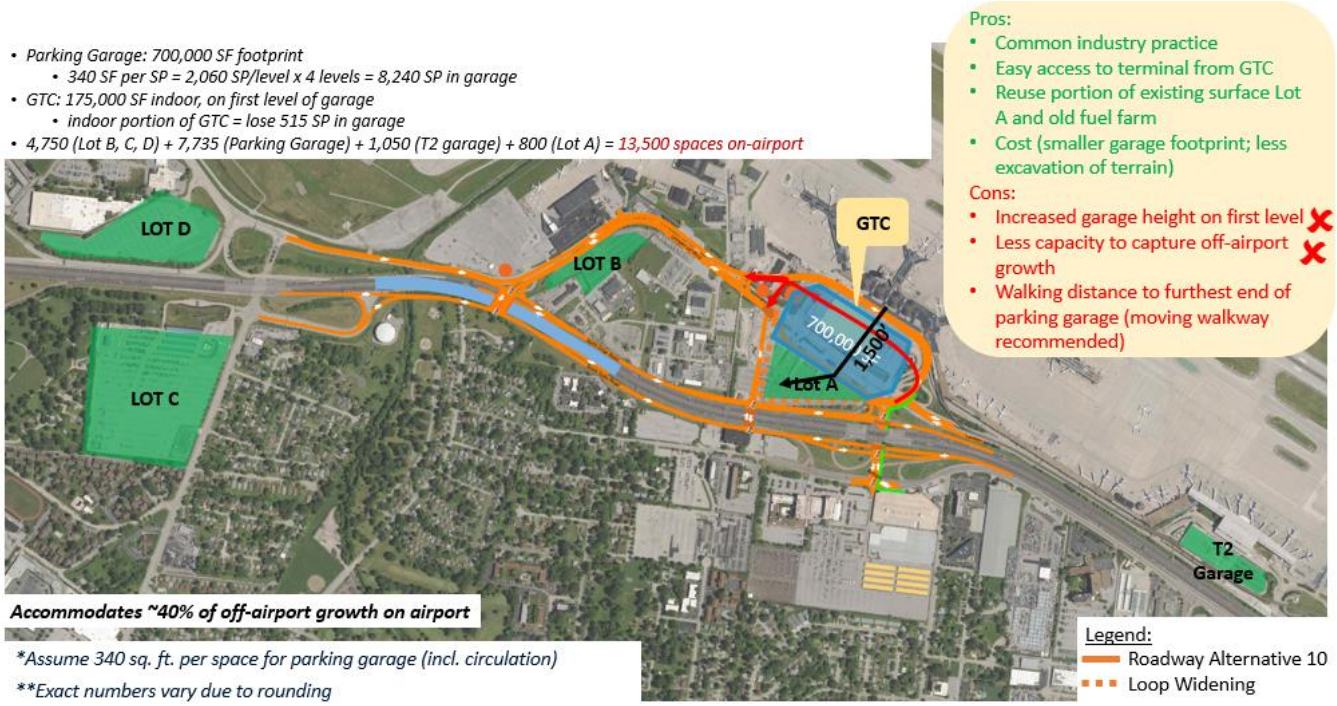


Figure 5.4-34: Parking Alternative 3A



Source: WSP USA, 2022.

Figure 5.4-35: Parking Alternative 3B

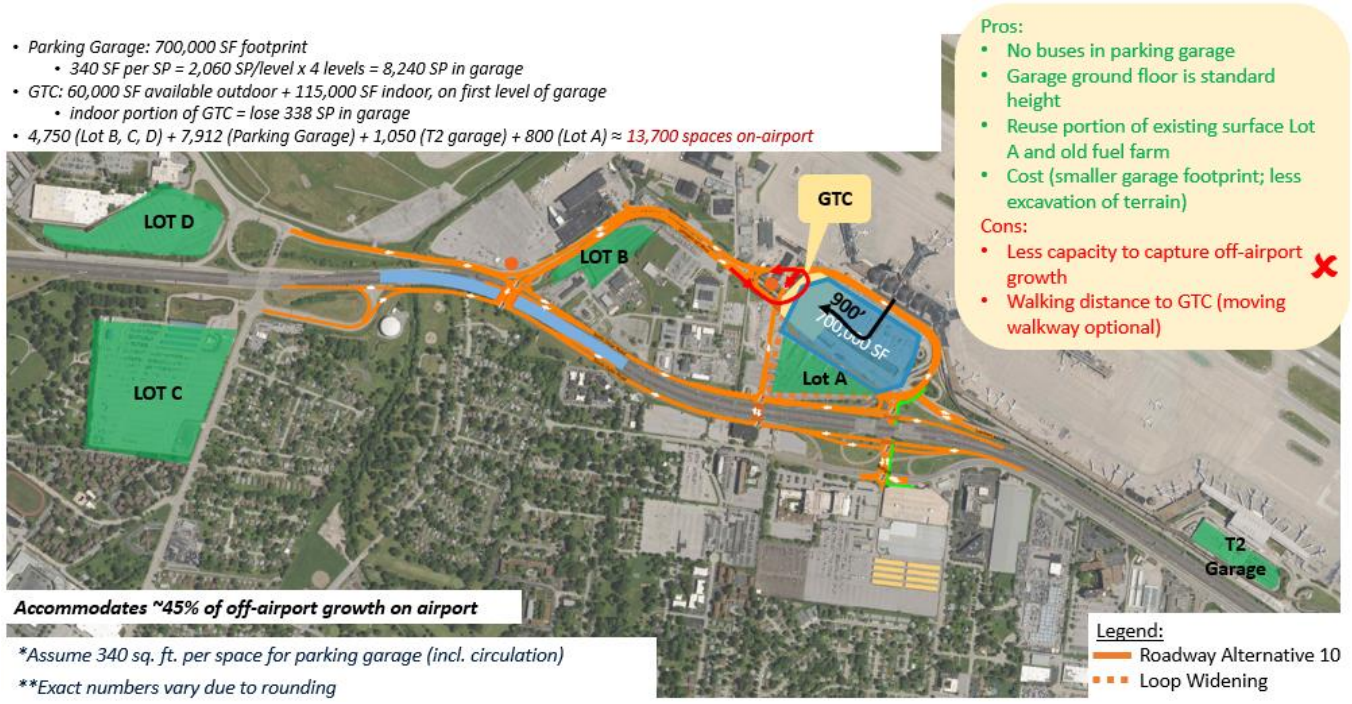
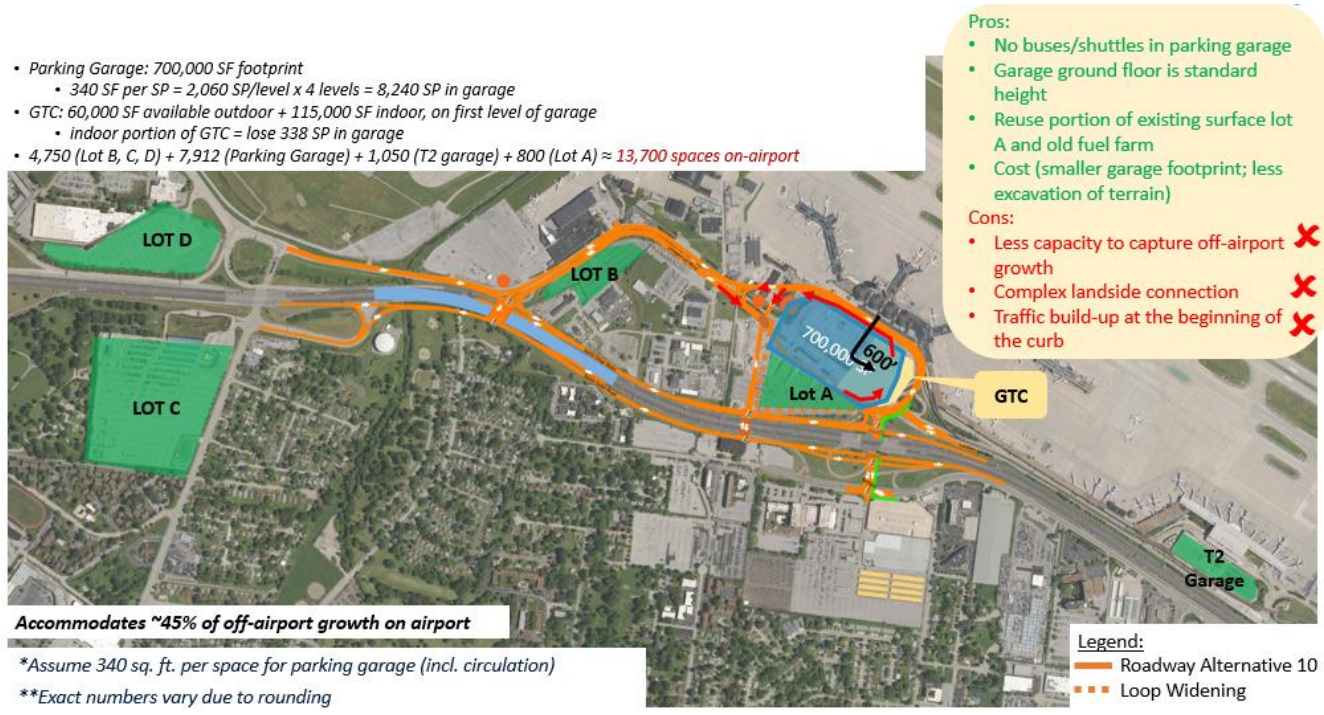
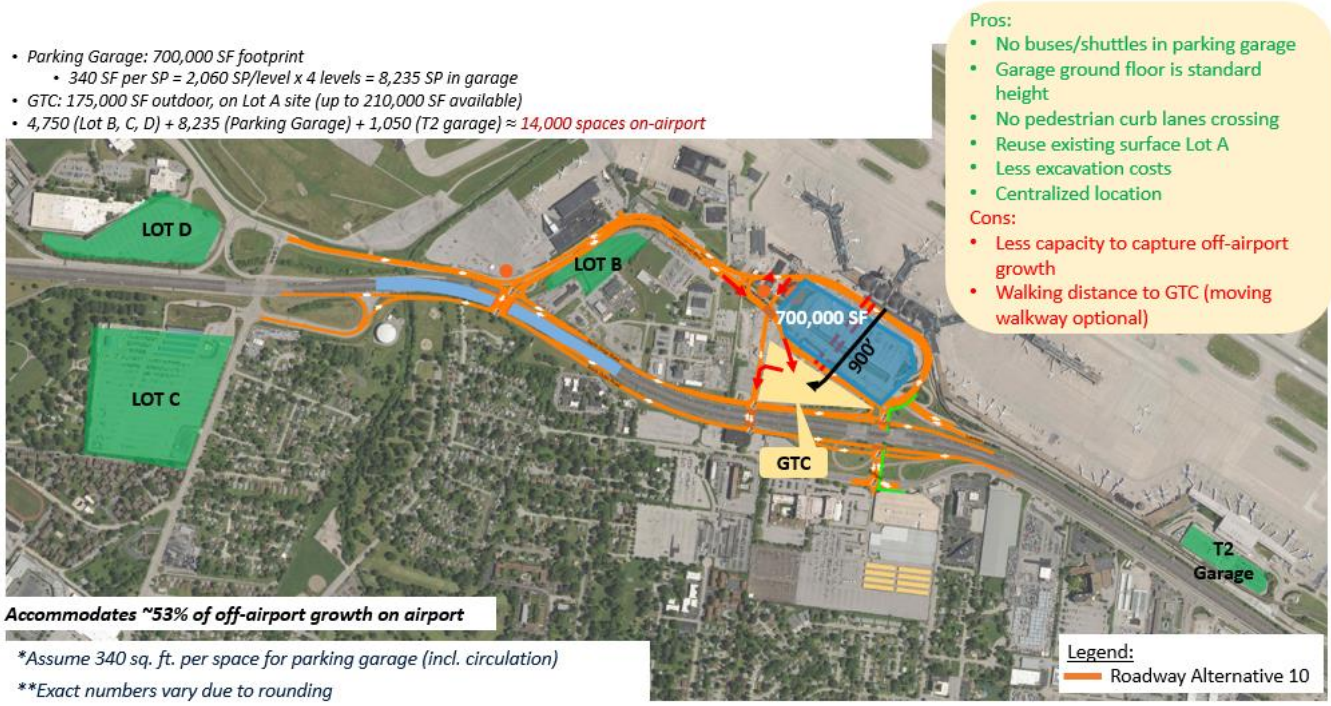


Figure 5.4-36: Parking Alternative 3C



Source: WSP USA, 2022.

Figure 5.4-37: Parking Alternative 4



Source: WSP USA, 2022.

Evaluation of Alternatives

The matrix shown in **Table 5.4-4** summarizes the results of the alternatives evaluation. Evaluation criteria are:

- GTC pedestrian access from terminal: pedestrians crossing terminal curbisde lanes is a safety concern
- Parking garage landside access
- Parking garage ground floor height: if the GTC were located inside the parking garage, the entire first floor of the parking garage would need to be raised to accommodate buses
- Cost
- Flexibility to capture off-airport growth: the smaller garage alternatives cannot expand once the new access roadways to the terminal are built

Two alternatives remain, Alternative 1A and Alternative 4.

Upon further review, STLAA staff selected a hybrid version of Alternatives 1A and 4, with a smaller garage footprint and the GTC on the west side of the parking garage. This alternative would only slightly impact the old Fuel Farm site. The parking garage would accommodate approximately 8,000 spaces. The preferred parking garage alternative is depicted on **Figure 5.4-38**. It assumes a parking garage footprint of 570,000 square feet, and 5 levels. A portion of the GTC would be outside (approximately 60,000 sq. ft.) and the remainder inside, on the ground floor of the parking garage.

Table 5.4-4: Parking Garage Alternatives Evaluation Matrix

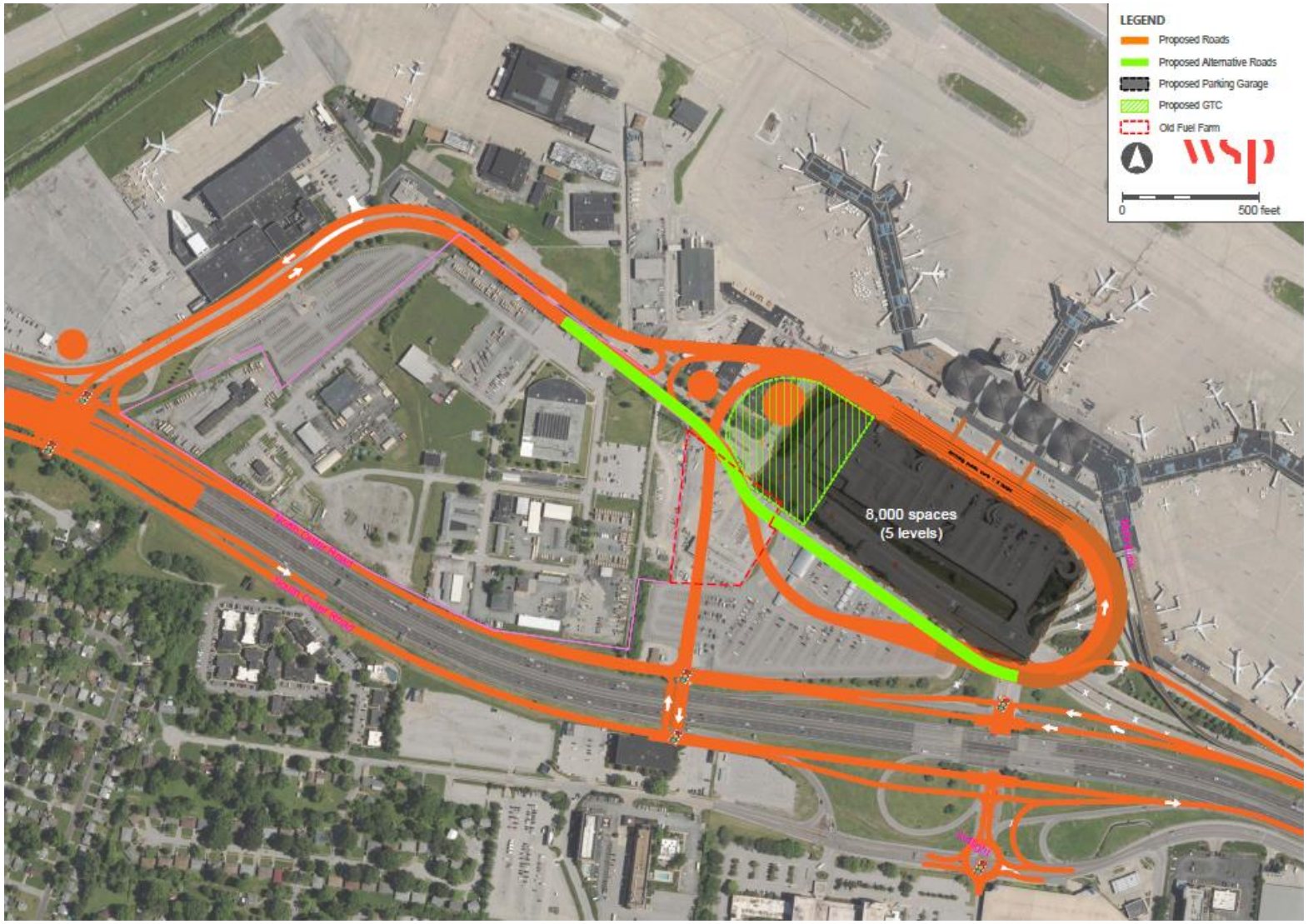
CRITERIA	ALT 1A	ALT 1B	ALT 2	ALT 3A	ALT 3B	ALT 3C	ALT 4
DESCRIPTION	Max Garage, GTC west in/outside, with T2 Garage	Max Garage, GTC inside, with T2 Garage	Max Garage, GTC inside, no T2 Garage	Smaller Garage, GTC inside, with T2 Garage	Smaller Garage, GTC west in/outside, with T2 Garage	Smaller Garage, GTC east in/outside, with T2 Garage	Smaller Garage, GTC/Moving Walkway on Lot A, with T2 Garage
GTC ACCESS FROM TERMINAL							
LANDSIDE ACCESS							
PARKING GARAGE GROUND FLOOR HEIGHT							
COST							
FLEXIBILITY TO CAPTURE OFF-AIRPORT GROWTH							
KEEP?	Yes	No	No	No	No	No	Yes

Legend:

- Good/minimal impacts
- Average/Moderate Impacts
- Bad/Fatal Flaw

Source: WSP USA, 2022.

Figure 5.4-38: Preferred Parking Garage Alternative



Sources: WSP USA, 2022.

EMPLOYEE PARKING

Employee parking is a flexible use that can be provided in different locations. Airports have different policies regarding the location, convenience and fees charged for employee parking. Many airports provide remote parking with shuttle access to the terminal.

SUMMARY OF FACILITY REQUIREMENTS

Table 5.4-5 summarizes employee parking requirements. The existing 314 parking spaces are located in the Terminal 1 parking Garage, on the Red Level and in Lot C. They accommodate STLAA staff and some Airport tenants. Other Airport tenants park off-Airport.

Table 5.4-5: Employee Parking Spaces Requirements

	NUMBER OF SPACES		ACRES
Public Parking	**2019 (EXISTING)**	**2040**	**2040**
Employee Parking	314	469	3.2

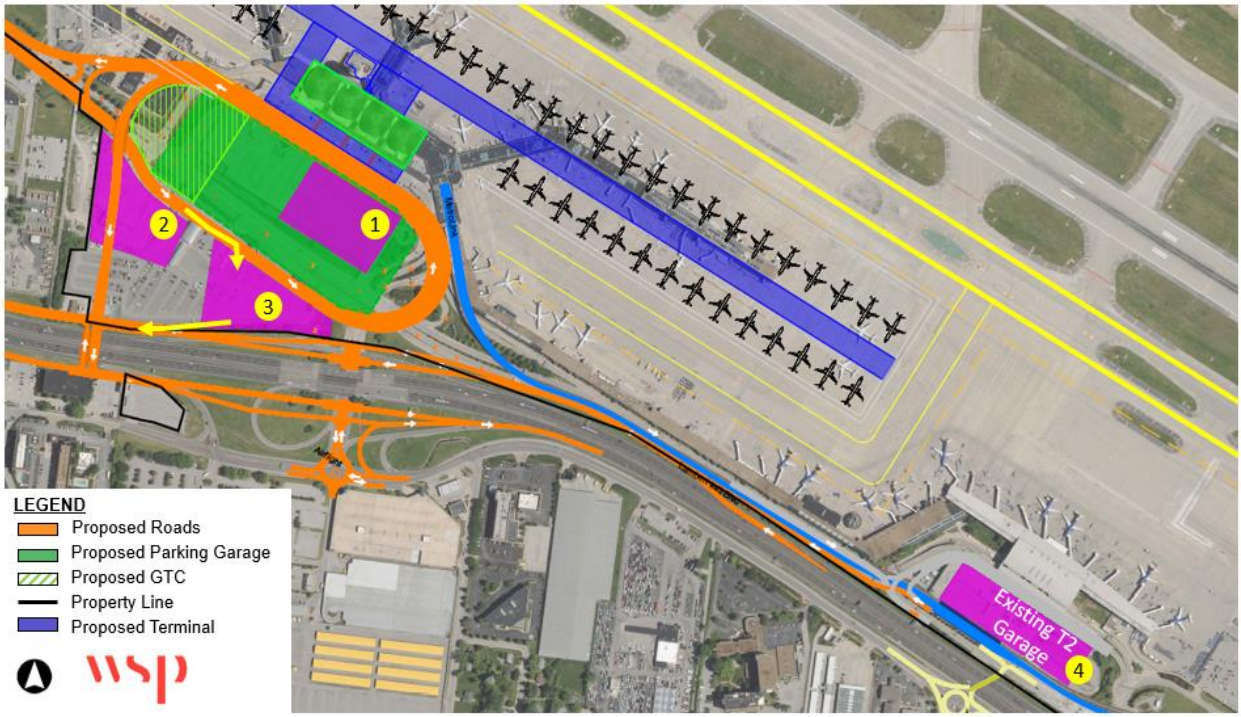
Note: assumes 300 sq. ft. per space and 90% utilization.

Source: WSP USA, 2021.

ALTERNATIVES

Figure 5.4-39 depicts the potential employee parking sites. Site 1 assumes employee parking would occupy space in the new parking garage. Sites 2 and 3 are surface parking options on the site of the former fuel farm and Lot A, respectively. Employees would walk to the terminal. Site 4 would offer employee parking in the existing Terminal 2 parking garage, and requires the use of shuttles or MetroLink.

Figure 5.4-39: Potential Employee Parking Sites



Source: WSP USA, 2022.

PREFERRED ALTERNATIVE

Considerations in selecting a preferred site for employee parking were proximity to the terminal, easy roadway access, avoiding unnecessary circulation on the terminal loop road/curb, and balancing paid users parking vs. employee convenience. STLAA policy is to provide convenient parking and multimodal access (by preserving MetroLink and MetroBus stations) for its employees. Site 3 was selected as the preferred alternative: it is within walking distance to the terminal, and does not occupy prime parking space in the garage.

CELL PHONE LOT

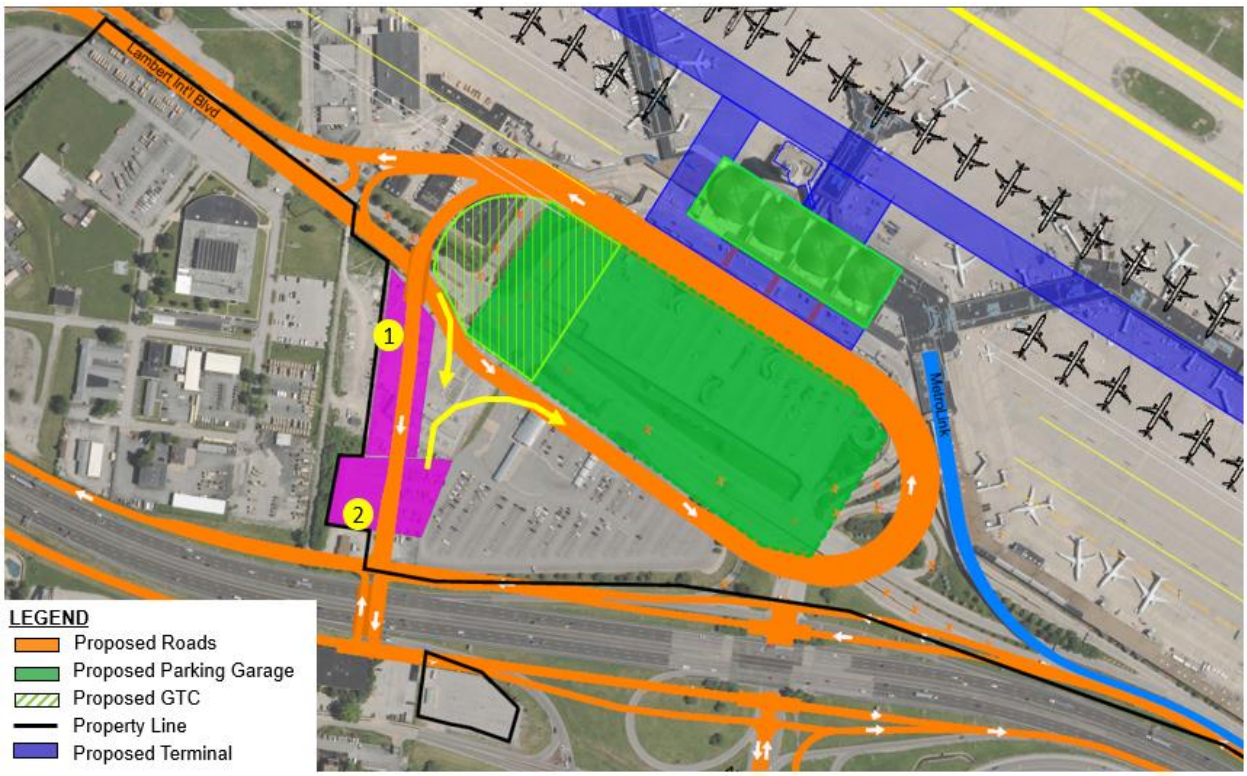
SUMMARY OF FACILITY REQUIREMENTS

An area approximately 1.5 acres was deemed adequate for cell phone parking needs through the planning horizon; it could accommodate approximately 215 vehicles. Cell phone lot parking is a flexible resource that may be relocated as needed, either to accommodate more spaces or to free up the site for a higher priority use.

ALTERNATIVES

Figure 5.4-40 depicts the potential cell lot sites. Site 1 is on the site of the former fuel farm, and Site 2 on a portion of existing Lot A. Both sites offer convenient access to/from the terminal loop road.

Figure 5.4-40: Potential Cell Lot Sites



Source: WSP USA, 2022.

PREFERRED ALTERNATIVE

Considerations in selecting a preferred site for the cell lot were proximity to terminal, easy access to/from the terminal loop road, and avoiding unnecessary circulation on the terminal loop road/curb. Site 1 was selected as the preferred alternative, for its proximity to the terminal loop road, although Site 2 would also be a suitable site.

TAXI AND TNC STAGING LOTS

SUMMARY OF FACILITY REQUIREMENTS

Table 5.4-6 summarizes taxi and TNC staging requirements.

Table 5.4-6: Taxi Staging Parking Spaces Requirements

	NUMBER OF SPACES		ACRES
	2019 (EXISTING)	2040	2040
Taxi Staging	106	158	1.1
TNC Staging	50	121	0.8
Total			**1.9**

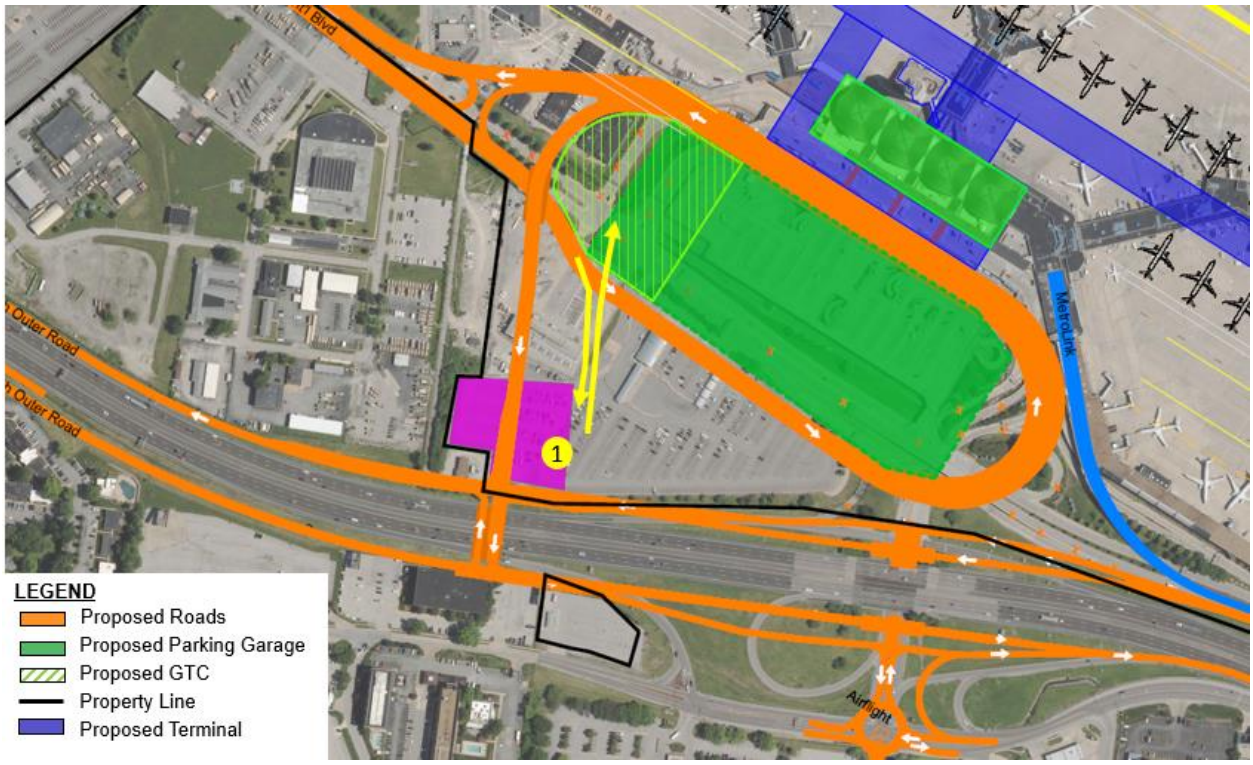
Note: assumes 300 sq. ft. per space and 90% utilization

Source: WSP USA, 2021.

ALTERNATIVES

Figure 5.4-41 depicts the potential site for taxi and TNC staging. Passenger pick-up will occur in the GTC, and passenger drop-off occurs at the terminal curb. Only one site is proposed, in the southwest corner of existing Lot A. The site provides convenient access to/from the loop road, and avoids unnecessary circulation in front of the terminal curb.

Figure 5.4-41: Potential Taxi and TNC Staging Lots Site



Source: WSP USA, 2022.

5.4.4 RENTAL CAR

At this point, the Rent-A-Car (RAC) operators have not expressed the desire to consolidate their operations into a CONRAC facility. As such, siting a CONRAC is not an ALPU/MP priority. However, for long-term planning purposes and to preserve future options, potential CONRAC sites were identified.

SUMMARY OF FACILITY REQUIREMENTS

Table 5.4-6 summarizes auto parking requirements.

Based on industry and planning standards, a site up to 81 acres may require accommodating a CONRAC at STL. This footprint could be reduced by constructing the CONRAC on multiple levels. The 81-acre footprint assumes all RAC functions would be accommodated on site (customer counters, ready/return spaces, QTA, vehicle storage, employee parking). A smaller footprint (minimum of 30 acres) would be a suitable solution, and would accommodate customer counters and ready/return spaces on site. The other CONRAC functions would be housed off-site.

Table 5.4-6: Summary of Rental Car Facility Footprint Requirements (in Acres)

	EXISTING (2019)	REQUIRED [3/] (2040)
Existing Surface Rental Car Facilities	42	
Required Surface Rental Car Facilities		90
Required ConRAC Facilities [1/ 2/]		81

Notes:

ConRAC – Consolidated Rental Car

1/ The ConRAC requirements are 10 percent lower than the surface requirements, due to efficiencies associated with a multi-level facility.

2/ The surface footprint of a ConRAC facility would be less than the acreage provided in the table, depending on the number of levels in the ConRAC.

3/ A 15 percent allowance was added for landscaping and circulation (rail/roadway access).

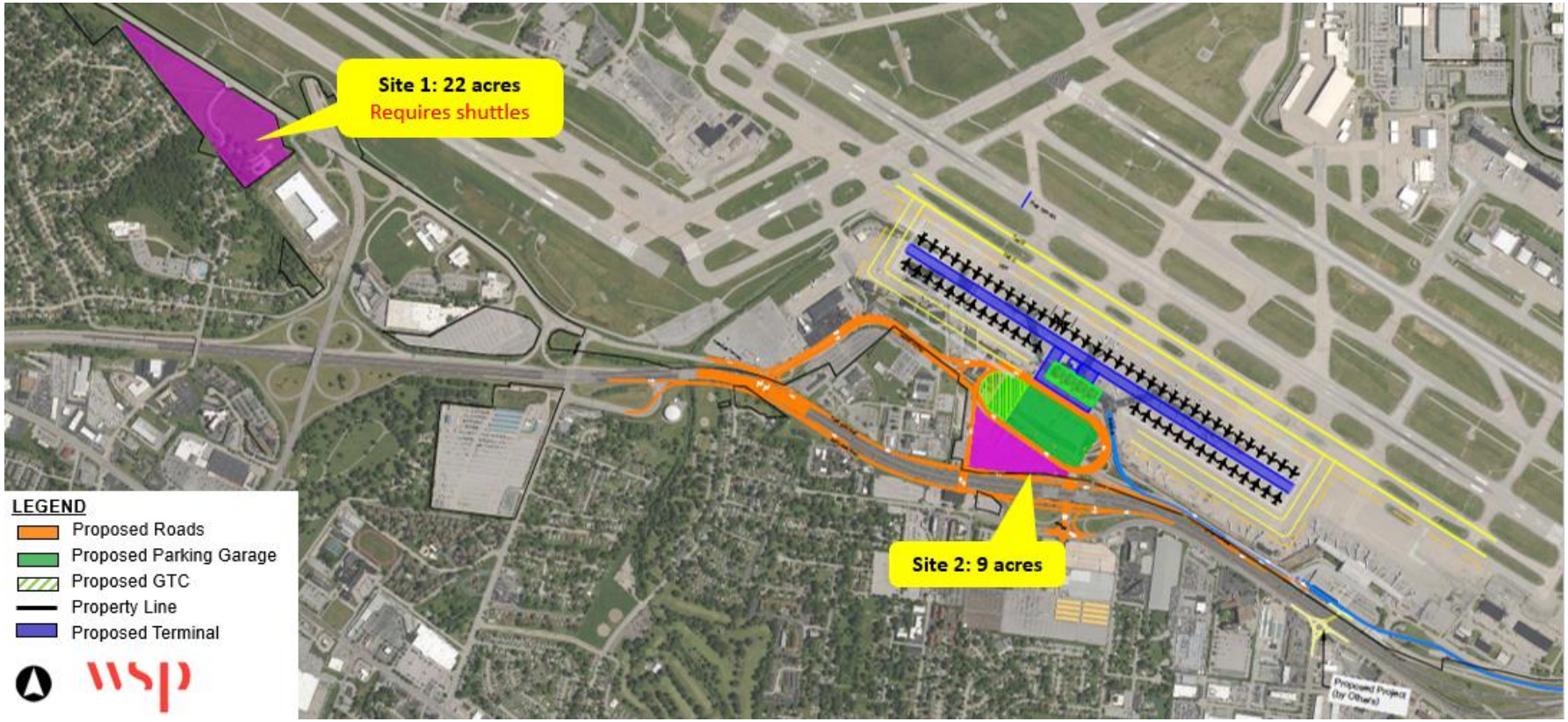
Sources: Rental Car Operators, 2020 (survey responses); WSP USA, August 2020 (analysis).

ALTERNATIVES

Two sites were identified for a potential CONRAC facility, as depicted on **Figure 5.4-42.**

Various footprint sizes are proposed (Site 1 is 22 acres while Site 2 is 9 acres), as the RAC operators would decide what functions they wish to accommodate on-site vs. off-site.

Figure 5.4-42: Potential Consolidated Rental Car Facility Sites



Source: WSP USA, 2022.

5.5 CARGO AND SUPPORT FACILITIES

As part of identifying the Airport's future long-term development options, cargo and support facilities requirements were defined based on tenants' input, future activity levels and industry planning standards.

This section explores different alternatives for the development of cargo and airport support facilities to meet future needs, as outlined in Chapter 4, while considering operational efficiency, aircraft fleet diversity and expansion potential beyond the planning period. As discussed in earlier chapters, some existing support facilities at the Airport are aging and in need of replacement. The following section summarizes the selection process for each support facility to meet functionality and capacity goals.

It is important to note that while support facility sites are selected to meet quantitative future needs, there are a number of factors such as the tenants' interest and business model that impact the final decision for providing additional cargo, airline support or general aviation facilities.

5.5.1 PRIORITY LIST

The selection of cargo and support facilities' sites followed a "best use" approach by establishing a priority list based on the functional value of the land uses. The priority order for these facilities is defined as follows:

1. Airfield
2. Terminal
3. Landside
4. Cargo
5. MRO
6. ARFF
7. General aviation (FBO, corporate)
8. All other support facilities:
   - RON
   - Central utility plant (CUP)
   - Belly cargo
   - GSE maintenance (Airline Services Building)
   - Building maintenance
   - Airfield maintenance
   - Centralized receiving and distribution facility (concessions logistics)
   - Airport Administration/Airport Police

- Airport Operations
- Fuel consortium servicing
- Landside snow removal equipment storage
- Livestock handling
- Triturators
- Glycol treatment facilities

9. Defense Contractor

5.5.2 CARGO INTEGRATORS

SUMMARY OF REQUIREMENTS

Existing integrator cargo aeras cover approximately 30 acres, located mainly in St. Louis Air Cargo occupied by FedEx, UPS and Prime Flight Aviation Services (formerly Majestic Terminal Services) and in Cargo City 2 occupied by WFS.

Future requirements for Air Cargo are calculated based on needs for building space, tractor trailers, employee parking and apron. The 2040 needs are as follows:

- Total of 31 acres for existing users
- Additional 10 acres for potential new cargo entrants
- This results in a total of 41 acres for integrator cargo operations (or an additional 11 acres)

ALTERNATIVES

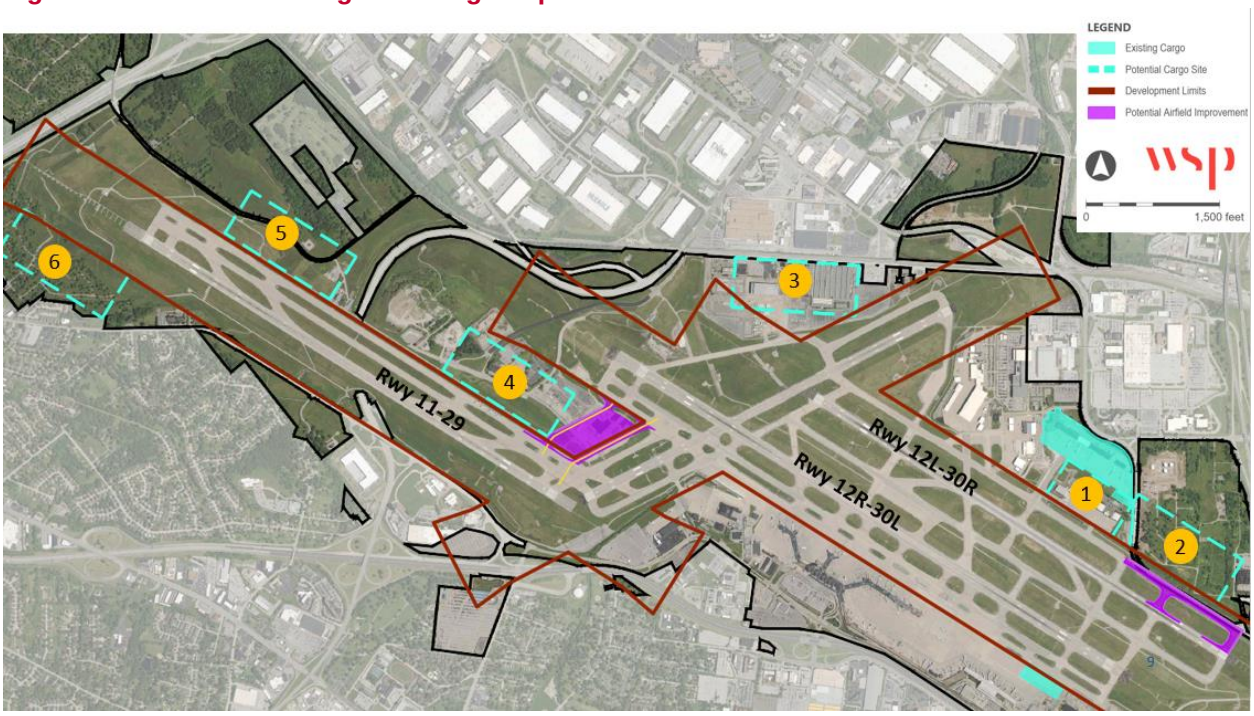
The existing cargo facilities located in Cargo City and St. Louis Air Cargo are not adequate in size to meet future demand. Six sites were explored as potential integrator cargo expansion sites, including the Northern Tract site (Site 3), north of Runway 11-29 (Sites 4 and 5), west of Runway 11-29 (Site 6), Brownleigh site (Site 2) and the existing general aviation site (Site 1), as depicted in **Figure 5.5-1**.

PREFERRED ALTERNATIVE

Each prospective site was evaluated for a number of factors such as landside access, proximity to airfield, taxi times, planned developments and potential for future expansion. Ultimately, the vacant Brownleigh site (Site 2), east of the existing GA site, was selected for future cargo development and additional discussion resulted in a refined cargo layout, as illustrated in **Figure 5.5-2**.

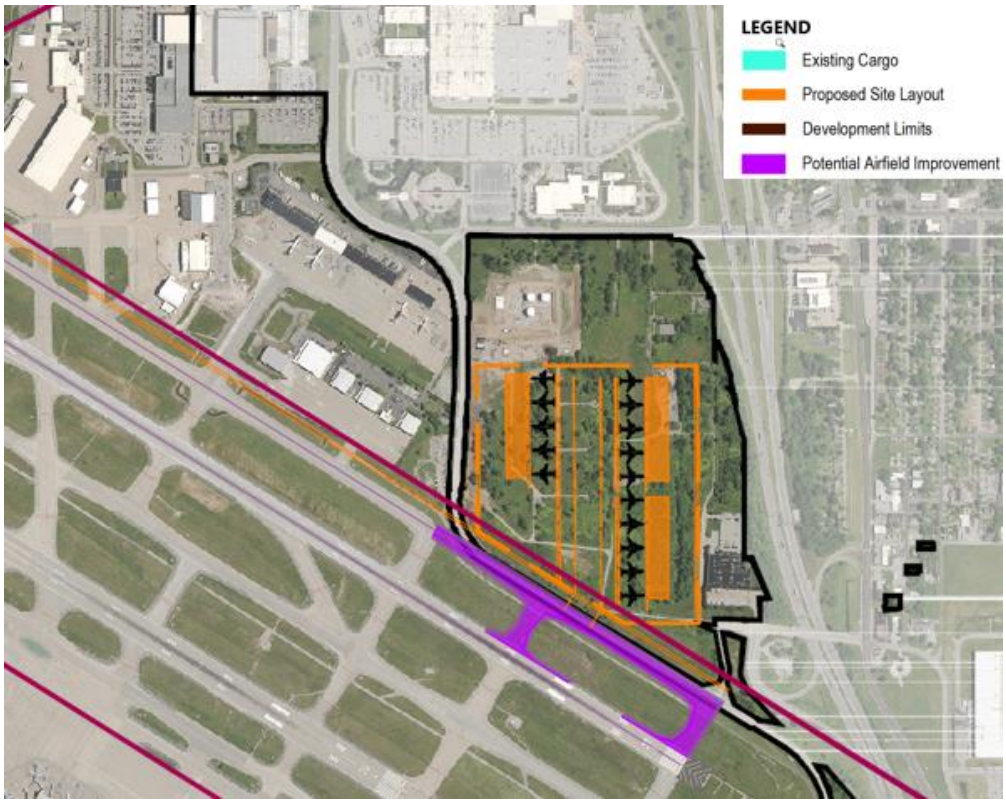
The relocation of Air Cargo to the Brownleigh site (Site 2) would require the relocation or closure of a portion of James S. McDonnell Blvd and the extension of Taxiway F. A new air cargo facility would be built with an efficient and optimized layout for Group IV aircraft layout, providing good landside access and short taxi times. Cargo deicing operations would occur either on the existing UPS Cargo apron, already equipped with deicing collection infrastructure, or a new deicing infrastructure would be installed on the future cargo ramp.

Figure 5.5-1: Potential Integrator Cargo Expansion Sites



Source: WSP USA, October 2021.

Figure 5.5-2: Preferred Integrator Cargo Expansion Site



Source: WSP USA, October 2021.

5.5.3 AIRCRAFT MAINTENANCE, REPAIR AND OVERHAUL

SUMMARY OF REQUIREMENTS

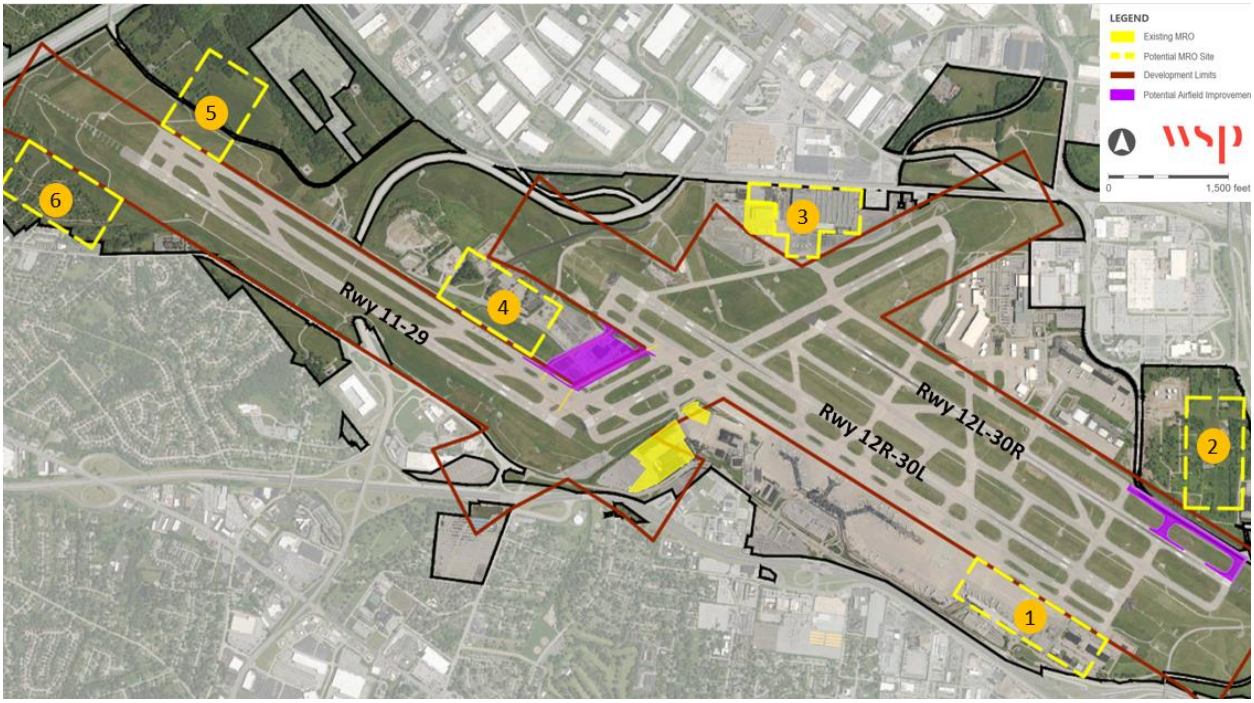
Existing aircraft MRO areas are undersized and/or in need of replacement. They cover approximately 21 acres. The 2040 needs include additional space needed for building, apron and auto parking, and are summarized as follows:

- Existing tenants: 35 acres (21 acres existing + 14 acres growth)
- Potential new MRO entrants: 14 acres
- Total = 49 acres (additional 28 acres)

ALTERNATIVES

Six sites were identified as potential MRO relocation or expansion sites, as depicted in **Figure 5.5-3.**

Figure 5.5-3: Potential MRO Expansion Sites



Source: WSP USA, October 2021.

PREFERRED ALTERNATIVE

Each potential site was evaluated for a number of factors such as proximity to airfield, runway crossings, landside access, expansion potential beyond 2040, site configuration and terrain.

Site 4 was selected as the preferred relocation site for MRO, north of Runway 11-29 and west of the existing Airport maintenance facilities. The site is close to the proposed consolidated terminal and offers potential for future expansion beyond the planning horizon. The preferred site was later shifted northwest, along

Runway 11-29, to accommodate the Airfield Maintenance Campus relocation between the proposed MRO site and the proposed West Deicing Pad.

5.5.4 AIRCRAFT RESCUE AND FIRE FIGHTING

SUMMARY OF REQUIREMENTS

Although the existing ARFF stations meet future requirements, considerations were made to consolidate the North and West stations into one ARFF facility. Future needs are summarized below:

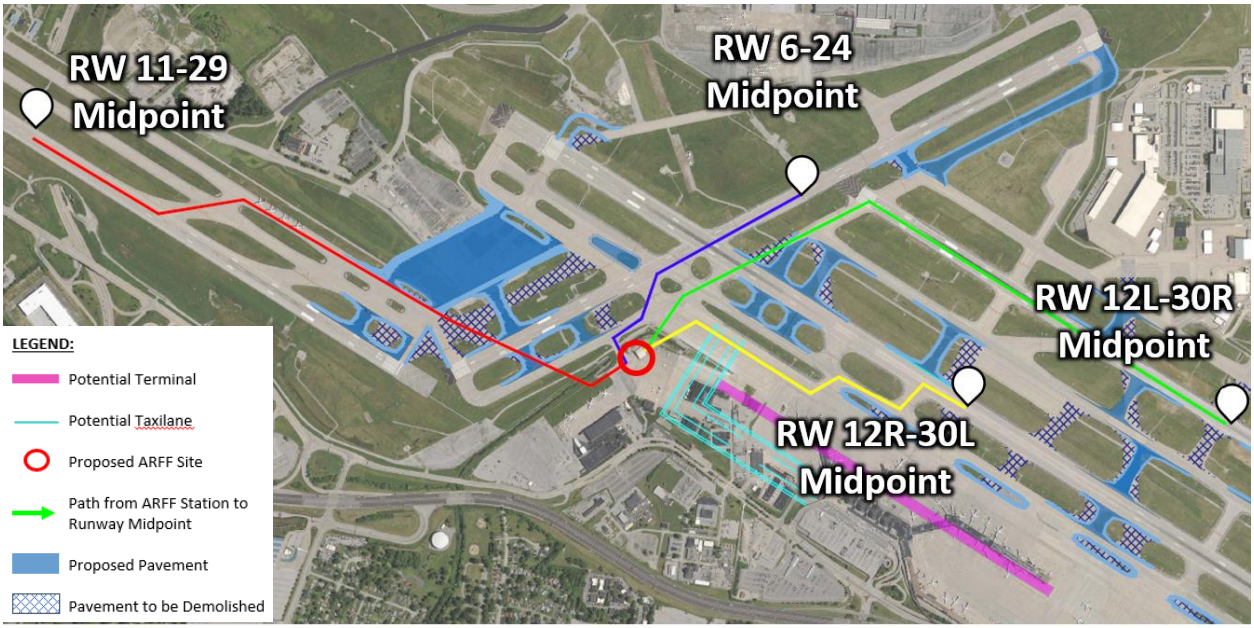
- Total of 4.1 acres for existing facilities:
  - West ARFF (Index D): 1.6 acres
  - North ARFF (Index E): 1.8 acres
  - Medical Supplies Building: 0.7 acres
- Per STLAA staff:
  - The consolidated ARFF station would meet Index E. A minimum site of 2.5 acres is planned for a consolidated ARFF station.
  - The consolidated ARFF station location would avoid runway crossings to the terminal.

PROPOSED RELOCATION SITE

Multiple routes were assessed as part of an ARFF response time analysis, to ensure a response time from the selected site to the furthest runway midpoint remains below 3 minutes. A site located west of the proposed consolidated terminal and east of Taxiway S meets both the response time requirements, and STLAA's request to avoid runway crossings to the terminal. The site is up to 3.5 acres.

Figure 5.5-4 depicts the response routes to the runway midpoints from the proposed ARFF station location. The response time to the furthest runway midpoint (6,985 feet to the Runway 11-29 midpoint) is 2'54'' (assuming a 60-second activation time).

Figure 5.5-4: Preferred ARFF Relocation Site and Response Routes



Source: WSP USA, October 2021.

5.5.5 GENERAL AVIATION

SUMMARY OF REQUIREMENTS

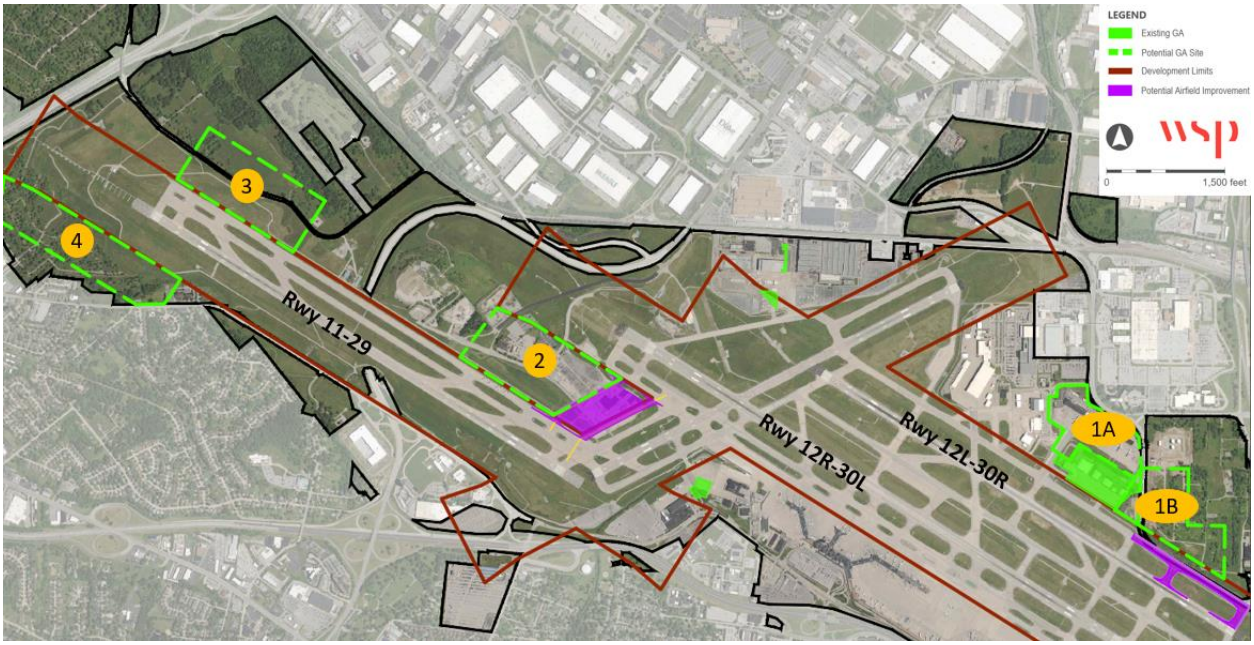
Existing general aviation facilities, including fixed-based operators and corporate aviation tenants, cover approximately 32 acres. The 2040 needs are derived from needs expressed by the tenants and needs to accommodate future potential entrants, and are summarized as follows:

- Total of 32 acres for existing tenants:
  - FBO: 20 acres
  - Corporate Aviation: 12 acres
- Additional 29 acres for potential new GA entrants and 4 acres for existing tenants
- This results in a total of 65 acres for general aviation operations, i.e., an additional 33 acres.

ALTERNATIVES

Four sites were identified as potential general aviation expansion or relocation sites, as depicted in **Figure 5.5-5**.

Figure 5.5-5: Potential General Aviation Expansion Sites



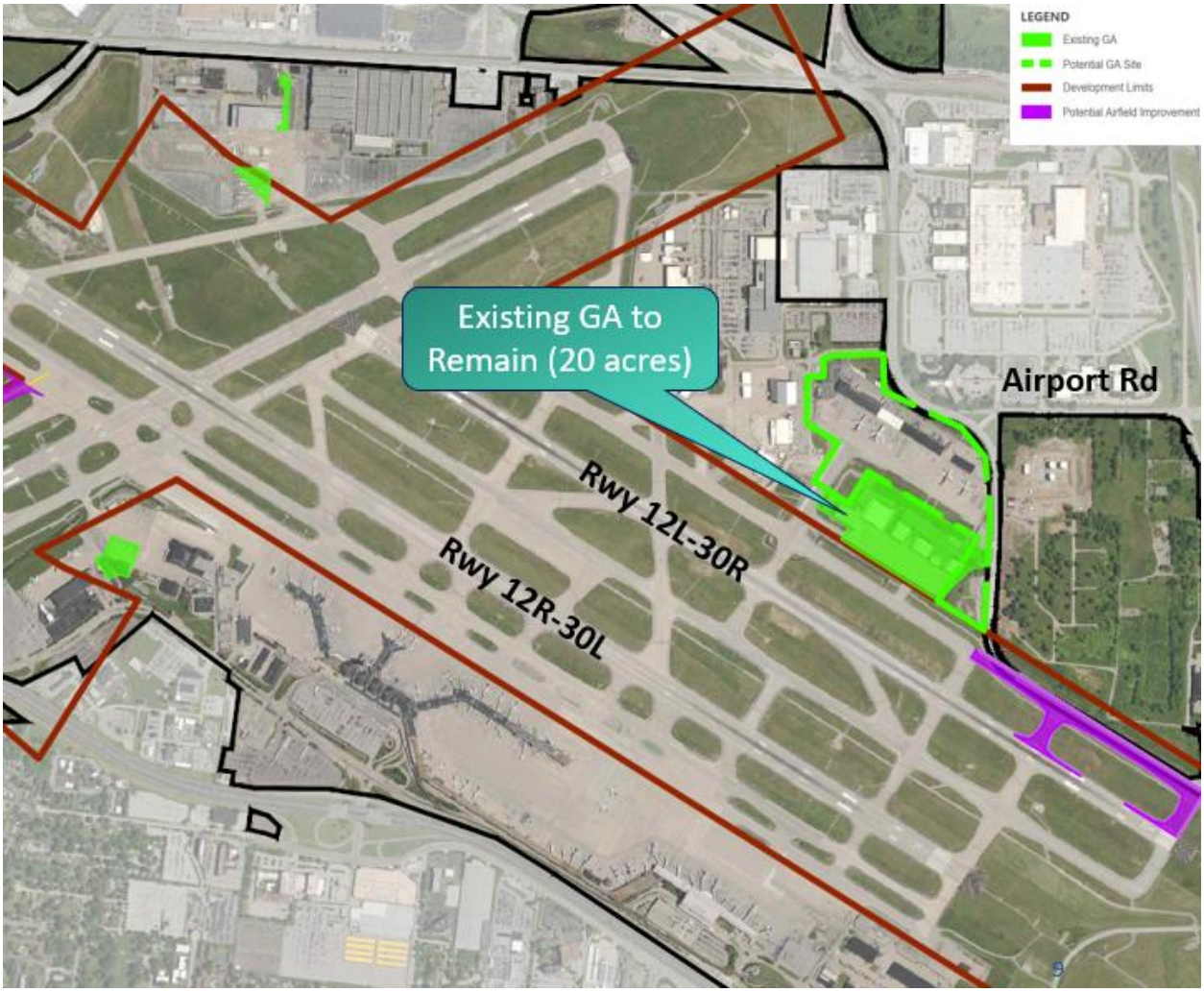
Source: WSP USA, October 2021.

PREFERRED ALTERNATIVE

Each potential site was evaluated for a number of factors such as proximity to airfield, proximity to other FBO or corporate hangars, land accessibility, existing terrain limitations, potential for additional growth and need for internal taxilanes.

Sites 1A, extending east of the existing Signature facilities and north into existing cargo, was selected as the preferred general aviation expansion site. This assumes the existing GA facilities remain in place and expands further east and north to provide 65 acres in total. The expansion site is currently occupied by cargo and will become available upon the relocation of cargo facilities into the Brownleigh site. The preferred corporate general aviation expansion site is depicted on **Figure 5.5-6**.

Figure 5.5-6: Preferred General Aviation Expansion Site



Source: WSP USA, October 2021.

5.5.6 REMAIN OVERNIGHT/HARDSTAND PARKING POSITIONS

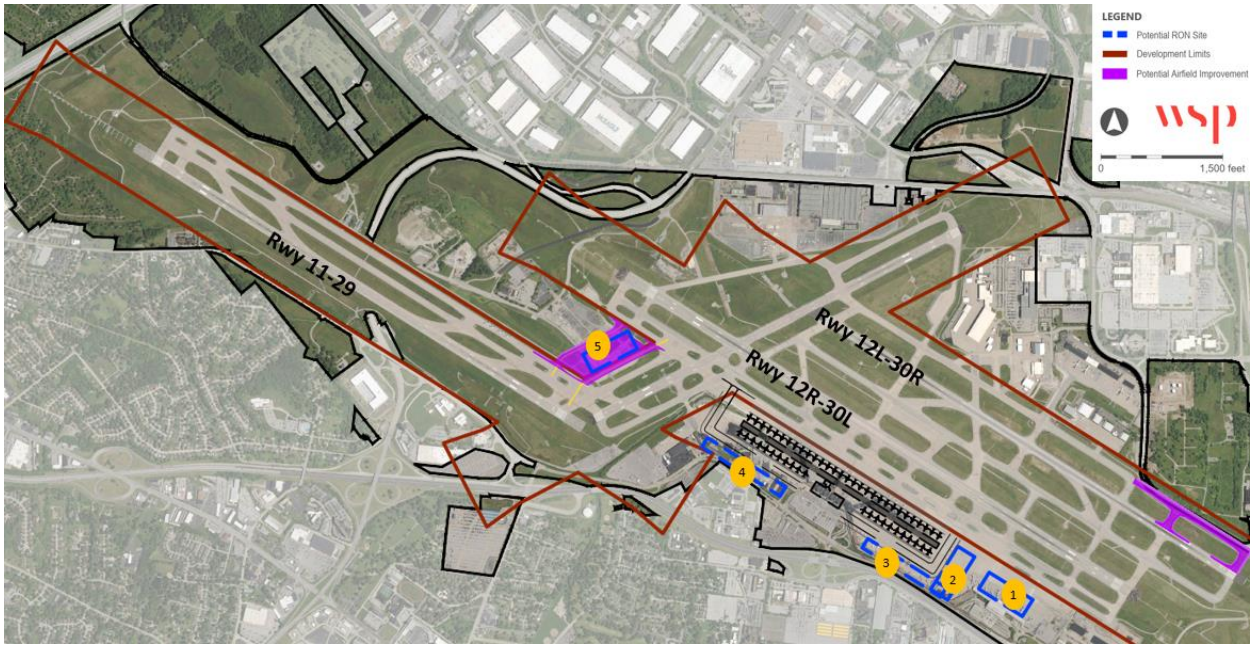
SUMMARY OF REQUIREMENTS

Based on STLAA input, 12 off-gate RON/hardstand parking positions are required in 2040, in addition to the 62 planned at-gate positions. Using a conservative approach, this corresponds to 8 acres for RON/hardstand parking, calculated based on the parking envelope for ADG III aircraft.

ALTERNATIVES

Five sites in the vicinity of the proposed consolidated terminal were identified for future RON/hardstand parking, as depicted in **Figure 5.5-7**.

Figure 5.5-7: Potential RON/Hardstand Parking Relocation Sites



Source: WSP USA, October 2021.

PREFERRED ALTERNATIVE

Each potential site was evaluated for factors such as proximity to the future consolidated terminal as well as the best potential use for the site. Site 1 was selected as the preferred site for RON/hardstand parking positions, north of existing Terminal 2. The potential East Deicing Pad could also be used for overflow parking.

5.5.7 CENTRAL UTILITY PLANT

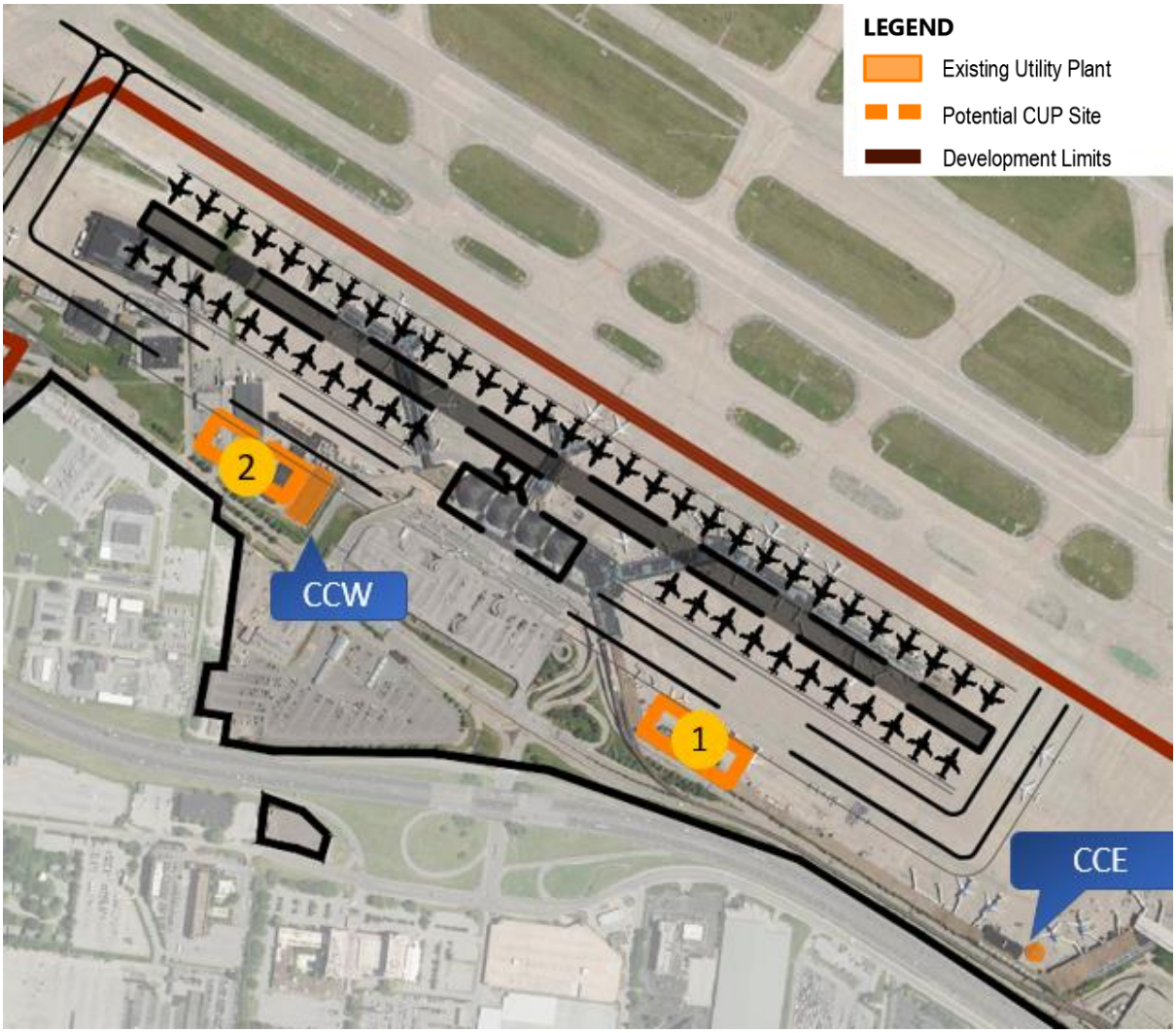
SUMMARY OF REQUIREMENTS

The Airport currently operates two climate control facilities, Climate Control West (CCW) and Climate Control East (CCE), occupying an approximate area of 1 acre in total. Considerations were made to consolidate the two climate control facilities into a Central Utility Plant (CUP).

ALTERNATIVES

Two sites were identified for a Central Utility Plant in the vicinity of the proposed consolidated terminal, as depicted in **Figure 5.5-8**.

Figure 5.5-8: Potential Central Utility Plant Sites



Source: WSP USA, October 2021.

PREFERRED ALTERNATIVE

The driving factor behind the selected site was its close proximity to the terminal. Site 2 was selected as the preferred site for building the CUP, west of the existing CCW. This site works best for phasing as it does not interfere with Concourse D's footprint should it be kept during construction.

5.5.8 BELLY CARGO

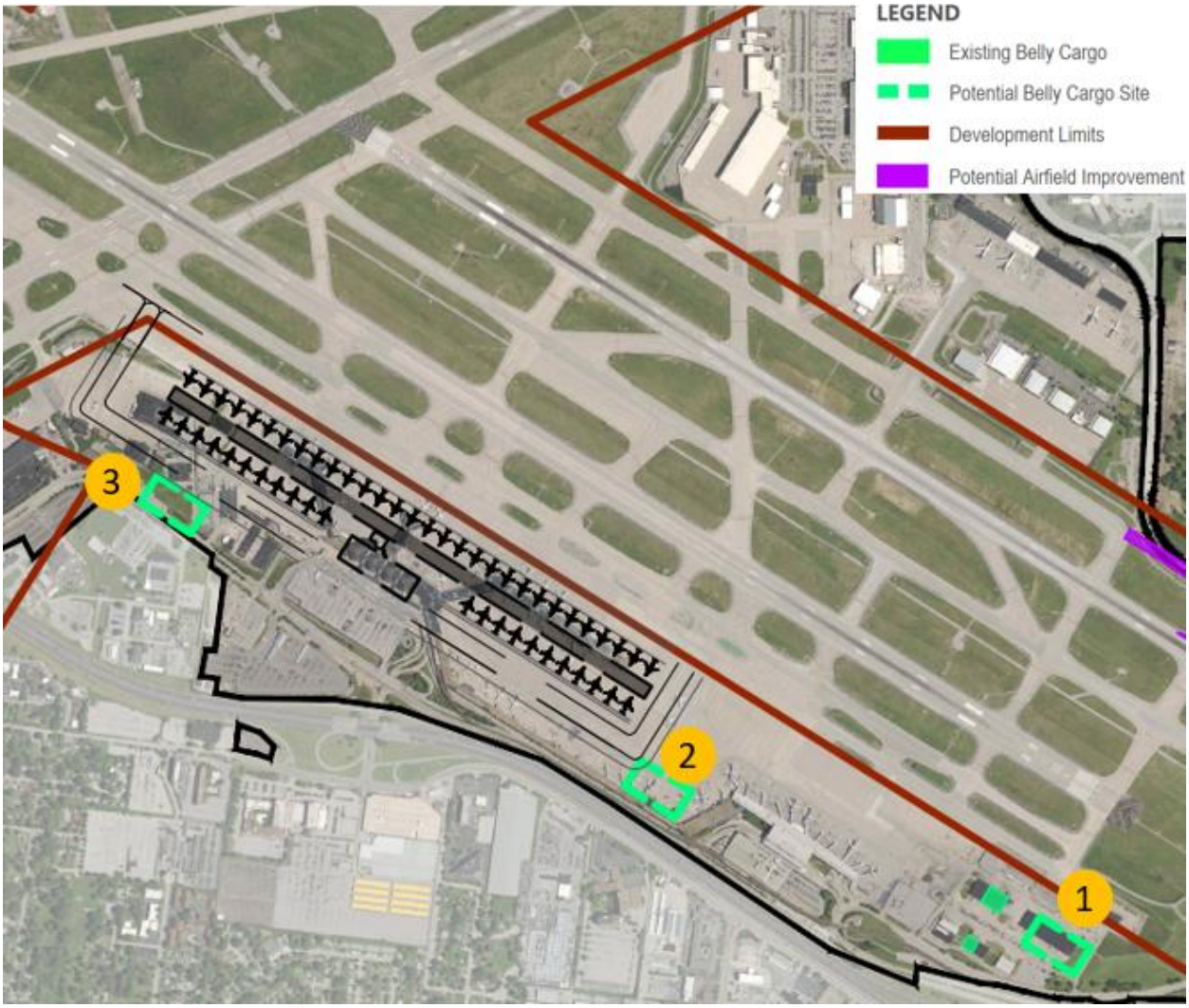
SUMMARY OF REQUIREMENTS

The existing belly cargo facilities are comprised of approximately 1.6 acres located in Cargo City. The 2040 calculated needs are approximately 2.4 acres resulting in an additional 0.8 acres in space needs.

ALTERNATIVES

Three sites for future belly cargo facilities were identified, one that assumes rebuilding Cargo City over the same footprint and two sites that assume building a new facility either southeast or southwest of the proposed terminal, as depicted in **Figure 5.5-9**.

Figure 5.5-9: Potential Belly Cargo Relocation Sites



Source: WSP USA, October 2021.

PREFERRED ALTERNATIVE

Each potential site was evaluated for a number of factors such as proximity to terminal area, landside access and site configuration. Site 1 was selected as the preferred site for the future belly cargo facility. This site assumes consolidating and rebuilding Cargo City in the same footprint with the potential to expand further east, if needed beyond the planning period.

5.5.9 GROUND SERVICE EQUIPMENT MAINTENANCE

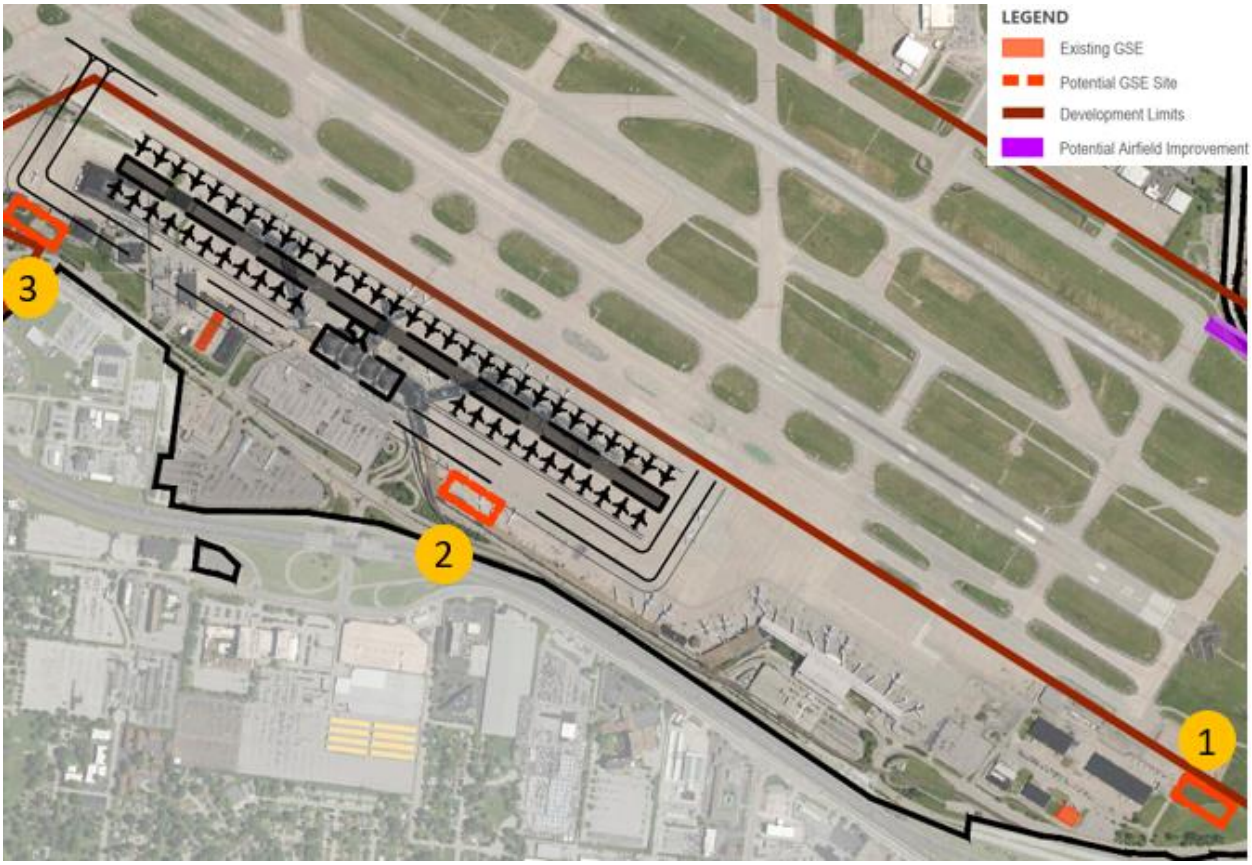
SUMMARY OF REQUIREMENTS

The existing GSE facilities (referred to as Airline Services building) are comprised of approximately 1 acre, excluding shared employee parking in Cargo City. The 2040 calculated needs are approximately 1.3 acres.

ALTERNATIVES

Three sites were identified for the GSE maintenance facility that meets siting criteria, as depicted in **Figure 5.5-10.**

Figure 5.5-10: Preferred Ground Support Equipment Relocation Site



Source: WSP USA, October 2021.

PREFERRED ALTERNATIVE

Each potential site was evaluated for a number of factors such as proximity to terminal area and apron access. Site 3 was selected as the preferred site, assuming a new facility south of the proposed terminal. Although sites 1 and 2 are considered good potential sites, site 1 is the furthest from the terminal and site 2 could potentially interfere with the terminal phasing or other future uses.

To accommodate a 36,000 sq. ft. building and associated vehicle parking on the landside, and GSE parking on the airside, a site approximately 2 acres in size is required.

5.5.10 BUILDING MAINTENANCE

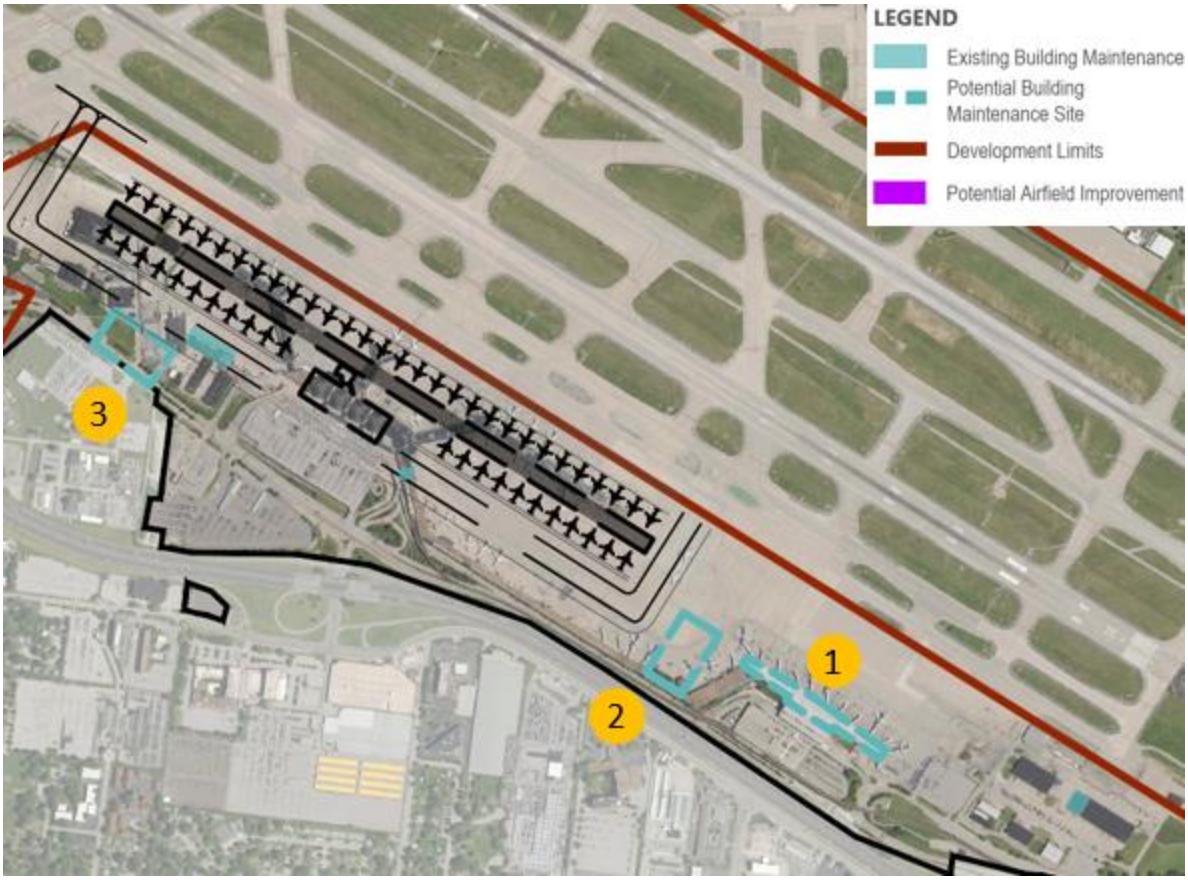
SUMMARY OF REQUIREMENTS

Building maintenance and operations facilities are spread out across the airport, including storage areas in Cargo City 1, Concourse D and various buildings southwest of the existing terminal, and cover approximately 2 acres. There would be benefit in consolidating into a single location and meet the 2040 needs of 3 acres.

ALTERNATIVES

Three sites were identified as potential Building Maintenance relocation sites, as depicted in **Figure 5.5-11**.

Figure 5.5-11: Potential Building Maintenance Relocation Sites



Source: WSP USA, October 2021.

PREFERRED ALTERNATIVE

Each potential site was evaluated for factors such as proximity to terminal area, airfield access and site configuration. Site 3, located south of the proposed terminal was ultimately selected as the preferred site for the future Building Maintenance facility.

A satellite Building Maintenance facility to address small repairs inside the terminal is proposed to be constructed on the apron east of the proposed SSCP, between the domes and new East Concourse.

5.5.11 AIRFIELD MAINTENANCE

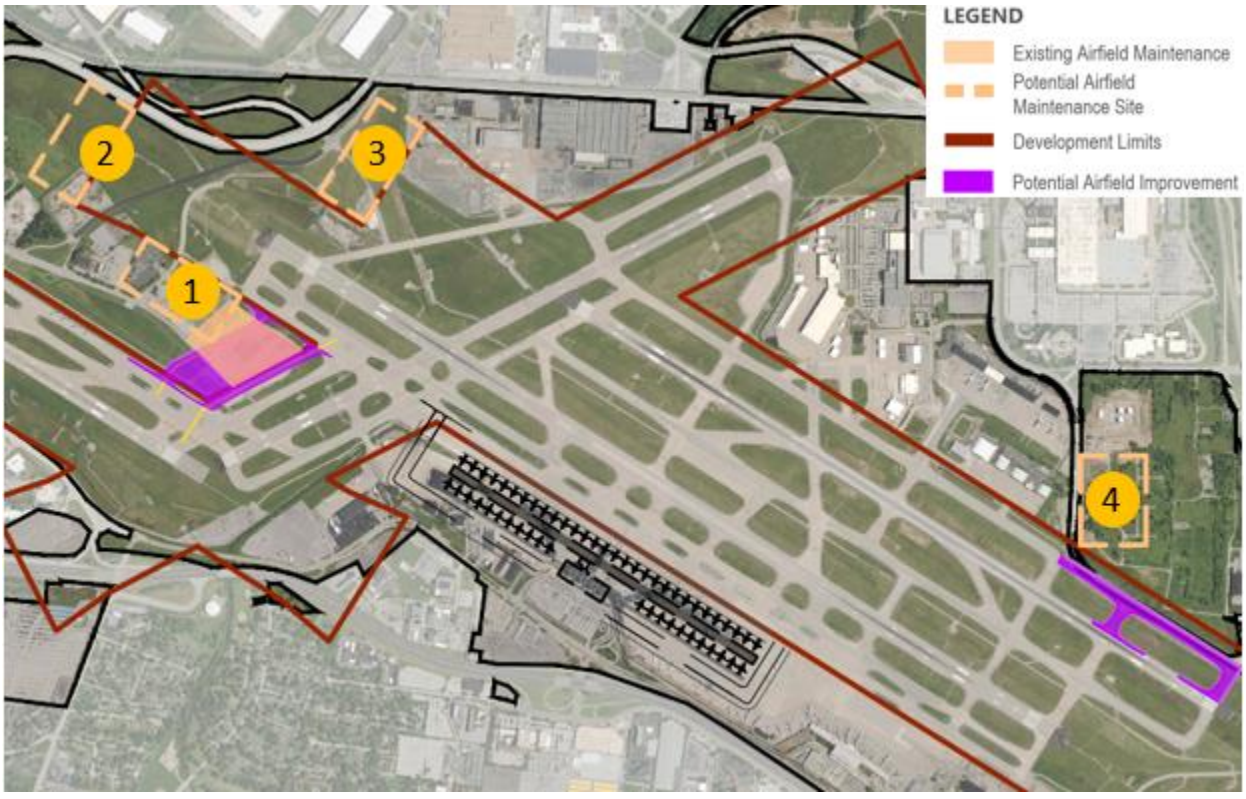
SUMMARY OF REQUIREMENTS

The existing Airfield Maintenance Complex covers approximately 16 acres. An 18-acre site is needed to accommodate future needs. The space should be well-configured for snow removal equipment storage, vehicle wash bays and large equipment staging. Additionally, the existing site is in the floodplain and experiences flooding. Due to its proximity to the airfield, the Airfield Maintenance Complex may be relocated to allow higher and better airfield uses on its existing site.

ALTERNATIVES

Four sites were identified as potential Airfield Maintenance relocation sites, as depicted in **Figure 5.5-12**.

Figure 5.5-12: Potential Airfield Maintenance Relocation Sites



Source: WSP USA, October 2021.

Appendix 5E summarizes the assumptions, considerations and space program calculations of the future Airfield Maintenance Complex.

PREFERRED ALTERNATIVE

Each potential site was evaluated for a number of factors such as airfield access, site configuration and future expansion potential. Site 1, located west of the existing airfield maintenance facility, was selected as the preferred site. This location also corresponds to the site identified in prior siting studies (2012 and 2016).

5.5.12 CENTRALIZED RECEIVING DISTRIBUTION FACILITY

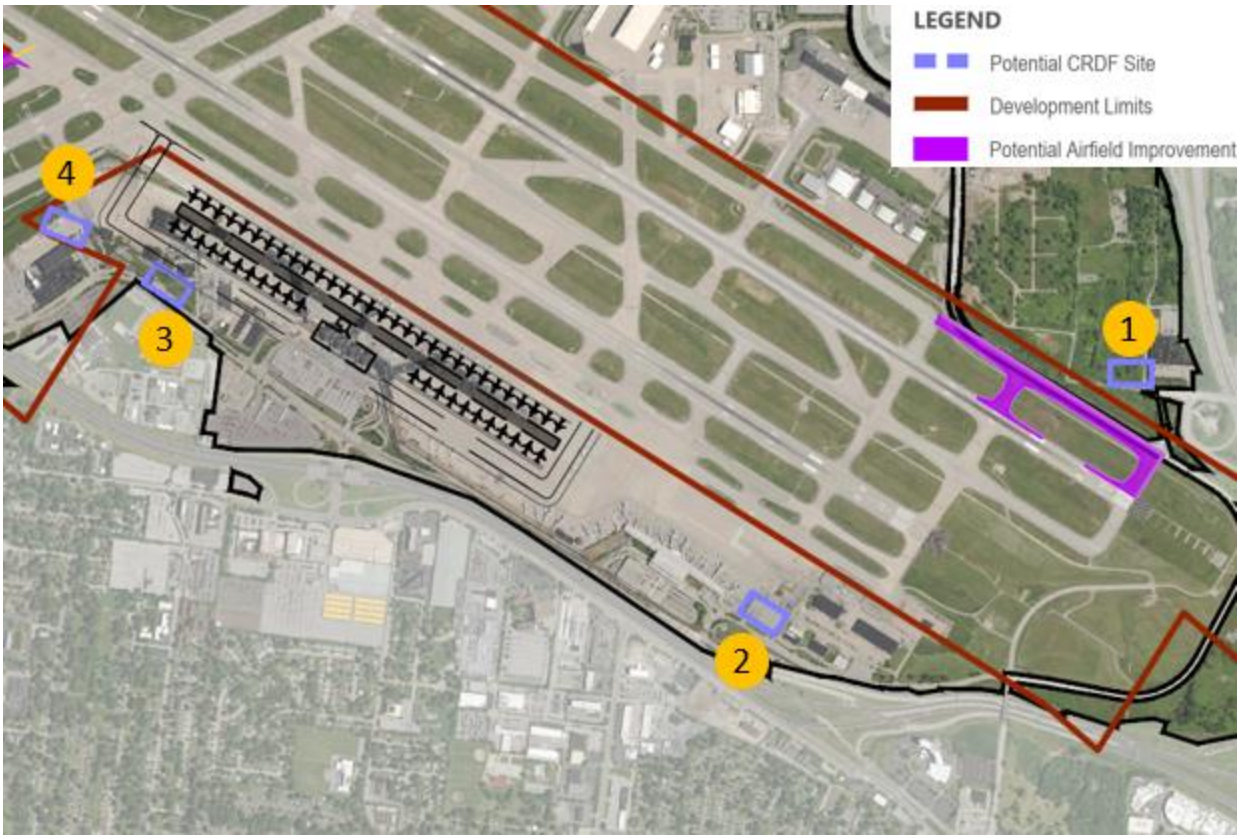
SUMMARY OF REQUIREMENTS

A site approximately 2 acres in size would be adequate to accommodate a Centralized Receiving and Distribution Facility (CRDF). This facility would replace the HMS Host Commissary (Building #307).

ALTERNATIVES

Four sites were identified as potential CRDF sites, as depicted on **Figure 5.5-13**.

Figure 5.5-13: Potential Centralized Receiving and Distribution Facility Sites



Source: WSP USA, October 2021.

PREFERRED ALTERNATIVE

Each potential site was evaluated for a number of factors such as airside access, potential interference between truck and passenger traffic and terminal proximity. Site 2, located on Lot E, was selected as the preferred site.

5.5.13 AIRPORT ADMINISTRATION AND AIRPORT POLICE

SUMMARY OF REQUIREMENTS

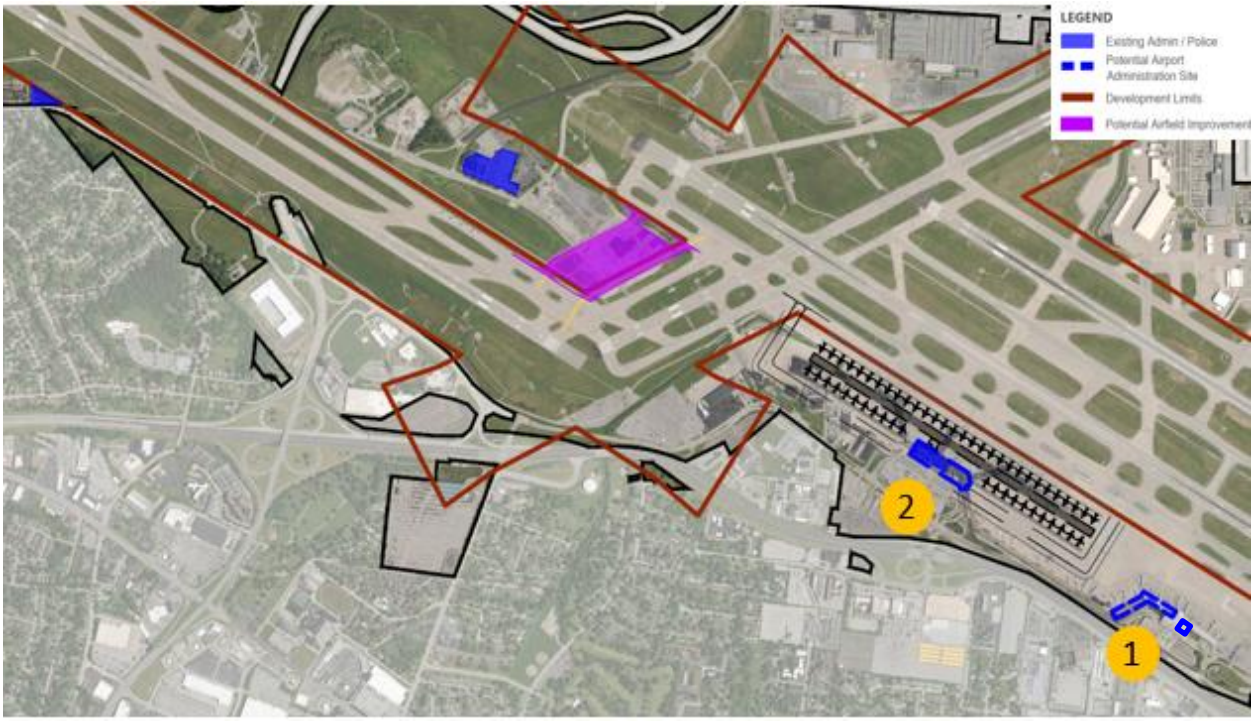
Airport Administration offices are currently located within Terminal 1 and in the AOB building, occupying a total space of 3.5 acres. Considerations are made to consolidate the administrative offices and meet the 2040 needs of 4.2 acres in total.

Airport Police existing facilities are in multiple locations and occupy approximately 0.9 acres in total space. Similar to Airport Administration, considerations are made to consolidate airport police and security into one facility inside the terminal footprint. The 2040 space needs for policy facilities are 1.2 acres in total.

ALTERNATIVES

Two sites were identified as potential sites for relocating Airport's administration and Airport police, as depicted in **Figure 5.5-14.**

Figure 5.5-14: Potential Airport Administration and Airport Police Sites



Source: WSP USA, October 2021.

PREFERRED ALTERNATIVES

In selecting the preferred sites for consolidating the administration offices and airport police, proximity to the terminal was one the main deciding factors. Therefore, Site 2 was selected as the preferred site. The Airport Police functions would be consolidated in the Concourse D connection, while airport administration functions would be consolidated in a new building within the proposed terminal processor.

5.5.14 AIRPORT OPERATIONS

Airport Operations facilities will be spread out across the Airport, similar to existing conditions, based on needs. Airport Operations personnel will share space with Airfield Maintenance and Airport Administration personnel. The Airport Operations Center/Emergency Operations Center (AOC/EOC) is anticipated to be located on the apron level of the consolidated terminal.

5.5.15 FUEL CONSORTIUM SERVICING

The existing Fuel Consortium Servicing facilities are located west of Concourse A, on a site approximately 2 acres. It is anticipated that a 2.5-acre site will be required in 2040 to accommodate growth in gate numbers. The proposed site is recommended to be south of the proposed west concourse, for proximity to terminal operations.

5.5.16 LANDSIDE SNOW REMOVAL EQUIPMENT STORAGE

SUMMARY OF REQUIREMENTS

Snow removal equipment (SRE) for ramp and airport roadways is currently stored on a 2.7-acre site northeast of Cargo City.

It is anticipated that a site approximately 3 acres would be required in 2040, as no additional aprons nor roads will be built.

ALTERNATIVES

In selecting potential sites for landside SRE storage, proximity to the terminal and landside access were critical factors. Two sites were identified, as depicted in **Figure 5.5-15.** Site 1 is located north of the American Airlines MRO facility, outside the RPZ. Site 2 is located on the American Airlines MRO site, outside the central portion of the RPZ. Both proposed sites would require the relocation of the AA MRO.

PREFERRED ALTERNATIVES

Site 1 was selected as the preferred site, as it remains clear of the Runway 29 RPZ. The site will be available upon the relocation of the American Airlines MRO.

Figure 5.5-15: Potential Landside Snow Removal Equipment Storage

Source: WSP USA, 2022.

5.5.17 LIVESTOCK HANDLING

Livestock Handling facilities are expected to remain in the Cargo City complex.

5.5.18 TRITURATORS

Two triturators are in use at STL. It is anticipated that two triturators will also be needed in 2040, preferably one on each side of the proposed consolidated terminal. Exact locations will be determined in advanced terminal planning.

5.6 EMERGING TECHNOLOGIES

5.6.1 URBAN AIR MOBILITY

ELECTRIC AIRCRAFT

The electrification of larger commercial service aircraft is anticipated to be beyond the planning horizon of the STL ALPU/MP. However, e-aircraft (new models or variant and retrofit 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 STL at this time to accommodate e-aircraft. Some factors for an airport sponsor to consider are:

- Would there be enough e-aircraft operations at STL 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. Issues 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).
- Ground handling infrastructure and apron layouts may have to be adapted to manage aircraft with unconventional shapes (such as longer/thinner wings).
- Air traffic control procedures would need to be modified to handle slower e-aircraft, potentially impacting 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 airports close to populated areas could operate for longer hours or overnight without disturbing local residents. It would also greatly improve the airport's environmental image.

VERTICAL TAKE-OFF AND LANDING VEHICLES/ UNMANNED AERIAL SYSTEMS

It is assumed that potential future operations by vertical take-off and landing (VTOL) aircraft and unmanned aerial systems (UAS) may operate from both existing/future terminal and/or FBOs, or the top of the existing/proposed parking garages. VTOL/UAs operations would either use the existing runways and taxi to their final parking spot, or vertiport landing areas (including the approach/departure surfaces) will need to be established if taxiing is not feasible. Siting of a vertiport, which would require approach and departure paths and further FAA review, would be conducted as the technology continues to evolve and the need arises.

5.6.2 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.

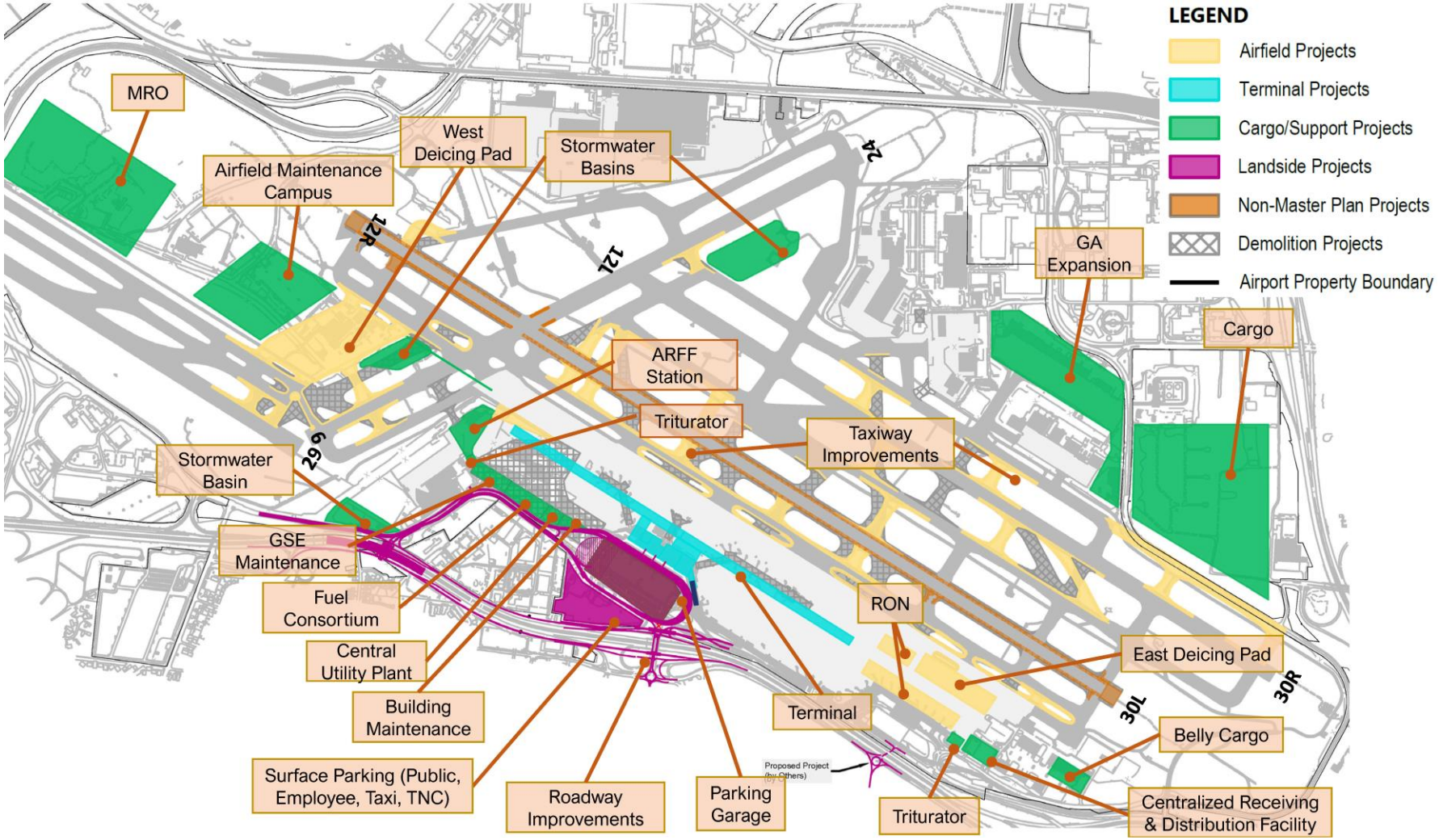
The technology for autonomous personal vehicles is evolving rapidly. Currently, autonomous vehicles typically don't operate well in congested environments, such as an airport's drop-off/pick-up curbside. As such, a lane dedicated to autonomous vehicle within the existing roadway system is recommended; autonomous vehicles 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.

5.7 PREFERRED AIRPORT DEVELOPMENT PLAN

The preferred Airport development plan is depicted on **Figure 5.7-1**.

Figure 5.7-1: Preferred Airport Development Plan



Note: I-70 improvements are under study, not funded at this time, and may therefore differ from what is shown.

Sources: CMT, 2021 (basemap); WSP USA, 2022